ITALIAN RAILWAYS.

The story of the iron way in Italy is closely bound up with the political history of the Peninsula, and only when the country became united was that complete system of railways projected and carried out which has gone a great way towards removing the reproach of Italy being merely "a geographical expression." A glance at the map of Italian railways in the present year—given below—shows that the country is provided, or will be when the lines in construction are opened for traffic, with an almost complete coast line, while all towns of importance are already connected. There are at the present time 11,500 kilometres, or 7146 miles, of railway opened, while as recently as in 1860 there were only 2000 kilometres, or 1243 miles. At first these lines were made by princes for their own personal convenience, though at the public expense. Then the Governments of the different States made railways for the defence of their territory, without any consideration for commercial interests or through communication—in fact just the contrary. But during the twenty-seven years that Italy has been united the great increase of railways has materially strengthened the credit of the country. Twenty years ago gold and silver were rare, and foreign money obtained a high premium when exchanged into Italian notes of a *lira*, or franc, and upwards, if not indeed for fractions of that amount; and these Italian railways have been pushed on under great material as well as financial difficulties, on account of the generally mountainous nature of the country. The line between Genoa and Pisa, of 168 kilometres, or about 100 miles only, passes under spurs of the Apennines by no less than 82 tunnels. At present most of the way is single; but the line is being doubled gradually, as soon as the necessary expense is justified by present or prospective traffic. It may be mentioned here that while *strada ferrata* is the classical expression, *ferrovia* is invariably employed by engineers and railway men; *binario* is way, and *scambio* points or switches. The long distances to be traversed in the Peninsula have made those at the head of affairs, especially on the Mediterranean system, which is shown on the map by thick black lines, turn their attention towards providing for all the material requirements of passengers, as is now done to a great extent by the Midland Company, and this not only for first, but also for second and third class passengers. The practice, originated by the P. L. M. Co., of letting out pillows with clean pillow cases for any through journey at 1 franc each, is adopted on all the Italian railways, and often procures an otherwise unattainable night's rest.

THE RAILWAYS OF ITALY.

The first railway made in Italy is that from Naples to Nocera by Torre del Annunziata, with a branch to Castellamare; and the portion between Naples and Portici, near to which is the Pietrarsa establishment, where the Mediterranean Company's locomotives are now made, was opened for traffic on October 4th, 1839. In the following year the Emperor of Austria had constructed a short line from Milan to his palace at Monza, half-way between Milan and Como. In 1842 a line of 33 kilometres, or 20½ miles, was made from Padua to the bridge on the lagoon, Venice; and in the following year a line of similar length between Naples and Caserta was completed. In 1844 Leghorn and Pisa, Portici and Torre del Annunziata, the latter town and Castellamare, and also Capua and Caserta, were connected, bringing up the total length of railways in the Peninsula to 50 kilometres, or 31 miles. In 1845 a line of 20 kilometres, or 12½ miles, was made from Pisa to Pontedera; and in 1846 lines were opened between Padua and Vincenza, Venice and Ponte-sulla-laguna, Milan and Treviglio, Nola and Cancello, Lucca and San Giuliano, and Pisa and the last-named town, bringing up the total length to 147 kilom. = 91 miles, which became 227 kilom. in 1848, 420 kilom. in 1849, and 476 kilom. in 1850, and 558 kilom., or 347 miles, in 1851. In the province of Naples the Nola and Sanseverino line was completed in 1861. But, before this, the Salerno-Sanseverino, the Naples and Brindisi, and the Naples and Tronto line by the Abruzzi, had been conceded. In 1860 a company, including Brassey, Buddicom, Talabot, and the Duca di Galliera, obtained the concession for a railway from Tronto to Taranto; and in the same year, on the fall of the Bourbon dynasty, Garibaldi conceded to the Adami-Lemmi Company the faculty of making several railways, both on the main land and in Sicily, some of which formed the nucleus of the future Meridionale system, this company being constituted on September 16th, 1862.

In Lombardy and Venetia, the Milan and Como line was ceded to the Austrian Government in 1852, in which year the Lombardo-Venetian line, the works of which had been commenced, was resumed by the State. New *concessionnaires*, however, took over this line, which was extended and fused with others; and in 1859, Victor Emanuel confirmed the concessions, that had been granted by the Austrian Government, of the lines which became the nucleus of the Alta Italia system. In the province of Tuscany, the Società della Strada Ferrata Centrale Toscana, formed in 1844, took over and completed the system which afterwards developed into the Ferrovie Romane.

In Piedmont the surveys for a line between Turin and Genoa, by Alessandria, were authorised as early as 1844; and in 1845 it was determined that the work should be carried out by the State. The first concession was made in 1850, respecting the Trofarello-Savigliano-Cuneo line; in 1852 the concession of a railway from Turin to Susa was confirmed; and in 1853, Bixio, Lafitte, and Co. were authorised to make a line from Modane to the Rhone, and work it on their own responsibility. Finally, in 1860, while the State worked the lines made by it, the Società delle Strade Ferrate Vittorio Emanuele was formed to work several private railways, which it took over.

In the Roman provinces, the first authorisation was given by the Papal Government in 1846, to make lines from Rome to Ceprano, Porto d'Anzio, Civita Vecchia, Foligno, Ancona, and Bologna, the first railway opened for traffic being that to Civita Vecchia in 1859. The line was made by a company that afterwards assumed the title of Società della Strada Ferrata Pio-Centrale, and was entrusted with the working of other lines, fusing in 1860 with the Società Pio-Latina, which made the Rome and Frascati line, under the style of Società Generale delle Strade Ferrate Romane, to work the Ferrovie Romane which were afterwards fused with those of Tuscany, mentioned above.

After the political events of 1859-60, when the greater portion of Italy became united as an independent kingdom, the various private companies became financially embarrassed, besides finding it difficult to work their circumscribed systems under the new conditions. Accordingly the national Government set about arranging a complete and harmonious network for the kingdom, ultimately confirmed by the law of May 14th, 1865, which sanctioned the fusion of the various systems and the formation of the three great companies—the Alta Italia, the Romane, and the Meridionali. By this arrangement the system of the Società Ferrovia ria dell' Alta Italia was made to include the Piedmont State lines, the lines hitherto worked by the Victor Emanuel Company, those belonging to the Lombardia Company, and those of Central Italy, to which were subsequently added the Modane and Bussoleno, the Udine-Pontebba, the Firenze-Pistoia-Pisa, the Pisa-Spezia-Genva-Ventimiagli and the Savona-Bra-Acqui Railways, besides others made in the Po Valley. It was arranged that the Società delle Strade Ferrate Romane should cede to the Government at cost price the important line from Ancona to Bologna with a branch to Ravenna, and should complete and work all the lines in the Roman group, and make the line from Spezia to Ventimiglia. It was also provided that the Società delle Strade Ferrate Meridionali should abandon the Pescara-Ceprano and Foggia-Eboli lines, although the works of the latter were in hand, and should, in their place, make the lines from Foggia to Naples by Benevento, from Pescara to Rieti by Aquila, and from Termoli to Benevento by Campobasso to join the Foggia-Napoli line. To this system was afterwards added the Ancona-Bologna-Ravenna Railway. After Rome became the capital of Italy in 1870 the conditions of the railways were altered, unimportant lines becoming important, and *vice versâ*. In consequence of the increasing financial difficulties of the companies, especially in the centre and south of the kingdom, the Government again tried to arrive at a practical solution of the problem. The Minghetti-Spartventa convention was brought before the Chamber in 1874; but, although examined by two different committees, and forming the subject of five reports, it was never passed. In accordance with a treaty made at Vienna, in 1866, which stipulated that the Italian portion of the Alta Italia system should be separated from that still left to Austria, the Government assumed the responsibility of the former, although the Austrian Sud-bahn continued to work the whole Alta Italia system for a subsequent period of two years. The Depretis convention of 1874, although a foreshadowing of the arrangement now in force, was never carried out; nor was a proposition by Rothschild of Paris—a large shareholder in the Alta Italia—for dividing the railways in the north of the kingdom from those in the south, and entrusting their exploitation to two large companies.

As a result of the Government inquiry, ordered in 1878, ministerial propositions in 1880, and the report of Brioschi and Genala in 1881, urged on, moreover, by the constantly-increasing financial difficulties of the companies; fresh conventions for working the lines on the mainland and in Sicily were brought before the Chamber by the Genala ministry, and, after a long discussion, definitely

sanctioned by the law of 27th April, 1885. By this law, defining the arrangement now in force, the lines on the mainland were divided, for purposes of working, into two systems of nearly equal importance, one—the Mediterranean—on the west, with the international lines of Modane, Ventimiglia, and Novara-Pino; and the other—the Adriatic—on the east, with the international lines of Cormons, Pontebba, and the Brenner; while the Milano-Chiasso line, by the St. Gothard tunnel, and also the Milano-Rogoredo, Pisa-Livorno, and Parma-Piacenza lines were made common to both, together with certain stations.

The Mediterranean system—shown by thick lines on the accompanying map—had a total length of 4554 kilom., = 2830 miles, opened on 1st October, 1887, but which will be 5804 kilos. = 3605 miles when all the projected lines are completed; and the Adriatic—shown by thinner lines—about 4700 kilom. = 2920 miles, to be increased to 5863 kilom. = 3643 miles. At the same time the Government, who already owned the Alta Italia and Roman railways, acquired the right to exert a supervision over the working of the Meridionali—all of which were now fused—that is to say, over all the railways of the kingdom. The arrangement is made for three periods of twenty years each, terminable by either party on giving notice two years before the expiration of any period. The companies took over from the State, at an estimate, the stock and stores, which are to be similarly transferred at the end of the contract. The companies are obliged, by the law of 1st July, 1885, to work what lines—belonging to their respective systems—the Government chooses to make; and the Government reserves the right to arrange the time-tables, to regulate the tariffs, and to use the railways in time of war.

The railways in Sicily were by the law of 1865 conceded to the Società Vittorio Emanuele, and now have a length of 791 kilom. = 492 miles, which includes the Palermo-Marsala-Trapani line, of 194 kilom. = 121 miles, in the West of the island, worked by the Società Ferrovia Sicula Occidentale. The distance between Italy and Sicily is 3 kilom., and there is a project by Sig. Gabelli to construct a tunnel 7 kilom. = 4·35 miles long, including the approaches, at a cost of 70,000,000 lire = £2,800,000. The Sardinian railways were conceded in 1863 to Sig. Semenza, the concession being transferred to the Compagnia Reale delle Ferrovie Sarde in the following year, when the works were begun. The length of lines now opened is 411 kilom. = 255 miles, but this will be increased by the Ferrovie Complementari Sarde now in construction. The Società Veneta per Imprese e Costruzioni Pubbliche works the lines from Vicenza to Treviso, and from Padua to Bassano, together measuring 108 kilom. = 67 miles; the Composampiero-Castelfranco-Montebelluna, 29 kilom.; Vicenza-Schio, 32 kilom.; Scio-Torre-Belvicino, 5 kilom.; Schio-Arsiero, 19 kilom.; Udine-Cividale, 16 kilom.; Conegliano-Vittorio, 14 kilom.; Padova-Fusina, 35 kilom.; Mestre-Malcontenta, 5 kilom.; and Padova-Conseloe-Bagnoli, 28 kilom., besides the following out of the Venetian Province:—Parma-Suzzara, 44 kilom.; Albano-Nettuno, 32 kilom.; Bologna-Imola, 33 kilom.; and Budrio-Bologna-Vitale, 16 kilom., making a total of 441 kilom., or 274 miles. The Società delle Ferrovie secondarie complementari, *concessionnaire* of the Saronno-Varese-Laveno, the Como-Grandate-Malnate, and the Saronno-Grandate lines, together measuring 114 kilom. = 70 miles, also works the Santhia-Biella branch, 30 kilom. = 19 miles long, of the Mediterranean Company's Novaro-Torino line. Excepting this last-named branch, the lines of this company are worked in connection with those of the Nord-di-Milano Company, viz., the Milano-Saronno and Milano-Erbae-Camnago, which, though only 63 kilom. = 39 miles long, have a large summer traffic, as they convey passengers from Milan, which has 350,000 inhabitants, besides a large floating population, to the picturesque districts between lakes Como and Maggiore.

There are, besides, the following lines of normal gauge, but of minor importance:—Fossano-Mondovi, 24 kilom. = 15 miles; Torino-Lanzo, 32 kilom. = 20 miles; Settimo-Cuorné, 33 kilom. = 20½ miles; Sassuolo-Modena-Mirandola, 68 kilom. = 42 miles; Reggio Emilia-Ventoso, 15 kilom. = 9 miles; Regio-Novellara and Bagnolo-Corregio, 28 kilom. = 17 miles; Bergamo and Ponte della Selva, 29 kilom. = 18 miles; Poggibonsi and Colle Val d'Elsa, 7 kilom. = 4 miles; Albano-Anzio-Nettuno, 38 kilom. = 24 miles; and Napoli-Bajano, also 38 kilom. = 24 miles which were in operation at the beginning of the present year. All the above railways are shown on the map, page 365, the Mediterranean by thick lines, the Adriatic by thinner lines, and the rest by thin lines. There are, besides, several secondary railways of small gauge, and steam tramways, which are not taken into consideration here.

During the financial year 1885-6, the Rete Mediterrania, with 4236 kilom. = 2695 miles in operation, produced the sum of 107,342,614 lire = £4294, with an expense of 68,568,651 lire = £2,742,746, showing a gross product per kilometre (0·62 mile) of 25,341 lire, or £1013, at an expense of 16,187 lire, or £647, the product and expense per train kilometre being 4·78 and 3·06 lire respectively. The Rete Adriatica, with 4379 kilometres = 2718 miles in operation during the same period, earned 49,706,645 lire = £1,988,266 at an expense of 30,915,747 lire = £1,236,630, showing a product per kilometre of 11,351 lire = £454 at an expense of 7060 lire = £282. The Rete Sicula, a Sicilian system, with 613 kilometres or 381 miles, earned 7,493,331 = £299,733, and spent 6,270,325 lire = £250,813, which gives a product per kilometre of 12,224 lire = £489 at a cost of 10,229 lire = £409 and a product per train kilometre of 3472 lire = £139 at a cost for the same of 2906 lire = £116.

The Indian Mail, in correspondence with a train leaving London every Friday evening, runs through Paris, Dijon, Macon, Amberieux, Culoz, and Modane to Turin, where there is a stoppage of several hours, and then by Allessandria, Piacenza, and Ancona, reaching Brindisi early on the following Monday morning. There are, besides, two daily international through trains each way by the Mont Cenis, and three by the St. Gothard tunnel. We may state, in conclusion, both by way of just recognition, and for the benefit of those of our readers who may desire more ample information as to Italian railways, that we have freely laid under contribution a valuable work by Sig. Ing. Giuseppe Lampugnani, general secretary of the Mediterranean Company, entitled, "Costituzione generale della Amministrazione Ferroviaria Italiana," and published, this present year, by the Unione Tipografico-Editrice, Turin.

RECENT CRUISER DESIGNS.

The question of the best type of cruiser is one which has caused almost as much discussion as that of the best type of battle-ship. The latest discussion on this question took place on the reading of a paper called "The Comparative Effects of Belted and Internal Protection upon the other Elements of Design of a Cruiser," by Mr. Biles in April last before the Institution of Naval Architects. The paper itself, as its title implies, was confined to a statement of the differences in two ships designed as cruisers—the one with a belt of armour in the vicinity of the water-line, the other with no water-line protection but an internal dome-shaped deck. In the discussion on the paper, which was characterised by the president, Lord Ravensworth, as "the most interesting, and probably the most popular, discussion upon this difficult subject which has been as yet held anywhere in this kingdom," the majority of the naval officers strongly advocated the adoption of a belt, while the naval architects favoured the more modern type of internal protection. The comparison made in the paper was between the belted cruisers of the Aurora type designed by the Admiralty, seven of which had been built, and several imaginary cruisers of the internally protected type. It may be remembered the dimensions of the belted cruisers are—length, 300ft.; breadth, 56ft.; depth, 37ft.; draught of water, 21ft.; displacement, 5000 tons. In the first design compared with the belted cruiser it was assumed that the length, draught of water, armament, protection on the flat of the deck, stability, speed, and coal supply were to be the same in the two cases, and it was shown that there was enough available displacement to spare in favour of the internally-protected type to add either 40 per cent. to the protection, or six-tenths of a knot of speed, or one large and two small guns, the actual displacement of the internally-protected ship being 4790, as compared with 5000 of the belted ship. On the assumption that the displacement of the two should be the same, it was shown that a knot and a-half of speed could be gained in the internally-protected type, or, in other words, the adoption of a belt meant a loss of a knot and a-half of speed in two ships of the same displacement. But the belt, it was shown, involved a great additional cost, and on the basis of the same first cost for the two types, a vessel of the internally-protected type could be built with 20 per cent. more protection on the slope, 50 per cent. more on the flat of the deck, two more guns of the heaviest calibre, 50 per cent. more coal supply, and a knot more speed. Taking the view of some of the naval officers, that cost was a matter of secondary consideration, it is a question of great interest to determine whether the belted ship has sufficient advantage in her belt to compensate for the loss of a knot and a-half of speed; but taking what appears to us to be the true view of the question, the cost as the basis, it is still more desirable thoroughly to realise what we have had to pay for the adoption of the belt in the last seven of our largest cruisers. The imaginary cruisers given in Mr. Biles's paper were sufficiently good for the purpose he had in view in making the comparison; but we were enabled in our last issue to give the particulars of an actual vessel built for the Spanish Government by Messrs. J. & G. Thomson, a firm with which Mr. Biles is connected, and we have in the particulars given the necessary data for making comparison of an actual vessel of the internally protected type with our own belted cruisers. In the following table we place side by side the principal particulars of these two vessels:—

	Reina Regente.	Aurora.
Length	317ft.	300ft.
Breadth	50ft. 7in.	56ft.
Depth	32ft. 6in.	37ft.
Draught, mean	20ft.	21ft.
Displacement	4800	5000
Thickness of belt	—	10in.
Thickness of backing	—	6in.
Top of belt above or below water	12in.	Above 1·6
Bottom of belt below water	6ft.	4·6
Length of belt	—	200ft.
Thickness of deck	4¾in. at side 3⅛in. at centre	2in.
Armament	4 9·6in. guns 6 5in. guns	2 9in. guns 10 6in. guns
Coals, normal	600	500
Coals, full	1300	1000
Speed	20·6	19
I.H.P.	12,000	8500

We thus see that instead of the 10in. belt with the 2in. deck on top of it, the Reina Regente has a sloping belt 4¾in. thick, which is at least equal in shot-resisting power to the 10in. belt, and she has a 3in. deck on the flat part, which is, of course, considerably stronger than the 2in. deck of our own cruisers. The speed of some of our own vessels of this type has been 19 knots, so that the Spanish cruiser has at least a knot and a-half more speed than our own. The armament is considerably more powerful, as she has four guns of the heaviest type instead of two as the belted class have. We need not go over the points which have been under discussion so long as to the value of side armour, further than to say that opinion in favour of the internally-protected type, for protection alone, is increasing. The French are going very decidedly in the direction the Spaniards have gone, and our own Government in its recent cruiser designs has not adopted the belt. We are therefore in the position that we have spent nearly two millions of money on seven belted cruisers, the superiority of whose protection is very doubtful, whose speed is certainly a knot and a-half less than it might have been if the internal type of protection had been adopted, whose armament might have been considerably more powerful than it is, whose cost might have been less, or whose number might have been more. At the time these ships were designed there was a great outcry in the country that we were short of cruisers, and those who took the narrow view of considering only the water-line protection of these ships, and who by their irresponsible clamouring induced the Admiralty to adopt this type, are very greatly to blame for bringing us to the position of having slower, weaker, and fewer ships than we might have had. It is to be hoped that in future designs due consideration will be given to the opinions of those who have carefully and thoroughly studied the question, uninfluenced by the personal feelings which would appear in a great measure to have dictated the procedure of naval constructors for some time back.

BENIER'S HOT-AIR ENGINE.

Although in principle the hot-air engine has for a long time been recognised as a most economical means of transforming heat into motive power, yet up to the present time it has met with little success. The reason of this is that the difficulties which attended the working have been very imperfectly provided against, and many engineers thought them even insurmountable after the failure of several hot-air engines elsewhere which had been planned with considerable care. In consequence of fresh dispositions, the defects which rendered the hot-air engines of little practical service have been, it is claimed by our contemporary *Annales Industrielles*, overcome in great measure by this new engine. We may cite among these advantages the absence of transport of heat, of hot-air leakage past the valves, and of transmission of heat by metallic tubes. The air may be utilised at a high temperature—1200 deg. to 1500 deg. Cent.—and the polished surfaces remain at moderate temperatures—60 deg. to 80 deg. Cent.—which lessens the causes of deterioration. In the engine of MM. Bénier the furnace is placed inside the cylinder itself. The cold air, driven in by a pump, traverses this furnace, producing combustion. The hot gases, much expanded, fill the cylinder and press upon the piston, which is placed directly above the furnace. The arrangement described below protects the polished surfaces of the cylinder and piston from the hot gases charged with cinders.

An engraving of this new engine—of 6-horse power—is given on page 372. The motive cylinder C C^1 is bolted on to the extremity of a bed-plate A. On this plate the column B is fixed, which carries the beam E. This beam transmits the motion of the piston P to the shaft D. A pump, G, placed in the bed-plate, drives a certain quantity of cold air at each stroke into the cylinder. The piston of this pump is worked by the connecting-rod G jointed to the beam F^1, which receives its motion from the rod F coupled to the same crank pin as the connecting-rod D^1. A slide-valve b^1, governed by a clack, regulates the introduction of cold air during its suction, and discharges into the motive-cylinder. There is a motive thrust on the piston during its ascending stroke; then an escape of the hot gases during its descending stroke by the exhaust valve *h*.

The motive cylinder is in two pieces, C and C^1. The upper part of the motive piston, which is very long, works in the cylinder C. The lower part of this piston is reduced to a smaller diameter—1 to 2 mm.—so as to leave a space between the piston and the cylinder. The furnace is placed at the lower part of the cylinder C^1. The sides of the cylinder above the furnace are protected by a packing of blacklead. When the motive piston is at the bottom the exhaust valve shuts. The slide valve b^1 establishes communication between the cylinder of the pump and the motive cylinder. The pressure of air in the pump, at the moment of communication, is nearly a kilogram. This air enters into the cylinder, and the communication between the pump and the cylinder is stationary, until all the air is driven into the motive cylinder, the piston of the pump being at the bottom of its stroke, and the motive piston about midway.

The air drawn in by the piston of the pump enters into the motive cylinder by two pipes; one conducts a part of the air to the upper part of the cylinder, the other conducts the remainder to the lower portion. The lower pipe discharges itself under the grate of the furnace; the air which passes through this pipe traverses the furnace and produces combustion, and the hot gases fill the cylinder. The upper pipe discharges itself into the cylinder C by a groove placed at the lower limit of the surface acted on by the piston. The air which passes through this pipe fills this neck, which distributes it into the circular space comprised between the piston and the cylinder. The heated gases produced by combustion can never therefore enter into this circular space, and cannot consequently come in contact with the smooth surfaces of the cylinder and the piston.

The quantity of air introduced at each stroke being constant, the amount of work produced by each stroke may be varied by changing the temperature of the gas which fills the cylinder; the temperature being lowered, the pressure, and consequently the work produced, diminishes; this result is obtained by regulating the respective quantities of air which pass through the furnace and around the piston. The pressure diminishes as less air passes through the furnace, the quantity of air which passes around the piston increasing at the same time in proportion. A throttle valve n^1, placed over the pipe which leads to the furnace, is directed by the governor L^1 placed inside the column. The load diminishing, the governor closes the throttle valve more or less, and the work produced diminishes.

The coke is put by shovelsfull into a pan I; four cups mounted around a plate I^1 pass over the store of coke and take up a lump of coke in passing; this lump, by the rotating motion of the plate I^1, falls on the cover J of the slide valve *j*, from thence it falls into the cavity of the valve, when this is uncovered, and from there into the pipe C^1 of the box f^1, when the cavity of the valve comes in front of this pipe. From the pipe c^1 the lump of coke falls into the furnace. A small glass peep-hole inserted into the cover J enables the furnace to be seen when the cavity of the slide valve is in front of the pipe C^1.

A stream of water is made to play round the cylinder C^1, as in gas engines, to prevent the walls becoming overheated.

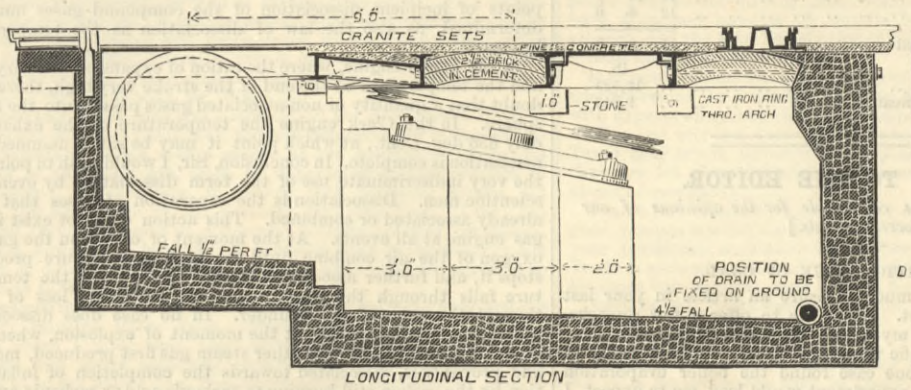
To start the engine, the bottom C of the cylinder C^1 is first opened to clean the grate. This operation completed, the door C is again shut, some lighted charcoal is put in through the pipe C^1, the valve *j* being raised. The slide valve is replaced, two or three turns given to the fly-wheel, and the engine starts. The engine continues to be fed automatically with the coke.

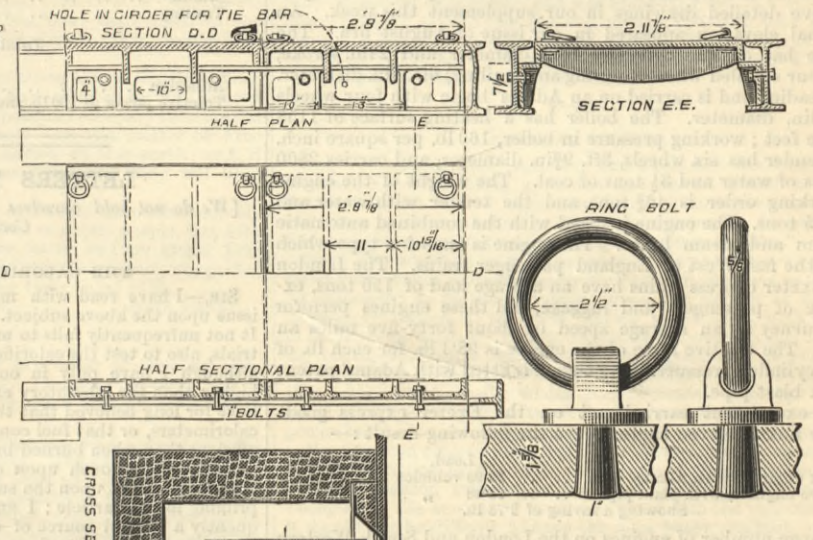
The organs for the transmission of motion, connecting rods,

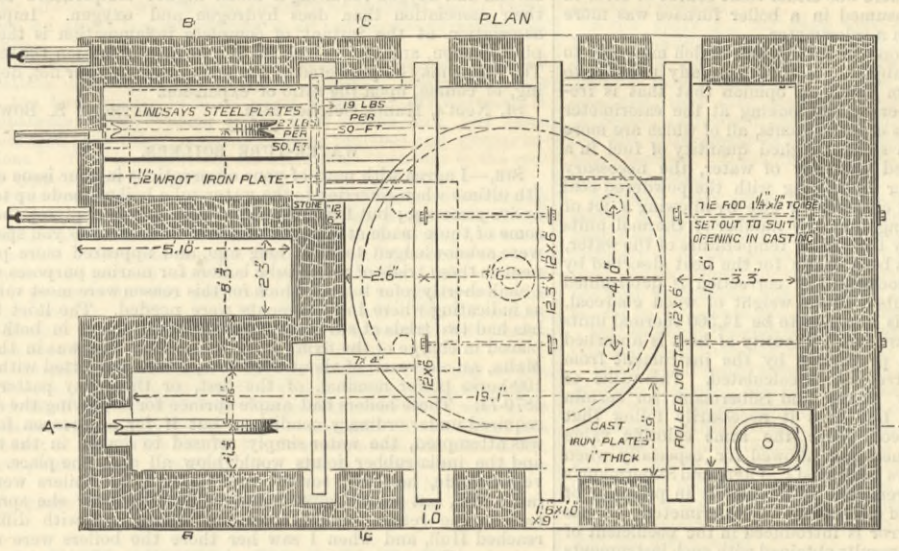
THE EDINBURGH NORTHERN CABLE TRAMWAY.

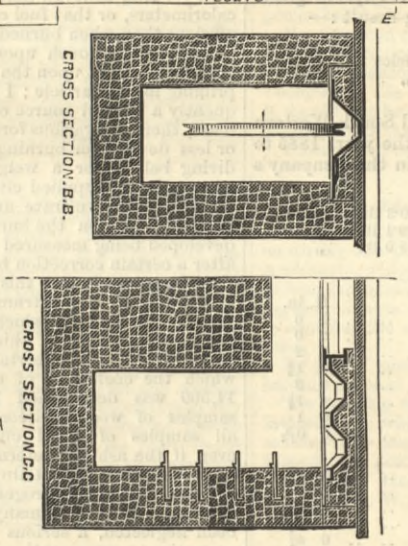
MR. W. N. COLAM, ASSOC. M. INST. C.E., ENGINEER.

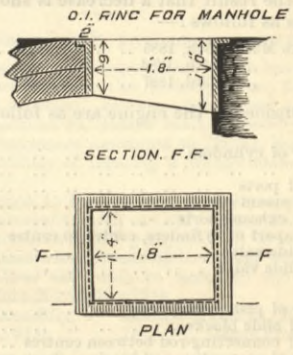
(*For description see page* 347.)

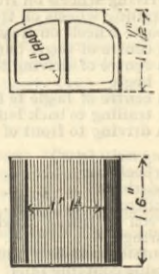


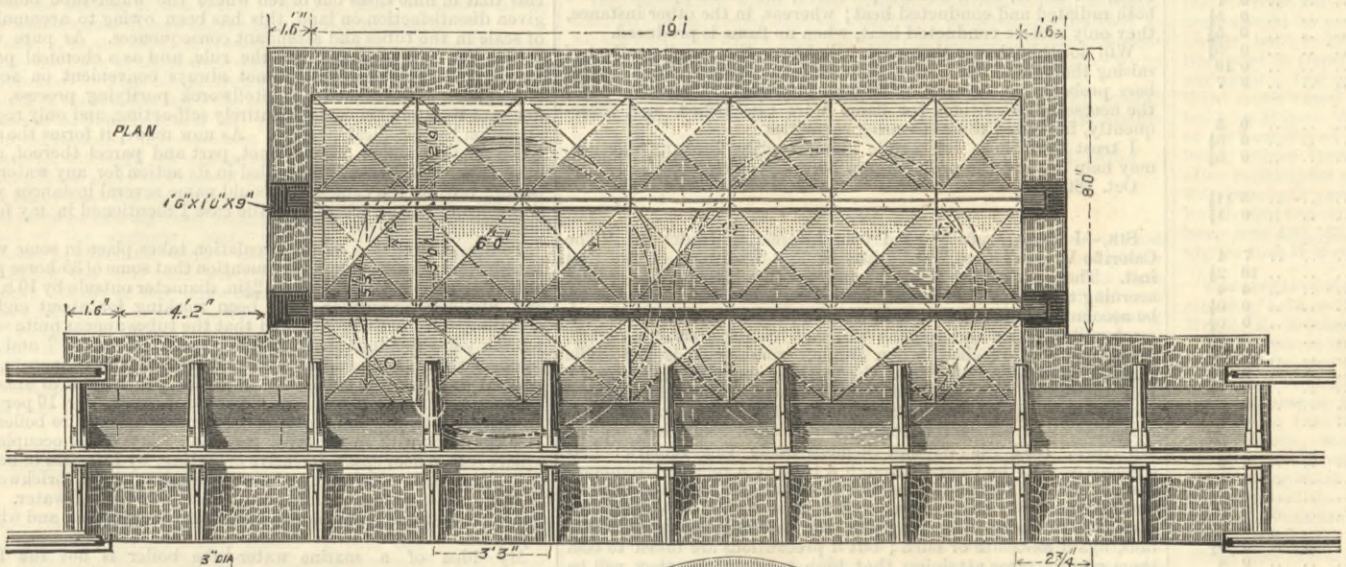


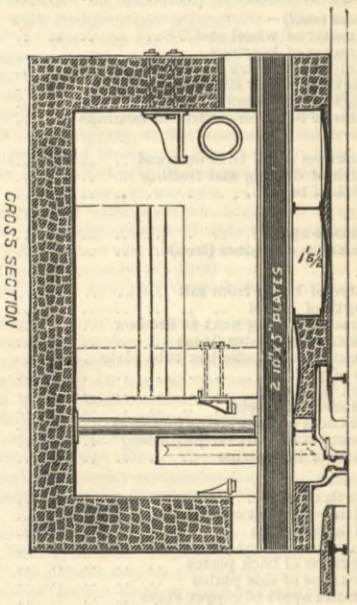


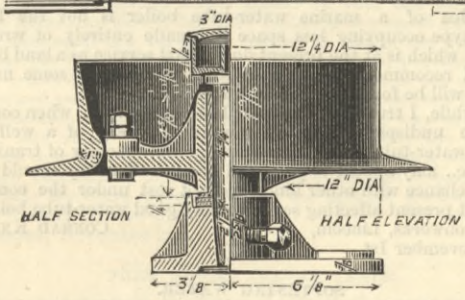


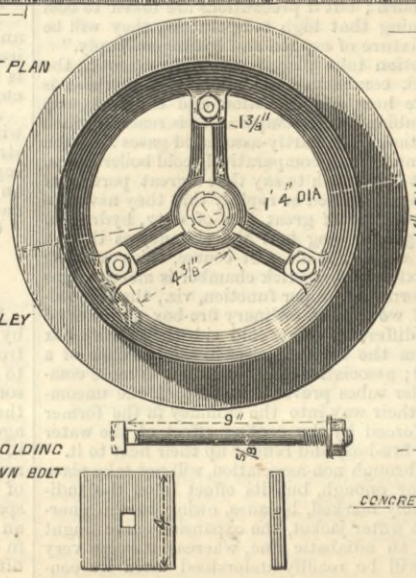


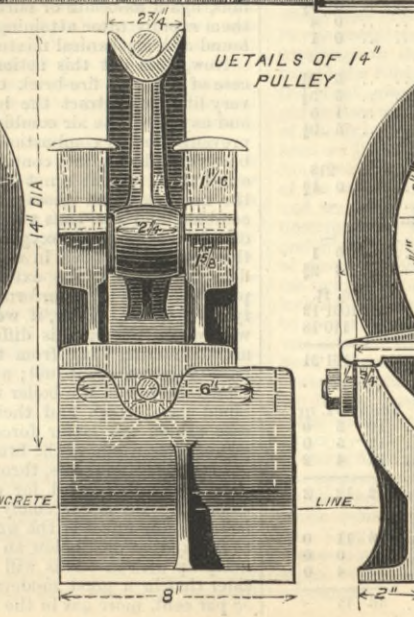


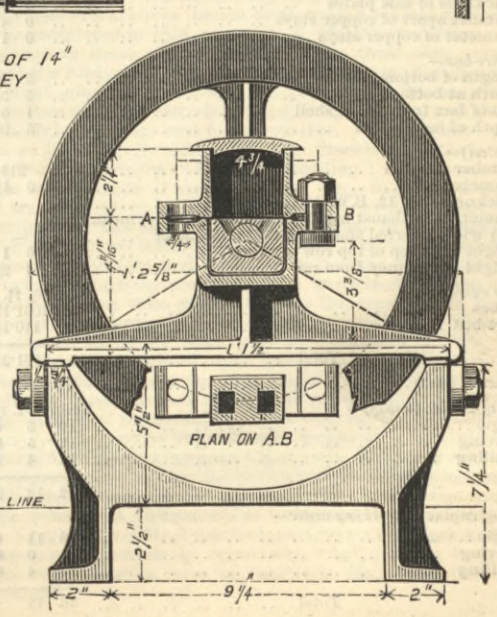












PASSENGER ENGINE, LONDON AND SOUTH-WESTERN RAILWAY.

Messrs. Robert Stephenson and Co. exhibited at Newcastle a four-wheeled coupled bogie passenger express engine and tender, built to the design of Mr. W. Adams, locomotive engineer of the London and South-Western Railway. Of this engine we give detailed drawings in our supplement this week. An external elevation appeared in our issue of August 5th. The engine has outside cylinders 18in. diameter and 24in. stroke, and four coupled wheels (driving and trailing) 6ft. 7in. diameter. The leading end is carried on an Adams' bogie with four wheels 3in. 4in. diameter. The boiler has a heating surface of 1158 square feet; working pressure in boiler, 160 lb. per square inch. The tender has six wheels, 3ft. 9¾in. diameter, and carries 2800 gallons of water and 3½ tons of coal. The weight of the engine in working order is 46¾ tons, and the tender with water and fuel 35 tons. The engine is fitted with the combined automatic vacuum and steam brake. The engine is one of a type which work the fast West of England passenger trains. The London and Exeter express trains have an average load of 150 tons, exclusive of passengers and luggage, and these engines perform the journey at an average speed of about forty-five miles an hour. The tractive force of the engine is 98·4 lb. for each lb. of mean cylinder pressure. The engine is fitted with Adams' patent vortex blast pipe.

An experiment carried out on the Exeter express goods engine link of eleven engines gave the following result:—

	Load.	Lb. of coal.
Six engines, with Adams' pipe	29·93 vehicles	27·21
Five engines, with plain pipe	28·48 ,,	29·94

Showing a saving of 2·73 lb.

A large number of engines on the London and South-Western Railway has been fitted with the pipe during the years 1885 to 1887, with the result that a decrease is shown in the company's coal returns as follows:—

Jan. 1st to March 25th, 1885	30·3 lb. per mile
,, ,, ,, 24th, 1886	29·1 lb. ,,
,, ,, ,, 23rd, 1887	28·0 lb. ,,

The dimensions of the engine are as follows:—

	ft.	in.
Cylinders—		
Diameter of cylinders	1	6
Stroke	2	0
Length of ports	1	2
Width of steam ports	0	1⅜
Width of exhaust ports	0	3
Distance apart of cylinders, centre to centre	6	1½
Lap of slide valve	0	1
Lead of slide valve	0	0 3/16
Motion—		
Diameter of piston-rod (steel)	0	3½
Length of slide blocks	1	4
Length of connecting-rod between centres	5	10½
Diameter of connecting-rod bearings (large end)	0	4½
Length of connecting-rod bearings (large end)	0	4¾
Diameter of connecting-rod bearings (small end)	0	3
Length of connecting-rod bearings (small end)	0	3
Wheels and axles—		
Diameter of driving wheels on tread	6	7
Diameter of trailing wheels on tread	6	7
Diameter of bogie wheels on tread	3	4
Distance from centre of bogie to centre of driving	9	11½
Distance from centre of driving to centre of trailing	8	6
Wheel base of bogie	7	0
Distance from centre of bogie to front buffer plate	6	0
Distance from trailing to back buffer plate	4	6
Distance from driving to front of fire-box	1	5
Driving and trailing axles (steel)—		
Diameter of wheel seat	0	8½
Diameter of bearings	0	7½
Diameter at centre	0	7
Distance between centres of bearings	3	9¾
Length of bearings	0	9
Diameter of outside coupling pins	0	3½
Length of outside coupling pins	0	3¾
Throw of outside coupling pins	0	12
Length of wheel seat	0	7
Bogie axles (steel)—		
Diameter of wheel seat	0	7
Diameter of bearings	0	5½
Diameter at centre	0	5½
Length at wheel seat	0	5¾
Length at bearings	0	10
Distance between centres of bearings	3	7
Tires—		
Thickness of all tires on tread	0	3
Width of driving and trailing	0	5½
Width of bogie	0	5¼
Frames—		
Distance apart	3	11½
Thickness of frames (iron)	0	1½
Boiler—		
Centre of boiler from rail	7	4
Length of barrel	10	2½
Diameter of ring next to fire-box	4	4
Thickness of plates (iron)	0	0½
Thickness of smoke-box tube plate	0	0⅝
Lap of plates	0	2½
Pitch of rivets	0	1⅝
Diameter of rivets	0	0¾
Thickness of butt strips (outside)	0	0½
Thickness of butt strips (inside)	0	0 7/16
Width of butt strips	0	7
Fire-box shell—		
Length outside	6	0
Width outside at central line of boiler	4	5
Width at bottom	3	10½
Thickness of front plates	0	0 5/16
Thickness of back plates	0	0 5/16
Thickness of side plates	0	0½
Distance apart of copper stays	0	4
Diameter of copper stays	0	1
Inside fire-box—		
Length of bottom, inside	5	4⅝
Width at bottom, inside	5	3¼
Top of box to inside of shell	1	5
Depth of box, inside	5	9½
Tubes (steel)—		
Number of tubes	218	
Diameter	0	1¾
Thickness, No. 13, B.W.G.	—	
Diameter of exhaust nozzle—annular orifice 6 1/16 mean dia., ⅛ wide, internal smoke pipe, 5in. diameter	—	
Height from top of top row of tubes	0	1
Height of chimney from rail	13	2¾

	sq. ft.
Heating surface—	
Tubes	1051·13
Fire-box	110·18
Total	1161·31
Area of grate	17·7

	Tons	cwt.	qr.
Weight of engine (empty)—			
Bogie	16	3	0
Driving	13	5	0
Trailing	13	4	2
Total	42	12	2
Weight of engine in working order—			
Bogie	16	11	0
Driving	15	0	0
Trailing	15	4	0
Total	46	15	
Weight of tender (empty)—			
Leading	6	4	0
Middle	5	10	0
Trailing	6	4	0
Total	17	18	0
Weight of tender in working order—			
Leading	12	2	0
Middle	10	14	0
Trailing	12	4	0
Total	35	0	0

	lb.
Adhesion	13,529
Tractive power at 100 lb. mean pressure	9,843

LETTERS TO THE EDITOR.

[*We do not hold ourselves responsible for the opinions of our Correspondents.*]

THE CALORIFIC VALUE OF COAL.

Sir,—I have read with much pleasure an article in your last issue upon the above subject. Allow me to offer a few remarks. It not unfrequently falls to my lot to carry out engine and boiler trials, also to test the calorific value of fuels in the laboratory, and although I have only in one case found the boiler evaporation higher than the laboratory experiment would lead me to expect, I have for long believed that there was either some source of error in calorimeters, or that fuel consumed in a boiler furnace was more efficient than when burned in a calorimeter.

I will briefly touch upon one or two points which may help to throw some light upon the subject. You have already referred to priming in your article; I am firmly of opinion that that is frequently a fruitful source of error, but looking at the calorimeter itself, there are various forms of instruments, all of which are more or less devised for burning a small weighed quantity of fuel in a diving bell under a weighed quantity of water, the necessary oxygen being supplied either by mixing with the powdered coal some potassium nitrate and chlorate, or else by allowing a jet of oxygen to play on the burning fuel, the number of thermal units developed being measured by the rise of temperature of the water, after a certain correction has been made for the heat absorbed by the instrument itself; this coefficient of correction is determined by burning in the instruments a given weight of wood charcoal, the calorific value of which is assumed to be 14,500 thermal units per lb. Then some of this known (?) quantity of heat is absorbed by the water, and a certain proportion by the instrument from which the coefficient of correction is calculated. This value of 14,500 was determined by Favre and Silbermann for certain samples of wood charcoal, but does it necessarily follow that all samples of wood charcoal have the same calorific value even if the ash be determined and allowed for, especially when the hydrogen is almost always neglected? Favre and Silbermann's charcoal had the hydrogen removed by heating it in presence of chlorine. When, as in many of our present day calorimeters, this has been neglected, a serious error is introduced in the coefficient of correction; consequently all results obtained with such instruments give too small values for the heating power of the fuels.

Again, the combustion in calorimeters is so exceedingly rapid, and the heated gases are so immediately condensed, that unless there is an abnormal supply of oxygen, a considerable amount of C O passes off; from my own analyses I have found this to be the case, and there is the greatest difficulty in preventing the loss of heat in this way—a second source of error in reducing calorimetric results—and further the dense fumes which are always given off from calorimeters, indicate that the combustion itself is incomplete—a third source of error in the same direction.

But now let us look at the boilers themselves: I have observed that some boilers will steam far better at certain times than at others, even when the same fuel is used, the wind in the same direction, and to the casual observer all the conditions are precisely the same; but a closer examination will show that when the boiler is steaming well the supply of air is so directed as to produce flame, and in the other case little or none is produced: the carbon in both instances is burnt to C O_2. My own opinion of this phenomenon is, that when flame is produced, the solid particles of glowing carbon radiate heat, while C O_2 at the same temperature is incapable of doing so: hence, when flame is produced, the furnace plates receive both radiated and conducted heat; whereas, in the other instance, they only receive conducted heat, when no flame is produced.

Will not this theory throw some light on the peculiar effect of raising the bars of the L. and N.W.R. locomotives? With the low bars probably no, or little, flame was produced; but, when raised, the necessary conditions for flame were established, and, consequently, improved their steaming capacities.

I trust that these few crude ideas, hastily thrown together, may help to solve the problem now before your readers.

Oct. 26th. John Goodman, Wh.Sc.

Sir,—I have carefully read your interesting leader on "The Calorific Value of Coal," published in The Engineer of the 21st inst. There appears to me to be one way in which the loss of heat accruing to the use of external fire-brick combustion chambers may be accounted for, and that is by the well-known circumstance that combustible gases and oxygen will only combine until a certain temperature is reached, when further combustion is impossible unless heat be abstracted from the partially combined gases by the performance of work in some shape or form. When Mr. Dugald Clerk's excellent paper on the "Theory of the Gas Engine" was being discussed before the Institution of Civil Engineers, on the 4th April, 1882, Sir William Siemens made this remark: "If aqueous vapour be passed through a tube at a sufficient temperature, the whole of the vapour will be dissociated, and the oxygen and hydrogen will be separated. It is true that if these gases be then left to themselves, they will, the moment the temperature falls, again associate or burn; but if precautions are taken to cool them rapidly after attaining that high temperature, they will be found as a mechanical mixture of oxygen and hydrogen simply."

Now, does not this action take place to a certain extent in the case of external fire-brick combustion chambers? Here there is very little to abstract the heat of combustion, and the fuel gases and oxygen of the air combine until a temperature is reached which prevents further combustion. The partly-associated gases are then brought suddenly into contact with comparatively cold boiler tubes, and I think that it is not too much to say that a great portion of the non-associated gases are cooled so rapidly that they never do combine, and are thus a source of great loss of duty, hydrogen, carbonic oxide, and oxygen passing into the chimney as though they had never been in contact at all. Of course, this reasoning does not apply if the external fire-brick chamber is merely a gas producer, as it then performs its proper function, viz., that of gasifying the fuel. Now, if we take an ordinary fire-box surrounded with water, the case is different. The cold sides of the fire-box are abstracting heat from the burning gases in the presence of a mass of incandescent fuel; association is rendered much more complete, and loss in the boiler tubes prevented. In fact, the uncombined gases which find their way into the chimney in the former case are in the latter forced by the cooling effect of the water jacket to continue in the fire-box, and render up their heat to it.

In the gas engine loss, through non-association, will not take place if expansion be carried far enough, but its effect upon the indicator diagram is extremely marked, because, owing to the enormous cooling effect of the water jacket, the expansion curve ought to fall a great deal below an adiabatic line, whereas it keeps very fairly up with it. This will be readily understood when we consider that in a good modern compression engine there is about 58 per cent. more gas in the mixture than is necessary to obtain the temperature after explosion, which is actually observed. Nearly 37 per cent. of gas is, therefore, not associated at the moment of complete inflammation, but as expansion proceeds this 37 per cent, gradually combines and keeps the expansion curve up much higher than it would otherwise be. If the cylinder were a non-conducting one the curve of association would evidently lie between an isothermal and an adiabatic one, but the precise nature of it would be a very complex business to ascertain, as all the points of incipient dissociation of the compound gases must be determined, as also the law of dissociation as the temperature increased.

In the Lenoir engine, where the ration of expansion was very low, and the temperature at the end of the stroke very high, there is no doubt that a quantity of non-associated gases passed into the atmosphere. In the Clerk engine the temperature of the exhaust is only 656 deg. Cent., at which point it may be safely assumed that association is complete. In conclusion, Sir, I would wish to point out the very indiscriminate use of the term dissociation by even very scientific men. Dissociation is the separation of gases that have already associated or combined. This action does not exist in the gas engine at all events. At the moment of explosion the gas and oxygen of the air combine until the high temperature produced stops it, and further association can only proceed as the temperature falls through the performance of work and loss of heat through the sides of the cylinder. In no case does dissociation take place unless, perhaps, at the moment of explosion, when part of the aqueous vapour, or rather steam gas first produced, may be, and probably is, dissociated towards the completion of inflammation by the carbon still burning to carbonic acid or carbonic oxide—carbon and oxygen requiring a much higher temperature to stop their association than does hydrogen and oxygen. Imperfect association at the instant of complete inflammation is the first phenomenon, and gradual association during expansion the second. The latter may be perfected at the end of the stroke or not, depending, of course, upon the ratio of expansion.

St. Neot's, Hunts, October 28th. Anthony S. Bower.

WATER-TUBE BOILERS.

Sir,—I agree with most of your observations in your issue of the 7th ultimo when referring to the water-tube boilers made up to four or five years ago; but I entirely differ from you in applying them to some of those made at the present time. The defects you speak of were acknowledged to exist long ago, and appeared more prominent in those trials of water tube boilers for marine purposes which I shall shortly refer to, and which for this reason were most valuable as indicating where improvements were needed. The Root boiler has had two trials at sea in this country, and I was in both cases placed in charge of the fixing and trials. The first was in the s.s. Malta, an old vessel of about 2000 tons, which was fitted with four 100-horse power nominal, of the first, or three-way pattern, in 1870-71. These boilers had ample surface for supplying the steam required under ordinary conditions, but if for any reason forcing was attempted, the water simply refused to remain in the tubes, and the india-rubber joints would blow all over the place. The vessel made, however, several voyages, and the boilers went on fairly well, but some twelve or fifteen months after she sprang a leak on the return voyage from the Baltic, and with difficulty reached Hull, and when I saw her there the boilers were under water. All the machinery was subsequently sold as scrap, and I do not know what became of the ship.

Root boilers were in 1871-72 put into the new Birkenhead ferry steamer Birkenhead. These were a great improvement in construction on those of the Malta, but a serious misunderstanding occurred as to the quantity of steam required, and this was unfortunately not discovered until it was too late for alteration. The boilers were specified to supply steam of about 70 lb. pressure, cut off at one-third stroke, whereas they were actually called upon to supply steam of about 50 lb., cut off at two-thirds stroke. The boilers were for this too small, and the only way in which they could be worked, and actually were worked for three or four years, was to get up high pressure at the landing stage, which on arrival at the other side would be all spent. If they had not really been better boilers than those in the Malta they would never have lasted as long as they did. Serious failures which followed with other types of water-tube boilers at sea created a strong prejudice against them all, and no marine engineer or shipowner has been daring enough to give them further trials.

I dealt in my former letter, which you published on the 21st ultimo, with some of the improvements made lately, and I will add to this that in nine cases out of ten where the water-tube boiler has given dissatisfaction on land, this has been owing to accumulation of scale in the tubes and attendant consequences. As pure water is here the exception and not the rule, and as a chemical process for purifying the feed-water is not always convenient on account of expense, I mentioned the Stollwerck purifying process, as it does not require chemicals, is entirely self-acting, and only requires attention to periodical cleaning. As now made, it forms the steam space for the boiler; it is, in fact, part and parcel thereof, and I have never heard that it has failed in its action for any water-tube boiler; but, on the contrary, I could name several instances where it is as complete a success as in the case I mentioned in my former letter.

To illustrate that a rapid circulation takes place in some water-tube boilers as now made, I may mention that some of 35-horse power nominal with tubes 13ft. long by 2¼in. diameter outside by 10 b.w.g., and Stollwerck's purifier, have been working for about eighteen months with forced draught, and that the tubes appear quite sound. I think you will admit that the water must be "solid" and good to effect this. I can supply a water-tube boiler to evaporate, with natural draught, 100 cubic feet of water per hour into steam of 120 lb. pressure, or more, ready fixed for work, for 10 per cent. more money than equal power of best make Lancashire boiler, but I do the work with 7½ per cent. less fuel. My boiler occupies 126 square feet of floor space, inclusive of setting, by 12ft. 6in. in height; it weighs with all framework—of course without brickwork—24 tons, and contains at mean water level 6¼ tons of water. You can, further, force this boiler as hard as any other kind, and without injury.

My idea of a marine water-tube boiler is not the Root; another type occupying less space and made entirely of wrought iron, and which is at the present doing good service as a land boiler, is what I recommend for this purpose, and I hope some marine engineer will be found bold enough to try it.

Meanwhile, I trust that the facts I have given you, when coupled with the undisputed and all important safety of a well constructed water-tube boiler, also their greater facility of transport, repair, &c., may appear to you good reasons why they should have an equal chance with other kinds and not rest under the condemnations at present affecting several really good water-tube boilers.

City Ironworks, Lincoln, November 1st. Conrad Knap.

SOFTENING WATER.

Sir,—Your articles relating to the difference of results obtained by professors of an exact science in analysing the water pumped from the Severn Valley Railway tunnel, and to their difference as to the fitness of such water for the supply of Bristol, have led to some correspondence in which my name has been associated with the process of the late Dr. Clark. What it pleased me ten years ago to call the "Porter-Clark" process has always been explained in my publications as being, in fact, certain mechanical arrangements admitting of the adoption of Dr. Clark's process where it was of most value, and where it could not be availed of, for want of space, for dealing with as theretofore it had been dealt with. By an adaptation of the filter press, I utilised the precipitate produced in the working of that process as the medium of filtration, and of filtration under pressure, so that the process can be carried on night and day continuously in the same vessels. It does not follow that where space is not of importance I should employ filter-presses.

I have pointed out in all my publications how simple as well as beautiful a process that of Dr. Clark's is, and that it can be demonstrated in a tumbler-glass, in a tub, or tank, as well as in the reservoirs the late Mr. Homersham designed for Canterbury, Caterham, and some other places. The Colne Valley Company, at Bushey, have an example of that system.

As to the particular water in question, Mr. Wanklyn tells us that it contains an objectionable quantity—as to hardness—of carbonate of magnesia, as well as carbonate of lime. As I apprehend the matter, Mr. Wanklyn affirms that this magnesia can be chemically disengaged and precipitated by Clark's process; while Dr. Frankland and others (?) say it cannot; and that therefore this Severn tunnel water cannot be made fit for the water-supply of Bristol. Sir, I side with Mr. Wanklyn.

When one of my sons was a student, in Dr. Frankland's time, at the Royal School of Chemistry, the late Demonstrator in the laboratory remarked to me with a glance at the student,—"Time and plenty of thrashing are often of importance in the practice of chemistry." I, therefore, in dealing with magnesic waters, act upon the suggestion of Dr. Valentin, and give both. I may not further argue this point of difference between learned professors. I stand, however, in less awe of chemists than of chemistry; the latter is, doubtless, exact and unprejudiced; I will not agree to so much as to the former.

I noticed in the correspondence that has arisen upon your articles a very sensible letter from Messrs. Bryan Donkin and Sons, from which I infer that they understand the merits of Clark's process and water softening better than they did when they brought to my notice the French apparatus I declined to take in hand. That apparatus was described afterwards in your columns, and Mr. Howatson, who makes recently so frequent use of them, became an agent for introducing it as the *ne plus ultra* in water softening.

Mr. Howatson and his coadjutors, Messrs. Gray and Son, send you letters in pairs, and at frequent intervals, announcing that they, too, have succeeded in softening water by Clark's process, in an apparatus which, "being of the most recent date, and quite distinct from any other, supersedes other previous and similar inventions." That is comforting for some of us! but that is the red-letter type of their prospectus.

They arrive at these results of reduction of hardness by mixing their "lime or soda solutions in two top tanks, beneath which are two small tanks, fitted with floats to maintain the levels, and cocks and nozzles of requisite sizes, so that with equal pressures the flow of water to be purified, and the chemical solution—lime water of Clark's process—for the purification, can be regulated with the greatest accuracy." These are the means by which Mr. Howatson and Messrs. Gray arrive at those admirable results with Clark's process they have been at such pains to publish.

Do I mean this as ridicule? By no means. They pay me the compliment of adopting my earliest plan as to the solution tanks—indeed, Sir Frederick Bramwell designed them in 1877; and as to the nozzles with "proportional areas"—my term—they will find it in my patent of 1879. My friend, Mr. Johnson, of Lincoln's-inn-fields, is their patent agent as well as mine, and the patent cannot escape them.

JOHN H. PORTER.

165, Queen Victoria-street, London, E.C., November 1st.

WATER SOFTENING—THE CLARK PROCESS.

SIR,—Allow us to contribute to this interesting discussion by stating the result of our practical experience. During several years' working of the Clark process, and treating waters of all kinds and for many purposes, we have not found a single instance of bad water that could not be very materially improved by our apparatus. And the improvement was not limited to the removal of the salts of lime and magnesia, although in most cases this forms the chief object in view. The lime and magnesia are precipitated throughout the liquid in exceedingly fine particles, and we find, beyond a doubt, that these particles seize the minutely divided matter in suspension in the water, and in sinking carry it with them to the bottom. In this way we are constantly able to render perfectly bright, without filtering, water which was badly discoloured by suspended organic matter. We have kept samples of hard and softened water for long periods, and while the untreated water speedily became green from fungoid growths, the softened water would remain perfectly bright, thus proving the reality of the cleansing action we have referred to.

It is a very common mistake to think that water treated by the Clark process is rendered unfit for drinking or cooking purposes. This is the reverse of the truth. Nothing need be added to the water which would in any degree be injurious to health.

Of course, in the mode of treatment employed with the Stanhope purifier, the form of apparatus which we ourselves use, the original unelaborated process originally adopted by Dr. Clark is constantly modified in accordance with the nature of the water, the degree of softness to be obtained, and the purposes for which it is required, but in no case does the resultant purified water contain anything deleterious, although our apparatus is now treating more than six million gallons daily of water of every kind.

We fancy that the opposition of chemists to the use of this process is more imaginary than real, and that the retarding influence is that of the engineers, many of whom distrust any mode of treatment to which the word "chemical" can possibly be applied, overlooking the fact that even the action of the air is purely chemical. Many of our large customers employ chemists of high repute solely for their own business, and in no instance has one of these gentlemen given any opinion in any way adverse to the process. We may say, on the contrary, that such eminent authorities as Professor J. J. Hummel, of the Yorkshire College, Leeds, Mr. John Womersley, chemist to Messrs. J. and J. Colman, of Norwich, and Mr. D. K. Clark, have openly declared in its favour.

THE STANHOPE COMPANY, Limited.
JOHN S. SAWREY, Managing Director.

20, Bucklersbury, London, E.C.,
November 2nd.

SIR,—The interesting article in your issue of October 21st has called forth two letters which appear in your last week's issue. These letters can hardly be called replies to the broad question you raise, because it is a very easy matter to treat a few hundreds of gallons per day effectually for the purpose of preventing hard scale or soft deposit in steam boilers, &c.; but it is not so easy to soften and purify effectually millions of gallons per day for use by the inhabitants of a large town. There are many ways of procuring pure, soft water for steam boilers, and besides the softening systems described in your columns from time to time, we have the surface condensers, which yield a pure and soft supply, but we have only the Clark process holding the field for town appliances, as at Canterbury and the Colne Valley.

A. B. C.

London, November 2nd.

FREE TRADE AND NO TRADE.

SIR,—As I see from the letter of "Trader" in your issue of the 14th inst. that he is unable to realise the advantages of that great system of Free Trade which has brought the trade of this country into its present condition, I should feel obliged by your giving me a small space in your paper, in order that I may show him how entirely wrong his ideas are according to Free Trade doctrines.

"Trader" speaks of a judicious import duty, to be followed by the employment of numbers of people who are now idle. In talking of idle people he uses a term quite out of date with Free Traders. According to Mr. Giffen, a great authority on this question, when imported goods displace native production capital and labour are freed for other industries; this feature was overlooked by Free Traders in the past, and it has been reserved to the present generation to make the discovery in seeking for the advantages of Free Trade under existing circumstances.

If "Trader" can grasp this idea, he will see that if his judicious import duty had the effect he anticipates, it would just do away with this freedom for other industries which is the greatest privilege we now enjoy from our fiscal system.

A proof that loss to the country must arise from employing our own people in the manufacture of goods which we now import would be found in the reduction of the volume of trade, which is taken by Free Traders as one of the infallible tests of our prosperity; they add the totals of exports and imports together, and prove that we are making great strides. As it is, if our exports have decreased, increase of imports has more than made up the amount, and the total has continually increased. What would it be if both went down together?

It is possible that the true bearing of these figures may have been misunderstood by "Trader," but in this country we are blessed with experts who make the science of political economy their special study; and why not take their opinion? In this matter of Free Trade they are in advance of every nation on this earth; and, if they are let alone by such people as "Trader," they will keep ahead of everybody.

I must not trespass on your space, or I could give other equally good reasons against the employment of our own people, but with your permission may do so in another letter, as I am afraid Free Trade is seriously attacked, and should now be properly supported by those who can give good reasons for their belief in it.

Park Lodge, Heath-road, Hounslow, JOHN BRETT.
October 25th.

SIR,—"Protectionist" has misread my letter of October 19th, for it is an admission that in theory "Trader" is right, but in practice he is wrong. Let me try to show this by examples as briefly as possible.

A few years ago our cities were supplied with granite entirely from Cornwall, Guernsey, and Aberdeen. The industry kept many quarrymen, &c., employed, and they lived on British goods of all kinds. Now a large part of that granite comes from foreign countries; they take payment in British goods, and practically, therefore, the trade in general goods is neither helped nor hindered, but the employment of British subjects as quarrymen has been much reduced. Foreigners consume the British goods instead of our own people.

Similarly a few years ago great numbers of Englishmen were employed as sugar refiners, and they consumed British goods; now nearly all our refined sugar comes from abroad. It is paid for as formerly in British goods, so again the general trade in goods has been neither helped nor hindered, but employment in this country has been diminished, and the goods that pay for the sugar are consumed by foreigners, not by Englishmen.

Our ships get freights to carry that our railways used to carry, but that is only robbing Peter to pay Paul.

The list of internal industries that have been thus injured might be much extended, and in every case a slight duty on the foreign goods would restore employment to our people, without laying any appreciable burden on the consumer. It is no answer to this to say that the men discharged from these industries have found work in others that are increasing, for we might have still increased our present successful industries and had the others as well. The retention of the granite-quarrying industry, for instance, would not have prevented any development of industry in other directions that has taken place.

The evil that afflicts our agriculture is similar, but far more serious either to remedy or to bear: to bear, because agricultural interests are so great; to remedy, because a duty sufficient to be a remedy would add 1d. to the 4lb. loaf, and this would be called a political grievance.

Suppose, however, that we were sufficiently patriotic and united to place all these industries under Protection, and suppose that our Colonies met us by allowing—to us only—a discount of, say, 10 per cent. on their present import duties, and that we let their produce in at 10 per cent. discount on the duties we would charge to the United States of America and Russia, &c., what would be the consequences?

We would regain many internal industries that our Colonies do not touch. The increased expenditure of farmers and landlords would add still more to our internal trade. The growth of food in Canada, India, and Australia would be stimulated, and their demands on us for railway plant and for manufactures of all kinds would be stimulated *pari passu*. Our trade with the United States of America and the rest of the world would diminish, but not to the extent that that with ourselves and our Colonies would increase. At first we would find ourselves vastly bettered.

But emigration would cease, population would rapidly accumulate, and in ten years' time we would find ourselves as troubled as we are now, and with a more unwieldy population helplessly dependent on an artificial state of things that would ever be liable to be overturned at the caprice of Parliament.

This, to my mind, is the conclusive practical argument against Protection. Before we dare try it we must have a political system in which laws affecting trade cannot be easily repealed.

5, Angel-place, Edmonton, Nov. 1st. WM. MUIR

A DEFECTIVE BRIDGE.

SIR,—Your correspondent, "Inquirer," in your issue of last week, raises a question of the greatest importance in good girder design. I refer to the proper arrangement of truss, so as to allow of the extension or compression due to the amount of duty each member has to perform. It must never be forgotten in designing a lattice girder that we have to deal with an elastic material when employing iron or steel. It is true that this elasticity is but small, but such as it is, we cannot have this alteration in length without a corresponding stress, nor the stress without its equivalent elasticity; or, in other words, a member must be so situated that if it is to take tension it is possible for it to extend without interfering with the extensions or compressions of the other members of the truss.

It is a little difficult to make a diagram of the girders complained of by "Inquirer," to agree with his description; but if I understand him aright, the struts are vertical and the ties inclined, right across the bridge from end to end in both directions. If this is so, it stands to reason that all the so-called ties which are situated past the centre of the bridge—*i.e.*, between the centre and the assumed theoretically lightly strained ties nearest the abutment—must of necessity come into compression instead of tension, owing to the truss becoming distorted, so as to shorten the diagonal distance occupied by the so-called tie, instead of its being increased, which is the only way in which the ties could ever act as such.

A very usual illustration of this is to be found in girders of a simple truss, in which the diagonal ties are continued past the centre of the girder, so as to take—so thinks the designer in his shortsightedness—the counter strains due to passing loads.

An inspection of such girders of moderate dimensions will invariably reveal these bars buckled—that is, if they are thin flat bars.

The only remedy I can suggest to "Inquirer" is to have the flat bars either cut out as useless, or else replaced by members capable of taking compression, in which case they will help to keep the bridge up.

A sketch of the bridge would, I think, be of great use in considering the case, and would, I feel sure, show that the design, and not the workmanship, is at fault.

WILFRID STOKES.

November 2nd.

INVENTION OF THE CIRCULAR SAW.

SIR,—The interesting notes given by Mr. M. Powis Bale on this subject in your issue of 21st inst. show undoubtedly that Samuel Miller anticipated the Americans in bringing out the circular saw. An account of its invention by a contemporary of Miller's, by one Murray, is found in the history of Mansfield, Nottinghamshire. I have taken pains to sift all the information I could obtain on the subject, and it seems that Miller's patent could only have preceded Murray's invention by a few years. At that date, 1770-80, when there was no penny post, no telegraphs, nor railways, it can well be supposed that the two inventors worked out the same invention independently. I have little doubt that Murray's invention was original. I have communicated with his granddaughter, who is still alive; she says that he made the first of wood, and tried it on a carrot; the date of this must have been about 1782, or only a few years after Miller's patent. The original saw was for years carefully preserved by a friend, and was eventually lost in a fire. The Murray above named was the son of the favourite and faithful servant of Lord Byron, at Newstead Abbey. Murray, the inventor, was employed as handy man at a local sawmill.

JOHN PLACE.

34, Highgate-road, N.W., Oct. 30th.

RAILWAY BRAKES.

SIR,—I notice in your paper for this week that Mr. Clement E. Stretton, in commenting upon the last issued Board of Trade Returns, alleges that a large number of vehicles have been fitted with two systems of brake, "because companies forming continuous routes cannot, or will not, agree upon one brake."

Now, Sir, whilst it cannot be denied that vehicles have been fitted with brakes as described by Mr. Stretton, it seems to me that his statement as to the agreement upon the system of brake is liable to refutation, as the three leading trunk lines, with termini in London—to which Mr. Stretton's remarks of course apply as forming continuous routes—have a complete agreement, as evidenced by their stock being equipped with the vacuum-brake. It remains, then, only for the smaller Scotch lines concerned to fit up with the standard adopted by these trunk lines to guarantee proper brake power being always available throughout the whole journey.

Mr. Stretton refers to the Highland Railway, but it appears they are rapidly fitting up the vacuum system, and therefore a complete brake connection with the L. and N. W. Railway will be assured. Considering the amount of stock now fitted with the vacuum-brake, it should not be difficult to have the same brake available on each journey, and that with a universal coupling

G. MITCHELL.

Hassendean-cottage, Gloucester-place, Windsor, Oct. 29th.

A PROVIDENT FUND FOR DRAUGHTSMEN.

SIR,—In consequence of a correspondence which has been carried on during the past few weeks in the *Building News*, the Society of Architects, which we represent, has been asked and has consented to lend its meeting room at St. James' Hall, Piccadilly, for a meeting of architects' and engineers' assistants on Friday, November 18th, to consider the advisability of forming a draughtsmen's provident fund.

By giving prominence to this in your next issue, you would be helping forward a movement which can only be productive of good.

The meeting will commence at 7 p.m., and all draughtsmen are invited to it, while those who are unable to attend would oblige by sending any suggestions they wish to make to the undersigned through the post before November 15th.

St. James' Hall, Piccadilly, London, W., Oct. 31st.

EDGAR FARMAN, Hon. Sec.
G. A. T. MIDDLETON, Secretary.

THE NEWCASTLE EXHIBITION.—The Royal Jubilee Mining, Engineering, and Industrial Exhibition at Newcastle, which was opened in May last by his Royal Highness the Duke of Cambridge, closed on Saturday. The total number of admissions, exclusive of attendants, exhibitors, and holders of complimentary tickets, was 2,092,273. It is understood that the Exhibition has been a financial success, but stall holders complain that their losses have been considerable, and tradespeople in the city also allege that they have similarly suffered.

GOVERNMENT SALE OF HISTORIC STEAMSHIPS.—It is not much more than a month ago since the Admiralty determined to offer for sale the first steam vessel ever used in the navy; and now it is announced that the Sprightly, another paddler nearly as old, is to come under the hammer as not worth further repair. The naval authorities in the reign of George IV. seemed to have taken some time in making up their minds to adopt steam propulsion, for at first they only ordered one steamer annually. The Monkey, which it is almost a crime to break up, was built at Rotherhithe in 1821, of 212 tons burden, with 80-horse power engines. The *St. James's Gazette* remarks:—"At the very least a model of this historical craft should be preserved." The second naval steam vessel was the Comet, built in 1822, by order of Lord Melville, in the Government dockyard at Deptford. She was of 238 tons and 90-horse power, and until a few years back she was in use at Portsmouth. The third steam vessel is the Sprightly, of 234 tons and 100-horse power, built by Messrs. Wigram and Green, at Blackwall, in 1823, and up to 1848 employed on the packet-service between Dublin and Holyhead. Since then she has been in use as a yacht or tender, and after running for more than half-a-century, is at last to go to the ship-breaker's yard. The original cost of this vessel was £10,429; but during the sixty-four years she has been employed her repairs have cost £38,552, or at the rate of £600 a-year. This scarcely argues that it is good policy to repair very old vessels.

ENGINEERING SOCIETY, KING'S COLLEGE, LONDON.—At a general meeting, held on Tuesday, October 25th, the president in the chair, Mr. A. K. Brydges read a paper on "Lighthouses." The author did not refer to the lighting of houses, but only gave particulars and descriptions as to the construction of different lighthouses. After a short sketch of the development of lighthouses from the early beacons up to those of the modern day, the author divided his subject into three classes: First, those upon headlands and large islands; secondly, on rocky eminences, too small to accommodate keepers' dwellings; thirdly, on rocks or reefs, either above or below water-mark. The first class do not require much skill in building, and the author only mentioned a few instances, such as the Belle Font and Beachy Head. The best example of the second class is the North Unst lighthouse, on the north coast of Scotland, which rises 250ft. above the sea-level, upon a conical pile of rocks. It was completed in 1858, at a cost of £32,000, including keeper's dwellings on shore. As belonging to the third class were mentioned the Eddystone, Bell Rock, and Skerryvore lighthouses. In the discussion which followed the paper, Mr. Preece gave some particulars as to the electric lighting of lighthouses, and the range of the light in clear and foggy weather. At a general meeting held on Tuesday, November 1st, the President in the chair, Mr. Long read a paper on "Railway Signalling." After a description of the three kinds of signalling, viz., fog, flag, and semaphore, and the uses to which they are put, the author passed on to a description of the semaphore signals as used at the present time, and the apparatus connected with them, including different forms of electric repeaters, and means of telling the signalman whether his lights are burning properly. The important question of interlocking gear was then gone into. By this means it is impossible by lowering a wrong signal to cause an accident. This system was introduced by Mr. Saxby and Mr. Chambers in 1860, and has been constantly improved upon lately, although the principle has always remained the same. The importance of this system can be hardly too much insisted upon, as it relieves the signalman of a large amount of responsibility. The working of the gear was very clearly pointed out by the author by means of a working drawing, showing the interlocking gear, the signals, and the points. After the apparatus for locking the points had been described, the block system was explained and discussed, as well as the permissive block system. A discussion then took place, in which Mr. Brydges, Mr. Vaughan, and Mr. Gask took part, upon the block system and means for automatically registering what goes on in a distant signal-box. After a vote of thanks to Mr. Long the meeting adjourned.

HOT-AIR ENGINE.

MM. BÉNIER FRERES, PARIS, ENGINEERS

(For description see page 366.)

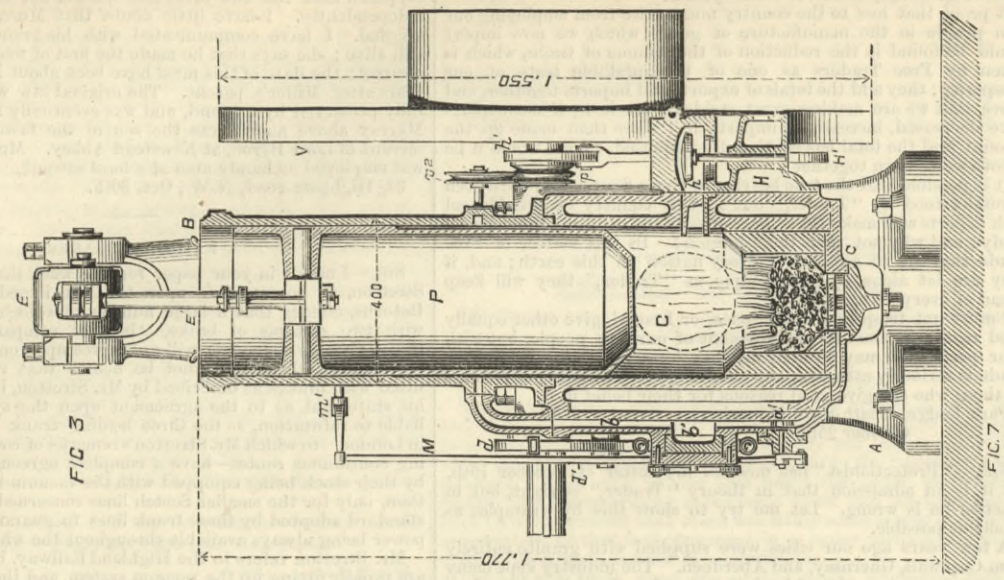


FIG 3

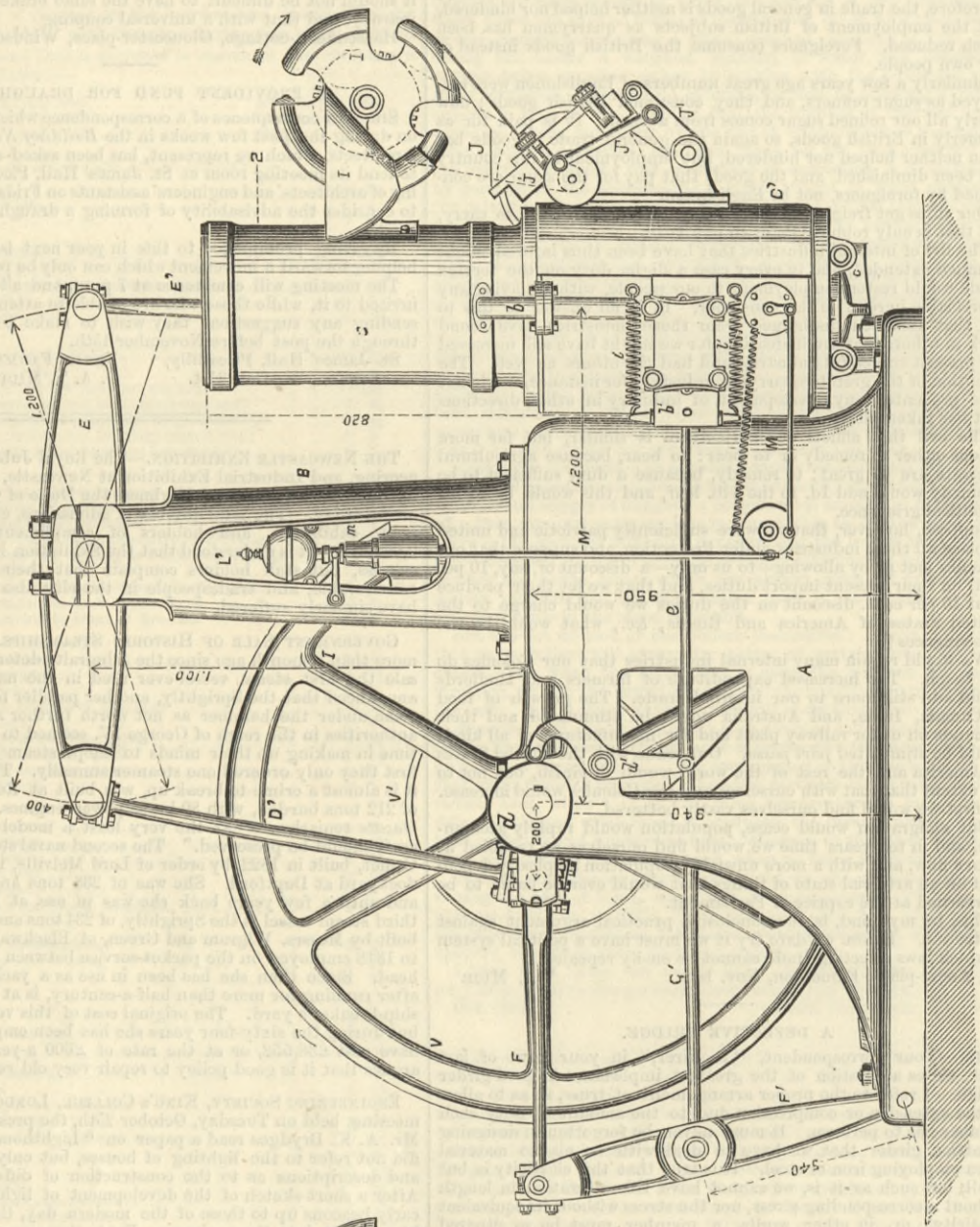
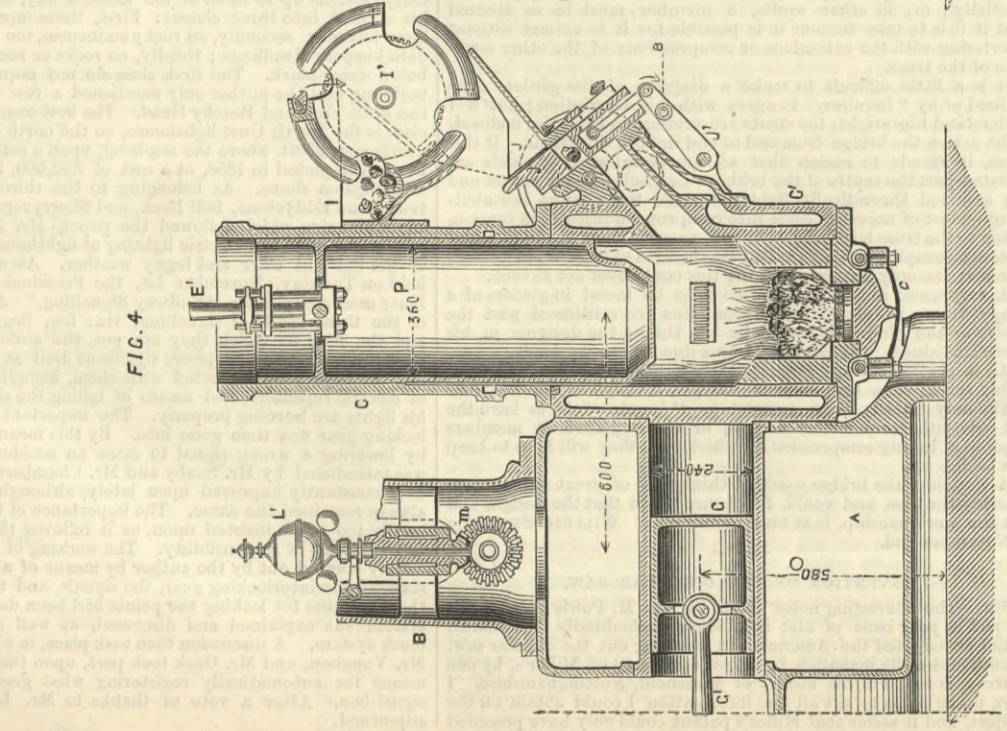


FIG. 4



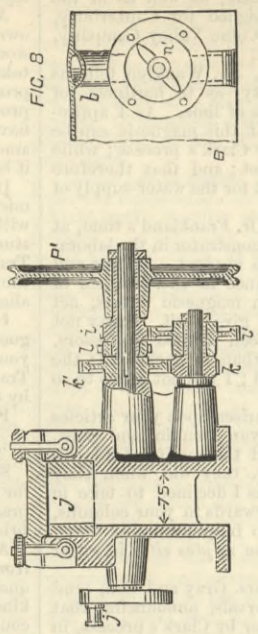


FIG. 7

FIG. 8

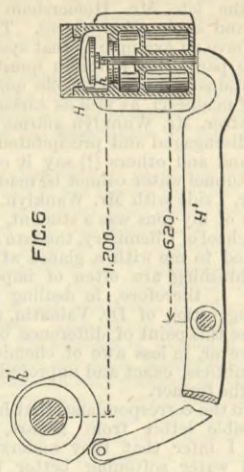


FIG. 6

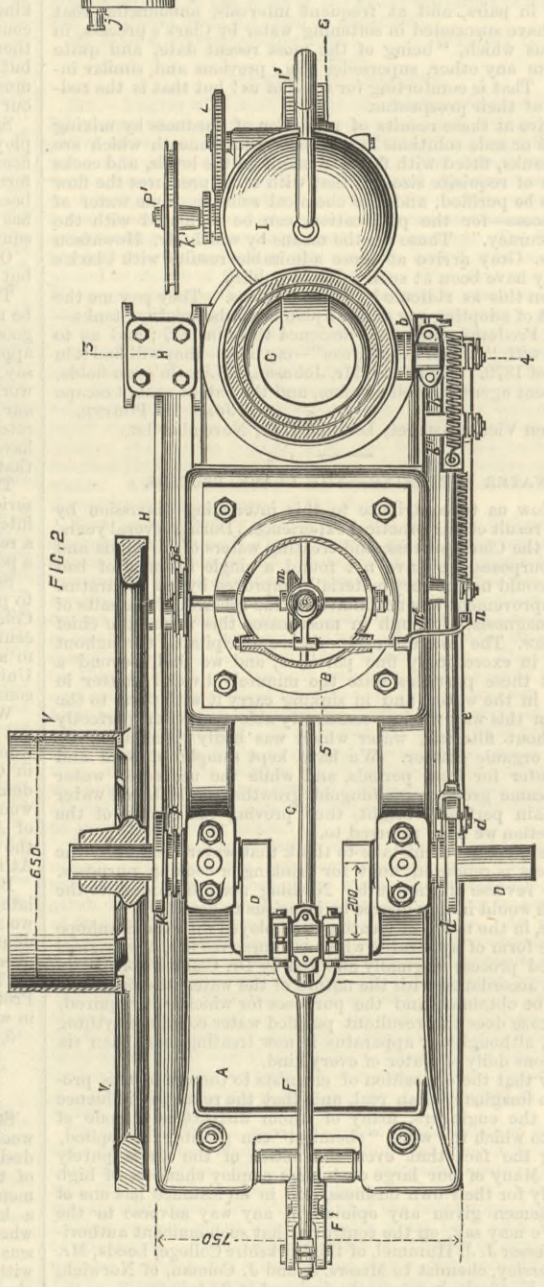


FIG. 2

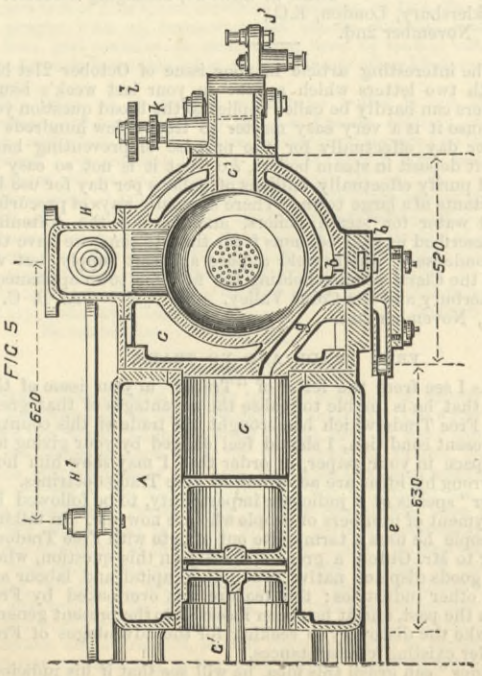
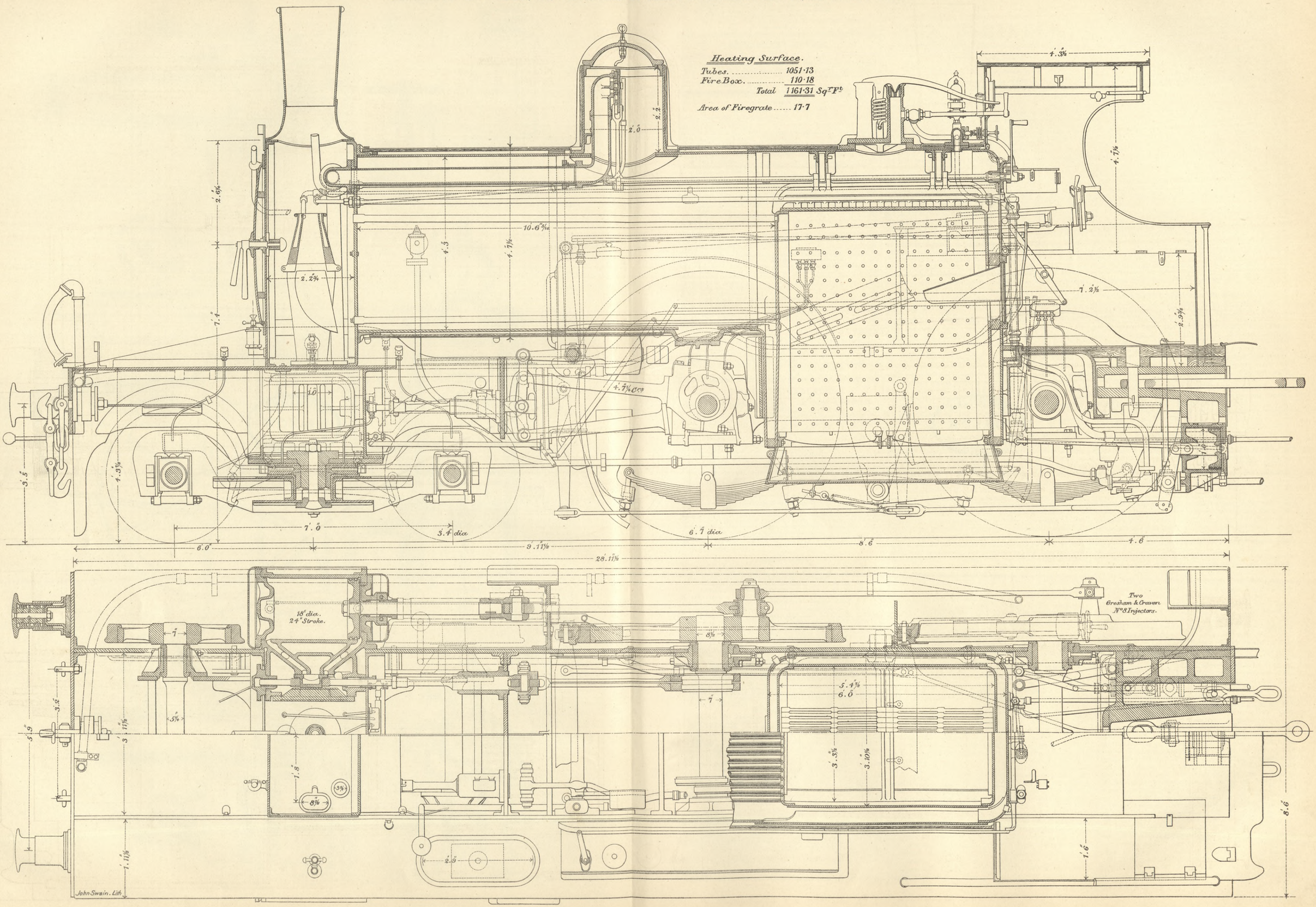


FIG 5

FOUR-COUPLED OUTSIDE CYLINDER LOCOMOTIVE, LONDON & SOUTH-WESTERN RAILWAY.

DESIGNED BY MR. W. ADAMS, C.E.; CONSTRUCTED BY MESSRS. R. STEPHENSON AND CO., NEWCASTLE-ON-TYNE.



FOREIGN AGENTS FOR THE SALE OF THE ENGINEER.

PARIS.—Madame Boyveau, *Rue de la Banque.*
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LEIPSIC.—A. Twietmeyer, *Bookseller.*
NEW YORK.—The Willmer and Rogers News Company, 31, *Beekman-street.*

PUBLISHER S NOTICE.

*** *With this week's number is issued as a Supplement a Two-page Engraving of a Four-coupled Passenger Locomotive on the London and South-Western Railway. Every copy as issued by the Publisher contains this Supplement, and subscribers are requested to notify the fact should they not receive it.*

CONTENTS.

TO CORRESPONDENTS.

Registered Telegraphic Address "ENGINEER NEWSPAPER, LONDON."

*** *All letters intended for insertion in* The Engineer, *or containing questions, should be accompanied by the name and address of the writer, not necessarily for publication, but as a proof of good faith. No notice whatever can be taken of anonymous communications.*

*** *We cannot undertake to return drawings or manuscripts; we must therefore request correspondents to keep copies.*

J. E. B.—*We fail to find anything original in your letter.*

C. J. L.—*We know nothing of the system of signalling to which you refer as having been tried twenty-two years ago on the Brighton Railway.*

W. H. B.—*We regret that we are unable to supply the information you ask for. Our drawings were copied from those in the Government report. You might obtain an answer by applying to the Marine Department of the Board of Trade, Whitehall.*

BEARINGS FOR HIGH-SPEED ENGINES.

(To the Editor of The Engineer.)

Sir,—Can any reader tell me what is the best material for the crank shaft bearings of an engine indicating about 100-horse power, and making 250 revolutions per minute? I am told white metal is best, but I cannot find what is the best composition. I have read in some place that a bearing made of alternate strips of lignum vitæ and Babbitt metal will give splendid results, with water as a lubricant. Can any reader say if they have tried this? Steam Launch.

Cowes, November 2nd.

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Remittance by Bill on London.—Austria, Buenos Ayres and Algeria, Greece, Ionian Islands, Norway, Panama, Peru, Russia, Spain, Sweden, Chili, £1 16s. Borneo, Ceylon, Java, and Singapore, £2 0s. 6d. Manilla, Sandwich Isles, £2 5s.

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Advertisements cannot be inserted unless Delivered before Six o'clock on Thursday Evening in each week.

Letters relating to Advertisements and the Publishing Department of the paper are to be addressed to the Publisher, Mr. George Leopold Riche; all other letters to be addressed to the Editor of The Engineer, 163, *Strand.*

MEETINGS NEXT WEEK.

The Institution of Civil Engineers.—Tuesday, November 8th, at 8 p.m.: Address of Mr. George B. Bruce, President, and presentation of medals, premiums, and prizes awarded during last session.

Society of Engineers.—Monday, November 7th, at the Westminster Town Hall, at 7.30: Ordinary meeting. Paper to be read:—"Primary Batteries for Illuminating Purposes," by Mr. Perry F. Nursey, past president, of which the following is a synopsis:—Introduction—A wide field open for primary batteries—Their principles and history outlined—Descriptions of batteries for special purposes, and batteries for general lighting, including those of Holmes and Burke, Ross, Coad, Lalande, Skrivanow, Upward, Pollak, Newton, D'Humy, and Friedlaender; and the Regent, the Union, and the Eclipse batteries—Conclusions.

Society of Telegraph Engineers and Electricians.—Thursday, November 10th, at the Institution of Civil Engineers, 25, Great George-street, Westminster: Council meeting at 7 p.m. Ordinary meeting at 8 p.m. "Deep-sea Sounding in connection with Submarine Telegraphy," by Edward Stallibrass, F.R.G.S., member.

Junior Engineering Society.—To-day (Friday), at Hawkstone Hall, Westminster Bridge, "The Illumination of Lighthouses," by F. R. Taylor.

THE ENGINEER.

NOVEMBER 4, 1887.

THE PRESTON DOCK SCHEME.

Common sense has prevailed at Preston. The Town Council has had to give way to the ratepayers, and the course we have advised has been adopted. An independent engineer of eminence is to be called in to report on the dock scheme, its progress and prospects. The people of Preston, are we think, to be congratulated, and will owe something to Alderman Hibbert and others who have made a firm stand against the raising of more money to be spent on the Ribble. On Wednesday, a meeting of ratepayers opposed to further expenditure without inquiry, was held in the Preston Guildhall, and after some discussion a resolution was put by Mr. Coulthard to the following effect:—"That the Town Council be memorialised:—(1) To take the opinion of an independent river engineer upon the sufficiency of the proposed works, and estimates, particularly that for dredging, whether it is probable that a navigable channel is likely to be made by the scour of the river after the dredging from the dock to the end of the training walls has been completed; if not, whether it will be necessary to dredge beyond the end of the south wall, and if so, how far and the probable cost; whether it is likely to be necessary to extend the south wall seawards, and if so, how far and the probable cost. (2) To give an assurance before the poll is taken that no further extensions will be made, and that the liabilities will be kept within the borrowing powers until Parliamentary sanction has been obtained for any proposed extensions. (3) To pay the engineer by salary and not by commission. (4) To alter the constitution of the Ribble Committee so that it will command the confidence of the ratepayers. (5) To restrict the present application to Parliament to the sum of £150,000." The resolution was carried all but unanimously. On Thursday the monthly meeting of the Preston Town Council was held, and after a good deal of conversation, Mr. Coulthard's resolution of the previous night received the assent of the Council. A selection of names of engineers eminent for their skill and experience in dealing with rivers will be made; from these three will be picked out and the names written on slips of paper. These will be put into a hat, and the first drawn will be that of the engineer requested to examine and report on the whole scheme. To all this there can be no objection. Meanwhile no attempt is to be made to raise money.

The more carefully the questions at issue are considered, and the fuller the information obtained, the more remarkable does it appear that any opposition should have ever been offered to the calling in of an independent, unbiased authority to report on the scheme. The Ribble Committee seem to have regarded the proposal to obtain further skilled advice as a direct insult to themselves and to Mr. Sykes. In this the Committee betray a lamentable ignorance of professional etiquette. It is perfectly well known that the work of making and maintaining a channel from Preston to the sea must be, in many respects, unique. There is absolutely nothing in the world precisely analogous. Under such conditions it is no insult to any engineer to say that he ought to have his opinions examined by experts. No man is infallible, and Mr. Sykes is certainly not superhuman. He is, of all other men, the one who ought to be best pleased to have what is really nothing more nor less than the best professional advice. We say "advice" with premeditation, because the report of the consulting-engineer must go much further than a mere statement that the work is or is not practicable. We have ourselves no doubt that the decision will be that a channel can be made and kept open from Lytham to the sea. We also believe, however, that the cost will be found to be enormous; so great indeed, that it will be an interesting question whether it will or will not be best to abandon the whole scheme and put up with the loss already incurred. It may be, however, that the new estimate, while much higher than that of Mr. Sykes, may still be sufficiently low to induce the Preston ratepayers to proceed with the work. Under such circumstances, the advice of the consulting engineer ought to be of the utmost value to Mr. Sykes, not only as a guide to him in carrying out his task, but as relieving him of a great load of responsibility. The Ribble Committee are in a very anomalous position; if they have done all for the best, and are quite satisfied with the sufficiency of the estimates on the strength of which they propose to borrow half a million of money, then they should court investigation by a member of the profession who has no ends to serve one way or the other. If he says they are right they can face their foes anywhere and everywhere. The reluctance manifested by a large party in the Town Council to call in further professional assistance has rightly or wrongly established the idea that the Council are afraid to submit the details of the scheme to independent inquiry. We are glad to find that wise counsels have at last prevailed, and that a course which should have been followed in this case—as it has been in many others—the moment it became necessary to raise more money, is at last to be taken.

During the discussion which took place in the Guildhall on the night of the 26th ult., certain remarkable statements were made, which leave the impression on our minds that nobody in Preston knows very much about the amount of work to be done. For the accuracy of the figures we are about to give, as a matter of course we do not vouch. We doubt very much if any one can say that they are more than a rough estimate. It will be remembered that much confusion exists in Preston and elsewhere as to what the extent of the works estimated and contracted for is to be. We may put the docks on one side; they present nothing for discussion at present. From Preston to Lytham is a distance of about seven and a-half miles, and the river bed is to be deepened and straightened, and at the place where the Ribble debouches on the sands at low water, training walls are to be constructed. But from Lytham to the bar is six miles. Is there to be a channel dredged through this length, or not? Is it for the construction of this that a part at least of the additional £500,000 is wanted? So far as we can make out, it is not contemplated by Mr. Sykes to make any such channel, but it is assumed that a channel of some kind will make itself, so to speak, by scour. On this point we quote Alderman Hibbert. Speaking at the Guildhall meeting, he is reported to have said:—"The ratepayers now heard officially for themselves what was in the Bill, and yet Alderman Forshaw had told them in the Council, backed by Mr. Davies, and there was a long rigmarole in one of the papers which endeavoured to set forth that the estimate of £94,000 for dredging did not include plant! It was the dredging of the Ribble which was the most important part of the undertaking. The making of the channel from the bar to wherever the new dock was to be was the vital portion of the undertaking, and moreover the portion that ought to have been undertaken first, and the estimates for which should have been most carefully considered. They were told that the estimates were carefully considered, and Sir John Coode and other eminent engineers went before a Parliamentary Committee, and said that this complete scheme for making the channel from the bar to the dock for a length of sixteen miles would cost—dredgers and plant included—£90,000 odd. What did Mr. Sykes say to-day? That the dredging would cost £232,000, and let them remember that that enormous sum did not take the dredging from the bar inwards, but from the dock sill seawards for a distance of about seven miles! He was the only one who dragged that admission with great difficulty out of Mr. Sykes in the Council Chamber."

We have already pointed out what should be known to everyone, viz., that the utility of docks must be and is greatly dependent on their accessibility at all states of the tide. It has been said that the Mersey, Birkenhead, and Liverpool prove that such accessibility is not essential. We have never said that it was; but there is really no true analogy between the Mersey and the Ribble. Ships have not to lie at Liverpool in a wide roadstead for hours off a sand-bank practically dry at low water; and the channel up the Mersey is good, once the bar is crossed. This is entirely a different state of affairs from that presented by the Ribble. As to whether Lytham can or cannot be conveniently reached by large steamers in the absence of what we may term a special canal some six miles long through the sands from Lytham to the sea, must at present be a matter of opinion to a large extent, but not wholly. It must not be forgotten that vessels now run up to Preston. It is interesting to hear what the captains of such vessels have to say on the subject. One of them, the captain of the Lady Alice Kenlis, writing to the *Preston Chronicle*, says:—"It takes me in the Lady Alice Kenlis as much as I can do to get out in safety in ordinary spring tides, and my vessel only draws 10ft. How on earth a vessel drawing anything like 20ft. ever can do so, I don't know! I intended to come here from Belfast yesterday—Friday—but I dare not do so, as I thought it would not be safe to run down to the bar at two or two and a-half hours' ebb. So instead of running down I stopped in Ramsey Bay until midnight, and I found I was right in not doing so yesterday, as when I got between the second and third buoys the whole place was a white foam—and this, mind you, only one hour and three-quarters before high-water—and had we steered by the buoys we certainly should have been ashore on the bank at the third buoy. I felt myself wondering how a 20-footer would have come in such weather! Even when I got up to the sixth buoy, at one hour and a-quarter before high-water, I had the greatest difficulty to find my way up, as the sea was breaking heavily right between the fair way of the buoys.'

If the docks are to be fully used there must be a canal to the sea. It has been said that as this canal would be made in hard marl, &c., it could be easily kept open. We have said, on the contrary, that sand would be washed in in gales, and fill it up. Let us once more quote some figures from Alderman Hibbert:—"Mr. Sykes gave as the quantities 20,000 cubic yards of red rock, 568,100 cubic yards of gravel and blue slutchy clay; 1,722,000 cubic yards of hard dry red marl, with gypsum and stones; *and* 1,301,500 *cubic yards of upper stratum of sand.* The quantities given in Mr. Walker's tender of 1885 were 2,310,000 cubic yards of rock, gravel, blue clay, marl, sand, silt, &c., to be got out for a length of seven and a-quarter miles. Comparing that figure with the figures of Mr. Sykes, they would find that practically they were about the same. But there was the next item in which there was an immense discrepancy. The tender for the upper stratum of overlying sand in addition to the quantity he had previously mentioned to them was to be found in printed documents, to which the ratepayers had access. The number of cubic yards of upper stratum of overlying sand, in addition to the quantity he had previously mentioned, was tendered for by Mr. Walker at 3,905,000 cubic yards, and yet Mr. Sykes put it down in his estimate at 1,301,500 cubic yards." The italics are ours. It will be seen that even on Mr. Sykes' own showing there is an abundance of sand lying ready to be carried into the navigable channel.

We have, we believe, now said enough to show how essential it is in the interests of the ratepayers that further advice should be called in. The Ribble Committee may be comforted, however. The course taken by the ratepayers presents nothing unusual. It implies no slight on the Committee or the engineer, and we have no doubt that all parties concerned will find in the carrying out of Mr. Coulthard's resolution relief from tension, and

an admirable solution of a very serious difficulty growing up between the ratepayers and the Town Council. We congratulate both parties.

REDUCTION IN THE PRICE OF GAS.

It is rather singular that attention has not been more generally directed to the substantial relief which the greater part of the metropolis is about to receive in respect to the charge for gas. The proposal for a continuance of the coal duty has met with vehement opposition in various quarters; but little is said concerning a reduction in the price of gas, equivalent in amount to nearly one-half the coal duty, and operating over a narrower area, thereby rendering the effect more perceptible. The announcement is made by the Gas Light and Coke Company—popularly designated the Chartered Gas Company—that on and after January 1st, 1888, its charge for gas to private consumers on the north side of the Thames will be 2s. 9d. per 1000ft. for common gas, and 3s. 5d. for cannel gas. The reduction will be equal to threepence per 1000ft. in the former instance and fourpence in the latter. At the same time there is to be a reduction in the price of gas supplied to public lamps over the whole of the company's district, north and south of the Thames. The fall in price for this portion of the supply is remarkable, and goes below the charge made by that pattern of cheapness, the South Metropolitan Gas Company. The rate in respect to public lamps is to be 2s. 2d. per 1000ft. for common gas and 2s. 8d. for cannel. The local authorities have thus every reason to be satisfied, and the ratepayer will be benefited as well as the gas consumer. It will be worth while to look a little carefully into this matter, to see what is the extent of the concession which the company is making, and what is the benefit to the recipients. For this purpose we have to commence by separating the northern portion of the Chartered district from the southern. The Chartered Company crossed the Thames when it absorbed the district of the London Company, which happened to lie on either side of the river. It is this southern portion of the old London district which is excluded from the coming reduction, for the good reason that it is already favoured with gas at 2s 5d. per 1000ft., and therefore has no desire to pay 2s. 9d. In 1876 the Chartered Company had carried amalgamation as far as it exists at present, except that it had not then absorbed the London. At that date the gas sold by the latter company was about equal to 12 per cent. of the quantity sold by the Chartered. Had the two companies then been amalgamated, the gas appertaining to the old district of the London Company would have been less than 11 per cent. of the total. We may assume that the same proportion holds nearly good at the present date. Judging from a map of the districts, we should be disposed to calculate that about half the gas now going into the area formerly possessed by the London Company is supplied to the northern side of the river. Consequently we cannot be far wrong if we reckon that 94 per cent. of the Chartered Gas is consumed north of the Thames. The total quantity sold by meter to private consumers in the last half year was 8,093,888 thousands of cubic feet. If we double this to get the year's consumption it becomes 16,187,776 thousands, and a reduction of 3d. per thousand feet will be found to exceed £202,000. If to this we add the reduction made in respect to the public lights we get a still higher sum. A further increment may be obtained by reckoning the reduction at 4d. instead of 3d. for the cannel supply. This will give an extra penny on 607,246 thousands, or rather more than £2500 per annum. Altogether, £205,000 per annum is certainly the minimum of the benefit accruing to the consumers of Chartered gas north of the Thames. Having recognised this side of the bargain, it will be interesting to compare the benefit thus conferred on the public, with the advantage accruing to the company. It is not at all likely that the shareholders will be able at once to realise the dividend of 13 per cent., permissible, under the reduced price of gas. But supposing they actually obtained such a dividend, we may as well see what it would amount to. The ordinary stock of the company, according to the last half-yearly statement, is £5,468,150. The entire capital account is much larger, but our present inquiry only relates to the ordinary stock. By charging the prices announced for next year, the company may receive on its ordinary shares an additional $\frac{3}{4}$ per cent., or about £41,000 in the course of the twelve months. Thus the public will receive a monetary benefit five times larger than that obtained by the company. The sliding scale, although admitting of high dividends, is thus seen to establish a partnership in profits which tends to the benefit of the gas consumer.

The extent to which gas may be ultimately cheapened is problematical, but the sliding scale is happily adapted to force down the price, by linking cheap gas with a high dividend. The companies placed under this system may be expected to put forth their best endeavours in order to realise a good price for their residual products. Competition is unfavourable to this policy, and hence it would be no marvel if the three companies which now supply London with gas were to amalgamate. In past years the Board of Trade considered it desirable that there should be at least two gas companies in the metropolis, it being thought that a degree of rivalry would thereby exist sufficient to put each company on its mettle. The low-priced gas of the South Metropolitan Company has presented an objection to amalgamation with the Chartered, especially as the latter company is entitled by statute to pay a dividend of 10 per cent., while charging 3s. 9d. for 16-candle gas; whereas the South Metropolitan Company can only pay the dividend while charging 3s. 6d. This difference of 3d. in what is termed the "initial price" is generally felt as a reason why the South Metropolitan Company should be kept separate from the other. The difficulty has been got over in one instance—namely, in the absorption of the London Company by the Chartered. In that portion of the London Company's district which lies on the southern side of the Thames the Chartered Company is compelled to observe the same price as the South Metropolitan. By this anomalous arrangement it comes to pass that the Chartered gas is at the present time sevenpence per 1000ft. cheaper on the southern side of the Thames than on the northern, although the conditions of purity and lighting power are the same in one case as in the other. No doubt a scheme might be concocted which would harmonise the discordant elements, though it may be objected that something more than the sanction of the Board of Trade would be necessary to give it legal force. Should an Act of Parliament be found necessary, it is probable that we shall hear very little more of amalgamation, unless the Chartered Company is prepared for a fall in the initial price all over its district, north as well as south. Certain it is that proposals for amalgamation have been lately under consideration—by no means for the first time—with a view to a fusion of the Chartered and the South Metropolitan. At present these proposals have not taken such a shape as to be acceptable to both companies, and there is no immediate prospect of an understanding being arrived at. Still, the question is one which may at any moment be revived, and the discussion it has already received may prepare the way for a final settlement. Amalgamation would conduce to economy of management, and would prevent that hurtful competition which is now affecting the price of residuals. A proper scheme of amalgamation would benefit both the shareholder and the consumer, and the principle has already been carried so far, by the fusion of thirteen companies into three, that there is nothing very extraordinary should the three become two, and ultimately one.

Among the organs of public opinion, one has given currency to the idea that the Chartered Company is going to compensate itself for a reduced price by adulterating the gas with air! This is an old delusion, which ought to have died a natural death long ago. Nothing could be more unfortunate for a gas company than to have air in its pipes. If the air were present in a large proportion there might be danger of a widespread explosion. Let us imagine the great Beckton mains exploding all along the lines of thoroughfare! The dynamiters never concocted anything half so terrible. But if we are to suppose that the air is introduced in a safe proportion, this at least follows—that the lighting power would be so diminished as to render the process exceedingly unprofitable to the company. The penalties prescribed by the statute for defective lighting power would far exceed the value of the extra bulk given to the gas. But it is astonishing what some people will believe when a gas company has to be criticised. The gas supplied to the metropolis must needs remain the same as before, let the price go down as much as it may. As for its cheapness, we see a vast improvement on the old order of things. Taking the Chartered gas of 1888 as our standard, we have the light of 16 candles for twelve hours at the cost of twopence. What is termed "a petroleum gas candle" has lately been described, which is stated to give a light equal to $1\frac{3}{8}$-candle, for a period of eight hours, at a cost of a farthing. This seems cheap, but it amounts to 3·6 pence for the light of 16-candles for twelve hours, thus showing it to be more than half as dear again as gas. A new electric lamp for mines is said to give the light of $2\frac{1}{2}$-candles for twelve hours at the cost of a penny. This would be more than sixpence for 16-candles, and in point of price bears no comparison with gas, though of course the latter would not be available for the particular purpose which the "Eclipse safety lamp" is intended to serve. The cheapness of gas is its stronghold, and the cheaper it is made, the more extensively it is likely to be consumed. Greater facilities for its use are required, and it is to be hoped the gas companies are becoming alive to the fact.

STEAMSHIP FREIGHTS AND THE IRON TRADE.

The marked change which is taking place in the steam shipping trade must have a considerable effect on the iron and allied trades. With a little more work to do we have now a mercantile fleet slightly less than we had, and as the result, the range of freight is beginning to rise with some rapidity. In the iron trade this is very marked. Spanish ore from Bilbao to some of the Welsh ports was carried for about 3s. 10d. per ton a few months ago, but it is now up to rather more than 5s. 3d. To the Tees and the Tyne the rate was 4s. 6d., and has risen to 6s.; to West Hartlepool, 6s. 4½d. has been more than once paid; and to the United States from the Spanish ports very high rates have had to be paid, to secure steamships—as much as 15s. per ton. Increases of freight have been known in other trades also, timber freights from the Baltic are double what they were, coal freights are more; grain from the Black Sea has advanced more rapidly; and in the conveyance of iron to the United States and of ore to this country there are even larger increases. So general, indeed, have been the increases in the rates of freight, that the position of the owners of steamships has in four or five months almost entirely changed. It was an industry in deep depression, perhaps more so than most, because works may be laid idle, but vessels can only be laid up in ports where the charges are heavy and continuous. Now, the range of freights has risen until it may be said to be remunerative, though it will not yield very large profits. One of the features of the shipping trade is its speedy equalisation. There are some vessels so large as to be designed for certain trades exclusively; but with the exception of these "monsters of the deep," vessels may be readily turned from one employment to another. Out of the 17,917 vessels all owned in the United Kingdom, only 385 are over 2000 tons each, so that it will be seen that the steamships employed in one voyage in the coasting trade may readily be sent the next one to America or other more distant port. Thus, if a rise in freights shows itself in any one trade to a large extent, steamships may be readily diverted into the trade from others, until abundance in one branch of employment and scarcity elsewhere produces a gradual levelling up. This is now in progress, and the rise in freights may be said to be slowly spreading itself into every branch of the trade from those in which it first showed itself. In ore its effects were early manifested. In a degree, the change in the shipping trade will be a corrective of low prices, but to what extent remains for the future to show. Cheap ocean communication was one of the great factors bringing about very low prices of commodities. For instance, the fall in freights in two years reduced the prices of grain by about 3s. per quarter, as far as the large American importation is concerned; and a similar decline showed itself in everything we obtain from that great country. Timber and tallow, iron ore and oranges, butter and bacon—all our imports have felt the lowering of freights; and it is certain that it is only a question of months before all feel the increase, if it continue, as seems at least probable. For in the period of low and falling prices, stocks were allowed to decrease in the consuming centres, and now seem likely to be enlarged. A check may be given to the upward movement by more rapid shipbuilding than has been known of late, but as shipping has long been unproductive, and as the season of heavier loss is setting in, this is scarcely likely to begin yet. But the influence of the rise in freights on prices will be watched with some curiosity, to say the least. It will affect the iron trade in two ways—it will increase the cost of the imported iron, and therefore give some impetus to the use of our own ores; and it will increase the cost of the manufactured article at the place of its use, so that the tendency will be to increase the cost of iron to the consumer. Where iron ore has to be carried very long distances, as to the United States, from Spain, the price of the iron will be very heavy. Just now the rate of freight from the Spanish ports to the United States varies from 14s. to 15s. per ton of ore, so that with two tons to the ton of iron, the ocean freight alone would be at least close upon £1 10s., and the land carriage and cost of smelting would make the iron from imported ore dear. It may be that the high price would check the sale of it; but it is very clear from what we have said that the continuance of the rise in freights would very considerably alter the position of the iron trade.

REVIVAL IN CLYDE SHIPBUILDING TRADE.

The shipbuilding trade of the Clyde seems now to have left the low-water mark of depression, and to have entered upon a period of comparative activity. This is evinced not so much by the increased output of new tonnage during October as by the exceptionally heavy booking of new orders. In all twelve vessels of 16,635 tons were launched during October, but during the same short period as many as twenty-six vessels of over 40,000 tons have been ordered. This tonnage, as will be seen, amounts to nearly two and a-half times the output for October, and is considerably more than double the output for September and October combined. While this is gratifying to the Clyde as an industrial centre in respect of affording employment to many artisans now out of work, it cannot be confidently regarded as evidence of a solid and permanent revival in the industry. Most of the contracts entered into are eagerly undertaken because of the abnormally low prices of material and labour prevailing, and have been taken on at prices which admit of a very small margin of profit—in many cases of none at all. Inquiries, however, are still plentiful, and there are tokens that if freights continue to show an upward tendency, the improvement already initiated will assume a stable and permanent character. Of the 40,000 odd tons contracted for, the lion's share has gone to the lower and middle reaches. Messrs. Russell and Co., of Port Glasgow, have secured contracts for no fewer than five vessels aggregating about 11,500 tons, two of these being for steamers of 2300 tons and 1800 tons respectively. The remainder consists of sailing vessels; one, of the unprecedented tonnage of 3300 tons, and two of 2000 tons each. Messrs. W. Denny and Bros., Dumbarton, have contracted with the Belgian Government to build a paddle steamer of great speed for the Ostend and Dover mail and passenger service, and have also arranged for the building of a steel screw steamer of 3300 tons which will be fitted with quadruple expansion engines. Messrs. McMillan and Son of the same town have booked orders for two tug steamers of 100 tons each and two composite steamers of about 750 tons the latter for the Newfoundland Government. Messrs. Napier, Shanks, and Bell, of Yoker, have secured the contract for a good sized steamer for a Canadian Company, and Messrs. Connell and Company, Scotstown, have booked a sailing ship of 1600 tons. Messrs. Barclay, Curle, and Co., Whiteinch, have contracted to build and engine a steamer of 3600 tons for the West India and Pacific S. N. Company of Liverpool, and a second steamer of 3000 tons for a Leith firm. Messrs. Aitken and Macneil, Whiteinch, have secured the order for a steamer of about 2000 tons, for which Messrs. J. and J. Thompson, of Glasgow, will supply the engines. Messrs. A. Stephen and Son are understood to have added to their existing contracts a couple of steamers, each of 2000 tons. The Fairfield Shipbuilding Company is about to begin the construction of a paddle steamer of considerable size, to attain a speed of 18½ knots, for the Brighton Railway Company. Messrs. D. and W. Henderson, Partick, have obtained the order for a sailing ship of 2000 tons, and Messrs. R. Napier and Sons have been instructed to build a twin-screw steamer of 600 tons for a South American firm. The shipbuilding yards of Paisley have also shared in the recent allocation of new work. The Abercombe Company have received instructions from the Indian Government to build and engine a torpedo boat 130ft. long for defending the harbour of Calcutta, and the same firm have also contracted to construct a steamer of 100ft. in length for a South American firm. Messrs. John McArthur and Co. have been ordered to build for a New Zealand firm a steel screw steamer 172ft. in length. When all these, and some of the additional orders that may reasonably be expected to come to the Clyde during the ensuing month, come to be added to the grand aggregate at the end of the year it will be found that 1887 has been a slight improvement, as regards output, on the two previous years. The total for the ten months already gone reaches 163,430 tons, showing an increase of 14,905 tons over the output for the corresponding period of 1886, and of 11,049 tons over that for 1885.

CLOSE OF THE BOLTON STRIKE.

After a protracted and disastrous struggle extending over nearly six months, conditions have been agreed upon between the employers and the employed by which the strike in the Bolton engineering trade has been brought to a close. The main conditions of this agreement, which was unanimously accepted at a meeting held on Saturday, were that the men on strike resumed work at once as required, at the present rate of wages, and that for a period of three weeks overtime should be restricted to breakdowns and shop repairs, after the expiration of which time all restrictions as to overtime to be removed; that a committee be formed consisting of five representatives of Bolton employers and five representatives of the workmen, as a Board of Inquiry and Conciliation, and that this committee should immediately examine into the question as to whether the state of trade existing in Bolton when the strike commenced, as compared with that existing when wages were last reduced, warranted an advance in the rate of wages; that if an advance was then warranted the committee should recommend the amount to be granted as an advance in the present rate of wages, such advance not to exceed the amount of 2s. per week, and that should no advance be recommended the committee might decide that the question be adjourned to a date to be

agreed upon, to be settled by the Board of Inquiry, whilst in the event of any dispute or impossibility of agreement the question to be referred to the umpire to be appointed by both sides. In accordance with these conditions, the men for whom the employers have been able to find work have gone back to their shops, the strike has been declared at an end, and all picketting has ceased. The principal difference between the present and the previously proposed basis of arbitration consists in the fact that no question of radius or of the rate of wages paid in other towns enters into the case; it is simply Bolton, 1886, *versus* Bolton, 1887, and the issue is to turn on a comparison of the state of trade in the industries concerned at the commencement of 1886, when the reduction in wages was made, and the middle of 1887, when the men were out on strike. The men have thus completely abandoned one important point upon which previous proposed settlements have been wrecked, but they have also given way on other important issues which have been raised during the dispute; they have practically put aside the questions of overtime and the retention of the workmen from other districts who have been engaged during the strike. Long ago the employers would have been quite ready to entertain a settlement of the dispute upon the conditions which have now been accepted on both sides; and if the men had been well advised the ruinous loss, the misery, and the bitter feeling which have been the result of the strike might have been averted. What has been the actual loss entailed through strikes it would be impossible to in any way accurately estimate. The cost to the trades union societies involved in donations to their members has, at a moderate estimate, not been less than £15,000, and quite another £5000 has been raised in voluntary subscriptions. The employers have been put to the expense of importing men and providing accommodation for them in their own works; whilst the borough has been put to a very heavy expense in employing military and extra police to maintain order in the town and protect the imported workmen engaged and the workshops of the employers. In addition to all this there is the incalculable loss sustained in the industrial prosperity of the town, which is always the inevitable result of a protracted struggle between capital and labour. This strike repeats the lesson which unfortunately has been so often previously taught by the bitter experience of former similar struggles, but it is perhaps too much to hope that it may be the inauguration of an amicable method of settling such disputes in the future. But, so far as Bolton is concerned, it is satisfactory to find that the proposed Board of Conciliation appears to be established as a permanent body, and it is to be hoped that it may be the means of preventing in the future any similar calamity to that from which the engineering industries of the town have recently so severely suffered.

THE BREWING TRADES EXHIBITION.

THE Exhibition which was held last week in the Agricultural Hall, Islington, did not present many remarkably new features, but it was on all hands said to be a good business exhibition; that is to say, all engaged in the classes of work of interest to our readers, including brewing-plant of all kinds and machinery for preparing, separating and cleaning grain, for malting purposes and grinding, admitted that orders were numerous. This has of late not often been admitted of exhibitions or shows, and is perhaps partly due to numerous causes, including the small and special character of the Exhibition, to the comparatively small number engaged in most of the manufactures represented, to the established annual character of the Exhibition, and perhaps to some improvement in demand. Amongst the chief machinery exhibited were gas engines in larger numbers than hitherto, some very fine, well-executed, and ingenious aërated water and bottling machinery, by Messrs. Barnett and Foster, Messrs. Galloway, Messrs. Dan and Rylands, and others. A large show of copper work was made by well-known firms, the polish on all of which was as good as ever, and the punching and rivetting nearly as bad. Grain conveyers were shown in action by the Grinding Machinery Company, who also exhibited the eclectic disintegrator working on very various materials, samples showing very excellent work on cotton seed, olive cake, gypsum, barytes, old boots, glue, and other things, the samples being all separated by the air-separation used by the company for grain and flour. A remarkable illustration of the value of the division of a process into numerous stages was exhibited by Messrs. H. Stopes and Co., of London, in a series of machines, manufactured for them by Messrs. Van Gelder, Apsimion, and Co., for cleaning malt and barley, and at same time separating into products of commercial value the seeds of numerous kinds which accompany a cargo of foreign barley. The plant for the purpose includes a considerable number of machines, but from a cargo costing an average of, say 25s. per quarter, the separations are so perfectly made that a much higher average value is reached through the use of the machines, some of the seeds, and these not the least numerous, being worth 40s. per quarter.

LITERATURE.

Annali di Agricoltura 1887. *Rivista del Servizio Minerario nel* 1885. 8vo. pp. cciii., 285. Florence: Barbara. 1887.

THE fact that the official control of the mines of Italy forms part of the duties of the Ministry of Agriculture, Industry, and Commerce accounts for the somewhat incongruous title of "Annals of Agriculture for 1887" applied to a volume of the produce of the mines of two years earlier, but like many other European countries, Italy still keeps rather backward in the publication of its statistical returns of mineral production. The keynote of the report is to be found in the first sentence, namely:—"The year 1885 was little propitious to Italian mineral industry." And this conclusion is unfortunately verified in almost every particular by a comparison of the details subsequently given. The total quantity of minerals of all kinds raised was 1,076,382 tons against 1,121,787 tons in 1884, the corresponding values being £2,542,234 in 1884, and only £2,359,198 in 1885, although the number of hands employed was only reduced from 52,500 in 1884 to 51,798 in 1885. The principal articles included in the above totals of 1,076,000 tons were—sulphur, 425,000 tons; iron ore, 201,000 tons; coal of all kinds, 190,413 tons; zinc ores, 107,887 tons; lead ore, 40,184 tons; copper ores, 27,236 tons; and gold ores, 11,106 tons. From these figures it appears that about 40 per cent. of the total tonnage produce consists of sulphur, and when the proportional value is still greater, it being about £1,500,000, or 60 per cent. of the total given above. The fall in price of about 7 per cent. that occurred on the year must therefore have acted very disastrously upon the most important article of Italian mineral industry.

The principal production of iron ore was in the Island of Elba, but the output was restricted to 176,000 tons in consequence of the new lease of the mines, which fixes the export at a maximum of 180,000 tons, for which a royalty of 4½f. per ton is paid, except for such portions as may be melted in the furnaces on the Tuscan coast, which are only charged 1·20f. per ton. In any case, a minimum rent of 350,000f. per annum is to be paid, whatever quantity of mineral may be exported or smelted. Other conditions are made giving the ores at preferential prices to Italian works, namely, 6½f. per ton for washed, and 5f. for rough ores at the mines. Such favoured ore is only to be melted in Italy, and in the event of its being sent abroad the exporter is to be charged the difference between the favoured and the current market price, with a fine of 10 per cent. in addition. By far the larger quantity of the Elba ore raised in 1885—160,000 out of 176,000 tons—was exported to America. The United States also appear to be the largest consumers of Sicilian sulphur. Thus in 1883, of a total export of 288,331 tons, America—United States and Canada—took 93,174 tons; France, 70,249 tons; Great Britain, 47,798; Spain, Portugal, and Gibraltar, 20,565; Greece and Malta, 12,230; Russia, 12,021, the quantities taken by the remaining countries being under 10,000 tons each.

Since the general adoption of pyrites in chemical works but little sulphur is consumed for sulphuric acid making, the principal uses being for sulphurising vines, the manufacture of gunpowder, sulphide of carbon, and lucifer matches, vulcanising india-rubber, bleaching textile fabrics and straw plaits, and for various medicinal preparations. For the treatment of cryptogamic parasites in vines, a new product known as acid sulphur, which appears to be finely-ground sulphur, containing about $\frac{12}{10000}$ of sulphuric acid, has lately been tried with considerable success.

The problem of finding a better method of liquating sulphur from the earthy waste with which it is associated in the ore than the old-fashioned calcarone or kiln, is still far from solution. Various kinds of regenerative furnaces, both continuous action and with retorts, have been tried, but hitherto no very decided advantage has been derived from their use. Superheated steam seems to answer well for very rich ores, but in almost all cases the improved yield from the ore is not more than sufficient to cover the cost of the fuel required. This will account sufficiently for the fact that out of 377,132 tons of sulphur produced in Sicily in 1885, only 17,500 tons were obtained from methods employing steam heat, and 17,000 tons in other kinds of improved furnaces; 3500 tons were collected in a melted state from solfataras, leaving a remainder of—about 90 per cent. of the total amount—the product of the calcaroni.

The question of probable duration of the sulphur deposits in Sicily has been for some time under consideration by the engineers of the Italian Government, but until lately the absence of general geological explorations, and more particularly of regular plans of the mines, has prevented the formation of any very definite opinions upon the subject. Both these requirements have now, however, been to some extent satisfied, and as the result of a preliminary estimate, Messrs. Mottara and Conti consider the quantity of sulphur contained in the deposits to be about 65,000,000 tons, which, after allowing for 15,000,000 tons raised up to 1885 inclusive, leaves about 50,000,000 as available for further working, or sufficient to maintain the present rate of production for about one hundred years.

The Island of Sardinia still maintains its position as a large producer of zinc ores, the mines of Malfidano and Plani Sarlu having contributed 33,000 tons of calcined calamine, or about one-third of the total produce of the year. In two cases Axland's rotating furnace and Ferrari's inclined reverberatory furnace have been substituted for the ordinary flat-bedded reverberatory calciner, with a notable saving of cost for fuel and wages in either case.

The detailed reports from the different mineral districts contain much interesting matter, but from the absence of a general analytical table of contents it is difficult to quote them in detail.

The technical training of mining officials in Italy is well provided for, there being five mining schools—Scuole Minerarie—in different parts of the country, the instruction in each being specialised according to the necessities of the district. In no case, however, was the attendance very large. The Scuole Superiore delle Solfare in Palermo—which takes the first place—has only six students to five teachers; the miners' school in Agordo, twenty-three students to four teachers; that at Caltanissetta, in the centre of the most productive sulphur mines, forty-nine students to nine teachers; that at Carrara, ten students to six teachers; and the school for foremen miners and smelters at Iglesias, in Sardinia, twenty students to seven teachers. An appendix to the report contains a very well-arranged account of the present produce and condition of the gold mines of the world, compiled from the newest sources of information. The result arrived at is 157,491 kilos.—about five million ounces troy—worth £20,904,774, as the probable annual production of the world.

The Civil Engineer's Pocket Book. By JOHN C. TRAUTWINE, C.E. Revised by John C. Trautwine, C.E., jun. New York: John Wiley and Sons. London: E. and F. N. Spon.

The Field Practice of Laying out Circular Curves for Railroads. By JOHN C. TRAUTWINE, C.E. Revised by John C. Trautwine, jun., C.E. New York: John Wiley and Co. London: E. and F. N. Spon.

THE full title of this now well-known pocket-book is a long one, but we need not repeat it, for the copy before us is one of the twenty-fifth edition of one thousand; and of a book which has reached this stage, and is kept up to date, it is not necessary to make many remarks. The book is necessarily in some respects much more complete as concerning American practice than with respect to that of this country; but it may certainly be said of it that to an engineer of ordinarily good elementary and practical education the book is a library of civil engineering principles, theory, and practice. It is beautifully printed on 866 pages of fine thin paper, and very fully illustrated by clear diagrams and other engravings. A great deal of the type is necessarily very small, but this will be overlooked by the many to whom so much in so little is of the greatest value. There is one point on which the book as a field book is weak, namely, in description of methods of setting out railway curves. This is, however, very completely given in the second book mentioned above.

BOOKS RECEIVED.

Steam Boilers: their Defects, Management, and Construction. By R. D. Munro. London: Chas. Griffin and Co. 1887.

District Railway Map of London and the *District Railway Country Map*—Jubilee editions—mounted and unmounted.

A Treatise on the Integral Calculus. Part I., containing an elementary account of elliptic integrals and application to plane curves. By Ralph A. Roberts, M.A. London: Longmans and Co. Dublin: Hodges, Figgis, and Co.

Construzione ed Esercizio dell Strade Ferrate e delle Tramvie. Per l'Ing. Pietro Oppizzi. Vol. III., Parte 1a. Unione Tipografico-Editrice Torniese, Torino. 1887.

Sixth Annual Report of the United States Geological Survey, 1884-5. By J. W. Powell, Director. Washington: Government Printing Office. 1885.

TENDERS.

CORPORATION OF LEICESTER.

LIST of tenders for the supply and erection of four independent rotative Woolf compound beam pumping engines, together with eight Lancashire steel boilers, and other machinery and plant in connection therewith, for the new sewage pumping station, according to designs, plans, and specifications of Mr. J. Gordon, M. Inst. C.E., borough surveyor:—

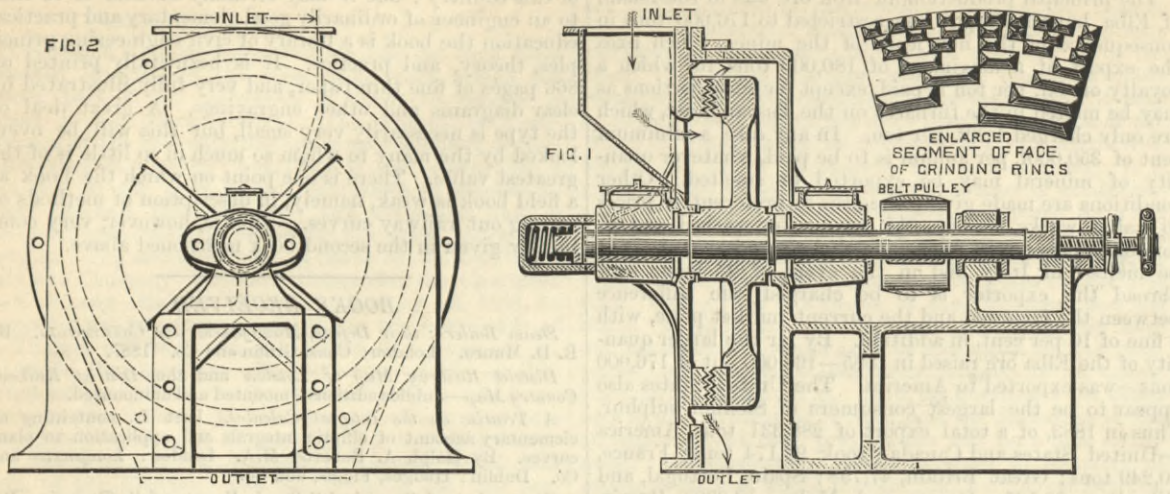
	Engine-builder's design. £ s. d.	Borough surveyor's design and specification. £ s. d.
Robert Daglish and Co., St. Helens, Lancashire	—	36,625 0 0
Jas. Simpson and Co., London	—	36,398 14 5
Ditto, for three compound high duty Worthington engines	31,477 13 3	—
Fawcett, Preston, and Co., direct-acting vertical compound intermediate receiver and surface condensing engines	33,000 0 0	—
Thornewill and Warham, Burton, Trent	—	32,500 0 0
Hathorn and Davey, Leeds	—	28,685 0 0
Ditto, improved differential compound surface condensing engines	21,685 0 0	—
Bever and Dorking, Dewsbury	—	28,417 10 0
Lilleshall Iron Company, Oakengates	—	27,800 0 0
D. Stewart and Co., Glasgow	—	26,422 2 0
Jas. Watt and Co., London	—	24,250 0 0
Easton and Anderson, London	—	23,794 0 0
Wood Brothers, Sowerby Bridge	—	22,852 0 0
Gimson and Co., Leicester (accepted)	—	22,629 6 0
Geo. Kirk and Co., Stoke-on-Trent	—	21,168 0 0
F. Silvester and Co., Newcastle, Staffordshire	—	18,947 0 0

NAVAL ENGINEER APPOINTMENTS.—The following appointments have been made at the Admiralty:—Edwin Little, engineer, to the Canada; William W. Wootton, engineer, to the Handy, both to date October 28th; George Finlay, paymaster, to the Ready; C. A. R. F. Dunbar, paymaster, to the Lily, both to date October 28th; John W. Henwood, engineer, to the Ready, additional, and for appointment when recommissioned; Charles R. James, engineer, to the Neptune; John W. Agnew, engineer, to the Asia, additional, for charge of reserve stores; William J. Bevan, engineer, to the Bloodhound; W. Brown, engineer, to the Swiftsure; John H. Walton, engineer, to the Northumberland; Robert A. Hunter, assistant engineer, to the Rover; Henry R. Teed, assistant engineer, to the Swiftsure; Edward J. Edgar, assistant engineer, to the Calypso; and E. S. Silk, acting assistant engineer, to the Active, all to date November 2nd.

COAL MEASURES IN UPPER BURMAH.—The existence of coal measures in Upper Burmah has long been known, and specimens have from time to time been examined by Calcutta experts and tried on steamers. The ascertained facts exceed the most sanguine expectations. Four extensive coalfields have been more or less thoroughly examined. The first is situated seventy miles above Mandalay on the left bank of the Irrawaddy and within a few miles of the river. A consignment of this coal was tried on the ex-king's steamers. The second lies 150 miles up the Chindwin River, within three miles of the main channel. Coal from this field has been burnt during the past year, and, indeed, for some time previously, on the Chindwin steamers, and is pronounced to be excellent fuel. The seams are thick, and the dip of the strata is moderate. There are also the Pan-Laung coalfield, with its most accessible known outcrop near Hlaingdet, and the coal measures and outcrops on the Shan plateau. With regard to the last two coalfields little is known, but the highest authority expresses a hope that when the geological surveyor—who has been at work since the beginning of the year—completes his examination of the whole, the private capitalist will not be slow to follow in his wake.

THE BOLTON STRIKE.—The Bolton strike has suddenly collapsed, the men, or at least such of them as are now able to find employment in their old shops, having gone back to work on what are practically the employers' terms, after carrying on a strike extending over a period of nearly six months. This action of the men has been taken without the sanction and without consulting the respective trades unions, and at headquarters there is a very bitter feeling that after the support the men have received not only from their own societies, but from voluntary subscriptions, they should thus unceremoniously retire from the struggle without gaining a single point for which they have been contesting. The collapse has come quite unexpectedly to the public; to the last the men have been showing an apparently bold front, and even whilst the terms of settlement were being actually settled, the strike committee were issuing their usual weekly balance-sheet, showing upwards of £500 still in hand, and headed with a defiant circular to the employers, and appealing for continued support to carry on the strike till a satisfactory settlement could be obtained. The basis of the settlement the men have now accepted is that a board of conciliation shall inquire into the state of trade in Bolton when the strike occurred, as compared with what it was when wages were reduced at the commencement of last year, and decide whether any and what advance in wages is warranted. The question of overtime, the comparison of wages in other towns, and the importation of workmen, for which the men were holding out, are all put aside, and it is only to be regretted that terms which the employers would have willingly agreed to five months ago have only been accepted by the men after a costly and disastrous strike.

THE "DEVIL" DISINTEGRATOR.—END ELEVATION & SECTION.



THE "DEVIL" DISINTEGRATOR.

THE disintegrator of the above name, illustrated by the accompanying engravings, is made by the Hardy Patent Pick Company. It is simple in internal construction, the guiding parts consisting of two discs of chilled or hard cast iron, having on their surface an annular band of concentric rings of teeth, gradually reducing in size to the outside of the discs. These discs are capable of being separated or closed at will, as the machine is at work, by means of the screw seen at the left-hand end of the spindle, and when adjusted the sample of material reduced remains uniform. The character of the mill and its action will be more readily gathered from the sectional and end view engravings, Figs. 1 and 2, which we give above. In Fig. 1 the form and width of the annular belt of grinding teeth is clearly seen, the revolving disc being shown in section. The grinding rings are made in segments, as shown to a larger scale at Fig. 1, one ring being fastened to the revolving disc, and the other to the fixed face of the machine.

The material acted upon is introduced into the centre of the machine, and is delivered by centrifugal force into the grinding discs, where it is chopped, ground, or torn piece by piece until it finally escapes at the outer edge of the discs, reduced to the fineness required and delivered at the bottom of the machine. The range of materials which can be reduced with rapidity by this machine is very great. Grain of all kinds can be cracked, kibbled, or reduced to meal as desired. It kibbles beans and Indian-corn at an incredible rate.

Bones, green or dry, hoofs and similar substances are also rapidly reduced. We are also informed that rags, rope, and similar fibrous materials can be torn into shreds, or reduced to flocks or ground into fluff. The discs are easily and cheaply replaced. It is in use in reducing fire-clay and similar substances, and in grinding slack and pitch for making briquettes or patent fuel. It also grinds the slack wet or dry.

The disc is attached to a strong spindle, which is supported in three bearings. The wearing surfaces of the grinding rings are of novel form, the arrangement of the projections being chosen with a view to enabling them to grasp the materials, and to cause them to be finely ground before leaving,

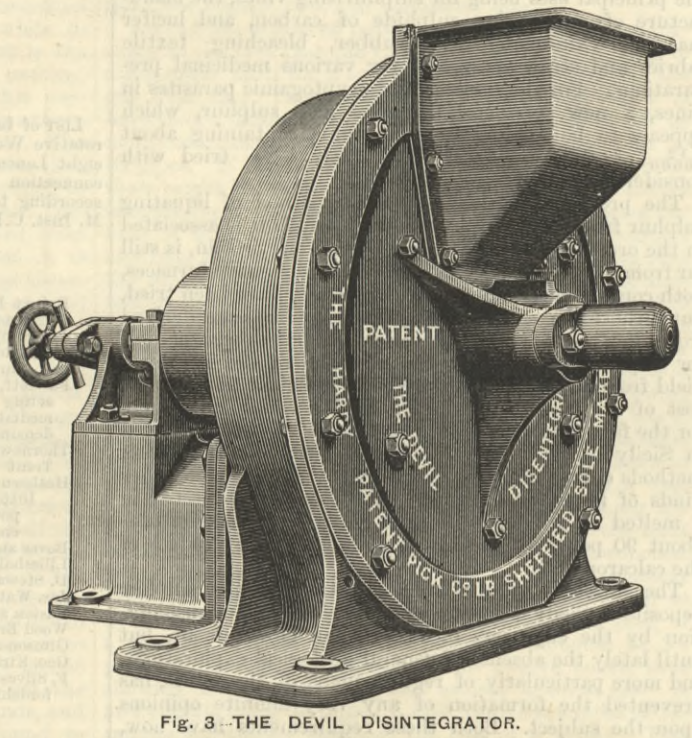
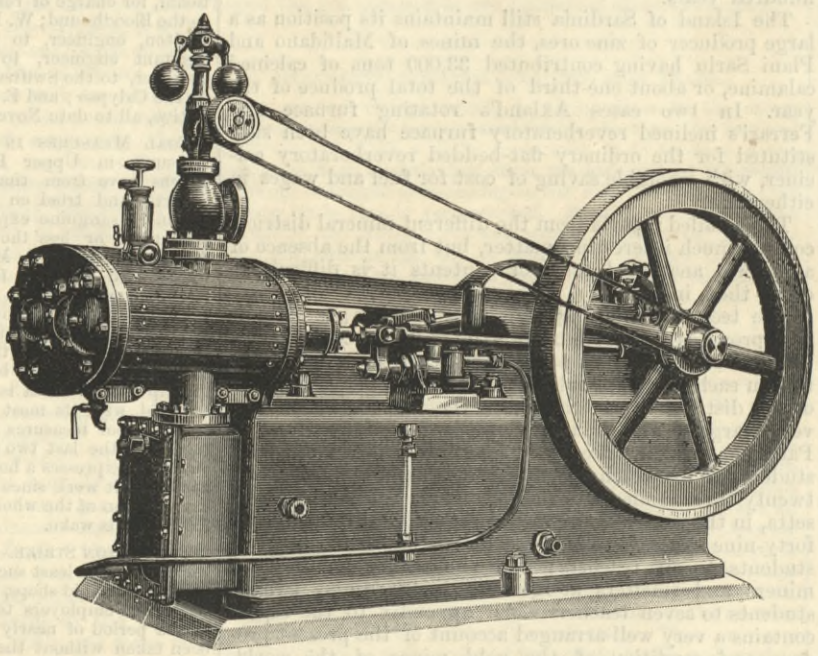


Fig. 3.—THE DEVIL DISINTEGRATOR.

the projections in one face being arranged so as to be opposite the spaces between the projections on the other face.

THE BARROW ENGINE.



THE accompanying engraving illustrates a horizontal engine exhibited at work in the Manchester Exhibition by the makers, Messrs. Westray, Copeland, and Co., of Barrow-in-Furness. The engine is of good design, is well made, and is suited for running at considerable speed. A feature in the engine is the attachment below the cylinder of a feed-water heater as made by Mr. J. Kirkaldy, of London. This, as seen in the engraving, occupies a very small space, and while it is exceedingly effective as a heater, it does not cause any increase in back pressure, but rather decreases it.

MODERN VIEWS OF ELECTRICITY.[1]

THE following passages are extracted from some lectures on this subject by Dr. Oliver Lodge, and recently published in an expanded form in *Nature*:—

"You know well that there have been fluid or material theories of electricity for the past century; you know, moreover, that there has been a reaction against them. There was even a tendency a few years back to deny the material nature of electricity and assert its position as a form of energy. This was doubtless due to an analogical and natural, though unjustifiable, feeling that just as sound and heat and light had shown themselves to be forms of energy, so in due time would electricity also. If such were the expectation, it has not been justified by the event. Electricity may possibly be a form of matter—it is not a form of energy. It is quite true that electricity under pressure or in motion represents energy, but the same thing is true of water or air, and we do not therefore deny them to be forms of matter. Understand the sense in which I use the word electricity. Electrification is a result of work done, and is most certainly a form of energy; it can be created and destroyed by an act of work. But electricity, none is ever created or destroyed, it is simply moved and strained like matter. No one ever exhibited a trace of positive electricity without there being somewhere in its immediate neighbourhood an equal quantity of negative.

"This is the first great law expressible in a variety of ways, as, for instance, by saying the total algebraic production of electricity is always zero; that you cannot produce positive electrification without an equal quantity of negative also; that what one body gains of electricity some other body must lose.

"Now, whenever we perceive that a thing is produced in precisely equal and opposite amounts, so that what one body gains another loses, it is convenient and most simple to consider the thing not as generated in the one body and destroyed in the other, but as simply transferred. Electricity in this respect behaves just like a substance. This is what Franklin perceived.

"The second great law is that electricity always, under all circumstance, flows in a closed circuit, the same quantity crossing every section of that circuit, so that it is not possible to exhaust it from one region of space and condense it in another.

"Another way of expressing this fact is to say that no charge resides in the interior of a hollow conductor.

"Another is to say that total induced charge is always equal and opposite to inducing charges.

"When we thus find that it is impossible to charge a body absolutely with electricity, that though you can move it from place to place it always and instantly refills the body from which you take it, so that no portion of space can be more or less filled with it than it already is, it is natural to express the phenomenon by saying that electricity behaves itself like a perfectly incompressible substance or fluid, of which all space is completely full. That is to say, it behaves like a perfect and all-permeating liquid. Understand, I by no means assert that electricity is such a fluid or liquid I only assert the undoubted fact that it behaves like one—*i.e.*, it obeys the same laws.

"Provisionally we will accept as a working hypothesis the idea of the ether consisting of electricity in a state of entanglement similar to that of water in jelly, and we are driven to this view by the exigencies of mode 1, the electrostatic or strain method of examining the properties of electricity, because otherwise the properties of insulators are hard to conceive. If it turn out that space is a conductor, which seems to me highly improbable, then we must fall back upon the other view that it is rigid only for infinitesimal vibrations, and fluid for steady forces.

"There have been, as you know, two ancient fluid theories of electricity—the one-fluid theory of Franklin, and the two-fluid theory of Symmer and others. A great deal is to be said for both of them within a certain range. There are certainly points, many points, on which they are hopelessly wrong and misleading, but it is their foundation upon ideas of action at a distance that condemns them, it is not the fluidity. They concentrate attention upon the conductors; whereas Faraday taught us to concentrate attention on the insulating medium surrounding the conductors—the 'dielectric,' as he termed it. This is the seat of all phenomena: conductors are mere breaks in it—interrupters of its continuity.

"To Faraday the space round conductors was full of what he called lines of force; and it is his main achievement in electrostatics to have diverted our attention from the obvious and apparent to the intrinsic and essential phenomena. Let us try and seize his point of view before going further. It is certainly true, as far as it goes, and is devoid of hypothesis.

"Take the old fundamental electric experiment of rubbing two bodies together, separating them, and exhibiting the attraction and repulsion of a pith ball, say, and how should we now describe it? Something this way.

"Take two insulated discs of different material, one metal, say, and one silk, touch them together, the contact effects a transfer of electricity from the metal to the silk; rub slightly to assist the transfer, since silk is a non-conductor, then separate. As you separate the discs the medium between them is thrown into a state of strain, the direction of which is mapped out by drawing a set of lines, called lines of force, from one disc to the other, coincident with the direction of strain at every point. As Faraday remarked, the strain is as if these lines were stretched elastic threads endowed with the property of repelling each other as well as of shortening themselves; in other words, there is a tension along the lines of force and a pressure at right angles to them. When the discs are near, and the lines short, they are mainly straight, but as the distance increases they become curved, bulging away from the common axis of the two discs, and some even curling round to the back of the disc, until, when the discs are infinitely distant, as many lines spring from the back of each as from its face; and we have a charged body to all intents existing in space by itself.

"This mode of stating the facts involves no hypothesis whatever—it is the simple truth. But the 'lines of force' have no more and no less existence than have 'rays of light.' Both are convenient modes of expression. At a certain point we are led to abandon lines of force and potential theories, and to try to conceive the actual stuff undergoing its strains and motions.

"In an utterly modified sense, we have still a fluid theory of electricity, and a portion of the ideas of the old theories belong to it also.

"Thus Franklin's view that positive charge was excess and negative charge was a deficit in a certain standard quantity of the fluid which all bodies naturally possessed in their neutral state, remains practically true. His view that the fluid was never manufactured, but was taken from one body to give to another, so that one gained what the other lost—no more and no less—remains practically true Part also—a less part—of the two-fluid theory likewise remains true, in my present opinion; but this is not a branch of the subject on which I shall enter in the present discourse. It will suffice to fix our attention on one fluid only.

"You are to think of an electric machine as a pump which, being attached to two bodies respectively, drives some electricity from the one into the other, conferring upon one a positive and upon the other a precisely equal negative charge. One of the two bodies may be the earth, in which case the charge makes little or no difference to it.

"But, as has been objected before, if electricity is like an incompressible and inextensible fluid, how is it possible to withdraw any of it from one body and give it to another? With rigid bodies it is not possible, but with elastic bodies it is easy.

"The act of charging this sphere is therefore analogous to pumping water into this elastic bag, or rather into a cavity in the midst of an elastic medium, whose thick walls, extending in all directions and needing a great pressure to strain them, better represent the case than does the thin boundary of a bag like this.

"Draw a couple of such cavities and consider fluid pumped from one into the other, and you will see that the charge, *i.e.*, the excess or defect of fluid, resides on the outside. You may also show that when both are similarly charged, the medium is so strained that they tend to be forced apart; whereas, when one is distended and the other contracted, they tend to approach.

"*Return circuit.*—Sometimes a difficulty is felt about electricity flowing in a closed circuit, as, for instance, in signalling to America and using the earth as a return circuit: the question arises, How does the electricity find its way back?

"The difficulty is no more real than if a tube were laid to America with its two ends connected to the sea and already quite full. If now a little more sea-water were pumped in at one end, an equal quantity would leave the other end, and the disturbed level of the ocean would readjust itself. Not the same identical water would return, but an equal quantity would return. That is all one says in electricity. One cannot label and identify it.

"To imitate the inductive retardation of cables, the tube should have slightly elastic walls; to imitate the speed of signalling, the water must be supposed quite incompressible, not elastic as it really is, or each pulse would take three-quarters of an hour to go.

"*Condensers.*—Returning to the subject of charging bodies electrically, how is one to consider the fact that bringing an earth-plate near a conductor increases its capacity so greatly, enabling the same pressure to force in a much larger quantity of fluid?—how is one to think of a condenser or Leyden jar?

"In the easiest possible way, by observing that the bringing near an earth-connected conductor is really thinning down the dielectric on all sides of the body.

"The thin-walled elastic medium of course takes less force to distend it a given amount than a thick mass of the same stuff took. A Leyden jar is like a cavity with quite thin walls—in other words, it is like an elastic bag.

"But if you thin it too far, or strain it too much, the elastic membrane may burst: exactly, and this is the disruptive discharge of a jar, and is accompanied by a spark. Sometimes it is the solid dielectric which breaks down permanently. Ordinarily it is merely the air, and since a fluid insulator constitutes a self-mending partition, it is instantaneously as good as new again.

"There are many things of interest and importance to study about a Leyden jar. There is the fact that if insulated it will not charge; the potential of both inner and outer coatings rises equally; that, in order to charge it, for every positive spark you give to the interior an equal positive spark must be taken from the exterior. There is the charging and the discharging of it by alternate contacts, as by an oscillating ball; and there are the phenomena of the spark discharge itself.

"But, as you know, all charging is really a case of a Leyden jar. The outer coat must always be somewhere—the walls of the room, or the earth, or something—you always have a layer of dielectric between two charges—the so-called induced and the inducing charge. You cannot charge one body alone."

[1] Expansion of a lecture delivered by Dr. Oliver Lodge, partly at the London Institution on January 1st, 1885, and partly at the Midland Institute, Birmingham, November 15th, 1886, but not hitherto published.

EDISON'S SYSTEM OF CONTINUOUS CURRENT TRANSFORMERS.

At Llewellyn Park, one of the pleasantest of the New York suburbs, there is now under construction a central station for the supply of electric light to which a very unusual degree of interest attaches. It represents the first attempt to utilise in practice the principle of the so-called continuous current transformer—perhaps a better name is the "motor-generator." Messrs. Paris and Scott have hitherto been the sole adherents of that system in this country, but we are not at the present moment aware that they have any plant in actual commercial operation. In the New York scheme the mains are laid out upon the three-wire system, and are to be placed underground. Two dynamos, each giving 600 volts, supply current at constant potential to the motor coils of the transformers, while the dynamo coils each give 100 volts for use upon the consumers' circuits. The generating plant is to be placed in the new laboratory which is now being built for Mr. Edison, and the whole scheme will be carried out in accordance with certain patents taken out by him. Although the existence of these patents was certainly unknown to the world at large, it appears that they date as far back as 1881, 1882, and 1883. It is further claimed for his system that a remarkable economy is effected in comparison with the cost of alternating current transformers for the same output.

Our readers will probably feel that it is desirable to obtain some further enlightenment on the subject before accepting a statement so subversive, the *Electrician* says, of accepted ideas.

The following description of Edison's American specifications is taken from our contemporary, the *Electrical Review* of New York:—"(1) Electrical distribution system, No. 266,793; dated October 31st, 1882; filed December 9th, 1881. (2) Apparatus for the electrical transmission of power, No. 265,786; specification filed August 7th, 1882; dated October 10th, 1882. Consisting of rotating transformers in series and secondary circuits in multiple arc. (3) Apparatus for translating electric currents from high to low tension, No. 278,418; specification filed August 14th, 1882; dated May 29th, 1883. Induction coil apparatus, the primaries being in multiple arc, with constant potential direct-current mains, the secondary circuit being in multiple arc as usual. (4) System of electric distribution, No. 287,516; specification filed May 14th, 1883; dated October 30th, 1883. Rotating transformers in multiple arc, with the source of electric current.

"In the interesting illustrations presented herewith Fig 1 is a diagram representing the disposition of induction coils connected with the rotating alternating device of which Fig. 2 is a drawing.

"The induction coils H, J, K, L, M, N, O, P, are built up of a core of laminated iron on which are wound two coils of copper, one of coarse wire as shown by the heavy lines for the secondary circuit, the other of fine wire for the primary circuit. The primary coils are connected, as also are the secondary. From each connecting wire are attached brushes B^1, B^2, &c., for the primary b^1, b^2, &c., for the secondary circuit. E and F are on the same shaft, and in a portion of their circumferences are inserted metallic contact pieces A, D, C, G. A and G are joined with two continuous rings on which press brushes connected with the dynamo circuit. As the shaft revolves, brushes B^7, b^7, and B^3, b^3 will touch the metal sections A, D, C, G. The direction of the current will therefore be reversed in the primary coils of O and K and induced currents generated in the secondaries of the same coils, which will be taken off by the brushes b^7, b^3, conveyed to two rings and thence by brushes to the local lamp or motor circuit. As the rotation continues the current in the primaries of the coils is in sucession reversed and the induced current in the secondaries commutated. The transformers are connected in multiple arc with the dynamo circuit as shown, by the patent No. 278,418, May 29th, 1883, a series system being extremely difficult of regulation. They may be described as a lot of closed magnetic converters arranged in a crown constituting a compound alternating and converting device, the commutation being obtained practically as in the coils of a Gramme ring. According to the ratio of the number of turns on the primaries and secondaries the electro-motive force can be raised or lowered. For long distance transmission, using a continuous current of high tension, small conductors only are needed. This current is converted into a continuous current of low tension for incandescent lamp or motor circuits. Reversals of the current are made so rapidly—100-200 per second—that the percentage of conversion is remarkably high. If the primary coils be supplied with current of constant potential the apparatus is self-regulating, and the slight variation of the potential of the secondary circuit is due to the resistance of the wires. Less than the energy of one 16-candle power lamp is required to operate a motor driving the rotating shaft to commutate current of 200 ampères.

"Fig. 3 represents a modification of this device. The primary and secondary coils are wound upon one iron core precisely as in a Gramme ring. Outside the whole is a mass of laminated iron, which is stationary, to concentrate the lines of force upon the copper wire. The primary coils of fine wire are connected with the commutator at the end of the shaft, and secondary coils of coarse wire with the remaining commutator.

"The coils and shaft revolve. Brushes convey current to the primary coils, the current being reversed in each coil twice each revolution. The reversals of the induced currents in the secondary coils, occurring at the instant, the coil passes from left to right-hand side, as in a Gramme ring. The above device was patented on May 29th, 1883, No. 274,418.

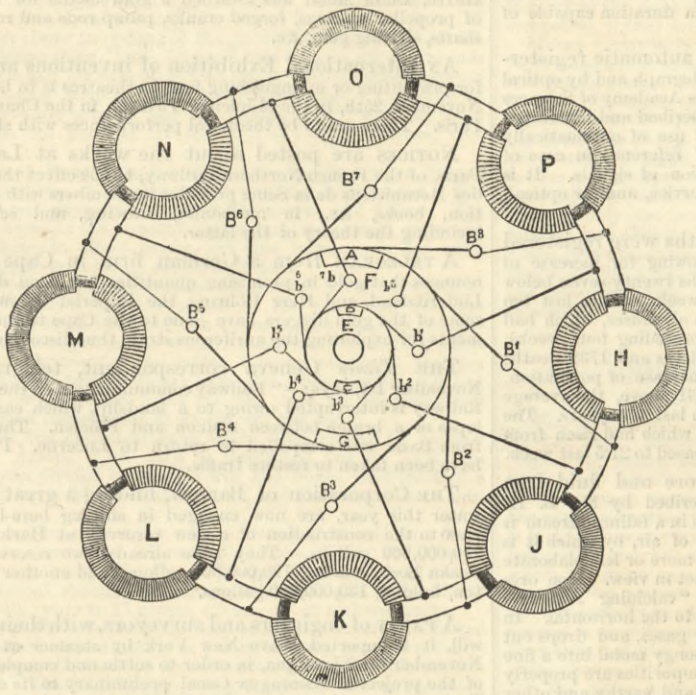


Fig. 1.—Edison's Transformer System of Electrical Distribution. Arrangement of Induction Coils and Commutating Alternator.

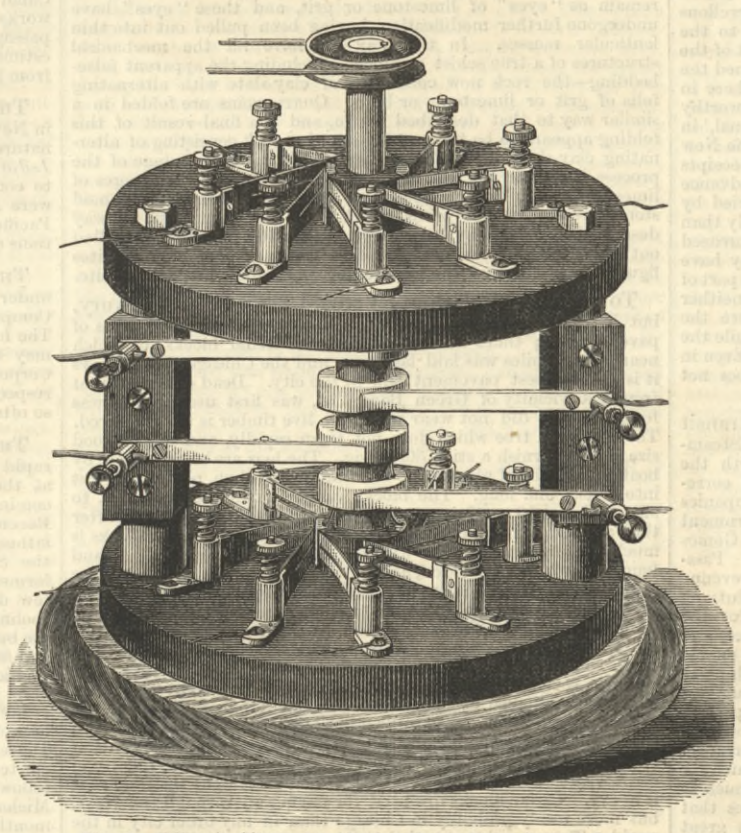


Fig. 2.—Edison's Alternator Used with his Transformer System.

"Mr. Edison's United States patent 265,786, dated October 10th, 1882, describes a system for the distribution of electrical energy in which one set of armature coils of a number of the rotating transformers are connected in series with the dynamo supplying the current. In the secondary circuits of the transformers are placed incandescent lamps or other apparatus. By this system the expense for conductors on long circuits is materially reduced over that of low tension multiple arc distribution. Owing to the difficulties of regulation, Mr. Edison patented October 30th, 1883, No. 287,516, a system of electric distribution consisting of motor generators or transformers, the primary circuits of which were connected in multiple arc with the dynamo circuit, as shown in the diagram Fig. 4.

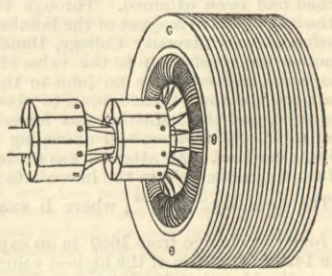


Fig. 3.—Rotation Transformer.

"Dynamos D D D D, connected as usual in the three-wire system, are wound to generate currents of high electro-motive force, admitting of the employment of small conductors. The three wires F, E, N, are connected at the sub-station with the primary circuits of the armature of the converters or transformers. The current for the field-magnets of the dynamos passes through the wires B B, the rheostats R R, which are at the sub-station, returning over the neutral wire N. The wires B are very small, preferably of iron for economy, and the slight loss of energy in them is of no consequence compared with the convenience of regulating from the sub-station the potential of the current supplied to the converters. The three-wire system is advantageous because the insulation of dynamos and converters will be subjected to one-half the potential of a two-wire system, and because the distribution from the sub-station is easily made on the three-wire system, and economy of conductors and increased area of distribution obtained.

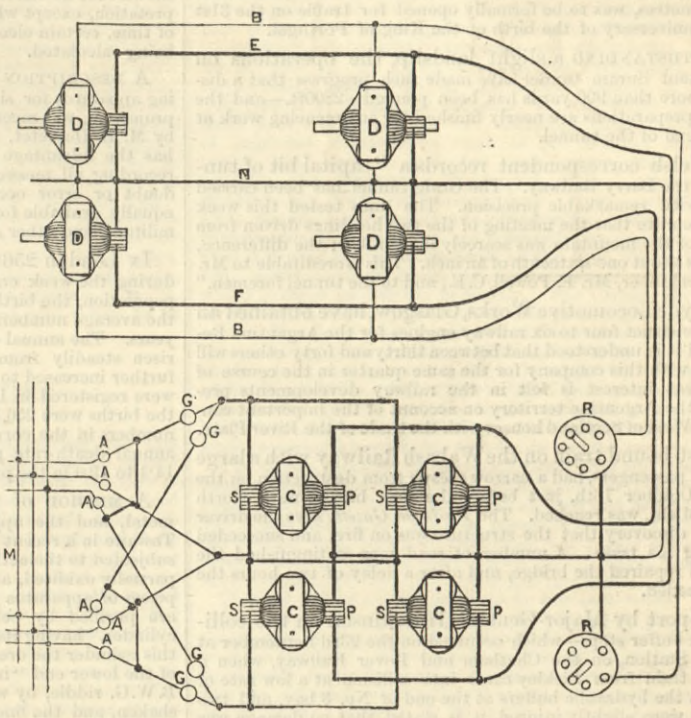


Fig. 4.—Edison's Plan of Rotating Transformers. The Primary Circuit Connected in Multiple Arc with the Dynamos.

"The current is collected from the commutators S S, of the secondary coils of the converters, and is distributed exactly as if the armatures of the converters were driven by an engine instead of a current of electricity from a distant source.

"From the indications of the ammeters A and voltmeters attached to pressure wires leading from desirable points on the distributing mains, the attendant at the sub-station regulates the potential of the distributing mains M by the feeder regulators G, and the rheostats R. By the use of the latter it is unnecessary to run back-pressure wires from the sub-station to the dynamo station.

"The armatures of the transformers or motor generators are wound with two sets of coils, large and small. As their names indicate, they are electric motors, the converting armatures revolving in a powerful field, by the influence of the current passing through their primary circuits. This disposition proves a potent factor in the economy of the system. As there is no belt strain, well-balanced armatures are run at double the speed of a dynamo of the same size. The output is, therefore, twice that of a dynamo of the same size. At an outlay of 50 per cent. of the cost of the dynamos of the central station, converters can be placed in a sub-station and current distributed four miles instead of less than a mile from the power plant, and at no greater expense for conductors.

"The motor generators require much less attention than a dynamo with well-balanced armatures; the weight alone of these causes any friction on the bearings. The number of ampères [? ampère turns] of the high and low-tension circuits of the armature is approximately the same—any tendency to distort the lines of force and cause a rotation of non-sparking point in a negative direction by the high tension or motor coils is neutralised by the current flowing in opposite direction—of low tension or dynamo coils. There is absolutely no sparking at the brushes of either commutator, and the brushes, when once adjusted, require no change for any variation of load.

A Jubilee Calamity.—On Jubilee Day, at Goole, during a discharge of fireworks provided by the town, an unaccounted-for explosion occurred. A boy was killed, and all but fatal injuries were inflicted upon Mr. James Lees, engineer to the gas and water company. Mr. Lees has recovered, but with the loss of sight, one eye having been removed to save his life. At forty-eight he finds himself blind and helpless, with a wife, and two daughters too young to replace his loss of income. The town is raising a fund, and the secretary to the trustees is Mr. G. W. Cutts, solicitor, Goole. Mr. Lees was formerly one of the partners in the Long Island Ironworks, Carlisle, which sent out girders, roofing, pier work, and machinery; and Mr. Lees superintended the construction of piers and markets in Lancashire and Cumberland. He was afterwards in the service of Messrs. Young and Co., of the Pimlico Foundry, London, and from thence he went to Goole, to take charge of the gas and water works. The appeal on behalf of Mr. Lees is therefore extended to the gas and water and the engineering and building worlds, and several responses have already been received. The list of contributions includes Mr. George Livesey, of the South Metropolitan Gas Company, £25; Messrs. R. and J. Dempster, Manchester, £20; Messrs. Spence and Co., Manchester; Messrs. Guest and Chrimes, Rotherham; Messrs. W. and B. Cowan, Edinburgh; Mr. T. Hawksley and Mr. C. Hawksley, London; Messrs. Harris and Pearson, Stourbridge; Messrs. Stainsley and Lyon, Knottingley; Messrs. G. Bray and Co., Leeds; Messrs Dixon and Son, Leeds; and several others in all parts of the country.

RAILWAY MATTERS.

THE Vienna correspondent of the *Times* is informed that Prince Ferdinand has made an advance of £40,000 out of his private fortune to the Bulgarian Treasury in order to hasten the completion of the Bulgarian railways.

IT is stated that in an arbitration case, O'Rourke and McSharry, New South Wales railway contractors, against the Government, £2433 has been awarded to the plaintiffs, and the costs of the arbitration amount to £30,000.

IT has been announced that the section of the Delagoa Bay Railway between the sea and the Transvaal frontier, a distance of 86 kilometres, was to be formally opened for traffic on the 31st ult., the anniversary of the birth of the King of Portugal.

NOTWITHSTANDING a slight landslip, the operations on the important Suram tunnel have made such progress that a distance of more than 900 yards has been pierced—2800ft.—and the necessary preparations are nearly finished for commencing work at the other end of the tunnel.

OUR Welsh correspondent records a "capital bit of tunnelling on the Barry Railway. The Graig tunnel has been carried through with remarkable precision. The lines tested this week were so accurate that the meeting of the two headings driven from each side of the mountain was scarcely discernible; the difference, in fact, was about one-sixteenth of an inch. This is creditable to Mr. Mackay's engineer, Mr. E. Powell, C.E., and to the tunnel foremen."

THE Clyde Locomotive Works, Glasgow, have obtained an order to construct four to six railway engines for the Argentine Republic, and it is understood that between thirty and forty others will be placed with this company for the same quarter in the course of time. Great interest is felt in the railway developments projected in the Argentine territory on account of the important connection of West of Scotland houses with the trade of the River Plate.

AN East-bound train on the Wabash Railway with a large number of passengers, had a narrow escape from destruction on the night of October 16th, just before the long bridge near North Morenci, Mich., was reached. The *Railroad Gazette* says the driver made the discovery that the structure was on fire, and succeeded in stopping his train. A number of road men extinguished the flames and repaired the bridge, and after a delay of two hours the train proceeded.

IN a report by Major-General Hutchinson on the collision—with buffer stops—which occurred on the 23rd September at St. Paul's Station, on the Chatham and Dover Railway, when a passenger train from Bickley came into collision at a low rate of speed with the hydraulic buffers at the end of No. 3 bay, and two passengers were slightly injured, it is stated that no damage was sustained by the train, which consisted of a tank engine, running coal bunk first, and seven vehicles, the available brake power being derived from a screw brake for the four coupled wheels of the engine, and from a hand brake in the last vehicle. The buffers were also not damaged. "This slight collision was caused by an error in judgment on the part of Ovenden, the driver of the train, and of eight years' service, during which he has run with passenger trains into terminal stations probably some 15,000 times without having ever before come into collision with buffer stops. I am sorry to observe from the last brake returns how little this company has done towards supplying its rolling stock with continuous brake appliances."

CONCERNING American trading prosperity the *St. James's Gazette* says:—"We are apt in this country to ascribe the marvellous progress of the United States somewhat too exclusively to the opening up of new land, forgetting that even the oldest part of the country—the New England States—is far from having attained the stationary condition at which we seem to have arrived here in England. Perhaps no single test of progress is more trustworthy than the railway earnings; and, according to 'Poor's Manual,' in the seven years from 1879 to 1886, while the mileage of the New England lines has only increased about 9 per cent., the receipts have amounted from 40,000,000 dols. to 62,000,000 dols., an advance of over 50 per cent. And, strange though it may seem, tried by this test, New England has actually advanced more rapidly than the States of the Pacific slope. These latter have also increased their traffic receipts 50 per cent.; but to earn this they have increased their mileage from under 4500 to over 7600. But the part of the country which has made the greatest progress of all is neither the east nor the west, but the States of the south. There the 13,000 miles of rail of 1879 have grown to 18,000 in 1886, while the receipts show an improvement of more than 80 per cent. Even in her commerce America is apparently democratic, and does not suffer King Wheat to reign as undisputed sovereign."

IN order to shorten and improve the passenger transit between the Cape Colony and Europe, the Union and Castle Steamship Companies are prepared to work harmoniously with the "Southern Express" *vid* Lisbon. But the *Times* Madrid correspondent says the combination of railway and steamship companies will not give the desired result unless the Portuguese Government convert the promises made on its behalf by Senhor Barros Gomes concerning the development of the port of Lisbon into acts. Passports should be done away with, and, if necessary, the revenue hitherto derived from these should be covered by a stamp duty on the passage tickets. Special facilities should be given for the transit of passengers between the express and the steamer, and *vice versâ*, and the sanitary laws should be modified so as to enable passengers arriving in manifestly and notoriously healthy ships to land immediately, under medical inspection. Passengers' luggage should be passed in bond, otherwise neither the public port of Lisbon nor the transport companies will derive any real benefits from a combination which is capable of acquiring great importance. The Government of Senhor de Castro has already done so much for the material prosperity of the country that it is not too much to expect that it will succeed in removing any minor difficulties that may tend to prevent Portugal from becoming one of the great highways to the far south and west.

CONCERNING the prospects for great railway extensions in the United States, notwithstanding the great recent growth, the New York *Times* says:—"The construction of thousands of miles of railroad in Eastern Kentucky and Tennessee, for which surveys have been made and financial support has been obtained, will cause great mineral deposits to be utilised and at the same time gradually civilise a region thus far given over to outlaws of the Tolliver type. The *Engineering News* recently published a map showing the railroads which were in use in the United States at the end of the calendar year 1885, and the roads made in the year 1886. A glance at this map shows that the new lines were for the most part built in the region lying between the ninety-fifth and one hundredth meridians, where the closely woven network of roads covering the region north of the Ohio river has been extended in Kansas, Nebraska, and Dakota. It also shows a broad belt almost devoid of railroads lying between Western Pennsylvania and Northern Georgia. Parts of this district can never support a dense population, and the mountain ranges in it preclude the construction of such a railway cobweb as exists in the region between Pittsburg and Topeka; but nevertheless the roads on the slopes and plateaus and through the gaps are to be multiplied in the next ten years. There are at least fifty counties of Kentucky and Tennessee that are not reached by railroads or telegraph wires. The new roads will serve as missionaries to transform gradually but surely the character of the secluded villages, and put an end to the feuds and vendettas in which the energies of the isolated people have been expended. These maps and the current news reports show that there is in the country a great deal of very raw material yet to be cooked on the railroad gridiron."

NOTES AND MEMORANDA.

DURING the week ending Saturday, October 22nd, the deaths registered in twenty-eight great towns of England and Wales corresponded to an annual rate of 19·8 per 1000 of their aggregate population, which is estimated at 9,244,099 persons in the middle of this year. The six healthiest towns were Birmingham, Brighton, Halifax, Norwich, Nottingham, and Salford.

IN a recent number of the *Comptes Rendus* is a paper on the formulas of dimensions in electricity, and on their physical significance, by M. G. Lippmann. Some of these formulas give the idea of a corresponding physical interpretation. But it is shown that no electric magnitude appears susceptible of such interpretation, except where the dimensions may be reduced to those of time, certain electric phenomena having a duration capable of being calculated.

A DESCRIPTION of a mechanical and automatic registering apparatus for signals transmitted by telegraph and by optical projectors, was recently read before the Paris Academy of Sciences by M. E. Ducretet. The apparatus here described and illustrated has the advantage over others in general use of automatically recording all messages for the purposes of reference in case of doubt or error occurring in the transmission of signals. It is equally available for ordinary telegraphic service, and for optical, military, and other systems.

IN London 2568 births and 1566 deaths were registered during the week ending the 22nd ult. Allowing for increase of population, the births were 215 and the deaths twenty-seven below the average numbers in the corresponding weeks of the last ten years. The annual death-rate per 1000 from all causes, which had risen steadily from 14·4 to 16·7 in the preceding four weeks, further increased to 19·4. Last week 2581 births and 1738 deaths were registered in London. Allowing for increase of population, the births were 256 below, and the deaths 131 above, the average numbers in the corresponding weeks of the last ten years. The annual death-rate per 1000 from all causes, which had risen from 14·4 to 19·4 in the preceding five weeks, increased to 21·5 last week.

A METHOD of purification of iron ore and fluid iron metal, and the apparatus therefor, is described by Mr. B. H. Thwaite in a recent patent. Molten pig iron in a falling stream is subjected to the action of one or more jets of air, by which it is partially oxidised, and so purified. Several more or less elaborate pieces of apparatus are shown with this object in view. Iron ores are purified by being passed through a "calcining revolving cylinder," having its axis somewhat inclined to the horizontal. In this cylinder the ore is subjected to reducing gases, and drops out of the lower end "in the form of reduced spongy metal into a fine B.W.G. riddle, by which the metal and its impurities are properly shaken, and the finer particles of the metal and earthy and other impurities fall into a trough in which there revolves a magnetised Archimedean screw, to which the finer metal particles become attached by magnetic attraction; the earthy particles fall through the perforations."

AT the British Association meeting at Manchester, a paper was read on "Some Effects of Pressure on the Sedimentary Rocks of North Devon," by J. E. Marr. The structures described in this paper are mainly seen in the Ilfracombe division of the Devonian system, as exposed near the bathing-place at Ilfracombe. The rocks there consist of argillaceous beds, with thin bands of grit and crinoidal limestone; these harder beds are folded into a series of small sigmoidal folds, which form portions of similar larger folds. When the middle limb is replaced by a fault, the cores of the folds remain as "eyes" of limestone or grit, and these "eyes" have undergone further modification, having been pulled out into thin lenticular masses. In this way we have all the mechanical structures of a true schist produced—including the apparent false-bedding—the rock now consisting of clay-slate with alternating folia of grit or limestone, or both. Quartz veins are folded in a similar way to that described above, and the final result of this folding appears to be the production of a rock consisting of alternating clay-slate, limestone, and quartz-folia. Every stage of the process is seen in the case of the limestone "eyes." The cores of limestone, when not dragged out, have their compound crinoid stems pressed into polygons, which have been formed in the way described elsewhere by Dr. Sorby. When the limestone is pulled out the stems are separated, as in the case of the Belemnites figured by Heim, and the intervening portion is filled with calcite.

TO pave a city with cedar would seem to be a luxury, but it appears that in the city of Chicago, out of 277·71 miles of paved streets, there are 213·35 miles of cedar blocks, of which nearly forty miles was laid last year, and the Chicago *Tribune* says it is the cheapest pavement laid in the city. Dead cedar brought from the vicinity of Green Bay, Wis., was first used, but it was found that it did not wear well, and live timber is now required. The cedar is a tree which does not taper rapidly, and one of good size should furnish a stick 30ft. long. The logs are brought here by boats in lengths of about 6ft., with the bark still on, peeled, and cut into blocks 5in. long. The blocks range in diameter from 3in. to 9in., and cost 50 to 60 cents a yard, measurement being made after they are laid. The process of paving a street with cedar blocks is much the same as was used with the Nicholson pavement. A sand foundation is first provided, and on this are laid boards which serve as stringers. On the stringers planks are placed parallel with the curb, and the cedar blocks are stood on end on the planks. The interstices between the blocks are filled with gravel and coal-tar. For the last three years block pavement has cost in Chicago from 1 dol. to 1.30 dol. a yard. The life of cedar-block pavement is three to seven years, and it is an excellent pavement when first laid. It is believed by many to be detrimental to health from the fact that it absorbs all liquids falling upon it, gives them back in the shape of vapour under the influence of the sun, and is itself constantly decaying. It is stated as a curious fact that this pavement wears out faster on streets where traffic is light than where it is heavy. Cedar blocks are used for paving all through the West, but more freely probably in Chicago than in any other city in the world. They are cheap, and that is a great point in their favour.

A PAPER on the magnetisation of iron in strong fields was read at the recent British Association meeting by Professor Ewing, F.R.S., and Mr. W. Low. Read by Professor Ewing:—"In the experiments described iron was subjected to very intense magnetisation by placing a narrow neck between two massive pole-pieces. In this way values of magnetic induction higher than those previously reached had been attained. Through the kindness of Professor Tait the large electro-magnet of the Edinburgh University had been transferred to University College, Dundee, and by its means the induction was pushed up to the value of 38,000 C.G.S. units. There seemed, indeed, to be no limit to the value attainable, and so the neck was then turned down to about one-sixth of its previous diameter, and the induction was forced up to 45,000. By turning the neck still further, and annealing it, the highest value of 45,350 was reached. An attempt was made to determine the strength of the magnetic field in the immediate neighbourhood of the neck. The quantity $\frac{B-\text{field}}{4\pi}$, where B was the magnetic induction, was found to change from 1680 in an experiment where B was 24,700, to 1420 in the case of the highest value of B attained. This would favour the idea that the intensity of magnetisation has a limit. But it is difficult to be quite sure that the field in the immediate neighbourhood of the neck is the same as in the neck itself. In order to overcome this difficulty the field in the air round the neck was explored by means of three or four coils wound one on top of the other. This will show if the field is varying fast near the iron. If not, it would be natural to assume that the field is much the same as in the iron, because in the median plane there is no surface magnetism.

MISCELLANEA.

THE Bath and West of England Agricultural Show will next year take place at Newport, Mon., from the 6th to the 11th of June.

UP to September 17th the total number of visitors to the Adelaide Exhibition was 384,725, comprising 192,775 cash and 191,950 season-ticket admissions.

THE steam pumps exhibited by Messrs. Hayward Tyler and Co. have been awarded the "First Order of Merit," being the highest award, at the Adelaide Jubilee Exhibition.

AT the recent Maritime and Industrial Exhibition at Havre, Delta Metal was awarded a gold medal for the exhibits of propeller castings, forged cranks, pump rods and rams, torpedo shafts, driving gear, &c.

AN International Exhibition of inventions and systems for preventing or extinguishing fires in theatres is to be opened on November 25th, in the Municipal Pavilion in the Champs Elysées, Paris. There are to be theatrical performances with sham fires.

NOTICES are posted about the works at La Chapelle, Paris, of the French Northern Railway, to the effect that the Union des Mécaniciens de la Seine provides its members with free instruction, books, &c., in mechanics, drawing, and screw-cutting, including the theory of the latter.

A TELEGRAM from a German firm in Cape Town announces that gold in promising quantities has been discovered in Lüderitzland, and Herr Göhring, the Imperial Commissary, and some of the gold diggers have gone to the Cape to make arrangements for exploiting the auriferous strata thus discovered.

THE *Times* Geneva correspondent, telegraphing on November 1st, says:—"Railway communication on the St. Gothard Railway is interrupted owing to a landslip, which caused the collapse of a bridge between Sisikon and Flüelen. The night train from Basle was compelled to return to Lucerne. Prompt steps have been taken to restore traffic."

THE Corporation of Barrow, finding a great scarcity of water this year, are now engaged in sinking bore-holes with a view to the construction of a new reservoir at Harlock, to hold 210,000,000 gallons. They have already two reservoirs, one at Poaka Beck, holding 190,000,000 gallons, and another at Pennington, holding 130,000,000 gallons.

A PARTY of engineers and surveyors, with their assistants, will, it is reported, leave New York by steamer at the end of November for Nicaragua, in order to settle and complete the route of the projected Nicaragua Canal preliminary to its construction. The cost is estimated at 50,000,000 dols., and the works are expected to be finished in six years. The canal will be the property of a company.

AN elaborate report by Col. V. D. Majendie, C.B., has been presented to the Secretary of State, and now published, on the circumstances attending the fire and disastrous explosion last June at the Cornbrook Chemical Works, near Manchester, of Messrs. Roberts, Dale and Co. It contains a great deal of information on the explosives concerned, and on those of a similar character, and is accompanied by several lithographs.

AT the sitting of the Academy of Science on the 31st ult., Count Ferdinand de Lesseps announced that the Panama Canal would be open by February 3rd, 1890. He added that the works would not be entirely completed by that date, but that the passage would be free for the transit of twenty ships daily, and he estimated that even this amount of traffic would give receipts of from 90,000,000f. to 100,000,000f. per annum.

THE recent operations in connection with the oil bores in New Zealand having convinced those concerned of the valuable nature of the oil, arrangements are being made, the *Colonies and India* says, for erecting a refinery and laying down a line of pipes to connect the oil springs with Gisborne. Several companies that were awaiting the results of the boring operations at the South Pacific Company's property are now preparing to commence operations on the leases which they hold.

THE Liverpool Corporation have granted a licence under the Electric Lighting Act to the Liverpool Electric Supply Company to supply the central part of the city with electric light. The licence stipulates for a continuous supply to all residents who may desire it within the area, with special privileges to the Corporation and theatre proprietors to obtain light for their respective uses at reduced rates. It is to be hoped that it will not so often fail as the light is said to have done in London lately.

THE *American Army and Navy Record* says:—"Such rapid progress is being made in the development of the gun plant at the Watervliet Arsenal that it is hoped by the 1st of the coming month to begin work upon finishing the first heavy guns. Recent advices state that all the machinery, except two Fitchburg lathes, has arrived. The concrete beds for the 120in. lathe and the 83in. lathe have been completed. The bed-plates of the former are in position, and those of the latter will be placed in a few days. The smaller lathes are nearly all in position. The cooling pit and the furnace for heating tubes, jackets, and bands are being completed. The tubes, jackets, and bands of the 10in. and 8in. rifles are already on hand, and a number of field guns of smaller calibre have arrived."

ON Wednesday there was an annual election in Wolverhampton of South Staffordshire Mines Drainage Commissioners. There were ten vacancies and some fifteen or sixteen candidates. The elected ten were made up of six retiring Commissioners and the following new names:—Messrs. B. Whitehouse, W. Addenbrooke, Michael Grangebrook, jun., and Rupert T. Smith. At the monthly meeting of the Commissioners, which succeeded the election, the representative of the Earl of Dudley, Mr. Chas. Tylden Wright, gave notice of his intention to move at the next meeting the rescinding of the resolution passed at the recent special meeting of the Commissioners determining to apply to Parliament for further powers. The chairman stated that there would be no necessity to take this course, since the triumvirate had already officially informed the Commissioners of their intention not to proceed with the Bill. The chairman then entered into a defence of the Commissioners against the criticisms recently passed by the opposing mineowners.

THE Derbyshire miners have had a conference to consider the resolutions passed at the Edinburgh meeting. These resolutions were (1) That eight hours be the maximum day's work; (2) that a general holiday be observed each week; (3) that there be a week or longer holiday, if necessary, so as to clear off stocks and secure an advance of 10 per cent.; (4) that the House of Commons be asked to fix by law the working hours at not more than eight hours in any twenty-four; and (5) that the whole of the miners be balloted, and their opinions ascertained on any or all of the above points. At the Derbyshire meeting the Edinburgh resolutions were adopted. Another National Conference is to be held to see whether the miners were prepared to carry out the programme thus announced. The men are urged to make "one gigantic effort" for their cause, being promised "that if they do, and act wisely afterwards, they will raise their wages in more ways than one—there is too much work done without pay to-day; stop a good deal of the robbery that is going on; ensure an amount of civility that you do not now receive; reduce your working hours to a reasonable number, and place yourselves, once for all, in a position to make something like fair contracts at your work."

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

(*From our own Correspondent.*)

A REVISED list, showing a reduction on their "S.C. Crown" iron—bars, sheets, plates, and strips, &c.—of 20s. per ton has been issued by Messrs. John Bradley and Co., Stourbridge, and a drop of 30s. on charcoal qualities. The reduction, however, is not likely to have any effect upon the other marked bar prices of South Staffordshire, since the action of Messrs. Bradley is only in common with that taken by other firms in May last year, when a 10s. drop in general marked bars occurred, and when Messrs. Bradley declined to make any alteration in their lists. The firm have long occupied an exceptional position in quoting their iron at from £1 to £2 per ton above the prices of the products of other list firms. By the reduction their "S.C. Crown" bars become £8 for rounds up to 3in. size and for flats up to 6in., while charcoal sheets become £17, and charcoal strip £15 10s. for ordinary sizes. The price of other Staffordshire marked bars still remains at £7, with the usaul extras of 12s. 6d. per ton for the Earl of Dudley's Round Oak brands.

The action of Messrs. Bradley is taken at a time when buyers are so susceptible of receiving unfavourable impressions. But buyers must not suppose any other reductions will follow. The obvious weakness in the demand for marked iron would naturally have a tendency to affect prices, but that influence is not sufficiently strong to induce any actual reduction.

The anticipated stronger demand for general bar iron, which is usually experienced at this period of the year, has not yet appeared. The inquiries from the colonies, however, are numerous, and taken altogether the work in hand is sufficient to provide pretty fair employment at the mills. General merchant bars are £5 10s. to £6 per ton; ordinary bars, £5; while hurdle bars can be got at as low as £4 15s. to £4 17s. 6d. Iron for pressing bolts can be obtained occasionally at £4 12s. 6d. per ton.

Some good bar contracts have lately been placed by London merchants. Among them may be mentioned one for 2000 tons which has been divided between North and South Staffordshire—two-thirds going to North Staffordshire, and the remainder to local firms.

The open market quotations of the Pelsall Coal and Iron Company are this quarter as follows:—P.C. bars, £5 5s.; P.C. hoops, £5 10s.; Crown bars, £6; Crown hoops, £6 5s.; Crown sheets, £6 10s.; charcoal sheets, £13; hinge strip, £6; gas strip, £5 5s.; nail strip, 24in. wide to 13 gauge, £5 5s.—all at makers' works.

The demand for tube strip has been somewhat adversely affected by the recent advance declared in prices, and also in some measure by a less vigorous business at the moment amongst the tube makers themselves. The association price remains at £5. Hoops are quiet, and for coopers' hoops, in which most is being done, from £5 5s. to £5 7s. 6d. is quoted.

The competition of steel continues to affect the position of the iron plate maker. The orders in hand are small, and prices are by no means uniform. Boiler plates range from £7 to £7 10s. for ordinary qualities, to £8 10s. for superior, and £9 10s. for best sorts. The reduction by the Low Moor Company has not yet had any effect upon local prices.

The proposal for incorporation which has been received by the English sheet makers from the Belgian black sheet syndicate has had a slight effect in strengthening prices. Whether the offer of the syndicate will be embraced is still a very doubtful question. The shipping demand for sheets continues large, and this, in addition to the requirements of the galvanisers, is affording full employment at the mills. In some cases makers are again being pressed for the completion of contracts. Sheets of 20 gauge remain at £6 5s., 24 gauge at £6 10s., and 27 gauge at £7 7s. 6d. to £7 10s.

The orders on the books of the galvanisers are sufficient to guarantee full running for the next few weeks, and there are indications that orders will not be found wanting even well beyond Christmas. Prices fluctuate. The sustained strength of spelter has a tendency towards establishing a further advance, but this is prevented by continued competition and consequent underselling. The basis price of sheets of 24 gauge, in bundles, f.o.b. Liverpool, keeps at £10 10s. to £11.

Operations at the steel works are being conducted without intermission. The orders arriving are hardly in equal bulk with those being completed, but they are sufficient to guarantee steady work for some months to come. The output of the Staffordshire Steel and Ingot Iron Company is being increased by running the converters ten heats per turn, instead of, as formerly, eight heats, and by enlarging the size of the Batho-basic furnace recently erected. This new form of furnace is expected to prove fully equal to the high anticipations which are now entertained of its efficiency.

There is a brisk demand for steel plate and other shearings, which are being bought up by ironmasters for re-piling, re-heating, and rolling down in the mills into light sections, such as hoops, strips, &c., as well as for using up in the steel converters and for other purposes.

A very meagre supply of iron scrap upon the market has resulted in the price of sheet shearings being firm at 44s. 6d. per ton delivered into this district from South Wales. Some buyers endeavour to secure an abatement of 2s. per ton, but buyers refuse to entertain any such overtures, alleging that they would find it more profitable to consume the scrap themselves.

Pig iron is being sent away with more regularity from the local furnaces. Production is increasing, and last month the deliveries of some makers were larger than at any other similar period this year. Prices are well maintained. Sales of imported Midland brands are not numerous, and prices have a tendency to ease.

Market this, Thursday, afternoon, in Birmingham, discussed a good deal the upward movement now observable in metals. The circumstance that tin, copper, and spelter are now at a higher point than at any time this year cannot but be regarded as satisfactory, and ironmasters would be exceedingly gratified if iron were to take any similar course. An advance in one month of £14 10s. per ton in the price of tin carries with it the conviction that the present available supply is within the demand, and if the upward movement continues we shall certainly see some advances in hardware prices other than those which have yet occurred.

On Wednesday the Bradley Fields Ironworks, Bilston, the property of Messrs. S. Groucott and Sons, were offered for sale by auction at Wolverhampton. The works were erected some thirty-seven years ago, and it is estimated that £40,000 has been spent upon them. They occupy an area of two acres, and have a mineral area of three acres. For about four years past they have been standing idle. The plant consists of 4 mills, 23 puddling furnaces, 6 heating furnaces, 3 condensing beam engines, 11 steam boilers, &c. The bidding only reached £3000, at which figure the property was withdrawn.

Local bridge and girder makers find much less work than before the introduction of the rolled girders from Belgium, Germany, and France. Whereas formerly web-rivetted girders were in almost universal demand for all class of erections in which constructive ironwork was at all needed, the rolled girders now built by continental makers, and freely imported into this country, have shut out the rivetted article from almost all departments except that of bridgework proper. No wonder that local engineers should protest that they "hate the sight of the Belgian article."

Among the Indian orders now upon the market is one for iron roofing for sheds and galvanised ironwork for the Indian State Railways, and another for locomotive and engineering stores for the South Indian Railway Company.

Colliery steam pumps show a little more activity in demand with the approach to the wet season. Engineers giving attention to this class of work are in receipt of rather better orders, though the general quiet conditions of the mining and iron trades of the kingdom do not hold out much encouragement.

The ironworkers in the Walsall district, being impressed by the recent agitation for a continuance of the payment of extras with the necessity of an efficient system of organisation, have resolved to form a local branch of the National Association.

The South Staffordshire and East Worcestershire chainmakers have again resolved to come out on strike, owing, they say, to the persistent reductions which are being made by a section of the employers. Unless some means are adopted to put an end to these harassing disputes, the trade of the district, which has already suffered severely, will become permanently crippled.

The Bromsgrove nailmakers are in a most deplorable condition, and existence is only maintained by voluntary aid. They are holding out in the hope that within a week or two the masters will be compelled, if they are to keep their trade, to concede the 1879 list.

Messrs. Chamberlain and Hookham have put down an electric light installation on the premises of the Linde British Refrigeration and Ice Company, Birmingham. The electric current is generated by two "Hookham dynamos," the one a ¾ unit, capable of supplying 12·55 volt 16 c.p. lamps; the other a 2 unit, capable of supplying 30·55 volt 16 c.p. lamps. At present only twenty-five lamps are wired, and these are fixed as pendants from two arches. The motive power is taken by a countershaft from the large engine used by the Linde Company in the manufacture of their ice, so that the only cost incurred is that of the extra coal burnt, and the interest and sinking fund on the first cost of the installation. These items together amount to an annual charge of less than one-fourth of that which would be incurred on gas lighting at 2s. 2d. per 1000 cubic feet. The light has been tried, and found to be satisfactory.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—An extremely dull tone characterises the iron market here. Except excessively low, and what may be termed "sporting" offers, which are put forward, more with the view of testing how low the continued downward tendency in Glasgow and Middlesbrough warrants is likely to induce sellers to go, than with the expectation that the offers are likely to find acceptance, there is just at present very little business either in common pig iron or hematites being put upon the market. The fair weight of buying which was going on a week or so back has to a considerable extent covered the present requirements of consumers, and where they are not actually in want, the present weak, unsettled state of the market is an inducement to hold back, the indications being that they have nothing to lose by waiting, but possibly something to gain. Some of the hematite makers seem determined not to follow the prices now current in the market, but business of any weight is only practicable at excessively low figures. A generally steady tone is being maintained in finished iron, especially in hoops and sheets, makers of which are still kept busy with shipping orders, but forges generally are in the position of having no weight of work ahead.

The Manchester iron market on Tuesday was fairly well attended, but there was only a very slow business doing, with prices, if anything, weaker, so far as pig iron was concerned. Lancashire makers, for the very small quantity they have at present to offer outside their regular contracts, still quote 38s. 6d. to 39s. 6d., less 2½, for forge and foundry qualities delivered equal to Manchester, but at these figures they can do no business in the open market. For Lincolnshire iron 36s. 6d. to 37s., less 2½, for forge and foundry qualities delivered equal to Manchester, remain the average figures, but although fair sales were made recently at about these prices they do not now seem to offer any inducement to buyers. Derbyshire foundry is still quoted at about 40s., less 2½, delivered here, with, however, little or nothing doing. Outside brands are easier; during the week best named foundry brands of Middlesbrough have been sold at about 41s. 6d. net cash delivered equal to Manchester, but sellers would now readily take 41s. or even less to secure orders, and Scotch iron is offered freely at under makers' quoted list rates. No. 3 foundry hematite of good quality is nominally quoted at about 52s., less 2½, delivered in the Manchester district, but to effect sales of any weight 1s. to 2s. per ton under this figure is being taken.

The extraordinary "bearing" in Scotch steel plates that I reported last week seems to have been a temporary speculative operation, and is regarded here as a somewhat smart expedient on the part of the operators to gain notoriety with a view to future business. The effect, however, has been to somewhat weaken prices, and £6 17s. 6d. is now the average maker's quotation for steel plates delivered in the Manchester district.

In the finished iron trade only a moderate demand is reported for bars at about £4 17s. 6d. for good ordinary qualities delivered equal to Manchester, but hoops and sheets continue in brisk demand, and are firm at £5 5s. for hoops, and about £6 10s. for sheets delivered in the Manchester district.

In the metal market there is a very strong tone as the result of the recent upward movement in the raw material, and during the week prices for manufactured goods have been advanced ¼d. per lb.; the quotations for delivery in the Manchester district being now as under:—Solid-drawn brass tubes, 5¾d.; condenser brass tubes, 6¾d.; solid-drawn copper tubes, 7d.; brazed copper tubes, 6¾d.; brass wire, 5¼d.; copper wire, 7¼d.; brass sheets, 5d. to 5¾d.; and sheet brass, 6¼d. per lb. At these prices there is a fair demand, buyers evidently believing that the lowest point has been touched.

The Parkgate Iron Company, of Rotherham, which is making a departure into steel, has commenced offering in this market its make of steel plates, and is prepared to quote for all qualities of angle tees and bars as in steel; it is, however, still carrying on its iron manufacture.

I hear that Mr. Ewing Matheson, of London, is leaving Messrs. Handyside and Co., to join the Farnley Iron Co., which has offered him an appointment as manager, and Mr. Matheson's place in London is to be taken by Mr. J. T. Chancellor, who now represents Messrs. Handyside and other firms in Manchester.

The condition of the engineering branches of industry remains much the same as I have reported from week to week for some time past. Generally, engineers and machinists are kept fairly employed, and on some special classes of work are busy. The bulk of the work that is to be got, has, however, to be taken at extremely low prices, and as the general position of engineers and machinists is that they are eager to secure new work, it is in many cases not so much a question of price as of securing orders, and there is no present prospect of improvement on this unsatisfactory condition of trade. The report of the Steam Engine Makers' Society for the past month shows a slight decrease in the number of unemployed, but nothing to point to any improvement. The reports from the various districts are still only moderate as to the condition of trade. The locomotive branches are reported to be fairly employed, with one large firm in this district starting men fairly extensively. Boilermakers, machine toolmakers, and machinists, are also reported to be fairly off for work. The unsettled state of the Bolton district for the last five months, and now a strike at Blackburn, where the men have gone out on some trivial matter of dispute, renders it difficult to form an accurate estimate of the condition of the stationary engine building trade, but generally there seems to be a fair amount of work stirring.

Mr. Joseph Dickinson, H.M. Chief Inspector of Mines, ex-President of the Manchester Geological Society, delivered an interesting address on Tuesday, in which he dealt especially with the progress which has been made in geology and mining during the last fifty years. Mr. Dickinson drew a striking contrast between the conditions under which mining operations were carried on at the commencement and even tolerably late on in the present century, and those which prevailed now. Fifty years ago the ventilation of the mines was so deficient that in the return air ways "caps" 2in. to 3in. in length were not unfrequently to be seen above the candles carried by the men, and explosions were frequently only prevented by the fact that there was not sufficient air in the gas to make it explosive. Those momentous times have now nearly passed away, but the transition from the inactive ventilation with scarcely sufficient air in the gas to cause a general explosion, to the active ventilation, which made explosions when they did occur much more violent, had not been effected without many thrilling incidents. In the lighting of the mines great changes had also been effected. Formerly it was only the fireman in making examinations who used the Davy safety lamp, the men generally working with candles, and it was even common to "try" for gas with open lights. The first safety lamp—the Claney—was a cumbrous arrangement, and had to be supplied with air forced through water from a bellows. From that period down to the present unceasing efforts had been made to construct what might be termed a real safety lamp. The earlier lamps, such as the Davy, Claney, and Stephenson, had been emphatically condemned in the recent report of the Royal Commission as unsafe in currents of ventilation much below those now encountered in well-ventilated mines. Safety lamps of improved construction, such as the Muesler and the Protector, had been in use for some years past, and, more recently, the Marsant. These and similar lamps were supplanting the Davy, Stephenson, and Claney, except that the Davy was still preferred by many persons for testing. The test of withstanding the current of air ordinarily met with in the mine, even if it were explosive, required by the Coal Mines Regulation, 1887, would necessitate great changes in lamps. The Stephenson would perhaps be difficult to modify. The Claney would have to be bonnetted, and apparently a double gauze added for some currents. The Davy would require in such currents either the tin can, the encircling glass cylinder up to and a little above the cap or smoke gauze, and in some currents, it might be, a double bottom gauze in addition. The electric light was now used at a few collieries for lighting near the shafts, and portable electric safety lamps were slowly coming into use, and for drawing props or other work requiring a good light, such lamps seemed very valuable.

The annual meeting of the South Lancashire and Cheshire Coal-owners' Association was held in Manchester on Tuesday, and Mr. John Knowles, who was President in 1866 and in 1872, when the last Mines Regulation Act was passed, was elected President for the ensuing year, which, he remarked, was rather a singular co-incidence, seeing that he would again be President when the Coal Mines Regulation Act, 1887, came into operation.

There is rather a quieting down in the coal trade. House fire qualities are moving off less freely, and other sorts for iron making, steam, and engine purposes continue in very slow demand, with supplies plentiful. There has been some attempt here and there to advance house-fire coal, but generally prices remain much the same as last week, and at the pit mouth average 9s. for best coals, 7s. to 7s. 6d. seconds, 5s. 6d. to 6s. common house coal, 5s. to 5s. 6d. steam and forge coal, 4s. 6d. to 5s. burgy, 3s. 6d. to 4s. best slack, and 2s. 6d. to 3s. common sorts.

Shipping is extremely quiet, and 6s. 6d. to 6s. 9d. is about the full average price obtainable for ordinary qualities of steam coal delivered at the high-level, Liverpool, or the Garston Docks.

Barrow.—No change of moment can be noted in the hematite pig iron trade, but the market shows a rather better tone, makers are much firmer in their transactions, and dealers in hematite warrants are asking more money for both Bessemer and ordinary hematite samples of iron. The work in the hands of makers is considerable, but it is probable that the make will soon be reduced. Messrs. Kirk Brothers and Co., at Workington, are about to blow out one of their furnaces at New Yard, owing to the fact that they already have a large stock of their special brand of pig iron. The business doing in Bessemer is not large considering the large consumption, but buyers are well bought forward. Stocks have slightly increased of late, but they are principally in the hands of warrant holders. There is a slight improvement in the prices at which warrants have changed hands, and sales are noted at about 41s. 6d. per ton. On the other hand, makers are quoting from 42s. to 44s. 6d., according to brand and time of delivery, and business has been done between these figures. The steel trade shows a continuance of life and activity. Rails are in good demand from all parts, and makers are so busily employed that they cannot entertain some important contracts offering. It is reported that the order for 40,000 tons of steel rails for Victoria has been placed in West Cumberland, but the rumour requires confirmation. So large a bulk of steel would represent six weeks' work for all the mills in the district. Rails of heavy sections are quoted at from £4 2s. 6d. to £4 5s. per ton net f.o.b. Blooms are in limited inquiry, the best quotations being £4 per ton net. Billets and slabs are in good demand, and orders are still largely held, prices being firm at £4 2s. 6d. per ton. Wire rods are quiet. There is nothing doing at the moment in spiegeleisen, as users are largely bought forward. Shipbuilders have no new orders to report. Engineers are a little better employed in the marine department, but they could undertake four times as much work, and not be over busy. Finished iron is in better request. Bars are quoted at from £5 to £7 per ton, less 2½ per cent. at a month. Iron ore is steady, and prices are firm at 9s. to 12s. 6d. per ton at mines. Coal and coke steady. Large shipments of iron and steel have lately been made to foreign ports.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

I HAVE private information which leads me to the belief that the Dore and Chinley Railway will not be abandoned after all. The conditions attached to the raising of the capital, and the time allowed for obtaining it, were unusually onerous; but the scheme is still alive, and the next heard of it will probably be under the wing of the Midland Company. Its idea is to seek for power to issue 4 per cent. debenture stock, and to get sanction to pay interest during the construction of the works. This step will no doubt be taken during the present November, in which case the Dore and Chinley directors will probably promote an Abandonment Bill to clear the way for the Midland.

The Parkgate Ironworks, which have a record extending over half a century, have commenced the manufacture of steel bars and plates. Captain Stoddart, the managing director, informed the workmen some time ago that in consequence of the anticipated increased demand for steel productions in lieu of iron, they must be prepared for the new order of things. Since then orders for steel bars and plates have been taken. Billets and blooms for the manufacture have been obtained elsewhere, the plant for the production of the raw material not having yet been laid down. The directors are stated to contemplate the erection of steel-making works on the Siemens' process, with the latest improvements.

Mr. Stuart Wortley, M.P.—Hallam Division of Sheffield—has received a letter from the Secretary of State for War on the subject of the quality of the tools supplied to the army during the Crimean War. Mr. Stanhope has caused inquiries to be made into this matter, and he finds that during the early part of the Crimean War the quality of the tools was undoubtedly highly unsatisfactory. In order to remedy this, contracts were entered into with Mr. W. A. Lyndon, and Messrs. Spear and Jackson, Sheffield, were largely employed. During the second winter few complaints were raised, and the War Secretary therefore thinks there is every reason to believe that the tools they supplied were satisfactory.

The London ivory sales, just concluded, have been of special interest to Sheffield manufacturers, who largely use this material in the staple trades. The supply was thirty-one tons below the average supply to the corresponding series for the preceding twenty-four years. The West Coast of Africa largely predominated in the supply. It was mainly composed of Niger, much of it said to be more or less defective, but there was only a very little "really common," and a moderate proportion "really good," chiefly of the

Angola character. Soft Indian and Eastern Africa tusks advanced £3 to £6 for fine, and £2 and £3 for defective; billiard ball measured pieces, and cut points for ball and bagatelle purposes advanced £2 to £4; soft Egyptian, £2 to £3; harder rather in buyers' favour; Cape slightly advanced; West Coast African tusks sold a trifle higher, some better quality lots making an advance of £2 to £4; choice bangle tusks advanced £1 to £3. Mr. S. J. Pitt, in his report of the sales, points out that the absence of supplies of what hitherto was known as Cape ivory, is readily accounted for, first, by prohibition to hunt the elephant in particular districts, with the object of cherishing what remains; second, by civilisation having had the effect of driving the animal further into the interior; and, third, because some of the class of tusks which formerly found their way to the Cape through the several passes, now get diverted by easier river, lake, and land transit to nearer ports on the Eastern African Coast, such as Quillimane, &c. Mr. Pitt adds that much of the Egyptian ivory is not the huntsman's recent spoil, but is the hoarding of potentates for some time past. This ivory finds its use almost solely in England, and chiefly for cutlery and pianoforte key purposes. Its absence is therefore keenly felt in the London market and by the Sheffield trade, though compensated for in some measure by the increase of West Coast African.

THE NORTH OF ENGLAND.

(From our own Correspondent.)

THE Cleveland iron market held at Middlesbrough on Tuesday last presented no new noteworthy feature. Although further reductions in price were announced, buyers seemed as reluctant as ever to operate. For prompt delivery merchants were willing to accept 31s. 6d. per ton for No. 3 g.m.b. Makers in some cases reduced their quotations to 32s., whilst in others, where orders are now much needed, as low a price as 31s. 9d. would have been taken. These figures represent a fall of 6d. per ton within a week, and about 3s. since the beginning of September. Even for prompt delivery few sales are made, and no one thinks of buying ahead in the present state of the market. Forge iron was on Tuesday quoted at 30s. 6d. per ton, as against 30s. 9d. a week previously. Consumers are in the meantime ordering forward only such small quantities as are sufficient to cover their immediate wants.

Stevenson, Jaques, and Co.'s current quotations: "Acklam Hematite," Mixed Nos., 44s. per ton; "Acklam Yorkshire," Cleveland, No. 3, 33s. 6d.; "Acklam Basic," 35s.; refined iron, 48s. to 63s., net cash at furnaces.

Not much has been recently done in warrants. Buyers offer 30s. 9d., but no sales have been made at less than 30s. 10½d.

The stock of pig iron in Messrs. Connal and Co.'s Middlesbrough store is still receding. The quantity held on Monday last was 327,223 tons, being a decrease of 657 tons during the week.

An improvement in the finished iron trade is reported from Scotland and Staffordshire, but in Cleveland the demand is no better, and prices remain unaltered. Ship plates are offered at £4 7s. 6d. per ton on trucks at makers' works, common bars at £4 10s., and angles at £4 5s.

Shipments of pig iron from the Tees amounted last month to 75,891 tons, which is 3379 tons more than in September; but 8431 tons less than in October last year. The chief items were as follows, viz.:—To Scotland, 32,569 tons; to Wales, 5150 tons; to Germany, 10,810 tons; to the United States, 3500 tons; to Belgium, 3497 tons; to Holland, 3285 tons; to Norway and Sweden, 2572 tons; to Australia, 2235 tons. The total quantity of finished iron shipped was 16,152 tons, and of steel 24,899 tons. India proved the best customer for both iron and steel, 4605 tons of the former, and 14,958 tons of the latter material having been sent there.

An explosion occurred on the evening of the 24th ult. in the Brockwell seam of the Ann pit, belonging to the Walker Coal Company, Walker-on-Tyne, whereby several lives were lost, besides serious injury to some of the survivors. It appeared that none of the sufferers were working in the seam referred to, and therefore the origin of the explosion is quite a mystery. A few weeks since a somewhat similar accident occurred in the Beaumont seam, which is situated thirty yards above the Brockwell in the same pit. On that occasion two lives were lost.

In course of the coroner's inquest held on the bodies of the men who were killed by the explosion of a blast furnace at Seaton, near West Hartlepool, Mr. Tomlinson, the manager, gave some curious evidence. His theory was that a quantity of carbon had accumulated in a pocket or hole in the lining of the furnace; that this carbon being in a highly-heated condition, happened to fall, at the same time crumbling into a finely-divided condition. Meeting with air, also heated, it combined with it and burst with sufficient rapidity to produce an explosive force. The jury having considered their verdict, said they were not satisfied that sufficient time had been allowed to the furnace to cool after being blown out, and before the men were set to work to dismantle it. They required more evidence on the point, and so the inquiry was adjourned until the 8th inst.

A curious right-of-way case has just been heard before the Middlesbrough county police-court, in which two large iron companies were concerned. The plaintiffs were the Clay-lane Iron Company, and the defendants six men in the employment of Messrs. Bolckow, Vaughan, and Co. The South Bank works of the latter company are situated between the railway and the river, and are cut off from any district where there are dwelling houses. Hitherto there have been neither bridges nor tunnels whereby the men could conveniently cross the line and get to and from their work; consequently they were in the habit of trespassing at any point which suited them, until at last they were stopped by the railway company. To obviate the difficulty negotiations were entered into by Messrs. Bolckow, Vaughan, and Co. with the plaintiff company for permission to cross their land, to obtain access to a foot bridge they agreed to erect. The bridge was actually built, but was scarcely in use when a hitch arose, and a fence was placed across the Clay-lane end until it should be adjusted. It was this fence that the defendants took the liberty to knock down. Their plea was that there was a right-of-way established by long usage. The Bench thought otherwise, and inflicted a small fine with costs. At the same time they expressed a hope that the important firms interested would endeavour to arrange their mutual relations, so that their workmen would not be impeded from getting safely to and from their work. Neither the fines nor the costs were pressed for by the plaintiffs.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

THE depression that has of late characterised the pig iron market continued this week, the warrant market having been exceedingly heavy. Now and again prices appeared to be turning upward, but the movement has been invariably followed by a reaction, which brought the rates back to the lowest level. The past week's shipments, although not large, were fair in amount, being 6645 tons, against 6364 in the corresponding week of 1886. The total included 1000 tons to the United States, 770 tons to Canada, 110 tons to India, 1330 to Italy, 175 to Spain, and smaller quantities elsewhere, the quantity sent coastwise being 1536 tons. The total shipments for the year to date are 332,382 against 333,973 tons in the same period of last year. Makers report a few orders this week from America, but the inquiry at the moment is slow, and the quantity going into store is on the increase.

An additional furnace has been put in blast by the Shotts Iron Company, and there are now eighty-four in operation.

The current values of makers' pigs are 3d. to 6d. lower than they were a week ago, as follows:—Gartsherrie, f.o.b. at Glasgow, per ton No. 1, 46s.; No. 3, 42s. 6d.; Coltness, 50s. 6d. and 43s.; Langloan, 47s. and 44s.; Summerlee, 40s. 6d. and 42s.; Calder, 47s. and 40s.; Carnbroe, 42s. 6d. and 38s. 6d.; Clyde, 45s. and 40s.; Monkland, 41s. 6d. and 38s. 6d.; Govan, at Broomielaw, 41s. 6d. and 38s.; Shotts, at Leith, 47s. and 44s. 6d.; Carron, at Grangemouth, 49s. and 43s.; Glengarnock, at Ardrossan, 46s. 6d. and 40s..; Eglinton, 41s. 6d. and 38s.; and Dalmellington, 42s. and 38s. 6d.

The week's arrivals of Cleveland pigs at Grangemouth were 6110 tons against 5200 in the same week of last year.

Rather more business is reported in the malleable iron branch, merchant bars being in better request, both for town consumption and for the country trade. The keenness of the competition is, however, threatening to effect a further reduction of prices, several lots being reported as being done at about 1s. 3d. per ton below the current quotation, which is £4 15s. per ton, less 5 per cent. discount. The inquiry for unbranded iron for India is dull at this moment, as is also that for scrap iron and old rails, the price of these being 47s. and 57s. respectively.

The market for Spanish ore is scarcely so firm as it has been for several weeks. Merchants were holding for 14s. 6d. per ton, delivered in the Clyde, but they now ask 14s. to 14s. 1½d. Hematite pigs are easier in price, in sympathy with the position of the warrant market.

Steel makers have received a series of fair shipbuilding orders, but the capacity of the works is by no means overtaken. Competition in this branch is very keen, and merchants do not hesitate to cut below makers' prices and place their orders in England, where it is possible to obtain the least advantage.

During October twelve vessels were launched from the Clyde shipyards, with a total tonnage of 16,385, against 6692 tons in October, 1886, and 18,390 in the same month of 1885. The output of the Clyde yards for the ten months is 136 vessels with an aggregate of 165,906 tons, as compared with 128 of 145,582 tons in the corresponding period of last year. The vessels turned out in the past month were all steamers, with only one exception, a sailing ship, named the Volga, of 1650 tons, built by Messrs. Russell and Co., of Port Glasgow, for Mr. James Nourse, of London. Most of the vessels were of steel, and they embraced one of 2750, another of 3000, and one of 3500 tons. The fresh tonnage placed during the month is about 27,000 tons, or nearly double the average output per month during the present year. It is expected that as much more will be fixed in the course of November.

The iron and steel manufactured goods shipped from Glasgow in the past week included £31,800 general iron manufactures, £13,300 steel manufactures, £3033 worth of sewing machines, and other machinery to the value of £5450.

There is unfortunately a rather serious falling off at present in the shipping department of the Scotch coal trade. The past week's shipments were 72,014 tons against 86,000 last week, and 87,127 in the same week of 1886. The shrinkage is ascribed to a lack of tonnage, and to the great activity that at present prevails in the shipping trade of the Tyne district. Steam coals are firmer in price, but other qualities are without change.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

THE plentiful rain of late has saved Dowlais from another stoppage. The calculation was that about a week's supply was the sole stock. Now all is right again. It is likely that the winter months will be utilised in extending the reservoirs, as the watershed is a poor one. Rhymney Works fared well during the drought by its natural resources and steady working at the pumps, and were enabled to use the water over again until thoroughly exhausted. The water difficulty is a problem for most of the works, and will have to be looked closely into, as in washing coal for the coke ovens and for the use of the steel works a much greater quantity is now required.

The steel works are going on steadily. Ebbw Vale was the only Welsh works represented at the Manchester Exhibition, but it was a host in itself. I had personal opportunities for examining the exhibits, and from samples of the coke to the finest production of steel saw nothing but to commend.

Cyfarthfa again was the only representative I have heard of at the Newcastle Exhibition, which was closed this week. I only express a general wish in hoping that both exhibits will have a permanent place at Cardiff.

There is little or nothing new in respect of rails, blooms, and bars. Colonial and home demands keep the mills tolerably busy. Prices remain unaltered. It is anticipated that the low price ruling for ordinary sections, £4 5s. to £4 7s., will lead to business, and that this winter there will be no complaint for the lack of work.

The condition of things in tin-plate are not so good, and a new "combination" has been brought about which is perplexing. Block tin has advanced beyond the figure which would harmonise with tin-plate quotations, and makers find themselves in a dilemma. There is ample inquiry for tin-plate at 3d. to 6d. advance beyond late quotations, but the advance in block tin is greater in proportion, and it will not pay many makers to continue working at the prices. Those works which hold stocks of tin, and orders at fair prices, will continue, but notices are being issued in several quarters both in Glamorgan and in Monmouthshire notifying a stoppage. Notice was issued at Melingriffith this week notifying a temporary stoppage from November 5th. The notice ran as follows:—"Owing to the high price paid for block tin and the low value obtainable for tin-plates, these works will be closed on completion of existing orders, viz., on November 5th, 1887. Work will be resumed whenever prices will allow of the manufacture being carried on without loss." In this and similar cases the intention, I hear, is not only to maintain the works in good condition, but to carry out extensive alterations, so as to start with a good prospect of being able to hold their own in this competitive age.

At the Swansea Exchange on Tuesday there was a good attendance. The prevailing features were—plenty of business offered, great difficulty in placing, and refusal of all but "immediate business," and that only at prices that would cover increased cost of block tin. Quotations, immediate make, were:—Coke, 13s. to 13s. 3d.; Bessemer, to 13s. 9d.; Siemens, to 14s. 3d.; terne in better demand—27s.; charcoal, up to 19s.; wasters, nothing under 6d. less than primes. Other quotations at the Exchange were:—House pig, 47s. 6d.; steel rails, £4 7s. 6d.; merchant bars, £4 7s. 6d. to £4 10s. Block tin quoted—London—at £120 10s. These are the highest quotations during the last twenty years.

There is a likelihood now of steadying influences being prevalent in the coal trade. One great source of uncertain trade, uneasiness amongst the men, is fairly removed, and from their point of view the scale appears to be accepted. Another week will show the course adopted by the employers. One or two meetings have been held, and the scale discussed, but adjourned. The three scales in operation in the district have determined the same course, namely, a retention of existing wages until the next arbitration.

During the past week there have been good exports of coal to foreign destinations from the principal ports, and there is little complaint in respect of quantity. Prices remain very much the same.

The quotations at the Cardiff Exchange this week were from 7s. 6d. to 8s.; best, from 8s. 3d. to 8s. 6d. Small steam was to be had at all prices, best commanding as much as 4s., but the ordinary rate was 3s. 6d. House coal is stiffening perceptibly, and 8s. 6d. can be had freely, though some trade is still doing at 8s. 3d. Coke was quoted on 'Change at the old price; furnace samples, 16s.; foundry, 14s.

As was anticipated, the rush of pitwood into the market has lowered prices fully 3d., and latest quotations for best are down to 15s. 3d. at Cardiff.

Cardiff suffered more than any Welsh port by this week's storm, seven or eight vessels having been more or less damaged in the roads. During the storm many slipped their anchors and came into collision. As in most cases vessels are only insured against total loss, this will fall heavily on the shipowners.

NOTES FROM GERMANY.

(From our own Correspondent.)

THE development of the iron and coal trades continues quietly and steadily. On the whole the demand has remained pretty nearly the same as for a few weeks past; for some articles, here a little brisker, there a little duller, but casting a glance at some of the other foreign markets, the works here should be contented. If, however, the American market should continue its downward tendency, its effects would soon be felt here. In the meantime, both in the Rhenish-Westphalian and Silesian districts, a good trade in crude iron is being done, and in the latter another furnace has been put into blast, which makes twenty-seven now in full work. Nowhere is pig iron going into stock, and the output has been increased, which indicates that large sales must have been effected last quarter. In the month of September 337,638 t., against 263,702 last September, were produced; 168,705 t. of forge pig and spiegel, 34 531 Bessemer, 90,408 basic, and 43,994 foundry pig; from January 1st to September 30th 2,849,491 t., against 2,512,119 last year. Spiegel iron continues in good request for abroad, the prices ranging from M. 50 to 57·60 for 10 to 16 p.c. Mn. respectively. It has already begun to be a question of new contracts for forge pig for 1888, which shows confidence in the future stability of the trade. The present price for best sorts is M. 46 to 46½ p.t. In foundry pig there is no change, the prices remaining M. 49 to 56 according to the Nos. For Bessemer there is, if anything, a rather quieter demand, and it is to be bought 6d. p.t. cheaper than last noted. In basic there is nothing new to report, and Luxemburg forge costs M. 43 to 44 p.t. on trucks at works.

Ores are not in quite such good request, and are about 2½d. p.t. cheaper, now ranging from M. 8·80 to 12·50, according to the sort and quality.

The rolling mills and forges are, as a rule, quite well employed, and the demand for all sorts and sections of rolled iron continues satisfactory. Orders for January and February next are already booked. Prices remain firm at M. 115 and above, as ground price, and there is every prospect of the convention raising this very shortly. The several groups of works have at last settled their mutual relations within the lines of their convention to their satisfaction, and each has secured a certain area of action for itself, whilst a common base price for all has been agreed upon. The weak point is that the Saar and Moselle group has not yet joined. These are large and wealthy works, and are well able to take care of themselves. Of boiler and tank plates there is only to say that prices remain firm at M. 150 to 152 p.t. For sheets of all kinds the demand has all along been very brisk, and the price in the Siegerland is now M. 137 to 142, and a couple of marks less in Westphalia. The Rhenish-Westphalia and Siegerland mills signed a new convention last week, and if the Dillingen Works, Moselle, join, a further advance in prices will ensue. The wire-rod branch appears to be the most remunerative one in the list, for not only has one work in Westphalia just paid a divided for last year of 10 p.c., but has at this moment 12,500 tons on the order-book at paying prices. The price of steel rods has gone up M. 1 p.t., and the tendency is upwards still. More orders have been given out for steel rails, which makes for October 94,000 t., and more are awaited. The lowest price at Breslau was M. 122 p.t., which is M. 6 higher than the tenders in July. At Bromberg, for 11,000 t. the lowest prices were M. 112·60 and 116. Only one offer, from Bolckow, Vaughan, and Co., was made from abroad at M. 123½ free at Swinemünde, and 124 free at Neufahrwasser and Pillau. Since Cockerill and Co. have ceased with their lower tenders the native works should be reaping a harvest. The steel works in general are moderately well employed on blooms and billets, besides rails, wheels, axles, &c. Last July the "Aachener Hüttenverein" had completed the first half-million tons of basic steel ingots, the largest quantity yet made by any one works in the country of this metal.

On the whole, the machine and boiler shops and constructive iron factories are satisfied with their present orders and prospects, if the prices are not particularly remunerative.

The coal and coke trade is rather more animated, and would be much better were it not that the Rhine is still, as it has been for months past, so low that shipments were unable to be made in full quantities, and more trucks were forthcoming. The price of industrial coal and coke has not appreciably risen, whilst some sorts of house coal have gone up M. 3 to 5 p.t. Desperate efforts are being made in the Westphalian coal basin to put the coal trade on a more remunerative footing, either by purchasing groups of collieries and subsequent consolidation, or by establishing one common sales bureau, or perhaps through both these means combined. It seems odd that such a splendid industry should require bolstering up in this fashion, but the reason would not be far to seek—laid out on too great a scale for the country, without the means of shipment we possess.

In France the iron trade is unstable. The extraordinary policy of the Paris houses seems as if it would never come to an end, and that dealers are not inclined to earn money when they can is certainly a very rare phenomenon, but such is the fact; for while the rolling mills in the Nord hold fast to their price of 125f., dealers are doing all they can to depress prices at Paris, all the time there being, for the season, actually a good demand. Rolled joists are being sold at 115f. p.t. Merchant bars are quoted 125f., but for good orders 25 to 50 p.c. rebate is not uncommonly accorded. There is a better demand for bar iron, and in the Haute-Marne district orders are flowing in more briskly. A wire-rod syndicate is in project. The strike at some works in the Ardennes continues. The price of steel rails may be judged of by the works "Aciéries de France" having tendered the lowest in a recent competition in Belgium and Holland, a fact which is not considered by the industrial press altogether a favourable symptom for the steel trade. Of the coal trade there is nothing particular to note.

The universal comments of the press and public on the last tendering for 8000 t. of steel rails, one lot of 4000 t. having been carried off by the French house, "Aciéries de France," at 114f. 90c., against Cockerill and Co. and four other firms, at 118f. for the other lot of 4000 t., are the order of the day in Belgium, as it took everyone by surprise, France having been hitherto out of the pale of competition altogether. The works are anxiously awaiting the decision of the State, whether the lot will really be awarded to the French house. The Belgian rail syndicate will cease to exist at the close of the year, because one works refuses to adhere to it. The 2700 t. of steel sleepers were given to four works at the price of the lowest tender of 155f. p.t. Six hundred wagons have been awarded, to one firm 300 covered ones at 2289f., and 100 open ones at 1523f.; and to another firm 200 covered ones at 2110f. The low prices sufficiently indicate how much work was needed in the shops.

Girders are still in full demand. The yearly output of them is set down at 160,000 tons. Angles and plates find ready sale at current prices. Foundry pig is firm at 46f., and forge at 43f. per ton. The Athus Works have already sold 20,000 tons at 43f. for the coming quarter.

The coal and coke market is firm, and a rise is being attempted; so sales have become brisk. Coal is noted 5·50f. to 9·00; coke, 10·50f. per ton.

At last, after much trouble and delay, a reform of the Austro-Hungarian Trade Mark Law is about to come into force. Some of the more important improvements are the following:—In future the judicature on trade mark cases is to be undertaken by the civil courts, instead of as formerly by the Government officials. This does away with one of the great weaknesses of the former law. Then there is to be a preliminary examination of all applications for trade marks, in order to ascertain whether such an one existed before the grant is made. For certain manufactures, as scythes, for instance, the registration of a mark is obligatory, with the object of, from the first, preventing falsifications. The legality of the registered trade mark lasts for ten years, after the lapse of which time a renewal of the application must take place. The rolls are kept at the respective offices of the Minister of Commerce of Austria and Hungary, and the laws concerning applications, &c. &c., are reciprocal in both countries.

NEW COMPANIES.

THE following companies have just been registered:—

Fourness Gas Lamp Company, Limited.

On the 21st inst. this company was registered, with a capital of £50,000, in £5 shares, to acquire and work certain letters patent granted to Henry Fourness for gas lamps. The subscribers are:—

	Shares.
W. A. Fourness, Brussels, engineer	1
H. Fishwick, Rochdale	1
H. Fourness, Manchester, gas engineer	1
H. Bannister, Manchester, glass merchant	1
J. Taylor, Manchester, auctioneer	1
J. T. Foster, Manchester, draper	1
E. K. Dutton, Manchester, consulting engineer	1

The number of directors is not to exceed five; the subscribers are to appoint the first.

Hull Forge Iron and Steel Company, Limited.

This company proposes to purchase the freehold works at Hull known as "The Hull Forge," together with the plant, machinery, and other assets of the Hull Forge Company, Limited. It was registered on the 21st inst., with a capital of £25,000, in £10 shares, with the following as first subscribers:—

	Shares.
*F. Cleeves, Rotherham, manager	1
*F. W. Roberts, Rotherham, manager	1
M. Thomlinson, Hull, cashier	1
A. Burt, Hull, ironworks manager	1
A. Lee, Sheffield, manager	1
C. W. Fincken, Barnsley, manager	1
*J. F. Evans, Sharrow, Sheffield, agent	1

The number of directors is not to be less than three, nor more than five, the first being the subscribers denoted by an asterisk; qualification, £500 of the nominal capital. The company in general meeting will determine remuneration.

Keighley Tramways Company, Limited.

This company proposes to construct tramways or railways in the county of York, and elsewhere in England, and to apply for and obtain the necessary powers. It was registered on the 21st inst., with a capital of £23,000, in £1 shares. The subscribers are:—

	Shares.
E. D. Marriner, Keighley, York, cotton spinner	10
B. S. Brigg, Keighley, York, manufacturer	10
J. Clapham, Keighley, York, ironfounder	10
W. Darling, Keighley, York, machine tool maker	10
E. Lee, C.E., Keighley, York	10
J. Smith, Keighley, York, provision merchant	10
T. E. Smith, Keighley, York	10

Registered without special articles.

Schooling and Company, Limited.

This is the conversion to a company of the business of Messrs. Schooling and Co., of 8, Great Garden-street, stove manufacturers, engineers, &c. It was registered on the 21st inst., with a capital of £50,000, in £2 shares, with the following as first subscribers:—

	Shares.
Hy. Schooling, 8, Great Garden-street, stove manufacturer	1
Wm. Schooling, 8, Great Garden-street, stove manufacturer	1
W. Wheeler, Wanstead, Essex, clerk	1
*H. Bourn, 182, Upper Thames-street, metal trades valuer	1
*J. Schwartz, 14, Mincing-lane, sugar refiner	1
J. F. Mason, 158, Holloway-road, clerk	1
J. V. Aspland, 6, Beaconsfield-road, Tottenham, book-keeper	1

The number of directors is not to be less than two, nor more than five; qualification, fifty shares; the first are the subscribers denoted by an asterisk, and Mr. Charles Ellis. The remuneration of the board will be at the rate of £50 per annum for each director, but the company in general meeting may vote additional remuneration. Messrs. Henry and Wm. Schooling are appointed managing directors, and for their remuneration will be entitled to £800 per annum, and to an additional sum equal to 10 per cent. of the profits remaining after payment of 5 per cent. per annum dividend.

Villiers Tin-plate Company, Limited.

This company was registered on the 21st inst., with a capital of £20,000, in £50 shares, to manufacture and sell iron, steel, tin, terne, block plate, and galvanised sheets. The subscribers are:—

	Shares.
W. Peddie Shrine, Neath, engineer	1
D. Bevan, Neath, colliery proprietor	1
D. T. Sims, Neath, merchant	1
J. Grierson, jun., Liverpool, iron and tin-plate merchant	1
H. F. Taylor, Neath, manufacturing engineer	1
M. G. Roberts, Briton Ferry, ironmonger	1
T. Gwynne, Briton Ferry, accountant	1

The number of directors is not to be less than three, nor more than seven; qualification, four shares. The company in general meeting will determine remuneration.

Hydroleine Company, Limited.

This company was registered on the 26th inst., with a capital of £110,000, in £1 shares, to acquire the business lately carried on in London, Leicester, and elsewhere, by F. J. Harrison and Co., Limited, as manufacturers of hydroleine and soap powder. The subscribers, who take 1000 shares each, are:—

	Shares.
*G. T. Wills, Crewkerne, surgeon	1000
*R. H. Randall, Guernsey, brewer	1000
*C. Devaux, 39, Lombard-street, merchant	1000
*H. Barrett, Menival, North Dulwich	1000
T. Satchell, 268, Upper Richmond-road, Putney, merchant	1000
*C. G. Elers, 6, Kensington-court, W., merchant	1000
R. Randall, Jersey, brewer	1000

The number of directors is not to be less than three, nor more than ten; qualification, 1000 shares; the first are the subscribers denoted by an asterisk; the remuneration, £300 per annum, and a sum equal to 10 per cent. of the annual net profits after 7 per cent. dividend has been paid.

Improved Switchback Railway Company, Limited.

Registered on the 22nd inst., with a capital of £10,000, in £1 shares, to acquire the business of proprietors of gravitation or switchback railways, carried on by James Fyfe Elliston, of Bolton, and Wynn Miller, of Ramsgate, theatrical managers. The subscribers are:—

	Shares.
Wynn Miller, Ramsgate	1
J. F. Elliston, Bolton	1
T. M. W. Newell, Bolton, printer	1
J. T. Atkinson, Bolton, master brewer	1
W. Morris, Bolton	1
P. Rudge, Bolton, accountant	1
T. Taberner, Heaton, Bolton, cashier	1

Registered without special articles.

LAUNCHES AND TRIAL TRIPS.

THE s.s. Gulf of Trinidad, built by Messrs. Raylton, Dixon, and Co., for the Greenock Steamship Company, of Greenock, sailed for Antwerp on the 28th ult., after a successful trial trip, on which an average speed of 12½ knots on the measured mile was obtained. She is built on the three-deck rule, to the highest class of Lloyd's, of the following dimensions:—Length, 312ft. 6in. by 40ft., by 25ft. 2½in., and will carry 3500 tons. She has water ballast in chambers, long poop bridge and forecastle extending almost the whole length, and every convenience up to the most modern style for a first-class merchant steamer. In addition she is fitted with handsome saloon and cabins for thirty first-class passengers. She has triple-expansion engines of 350 nominal horse-power by Messrs. Blair and Co., Stockton.

Two steamers, the Candia and Malta, belonging to the Navigazione Generale Italiana—Florio-Rubattino—were recently fitted with new triple-expansion engines while undergoing general repairs and alterations at Messrs. R. and W. Hawthorn, Leslie and Co.'s works on the Tyne. The two sister ships, 250ft. 5in. by 27ft. 6in. by 19ft. 6in. and 1042 T.G., are intended for the mail service between Naples and Palermo. They have splendid first and second-class accommodation, with saloons 8ft. 6in. high. There is a large smoking and conversation room on deck, also a promenade deck. With the old compound engines, indicating about 900-horse power, the vessels could be driven at a speed of 12·6 knots on trial with a consumption of 18 tons of Welsh coal per day. On a long run at the trial trip that took place on the arrival of the ships in Genoa, the new engines developed easily 1450 indicated horse-power, and a speed of 14·6 knots was maintained on 21 tons consumption only. Particulars of the engines are:—High-pressure, 24in.; intermediate pressure, 38in.; low-pressure, 62in. by 3ft. stroke. Marshall's valve gear has been fitted. Steam at 150 lb. pressure is supplied by two steel double-ended boilers, 11ft. 3in. diameter by 14ft. long, each with four furnaces. As on all the boats of the same company, there is fitted Mr. Ferrando's system of fire-bars, the air being supplied in the closed ashpits by means of a fan, and the draught is easily regulated. The results arrived at speak of themselves very highly of the advantage of the triple expansion and of Ferrando's system, and of the successful work turned out by Messrs. Hawthorn, Leslie, and Co.

On the 2nd inst. Messrs. Edward Withy and Co. launched from their yard at Hartlepool the steel screw steamer Amphitrite, built for Messrs. Hickinson, Son, and Co., West Hartlepool. She is a splendid vessel of 300ft. in length, with a large deadweight and measurement carrying capacity, and built to the 100 A1 class at Lloyd's. The vessel has a long raised quarter deck, short poop, long bridge house, and a top-gallant forecastle. The main, bridge, quarter, and forecastle decks and five water-tight bulkheads are of steel, the chart-house, cabin, skylight, engine-room skylights, bulwarks, rails, galley and cargo battens are of iron. The steamer is built on the web frame system and fitted with Withy and Sivewright's cellular double bottom for water ballast all fore and aft, four steam winches, patent windlass, three stockless anchors hauling up into hawse, two donkey boilers, hand and steam steering gear amidships, and right and left-hand screw gear aft. The vessel is rigged as a two-masted fore-and-aft schooner with iron lower masts, and will be fitted with triple expansion engines by the Central Marine Engineering Company, of West Hartlepool.

THE INSTITUTION OF CIVIL ENGINEERS. — The ordinary meetings will be resumed on Tuesday, November 8th, and be continued weekly till the end of May. At the opening of the session Mr. Geo. B. Bruce, president, will deliver his address. On subsequent occasions the following papers are to be read, with a view to discussion:—"Accidents in Mines," Part II., by Sir Frederick Abel, C.B., F.R.S.; "Electrical Tramways: the Bessbrook and Newry Tramway," by Dr. Edw. Hopkinson, M.A.; "The Use and Testing of Open-hearth Steel for Boiler-making," by the late Hamilton Goodal; "The Jubilee Bridge over the River Hooghly on the Line of the East Indian Railway," by Sir Bradford Leslie, K.C.I.E.; "Manganese in its Application to Metallurgy," and "Some Novel Properties of Iron and Manganese," by R. A. Hadfield; and "The Alexandra Dock, Hull," by A. C. Hurtzig. The supplemental meetings of students have been appointed to commence on Friday, November 18th, and to take place at nearly fortnightly intervals. The subjects which will engage attention during the early part of the session are:—"Boiler Experiments and Fuel Economy," by John Holliday; "The Classification of Continuous Railway Brakes," by A. Wharton Metcalfe; "River Gauging at the Vyrnwy Reservoir," by John H. Parkin; and "Railway Engineering in British North America," by Robert J. Money. The pamphlets recently issued by the Institution are:—"Propelling Machinery of Modern War Ships," by Sidney H. Wells, Wh.Sc., and "Sewage Clarification and House Refuse Disposal Works at Southampton," by W. B. G. Bennett.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Application for Letters Patent.

*** When patents have been "communicated" the name and address of the communicating party are printed in italics.

25th October, 1887.

14,465. FEEDING AMMUNITION in TOY GUNS, J. W. Jones, London.
14,466. PROPELLING VESSELS, S. Douglas, Salford.
14,467. MANUFACTURE of ROPES, &c., C. H. Lay, London.
14,468. CONSTRUCTION of VERMIN TRAPS, W. H. Tildesley, Birmingham.
14,469. PREVENTING OVERWINDING in COLLIERIES, M. Settle, Manchester.
14,470. CARTRIDGES for BLASTING, M. Settle, Manchester.
14,471. MOTIVE-POWER STORING CAR STARTER, L. C. Jackson, London.
14,472. COMBINED PIPE CLEANER, &c., W. L. Dennis, Birmingham.
14,473. BOOTS and SHOES, E. and A. Rose, Birmingham.
14,474. SPRINGS of VEHICLES, W. P. W. Weatherill, Hightown.
14,475. BOXES for the RECEPTION of LETTERS, J. W. Nasmith, Manchester.
14,476. SLIDER BOTTLE BIN, J. C. Stringer, Wincobank.
14,477. PRODUCING VARIEGATED YARNS, T. A. Boyd, Glasgow.
14,478. SAFETY LOCKS, F. Bosshardt. — (*A. Corse, France.*)
14,479. WIRE CARD FILLETS, R. Sellers, Bradford.
14,480. LOCKED NUTS for FISH-PLATES, G. Slater, Sheffield.
14,481. FIREGRATES of FURNACES, A. Firth, Sheffield.
14,482. SURFACES for SEPARATING GOLD, E. B. Smith.—(*J. Brown, New Zealand.*)
14,483. VESSELS for MILK, W. S. Llewellyn and C. Simmons, Cardiff.
14,484. A GAME, W. J. J. Gyngell, Wellington.
14,485. DYEING WOOL, &c., P. H. Booth, Gildersome.
14,486. VELOCIPEDE SADDLES, J. B. Brooks, Birmingham.
14,487. COILED SPRING CHARCOALED for PIPES, H. Allcock, Birmingham.
14,488. METALLIC SPRING MATTRESS BED, D. Mason.—(*A. Guillon-Bainville, France.*)
14,489. PRODUCTION of ALCOHOLIC FERMENTATION, D. Mason.—(*V. d'Ostachiewiez and L. de Gerlicz, France.*)
14,490. SYPHONS for DISCHARGING BEVERAGES, W. A. Ross, Belfast.
14,491. MANUFACTURE of SWEETENED BEVERAGES, W. A. Ross, Belfast.
14,492. RAISING ROCK SALT from MINES, C. E. Moncrieff, Belfast.
14,493. ELECTRIC MOTORS, L. and G. Happe, London.
14,494. CHEMICAL COMBINATIONS, W. Spilker, London.
14,495. SIGNALLING at SEA, &c., F. W. P. Bouverie, London.
14,496. OPENING and CLOSING WINDOWS, J. Taylor, London.
14,497. OIL LAMPS, A. J. Aspinall, Liverpool.
14,498. SCREENING, &c., COAL, C. E Rhodes, Sheffield.
14,499. PNEUMATIC DISPATCH TUBE SYSTEMS, A. J. Boult.—(*C. M. Johnson, United States.*)
14,500. GRINDING SUGAR, &c., A. Stevenson, Liverpool.
14,501. SPINNING MACHINES, J. O. O'Brien.—(*A. Briggs, Spain.*)
14,502. CIRCULAR KNITTING MACHINES, B. Kerr and I. L. Berridge, London.
14,503. GARMENT STAYS, W. P. Thompson.—(*C. W. Russell, United States.*)
14,504. HEATING RAILWAY CARS, A. J. Boult.—(*W. Martin, United States.*)
14,505. FORCING or COMPRESSING FLUIDS, W. A. Granger, London.
14,506. TRUSSES, W. W. Matthews, London.
14,507. BALANCING ELBOW LEVERS, C. J. Watts, London.
14,508. CHECKING CONDUCTORS' RECEIPTS, A. E. Adlard, London.
14,509. MEASURING TEMPERATURE, H. L. Callendar, Cambridge.
14,510. ARITHMETICAL COMPUTATIONS, C. F. Findlay, London.
14,511. BEARING for SHAFTS, N. Dymcoff and T. S. Bourmow, London.—[Received 25th October, 1887. Antedated 30th September, A.D., 1887. Under International Convention.]
14,512. PUMPING ENGINES, J. Fielding, London.
14,513. HAT LININGS, C. Müller, London.
14,514. THROSTLE RINGS for SPINNING MACHINES, B. Hänsel, London.
14,515. FORGING METALS for CYLINDERS, M. Gledhill, London.
14,516. MACHINE BEARINGS, W. E. Rogan, London.
14,517. DISTRIBUTING, &c., TYPE, The Thorne Machine Company and J. Thorne, Lonon.
14,518. DISTRIBUTING, &c., TYPE, The Thorne Machine Company and J. Thorne, London.
14,519. JUSTIFYING, &c., TYPES for PRINTING, The Thorne Machine Company and J. Thorne, London.
14,520. VELOCIPEDES, A. and E. Easthope, London.
14,521. PAPER, C. J. Richardson and R. Squire, London.
14,522. HYDRAULIC PRESSURE for TESTING, &c., F. Holt and H. E. Bodley, London.
14,523. EXHIBITING ADVERTISEMENTS in PUBLIC VEHICLES, C. D. Alexander, London.
14,524. FLUID PRESSURE MOTORS, G. M. Capell, London.
14,525. UTERINE SUPPORT for RIDING, E. Huxley, London.
14,526. WRENCHES or SPANNERS, A. Mecredy, London.
14,527. COMPOUNDS of COFFEE and COCOA, J. F. Henderson, London.
14,528. MICROPHONES, C. Bell. — (*L. M. Ericsson, Sweden.*)
14,529. MICROPHONES, C. Bell. — (*L. M. Ericsson, Sweden.*)
14,530. BATH COCKS, E. M. Sjöholm, London.
14,531. PRESSES for MOULDING BLOCKS of ARTIFICIAL FUEL, J. Y. Johnson.—(*G. Mülheims and R. Zimmermann, France.*)
14,532. HOLLOW METAL CYLINDERS, &c., M. Gledhill, London.
14,533. CONSTRUCTION of CRANKS, &c., M. Gledhill, London.
14,534. STEAM BOILERS, M. Gledhill, London.
14,535. OVERHEAD TRAVELLING CRANES, C. Davy, London.
14,536. REPRODUCTION of WRITINGS, &c., G. H. Block, London.
14,537. ROLLER PRESS, G. H. Block, London.
14,538. PEGGING, &c., BOOTS, G. Dorwart, London.
14,539. VACUUM APPARATUS, W. L. Horne, London.
14,540. EGG BEATERS, D. T. Winter, London.
14,541. PROCESS of PREPARING CEREALS, J. Franklin, London.
14,542. ELECTRIC MOTORS for TRAMS, &c., W. D. Sandwell, London.
14,543. INCOMBUSTIBLE SCENERY for THEATRES, E. Tepper, London.
14,544. TOBACCO PIPES and CIGAR TUBES, E. W. Stead, London.
14,545. PARQUETRY WOOD FLOORING, M. Frankenburg, London.
14,546. COUPLINGS for RAILWAY VEHICLES, C. Lock, London.
14,547. AUTOMATIC DELIVERY BOXES, A. J. Boult.—(*F. Bisson, France.*)
14,548. WINE, J. F. Henderson, London.
14,549. PROTECTION of PARCELS, H. J. Haddan.—(*H. Zwanziger, Germany.*)
14,550. FISHING RODS, S. G. Monce, London.
14,551. HOLDERS for MUSIC SHEETS, H. H. W. Wigg, London.

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14,552. LOCKS for TRUNKS, &c., H. H. Chilton, Wolverhampton.
14,553. CONDUCTING ELECTRIC CURRENTS, R. B. Lee, Manchester.
14,554. CEMENT FIREPROOF BUILDING MATERIALS, R. B. Lee, Manchester.
14,555. SHOW-CARD, R. T. Challand, Langside.
14,556. IRON CURTAINS, J. Stones, Ulverston.
14,557. SELF-ACTING VALVES, J. B. Archer and W. Bailey, Newcastle-on-Tyne.
14,558. EFFLUENT STRAINING APPARATUS, S. H. Adams, York.
14,559. HOT AIR APPARATUS, T. R. Weston, London.
14,560. AUTOMATIC LIQUOR MEASURER, L. G. Moore, Northampton.
14,561. SWITCHES for ELECTRIC CIRCUITS, A. C. Cockburn and E. Thomas, London.
14,562. TEA and COFFEE POTS, &c, P. M. Watkins, London.
14,563. PRINTING upon OIL BAIZE, &c., N. W. Helme, R. Stockdale, and R. N. Helme, Manchester.
14,564. STOP MOTION for DOUBLING FRAMES, G. Ashworth, Manchester.
14,565. RECEPTACLES for INK, &c., H. Meynell, Bloxwich.
14,566. ATTACHING METAL LABELS to OSIER BASKETS, J. van den Bergh, London.
14,567. RIDING STIRRUP, C. Stokes, Bloxwich.
14,568. CIGAR END PIERCER, F. W. Brown, Preston.
14,569. WORM BLADE for CONVEYING GRAIN, J. Black, Dumfries.
14,570. HECKLING MACHINES, G. Lowry, Barnsley.
14,571. BELT-SHIFTING MECHANISM, J. Clegg and J Moorhouse, Manchester.
14,572. CLOTH-DRESSING MACHINES, W. Armitage and J. Thompson, Halifax.
14,573. DOBBY for OPERATING the HEALDS of LOOMS, R. H. Place, Halifax.
14,574. PACKINGS for STEAM JOINTS, J. Kirkman, Manchester.
14,575. FIRE EXTINGUISHER, A. Cockburn, Durham.
14,576. SECURING the STOPPERS in BOTTLES, A. Darton and F. G. Phillips, London.
14,577. MANUFACTURE of ADVERTISING PLATES, T. Hughes, London.
14,578. CHEST and LUNG PROTECTORS, A. H. Saunders, London.
14,579. EXTINGUISHING FIRES, &c., A. W. Addinsell, London.
14,580. LABELS for BUTTER, C. H. Bartlett, London.
14,581. CLEANING STEAM BOILERS, J. T. Billson and W. Cooper, London.
14,582. WRINGING and MANGLING MACHINES, G. H. Slack, London.
14,583. BOTTLES to CONTAIN AERATED LIQUIDS, H. Benson, London.
14,584. HOLDERS for FLOWERS, T. C. March, London.
14,585. HAT and BONNET SHAPE WIRE NETTING, I. Thomas, London.
14,586. DETACHING DOORS from THEIR SPINDLES, H. B. Harriss, London.
14,587. CHECKING the RECEIPT of MONEY in PUBLIC VEHICLES, J. M. Black, London.
14,588. DELIVERING ARTICLES for COINS, A. J. Maffuniades and E. O. Eaton, London.
14,589. GENERATING GAS from VOLATILE HDYROCARBONS, R. H. Courtenay, London.
14,590. HYDROPATHIC BATHS, &c., W. W. Marsden, London.
14,591. FLUID PRESSURE MOTIVE-POWER ENGINES, W. Lillico, Glasgow.
14,592. WINE WARMERS, W. C. Ritchie, Glasgow.
14,593. FOOTBALLS, W. Leat, London.
14,594. COMBINED CHAIR, DESK, and TABLE, H. G. Powell, London.
14,595. METAL TIPS for the HEELS of BOOTS, E. Tuthill, London.
14,596. HOODS for VEHICLES, G. and L. Roduwart and E. J. F. I. Babonneau, London.
14,597. SAFETY ENVELOPES, C. J. Eyre, London.
14,598. TROUSER PRESERVERS, W. Carey, London.
14,599. GRINDING and SIFTING APPARATUS, G. F. Redfern.—(*E. J. Noblot, France.*)
14,600. SPORTING GUNS, A. Picard, London.
14,601. CHECKING FIRE in BUILDINGS, T. R. Douse, London.
14,602. SODIUM and POTASSIUM, C. Netto, London.
14,603. COMPOUND MARINE STEAM ENGINES, J. McGregor, London.
14,604. RAILWAY BUFFERS, D. Macnee, London.
14,605. WATER WHEELS, J. F. Lefort, London.—[Received 26th October, 1887. Antedated 2nd June, A.D. 1887. Under International Convention.]
14,606. MEASURING the HUMAN FRAME, A. Wächter, London.
14,607. DIVIDING SLIVERS from CARDING MACHINES, G. Lamparter, London.
14,608. STEAM HAMMERS and ROCK DRILLS, A. Davy, jun., London.
14,609. SOLITAIRES and STUDS, H. T. B. Dumelow, London.
14,610. EMBROIDERING MACHINES, H. H. Lake. — (*Messrs. Wirth and Co., Switzerland.*)
14,611. PERAMBULATORS, B. Thompson, London.

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14,612. ROUGHING SHOE for HORSES, J. W. Cunningham, London.
14,613. ROLLER BEARINGS, J. Hirst, J. Hirst, and A. Hirst, Halifax.
14,614. CARDING ENGINES, D. B. Briggs and W. Eastwood, Bradford.
14,615. LUBRICATORS, R. W. B. Sanderson.—(*W. E. Plummer, United States.*)
14,616. CRICKET, &c., BATS, J. Hayward, Wolverhampton.
14,617. METALLIC BELTS, J. Clark, Alfreton.
14,618. SHUTTLES, T. Webster, Leeds.
14,619. FORMING KECKS or TOPS on GLASS BOTTLES, J. Armstrong, London.
14,620. BRUSHES for BATH, &c., USE, C. J. Bailey, London.
14,621. NOZZLES, P. Birchall and W. Bainbridge, Longport.
14,622. ELECTRIC ACCUMULATOR, E. E. Vaughton, Birchfield.
14,623. CLEANING the TEETH of SPUR RACK CASTINGS, H. Noble and P. Lund, Newcastle-on-Tyne.
14,624. CURLING the HAIR, G. Verrall, Worthing.
14,625. BUSTLES or DRESS IMPROVERS, E. Schmolle.—(*J. Lowenthal and Co., France.*)
14,626. MAKING GAS, J. W. Newall, London.
14,627. COMPOUND for WASHING, &c., C. Baines and W. Thompson, London.
14,628. MECHANICAL POTATOE DIGGERS, J. B. Donaldson and E. Ellis, Liverpool.
14,629. PACKINGS for STUFFING-BOXES, A. Webster, Liverpool.
14,630. LADDERS, W. B. Ihne, Liverpool.
14,631. BASSINETTES and PERAMBULATORS, L. L'Hollier, Birmingham.
14,632. ELECTRICALLY LIGHTING RAILWAY TRAINS, I. A. Timmis, London.
14,633. SELF COUNTER-SINKING SCREW, H. C. W. Emery and E. Christian, London.
14,634. ROCKING BASIN WATER CLOSET, J. Newton, London.
14,635. COLLECTING HORSE, &c., ALVINE SOIL, J. Newton, London.
14,636. CLEANSING WHITE MARBLE, &c., J. R. Westbrook, London.
14,637. PROTECTING SMOOTHING IRONS from FLAME, &c., W. S. Simpson, London.
14,638. HOOK for HANGING PICTURES, W. S. Simpson, London.
14,639. VENTILATOR for SHAFTS, &c., H. J. Alexander, London.
14,640. SMOKING TOBACCO in PIPES, D. Grunfield, London.
14,641. BINS for GROCERS, &c., C. H. Bartlett, London.
14,642. CARTS for WATERING, &c., ROADS, A. J. Boult —(*F. Orduna, France.*)

14,643. Adjustable Holder for Slicing Bread, A. J. Norman, London.
14,644. Bleaching Jute, H. J. Newton.—(*The Actiengesellschaft fur Papier und Druck Industrie Leykam Josefsthal, Austria.*)
14,645. Ironing Clothes, T. McGillivray, Glasgow.
14,646. Production of Coloured Compounds, C. A. Bennett, London.
14,647. Electro Deposition of Silver, &c , upon Iron, &c., H. H. Lake.—(*A. Breden, Austria.*)
14,648. Automatic Supply of Goods, A. G. Mumford and J. Dalby, London.
14,649. Reservoir Pen, W. E. Burton, London.
14,650. Cartridge Magazines for Breech-loading Fire-arms, C. G. Harston, London.
14,651. Measuring Tapes, W. Chesterman, London.
14,652. Liquid Meters, J. J. Tylor, London.
14,653. Preparing Oxychloride of Magnesium, W. F. R. Weldon.—(*A. R. Pechiney, France.*)
14,654. Dessicating Oxychloride of Magnesium, W. F. R. Weldon.—(*A. R. Pechiney, France.*)
14,655. Heating or Lighting, J. Roots, London.

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14,656. Sewage Disposal, T. Glennie, Glasgow.
14,657. Raising Beer, J. Crawford, Glasgow.
14,658. Electric Indicators, G. E. Fletcher, Stockport.
14,659. Ladders for Ships, &c., J. McCallum, Hebburn-on-Tyne.
14,660. Launching Ships' Boats, W. K. Couper, Glasgow.
14,661. Bottles, J. Coates, J. Darling, and R. C. Lyness, Glasgow.
14,662. Parts of Cable Tramways, J. More, jun., Glasgow.
14,663. Guides for Band Saw Blades, P. J. Mouw, London.
14,664. Plates for Shipbuilding, J. H. Bell and W. Rockliffe, Sunderland.
14,665. Stoppers for Bottles. B. C. Cross, Morley, near Leeds.
14,666. Brackets for the Drawing Rollers of Spinning Machinery, R. Taylor, jun., Manchester.
14,667. Digging Potatoes, J. P. Milbourne, Manchester.
14,668. Paraffine Lamps, I. Sherwood, jun., and F. Sherwood.
14,669. Lubricators, W. Brierley, Rochdale.
14,670. Mottling Felt Hat Bodies, B. and A. Taylor, Stockport.
14,671. Safety Fire-arms, T. R. Weston, London.
14,672. Sharpening Razors, &c., A. Martin and H. D. Light, Old Charlton.
14,673. Checking Sales, A. Clare and R. Cook, Manchester.
14,674. Spanners, A. Anderson and G. Robertson, Glasgow.
14,675. Snow Plough, J. G. R. Howe, London.
14,676. Brace Buckles, J. Cadbury and J. G. Rollason, Birmingham.
14,677. Pencil-cases, J. Appleby, Birmingham.
14,678. Weft Catch for Looms, W. Aitken, Glasgow.
14,679. Breech-loading Small-arms, W. H. Brighton, Birmingham.
14,680. Tin Cases, J. Collins, Glasgow.
14,681. Handles for Vessels, J. H. Hardy, Sheffield.
14,682. Stay-busk Fittings, R. Simpson, H. Simpson, and B. G. Simpson, Sheffield.
14,683. Mustard Pots, &c., R. H. Finlay, Glasgow.
14,684. Photography, G. T. Holloway, London.
14,685. Pipe Connection, W. Price, Birmingham.
14,686. Making Refractory Bricks, A. M. Crossley, Glasgow.
14,687. Spiegeleisen, A. M. Crossley, Glasgow.
14,688. Coal Briquettes, A. M. Crossley, Glasgow.
14,689. Aerated Beverages, W. Stevenson and R. Howell, London.
14,690. Fire-escapes, T. Nugent, London.
14,691. Steam Engines, J. H. Adams, London.
14,692. Covering for Meats, E. Metzger, Pittsburg, United States.
14,693. Decolorising Tallow, &c., M. I. Whibley, H. G. Whibley, and A. Williams, London.
14,694. Bottom Valve for Closet Cisterns, T. Banks, Preston.
14,695. Delivering Prepaid Goods, A. J. Maffuniades and E. O. Eaton, London.
14,696. Securing Neckties to a Stud, E. Hubertz and A. George, London.
14,697. Keyless, &c., Watches, I. J. T. Newsome, London.
14,698. Velocipedes, C. K. Welsh and F. B. Bale, London.
14,699. Antiseptic Treatment of Skins, L. A. Groth.—(*C. Collins and L. Benoist, Paris.*)
14,700. Manufacture of Chrome, L. A. Groth.—(*V. and E. Rouff, Paris.*)
14,701. Stop Cocks, W. Hiergesell, London.
14,702. Construction of Furnaces, P. Hodkinson, London.
14,703. Generating, &c., Steam, O. D. Orvis, London.
14,704. Manufacture of Manure, F. H. Danchell, London.
14,705. Postal-boxes, J. A. Jacobs, London.
14,706. Carbonisation of Organic Matter, J. Nicholas and H. H. Fanshawe, London.
14,707. Coffee Filter, D. Linet, London.
14,708. Tightener for Boot Laces, W. Buck, London.
14,709. Horseshoes, H. Müller, London.
14,710. Generating Steam, &c., L. Serpollet, London.
14,711. Treating Oats, S. M. Macrory, London.
14,712. Corkscrews, H. A. Fleuss, London.
14,713. Horseshoe, W. Snell, London.

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14,714. Steam Stop Valve, J. Wescott, Wokington.
14,715. Filling of Bottles, &c., J. McEwen, Barnsley.
14,716. Fastening Blocks of Wood, A. J. Hopkins, London.
14,717. Tilting Hogsheads, &c., W. Greenwood, Bristol.
14,718. Stoppering Bottles, J. E. Hunter, Manchester.
14,719. Controlling Speed of Steam Engines, J. Lumb, Halifax.
14,720. Rack Pulleys for Window Blind Cords, W. H. S. Aubin, Bloxwich.
14,721. Wet Governors for Regulating Flow of Gas, F. Wood, Sheffield.
14,722. Continuous Potato, &c., Masher, C. Warren, Ipswich.
14,723. Counting Railway Tickets, F. Hurter.—(*J. Müller-Hurter, Switzerland.*)
14,724. Screw-gill Boxes for Preparing Wool, &c., G. W. Douglass and J. Shaw, Bradford.
14,725. Photographic Shutters, G. S. Grimston, London.
14,726. Perpetual Calendars for Pencil Point Protectors, &c., T. H. D. Allen, London.
14,727. Lamp Extinguisher, J. Swain and H. H. Kirby, Birmingham.
14,728. Shaping Sheet Iron, &c., W. and J. Crawford, Glasgow.
14,729. Meter for Measuring Electrical Currents, W. H. Douglas, Birmingham.
14,730. Lamp Attachments for Cycles, J. E. Park, Glasgow.
14,731. Anti-friction Journal Bearings, D. T. Lees.—(*G. M. Lees, Argentine Republic.*)
14,732. Preventing Opening of Doors of Railway Carriages while in Motion, J. Cocking and C. Fox, Halifax.
14,733. Preparing Safety Paper, J. Jameson, Newcastle-on-Tyne.
14,734. Turning Venetian Blinds, &c., S. Carnaby, Liverpool.
14,735. Feeding Paper to Printing Machines, F. Hoyer, Liverpool.
14,736. Cutting Blanks for Animal Shoe Nails, G. Macaulay-Cruickshank.—(*J. O. J. and A. B. J. Kollén, Sweden.*)
14,737. Purifying Alcohols, T. G. Bowick, Harpenden.
14,738. Preventing Heavying of Pastry, T. Thorn, London.
14,739. Fog-signalling for Railway Signals, A. C. Brown, London.
14,740. Ploughs, A. Ferrier, Moss Side.
14,741. Ships' Speed Log, J. H. Amour, Glasgow.
14,742. Ships' Power Steering Gear, J. H. Amour, Glasgow.
14,743. Miners' Cages, T. Penn and A. E. Penn, London.
14,744. Condensing Milk, E. Scherff and C. Drenckham, London.
14,745. Surplus Force Utiliser for Wheels, L. Wacks, London.
14,746. Washing Crockery, M. Aflalo and P. J. Ormiston, London.
14,747. Propulsion of Boats, G. Dawkins, London.
14,748. Fixing, &c., Bicycle Lamps, J. L. Watkins, London.
14,749. Spoons, P. A. Newton.—(*O. Levinger, United States.*)
14,750. Lining Puddling Furnaces, W. Lloyd, London.
14,751. Automatic Weighing Machines, M. R. Marelle, London.
14,752. Trouser Straps, T. C. Blanchflower, London.
14,753. Combination Tool, W. S. Simpson, London.
14,754. Construction of Wheel Toy, W. S. Simpson, London.
14,755. Foundations for Lighthouses, &c , J. Lewthwaite, London.
14,756. Production of Sound in Pianos, S. Williams, Newport.
14,757. Scarfs, C. E. Smith, London.
14,758. Smokeless Furnaces, A. Schreiber, London.
14,759. Double Action Single Cylinder Pump, S. Stone, London.
14,760. Button Hole Strips, J. Stone, London.
14,761. Fire-arms, H. H. Lake.—(*A. Ritter, Upper Austria.*)
14,762. Bustle, R. Goff, London.
14,763. Safety Apparatus for Stirrups, E. Noirit, London.
14,764. Hot-air Engines, A. M. Clark.—(*M. Honigmann, Germany.*)

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14,765. Locking the Brakes of Velocipedes, J. B. Brooks and W. Fisher, Birmingham.
14,766. Drying Tea Leaf, M. Ross, Inverness.
14,767. Transporting Cleat for Ships, T. D. Lambert and J. Colling, jun., Sunderland.
14,768. Switches for Electric Currents, C. M. Dorman and R. A. Smith, Manchester.
14,769. Brooms and Brushes, A. W. Hudson, Birmingham.
14,770. Securing Nuts and Bolts, J. Harrison, Castle Bytham.
14,771. Electric Switch, C. E. Knowles, Manchester.
14,772. Globe Holders, J. Empson and J. Hewitt, Birmingham.
14,773. Testing Muscular Strength, G. Bryant and A. McC. Harcourt, London.
14,774. Electrical Attractor, G. B. Wilkes, London.
14,775. Gas Apparatus, E. Luhmann and C. G. Rommenhöller, Berlin.
14,776. Spring Catches, S. Timings and S. Hill, Birmingham.
14,777. India-rubber Waterproof Textile Fabrics, P. M. Matthews, jun., Edinburgh.
14,778. Belt Pulleys, &c., J. P. Tapley, C. Wilson, and W. T. Alexander, Manchester.
14,779. Pencils, W. Routledge, jun., Carlisle.
14,780. Fastening Linings to Hats, A. T. Allen and J. Willis, Sheffield.
14,781. Show-card Holder, &c., W. H. Swingler, Birmingham.
14,782. Mariners' Compass, D. McGregor, jun., Glasgow.
14,783. Mariners' Compass, J. C. Dobbie, Glasgow.
14,784. Pig Iron, B. C. Tilghman, Broadheath.
14,785. Wheels for Carts, Carriages, &c., P. Fleming, Birmingham.
14,786. Trusses, &c., H. Barrow, London.
14,787. Hoes, Spades, &c., D. Smith, jun., Wolverhampton.
14,788. Temperature Alarm, D. M. Macleod.—(*A. E. Morrison, Canada.*)
14,789. Producing Currents of Air, &c., J. Anderson and R. McKinnell, Glasgow.
14,790. Chain Clips, D. Stewart, Glasgow.
14,791. Holder for Boxes with Drawer, C. R. Bonne, London.
14,792. Casting Metallic Ingots, H. J. Allison.—(*J. B. D'A. Boulton, United States.*)
14,793. Cast Steel Shells, &c., J. E. Bott and C. H. Cousins, London.
14,794. Back-of-Neck Collar Stud, J. Murdoch, London.
14,795. Stopper for Barrels, C. Booth and E. Upton, Nottingham.
14,796. Cotton Bands and Ropes, W. Haigh, Halifax.
14,797. Securing Key Block in Chair of Railway Line, H. S. Cowan, Hampton Wick.
14,798. Stoppers for Bottles and Jars, T. H. and A. Johns, Manchester.
14,799. Fire-bars, F. Wiedenbrück and H. Wilms, Barmen.
14,800. Game for Teaching History, W. K. Taunton, London.
14,801. Winding Fibrous Yarns, &c., J. Horrocks, London.
14,802. Generating Gases for the Aeration of Liquids, J. S. Fairfax, London.
14,803. Removing Slag from Furnaces, W. Hawdon, London.
14,804. Drying Slabs of Sugar, B. E. R. Newlands, London.
14,805. Fire Lighter, J. and W. Marlow, London.
14,806. Lamps, &c., F. Barker and H. M. Nuthall, London.
14,807. Fluid Pressure Vibrating Motor and Electric Machine, G. M. Capell and J. S. Raworth, London.
14,808. Lighting Gas Lamps, J. R. Schiller and C. Meyer, London.
14,809. Telescopic Fronts for Optical Lanterns, A. Wrench, London.
14,810. Tempering Steel, W. L. Purves, London.
14,811. Indicator for Railway Stations, L. Wacks, London.
14,812. Match-box and Cigar Cutter, A. Heilbuth, London.
14,813. Arranging Match Splints, H. C. Zappart, London.
14,814. Engine Governors, J. Shanks and D. S. Mathew, London.
14,815. Sheep Shearing Machine, V. Petherick, London.
14,816. Apparatus for Drying Materials, L. Kasparek, London.
14,817. Friction Clutches, I. G. Hooper, London.
14,818. Garments, W. R. Lake.—(*A. S. Haight, United States.*)
14,819. Refrigerators, C. Cimetière, London.
14,820. Iodised Sulpho-acids of Phenol, &c., E. Ostermayer, London.
14,821. Separating Sheets of Paper from Rolls, S. Wheeler, London.
14,822. Automatic Expansion Valve Apparatus, C. W. Vaughan and P. E. Ripley, London.
14,823. Mustard-pots, A. J. Boult.—(*M. Dehnert, Germany.*)
14,824. Hand Looms, A. J. Boult.—(*W. Wagenknecht, Germany.*)
14,825. Pianofortes, W. H. Davies, Liverpool.
14,826. Cane-lined Cigarette Mouthpieces, R. L. Hickes, London.
14,827. Fastener for Gloves, Boots, &c., E. Fisher, London.
14,828. Expelling Water from Floating Bodies, J. Wing, London.
14,829. Greeting Cards, G. F. Redfern.—(*J. Latapie, France.*)
14,830. Lubricating Apparatus, G. F. Redfern.—(*P. G. Pasquet, France.*)
14,831. Obtaining Nitrogen from Nitrogenous Substances, M. von Maltzan and L. Tralls, London.
14,832. Notifying the Approach of Trains, J. Steele, London.
14,833. Ash-catchers for Locomotives, C. A. V. W. Ebeling, London.
14,834. Regulation of Steam Engines, W. R. Lake.—(*C. L. R. E. Menges, The Netherlands.*)
14,835. Submergable Torpedo Boats, J. E. Tyler, London.
14,836. Envelopes, H. J. Haddan.—(*J. A. Anderson, Russia.*)
14,837. Gas Lamps, J. von Quaglio and C. Westphal, London.
14,838. Cigarette Cases, R. Tucker and R. Fowles, London.

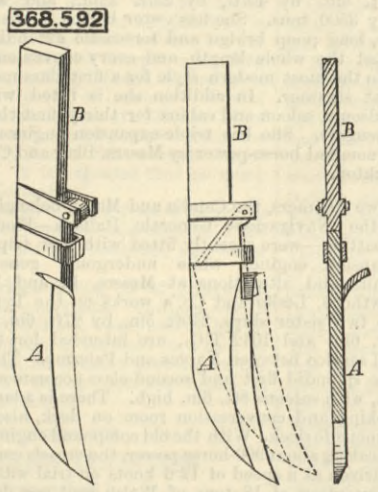
SELECTED AMERICAN PATENTS.

(From the United States' Patent Office Official Gazette.)

368,592. Coulter, *J. A. Kennedy, Carthage, N.Y.*—*Filed June 21st*, 1887.

Claim.—In a coulter, the combination of the stock B, constructed as set forth, and the blade A pivotally connected with said stock and provided with a laterally

368.592



bent spur integrally formed with the upper portion thereof, substantially as described.

368,608. Secondary Battery or Accumulator, *A. E. Peyrusson, Limoges, France.*—*Filed March 19th*, 1886.

Claim.—(1) In an electric accumulator, the electrolytic liquid containing sulphate of tin in solution, in combination with the electrode of the negative pole

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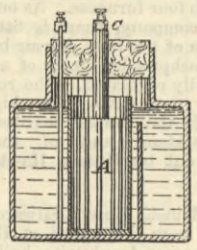

with which said liquid is in contact, as specified. (2) The electrode constructed of a central rod C of lead, and of surrounding radiating strips A A and lower plate B, substantially as herein shown and described.

368,714. Securing Railway Rails to Metal Sleepers, *L. P. Goffin and E. Vanriet, Brussels, Belgium.*—*Filed April 27th*, 1887.

Claim.—(1) The railway tie, perforated as described, and an angularly movable resting plate A provided with two lock-holes, in combination with two lock-pieces B C, and a wedge or key D, the arrangement being such that in the first position of the resting plate, parallel to the rail, one of its lock-holes corresponds with a similar opening in the sleeper, so as to

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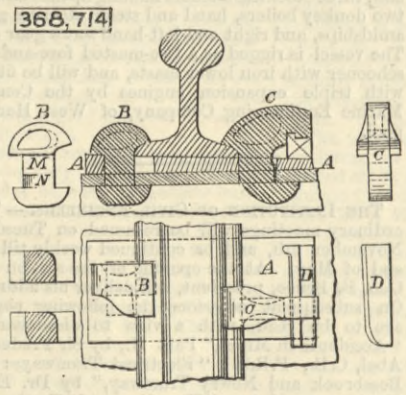

permit of the introduction of the external lock-piece B, whereas, in its second position, transverse to the rail, the other lock-hole coincides with a second opening in the sleeper, thus permitting the introduction of the inner lock-piece C, substantially as described above, and shown in the annexed drawings. (2) The combination of the resting plate A, with an external lock-piece B of such a section at N as will permit of its free motion in the opening of the sleeper and of such a section at M as will compel it to partake of the angular motion of the resting plate A, substantially as shown in the annexed drawings. (3) The combination of the resting plate and the external lock-piece B, with one or more lock-pieces C secured by means of a ribbed key D, and situate between the said key and the rail, as specified.

368,762. Steam Engine, *F. A. Gardner, Catskill, N.Y.*—*Filed July 1st*, 1886.

Claim.—(1) The combination, in an engine, of a valve chest provided with a tapered hole and annular steam spaces or ports surrounding and communicating therewith, a perforated tapered valve case fitted into the said tapered hole, a hollow valve cap adapted to receive the small outer end of the valve, and secured firmly in the valve chests and against the outer end of the valve case, and a cylindrical tubular slide valve whose inner and larger end is adapted to slide in the valve case, and whose outer small end is adapted and fitted to move in the hollow valve cap, and a connecting rod for connecting the valve with the operating excentric on the excentric shaft, substantially as described. (2) The combination, in an engine, of the perforated cylinder sleeve 13, closed at its outer end

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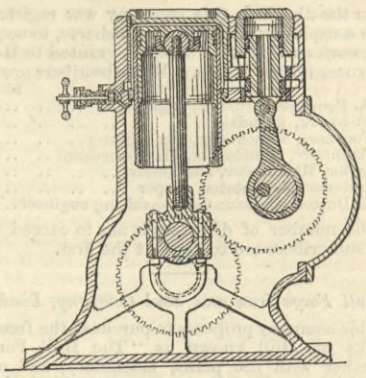

and secured firmly in the casting, and the cylinder 3, open at both ends and secured in the inner end of the sleeve, with an annular steam space extending around between the sleeve and that portion of the cylinder inclosed within the sleeve, substantially as described.

368,746. Revolving and Tilting Mould for Casting Tubes, *G. Adams, Ansonia, Conn.*—*Filed June 27th*, 1887.

Claim.—The combination of the mould 23, and suitable mechanism for revolving the same on its longitudinal axis, with the ring 18, surrounding the

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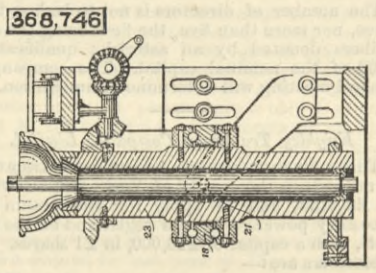

middle of the mould and supporting it by an annular or other ledge projecting from the sides of the mould, the ring being supported by the trunnions 21 and 22, turning in proper bearings in suitable standards or arms, substantially as set forth.

368,857. Electric Safety Lamp for use in Mines, *M. Settle, Snow Hill, Darcy Lever, Lancashire, England.*—*Filed November 2nd*, 1886.

Claim.—In an electric safety-lamp, the combination of an air and liquid-tight vessel containing water or other suitable fluid, with a float therein supporting the incandescent lamp, and contacts for the wires carried by the float and by the vessel, whereby the escape of the fluid will break the electric connection and ex-

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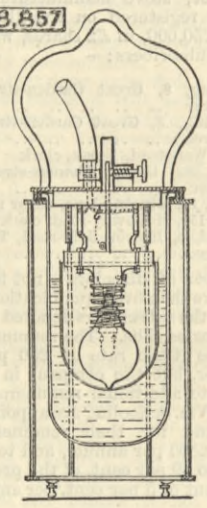
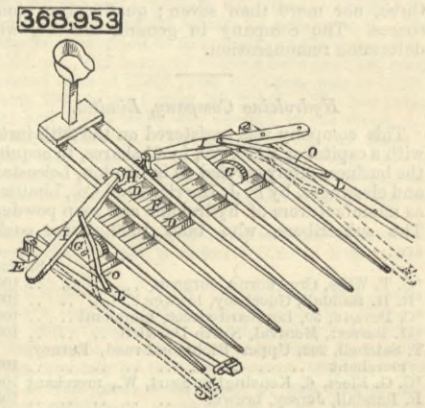


tinguish the lamp. (2) In an electric safety-lamp, the combination of an air and liquid-tight vessel containing water or other suitable fluid, with a float therein, an incandescent lamp, contacts for the wires carried by the float and by the vessel, and an automatic locking bolt to prevent accidental restoration of the electrical connection when once broken, all substantially as set forth.

368,953. Horse Hay Rake, *W. Klinker, Union Mills, Iowa.*—*Filed October 26th*, 1886.

Claim.—(1) The combination of the rake teeth, the axle placed under their rear ends and provided with the wheels G, the cross-bars D, extending across the rear ends of the teeth, the castings H, placed upon the teeth, the draught-rods, which have their inner ends loosely held in the castings, the rods L, loosely fastened at their rear ends upon the extended ends of

368,953



one of the cross-bars D, and rigidly fastened to the draught-rods near their outer ends, substantially as shown. (2) The combination of the rake teeth, the axle F, wheels G, and cross-bars D, one of which has the extended ends E, with the castings H, secured to the teeth, the draught-rods I, which have their inner ends loosely held in the castings, so as to have a turning movement therein, the rods L loosely fastened upon the extended ends and rigidly secured to the draught-rods, and the braces O, which serve as stops for the hay, substantially as set forth.