VISITS IN THE PROVINCES.

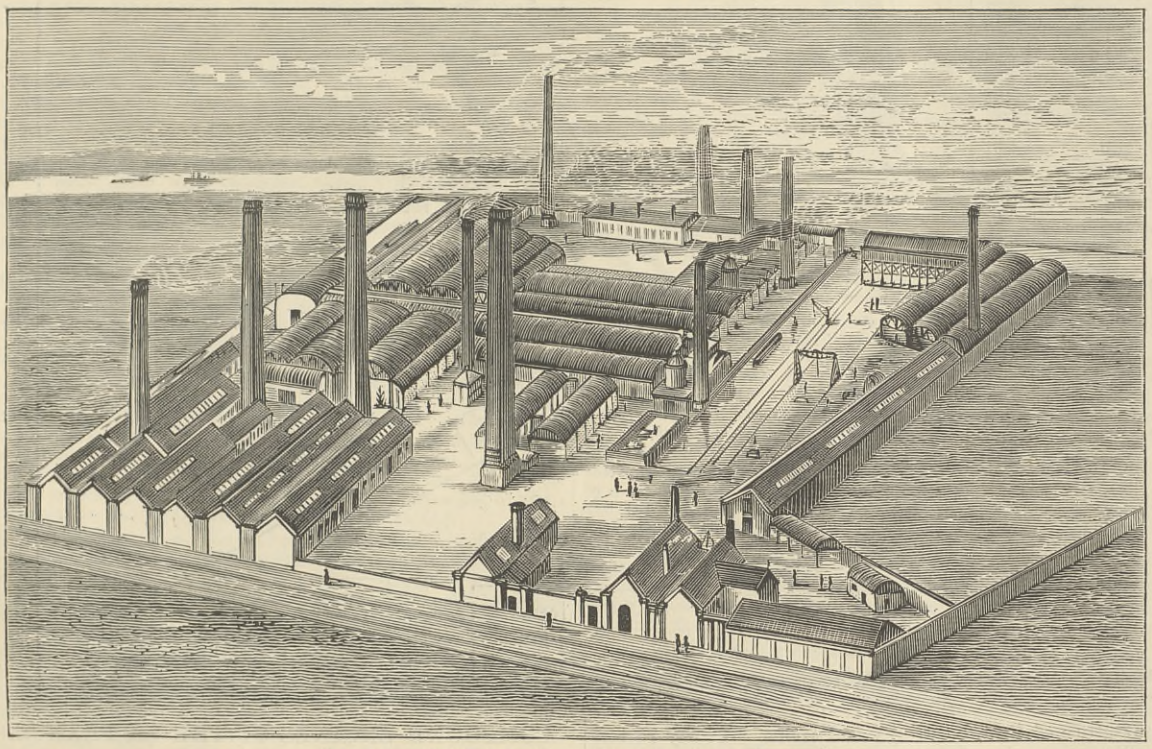
MESSRS. MOREWOOD & CO.'S SHEET MILLS, SOHO.

THE manufacture of sheet iron constitutes a special branch of the iron trade. The plant presents several peculiarities, and the system of working involves the employment of many processes. For these reasons the production of sheet iron is usually carried on as a distinct business, although it is sometimes coupled with the manufacture of wire on the one hand, and on the other with the making of certain articles in the construction of which sheet iron is largely used. In a recent impression we described at some length the manufacture of Russian sheet iron. The sheet manufacture in England has little in common with it, and it may be well to explain here very briefly how sheets are made.

In the first place pig iron is puddled. The balls are then worked usually under a steam hammer, although in some places the old helve is still retained. The blooms from the hammer are then heated and rolled down to make puddled bar. This bar is cut up into lengths, piled and reheated and rolled into bars. These bars are cut to lengths and charged into a suitable furnace. From this, when hot enough, they are withdrawn, and rolled two at a time by the roller and his back hand. The sheet mill consists of two chilled iron rolls from 18in. to 22in. in diameter, and from 3ft. to as much as 6ft. long, according to circumstances. The surfaces of the rolls are very smooth and polished. They make about thirty to thirty-five revolutions per minute. The two billets being rolled are actual work done while a "double," which when finished will shear to 6ft. by 3ft., is passing through the rolls, is about 120-horse power. So much premised, our readers will be able to comprehend more fully what we are about to describe.

Messrs. Morewood and Co. have two sets of works, one in Birmingham, where galvanising is carried on on a very large scale. The processes employed in coating the sheets with zinc are patented and peculiar. At these works are also made a large number of articles, such as tanks, cisterns, buckets, and all other kinds of galvanised hollow ware made from sheet iron, and in addition, a very large quantity of cut nails and tacks which are cut from sheets rolled in the mills at Soho. About these works we may have more to say at another time. It will suffice now to state that the plant includes one steam crane, three steam travelling cranes, a steam fire-engine, a steam pump, two steam hammers, seven steam engines, three boilers, and a few hundred nail-making machines, to say nothing of the galvanising tanks, stamping presses, &c. Our business at present is with the Soho Works of the firm.

The accompanying engraving gives a bird's eye view of the Woodford Ironworks, which is supplemented by a ground plan, on which will be found named all the different departments. The works contain three steam cranes, eight steam pumps, two steam hammers, no fewer than twenty-six steam engines, and nineteen boilers. There are ten rabbling machines, and five fixed fuel economisers. At these works are produced, first, sheet iron; second, iron roofs and buildings; and, lastly, large quantities of nails both wrought and cast.



GENERAL VIEW OF WOODFORD IRONWORKS, SOHO.

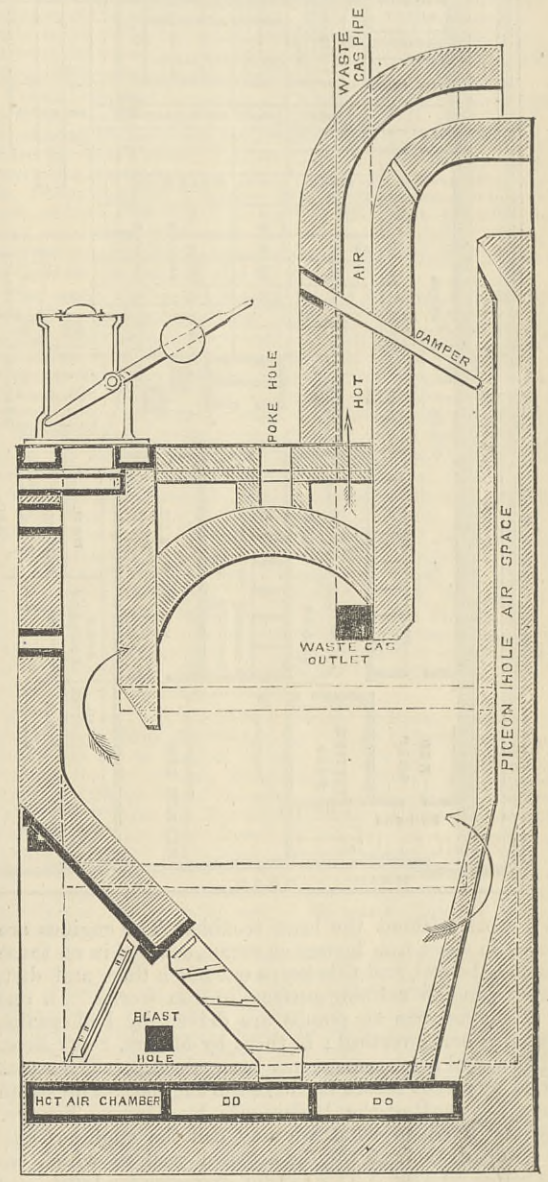
passed crosswise—that is to say with the length of the billet parallel with the axis—through the rolls one at a time; the back hand receiving each as it comes through and returning it over the top of the roll to the roller. The billets may be as much as 1¼in. thick at first, and the top roll jumps up through this range and falls again on the bottom roll as each bar passes. After each passage the screw in each housing is turned to reduce the space between the rolls, and by degrees the billets flatten out into sheets, at first nearly square. After they have been reduced to a thickness of about ⅛in., the plates are put one on the other and again passed through the rolls a few times. Finally there result two sheets about, say, 3ft. 4in. wide and 5ft. long. These are now taken to a large annealing furnace, where they, in company with many others, are brought to a red heat. They are then returned once more to the rolls, but together in pairs, and further reduced in thickness and extended in length. When the sheets are to be very thin, each one is doubled on itself crossways, reheated, and rolled again. The sheets are then put on one side to cool. Then they are sheared to size and annealed, and are then made up in bundles like so many thin packs of cards, and are ready for sale. Such, in few words, is the process of manufacture, broadly stated. Many modifications are, however, introduced for the purpose of producing just that quality of sheets which the maker desires to get. Although the product of the rolling mill is so light, the power required to drive a sheet mill is very great, and the strain on the housings or standards carrying the roll necks at each end is very heavy. It has been estimated that with a sheet 4ft. wide the rolls are forced apart with a strain of not less than 400 tons. For this reason the mills are made of enormous strength; but roll necks of sound, tough cast iron 18in. in diameter are often broken. To give an idea of the power required, we may say that a non-condensing engine with a 35in. cylinder, 5ft. stroke, driving the rolls direct, a fly-wheel of 70 tons being mounted on the crank shaft, will drive a double sheet mill with 50 lb. steam. But some manœuvring will be required if the sheets are very long, so that both mills shall not have long sheets in them at the same time. A non-condensing engine 27in. diameter, 5ft. stroke, making 70 revolutions per minute, with 50 lb. steam, and a 10-ton fly-wheel, will drive a single sheet mill with 20in. rolls 32 revolutions per minute, and will roll the largest sheet made, provided a little care is taken to let the engine recover its speed for a few strokes after each passage. With ordinary sheets it will deal without trouble. The

Messrs. Morewood and Co., up to the year 1877 had for a number of years rolled sheet iron at Bilston, but the works, being of the ordinary South Staffordshire type, wasted large quantities of fuel and other materials, and the firm, acting upon the advice of Mr. Richard Heathfield, the managing partner, decided to remove their plant from Bilston, and begin *de novo* to build works in which every possible economy in the manufacture of sheets could be practised, and where, by employing gas furnaces, they could use slack instead of coal, and thus have an ironworks which, as far as the stacks working to the gas furnaces were concerned, should be almost smokeless. It may seem chimerical, the idea of constructing an ironworks where no smoke shall be seen, but Messrs. Morewood have very nearly, if not absolutely, succeeded. It is right to add, however, that they could not have succeeded if they had not had plenty of space in which to work and ample funds.

Entering the premises we have first the offices, the precise position of which is shown on the plan; passing these we enter the yard, and find that while one side of the works is bounded by the canal, two docks from the same canal run across the yard in very convenient situations. Alongside these docks is a gantry, on which work steam cranes, by which the coal is lifted out of the canal boats, and deposited in small wagons running along the gantry. From these the coal is tipped as it is wanted into hoppers on the furnaces. These furnaces are the most important feature perhaps of the place. They are modifications of the Casson gas furnace, and the gas producer of one, as originally designed by Mr. Casson, is shown in section in the accompanying engraving. Messrs. Morewood and Co. have, however, in erecting all their latest furnaces, in many ways modified Mr. Casson's original plans, and they have also reconstructed, from ideas of their own, many leading parts of the furnaces first erected at Soho. The puddling furnaces are almost without exception double, and on the top of each is fitted a rabbling machine, each driven by a three-cylinder engine by Clough. The rabbling machines are of a well-known type. The rabble being hooked on to a drop rod is guided by the puddler, while the machine does all the hard work. These furnaces puddle 13 cwt. in each heat, instead of the 4¼ cwt. usual in the district.

It will be understood that the portion of the furnace illustrated above is really a gas producer. The air is admitted in rather limited quantities through the grate bars, and rising through a heavy body of fuel, the oxygen is gradually absorbed and replaced by carbonic oxide and hydrogen. Air to burn the gas is admitted as shown. The flame then fills the puddling hearth, and the action altogether is not unlike that of a Siemens furnace without a regenerator. A large blowing machine has been provided to supply air to the furnaces, but it is seldom used. At the side of each is a cast iron pipe, through which air enters. Over the mouth of each pipe is fitted a small cock, through which a jet of steam may be turned to induce an air current, but it is very seldom found necessary to use them. The furnaces are indeed extremely simple to manage, and so long as the hoppers are kept full of coal, and the bars are not allowed to choke up, they give no trouble. There is an almost complete absence of smoke; a light cloud of it sometimes rolls away from the chimney top when the grates have to be cleaned, or a damper dropped, but to all intents and purposes the process is a great success in the prevention of smoke, and we may add that the economy of fuel secured is very marked. With the ordinary single puddling furnaces in use in the district, about 28 cwt. of coal are required to puddle a ton of iron. Messrs. Morewood do the same work, in double puddling furnaces, with about 18 cwt. of coarse slack.

We must refer our readers to the plan of the works, that

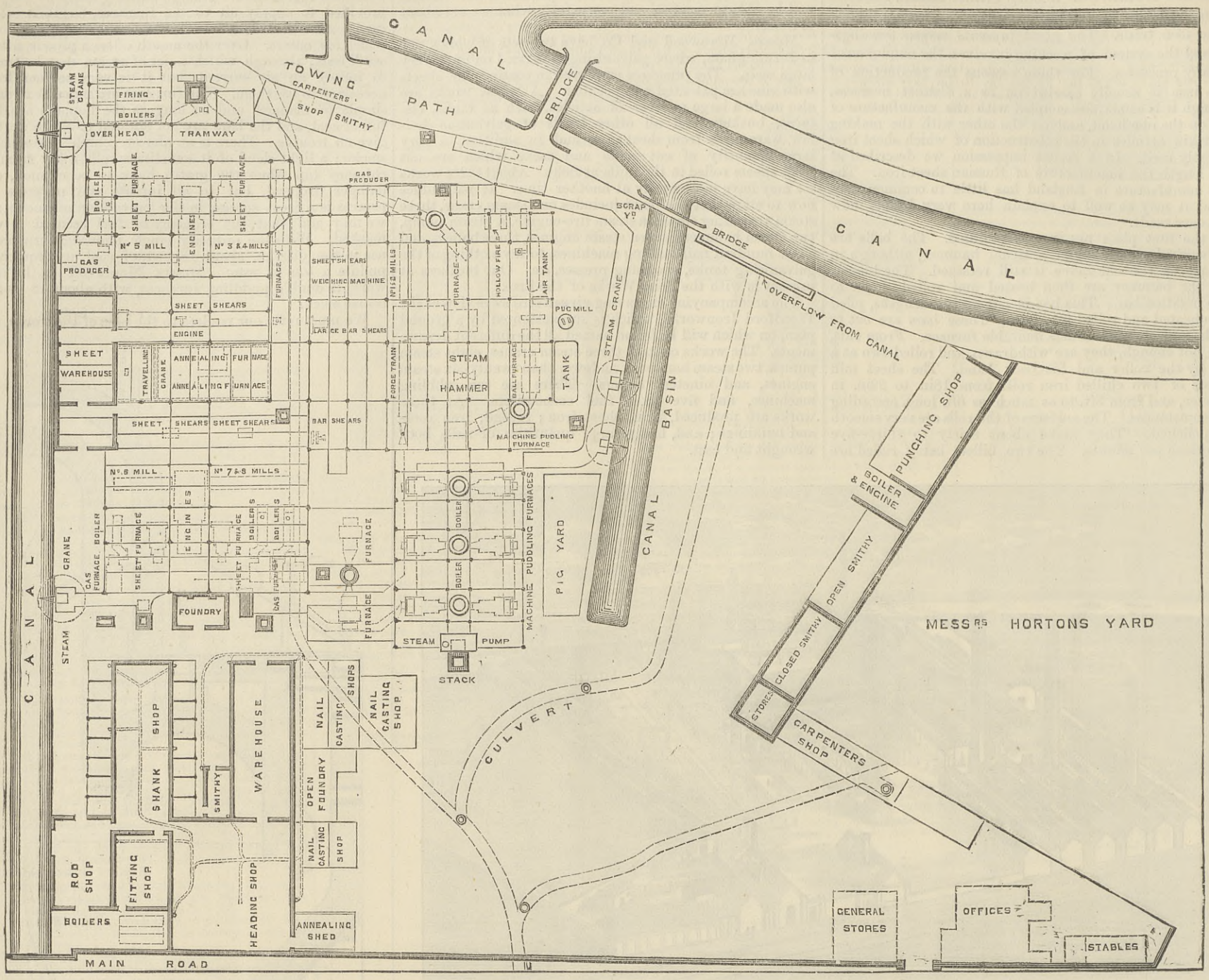


CASSON'S GAS PRODUCER.

they may see the arrangement of the different furnaces. Before leaving this part of the premises we may explain that a large supply of excellent water is obtained from the deep well. A great deal of steam is obtained from the Rastrick boilers, each 26ft. high by 7ft. 6in. diameter, with 3ft. 6in. flues, two double furnaces heating each boiler.

The puddled balls are worked under two 4½ tons double-acting steam hammers, by Messrs. Davy Bros., of Sheffield; and are then passed on to the forge. The furnaces here are in principle the same as that already described, modified to suit the use for which they are intended. The arrangement of the rolling mills, which are eight in number, each with a separate gas producer, and all working to boilers, is very good; it will be best understood from the plan. The arrangement of all the mills is the same, although the engines have not all been made by the same firm—Messrs. Davy Brothers. Each mill is driven by a pair of coupled condensing engines with cylinders 26in. diameter and 3ft. stroke. One pair we illustrate at page 137. The engines have no crank shafts, but a straight fly-wheel shaft. On the centre of the length of this is keyed the fly-wheel, which weighs 30 tons; and at each end is keyed a cogged wheel 5ft. in diameter, 18in. wide across the face, and 6½in. pitch. In each of these wheels is secured the crank pin. The whole revolving weight is 45 tons. Each of the crank-pin wheels, as we may call them, gears into a spur wheel 10ft. in diameter. One of these drives a 22in. single sheet mill with the usual rolls, while the other spur wheel drives a double 22in. sheet mill. This is a wonderfully good job. The foundations of the engine and gearing have been put in in brick in cement to a great depth, and the framing of the engine and the gearing is so bolted and keyed together that it is impossible for movement to take place; consequently, there are no cross strains set up, and although the pitch of the gearing is small, no breakdowns have taken place. The mills, too, are kept in first-rate order, with the result that little power is wasted in friction, and thus the two comparatively small engines we have named drive the three sheet mills on

PLAN OF WOODFORD IRONWORKS, SOHO.



heavy work without the least trouble. The engines are enclosed in sheet iron houses or rooms, covered in on three sides and the top, and this keeps out much dust and dirt, always trying to rubbing surfaces in iron works. In one pair of engines the air pumps are driven by bell cranks, the pumps being vertical; in those by Messrs. Davy Bros. the horizontal arrangement has been adopted. The steam is dried by a trap before it enters the engines. The steam pumps for feeding the boilers are by Messrs. Tangye. They are fixed in what we may call the engine-rooms. The pumps draw from the the artesian well to which we have before referred. This is 12in. diameter for 180ft., and 8in. diameter for 96ft.

In the forge there are two splendid shears, one weighing 25 tons, by Messrs. Davy Bros.; and the other, weighing 15 tons, by Messrs. Craig and Donald, of Johnstown, N.B. We should also add that the forge train is 22in., and contains three pairs of rolls. This is a very fine massive train.

The sheets are made in the usual way as already described, special precautions being employed in the selection of the iron, and so on, in producing the highest class of sheets. A great deal of the output is of this kind, and it all goes through the process of close annealing. When finished and cut to size the sheets are packed in annealing "pots," which are really rectangular wrought iron boxes. The sheets are piled up on a cast iron base-plate, and the wrought iron boxes are turned over them like a dish cover. Each box holds about 18 tons of sheets 10ft. long. The boxes, when "filled," are run into furnaces, in which they remain for twenty-four hours, when they are withdrawn, and allowed to cool for four days. The object is to prevent the air getting access to them while hot. Each box is 10ft. 6in. long, 5ft. 6in. deep, and 3ft. 6in. wide. An overhead crane travelling on a gantry is used to lift the boxes. They do not last very long, although they are made of stout boiler-plate and angle iron—warping and twisting into extraordinary shapes. The sheets come out quite clean and without scale, very much resembling Russian iron.

A considerable space is devoted to the manufacture of nails, but this part of the works presents nothing calling for special comment, save the excellent character of the nails. In London, at all events, the cut nail is a thing of reproach, a bye-word—so bad that many persons do not believe a good cut nail can be had. But Messrs. Morewood make hundreds of tons of nails, which can be bent cold flat on themselves without breaking. Curiously enough, these find little sale in this country. They all go abroad. Our colonists cannot afford to use bad nails.

The sheets being finished are shipped on board canal boats and sent up to Birmingham to the galvanising department direct.

A considerable space has been laid out at Soho for the manufacture of iron buildings and roofs. A lofty 15-ton travelling crane has been put up for erecting roofs, and bridges, and most of the machinery employed for straightening, punching, shearing, and rivetting, is of the well-known De Bergue type, while the hydraulic machinery and appliances are by Messrs. Tangye. Among it may be noticed a heavy hydraulic press for stamping the heaviest size of wrought iron boiler plate gutters. Power is obtained from an accumulator loaded to 2 tons on the square inch. The system of roofing adopted is the invention of Mr. Beattie, and has been patented. In a future impression we shall describe it. It appears to be one of the best systems of constructing iron roofs yet devised. The leading principle is that no holes shall be made in the rafters or principals, and that there shall be no welds in the ties. The first object is attained by cutting the T-iron rafters to the proper lengths, and clamping on them specially formed castings, which receive all the tie rod and purlin attachments. How the other object is secured we shall explain at another time. The firm have put up a very large number of iron buildings, some of considerable span. Among the most recent of their operations in this direction may be mentioned the new sheds at the Barrow-in-Furness Docks, some of which are 600ft. long and 80ft. wide, by 20ft. in height to eaves.

It is impossible within the limited space at our disposal to give more than a general idea of the arrangements and work of a great establishment such as this, employing not fewer than about 600 hands. It is in every respect a model establishment, and the utmost success has attended the adoption of the furnace which we have illustrated. But our readers must not run away with the idea that because Messrs. Morewood have been successful, everyone who makes iron ought in future to cease to make smoke. They have been fortunate enough to have plenty of space to work in, and the Casson furnace takes up a great deal of room. It would be simply impossible in the greater number of iron-works to find space enough for the purpose. Again, the furnaces are very expensive. It is quite true that they are so economical that they pay for themselves; but nevertheless they cannot be put up without plenty of capital. But something more remains to be said. A great deal of the success of the furnace is due to Mr. Heathfield, and his manager, Mr. Parry, who have introduced various modifications tending to simplify it and make it better, and we are not quite sure that in the absence of Mr. Heathfield's supervision it would answer quite so well as it does. The chimneys at Messrs. Morewood's works, Soho, may be readily distinguished from their neighbours. Perhaps the same thing may be said of the management. The works are a standing reproof to those ironmasters in that district who insist on making iron in the same way that their fathers did fifty years ago.

COMPOUND ENGINES OF THE LA FRANCE.

Engineers in France have shown a decided preference for the three-cylinder type of compound engine, using it for moderate pressures and powers, while English engineers have only adopted it when the use of but two cylinders would have rendered a low-pressure cylinder of excessive diameter necessary. A good example of the French type of compound marine engine is supplied by the machinery of the corvette Mytho, constructed by M. Schneider, of Creusot, exhibited at Paris in 1878, and illustrated in our pages at the time. The engines of the Atlantic mail steamer La France, illustrations of which we are now publishing, supply another example of modern French practice.

We have already given the principal dimensions of these engines, and it only remains here to say a few words of explanation. It will be seen that the high-pressure cylinder has two slide valves. The reversing gear consists of a hand wheel and screw. On the screw runs a nut coupled to the piston-rod of a horizontal steam cylinder. The pitch of the screw is such that the steam cannot cause the revolution of the shaft, but it can greatly facilitate it. Thus the engineer, when working the hand wheel, finds that the labour of turning the screw is taken off his hands, and he has to little more than help the piston in the running cylinder. It is stated that this system acts admirably. The action of the expansion gear requires no special description.

The general features of the engines are very clearly shown, and will be readily understood by our readers. There are many points on which English engineers will differ from French engineers, and on none more, perhaps, than on the wisdom of adopting such a type of engine for a pressure of but 45 lb. The drawings show recent French practice very clearly, and that is sufficient reason for their appearance in our pages.

In a succeeding impression we shall give additional views of these engines.

Launch of a Glen Liner.—On the 9th inst. the London and Glasgow Shipbuilding and Engineering Company launched from their yard at Govan a large addition to the Glen Line fleet of tea clippers, named the Glenogle, for service between London and China, the managing owners being Messrs. M'Gregor, Gow, and Co., Glasgow and London. The Glenogle is the largest steamer built for the company. her dimensions being—Length, 440ft.; breadth, 45ft.; depth, 29ft. 2in.; with a gross tonnage of 4000. She is built on the cellular system, with sharply-defined lines, and to the highest class at Lloyd's, and all the Board of Trade requirements. In addition, the new Glen Liner has been specially surveyed by the Admiralty officials, and put on the list of cruisers which can be used in the event of war with another maritime nation, and also for the conveyance of troops. The engines, which are being built by the firm to the designs and specifications of Mr. Wm. C. Roberts, are of the three-cylinder type, one of these being 59½in. and two of 83½in. diameter, and 60in. stroke, having all the latest and several new improvements, and, when in full working order, are expected to develope at least 5250-horse power. Her equipment will include Messrs. Muir and Caldwell's steam steering gear, Messrs. Napier Brothers' hand steering gear and windlass, Messrs. Clarke's steam winches, and Messrs. Chapman and Gurney's patent cranes. The Glenogle, besides carrying a large cargo, will be fitted up for a limited number of first-class passengers, and in the internal fittings teakwood will be largely used, and the saloon and berths are to be heated by steam pipes.

RAILWAY MATTERS.

THE line of trams between Dudley and Wolverhampton *viâ* Sedgley in now in construction. It has been decided to start at the Dudley end. As the work has to be completed within what is now rather a short time, the staff of workmen employed is larger than is usual.

THE preliminary arrangements in connection with the Forth Bridge scheme, as well as that of the Tay Bridge, says our Scotch correspondent, are being carried forward, and whenever certain necessary matters are settled these undertakings will be pushed forward with all possible vigour.

THE engines of the North London Railway Company made during the half-year ending 31st December, 1881, 990,637 train miles, 853,998 being by passenger trains and 136,639 by goods trains. The total cost of the coal and coke for this work was £13,598 2s. 8d., or, as it appears, 3·29d. per train mile taking goods and passenger train work together.

THE coroner's jury on the Spuyten Duyvil accident recommended that candles should be used instead of oil lamps. Another jury will perhaps recommend that the tinder box, steel and flint, shall be used instead of matches, because matches have been known to cause a fire. Oil lamps may be far from the best means of lighting carriages, but there is no reason for going backwards from oil, instead of employing the oil gas lights which are superseding oil.

A DUSSELDORF paper says that about a fortnight ago the first train on the Continent lighted with electric lamps ran between Frankfort-on-the-Maine and Hanau with complete success. A dynamo machine was fixed on the locomotive, besides which it is stated the rotary motion of the carriage axles was used for creating a current presumably by other dynamo machines in brake vans. The entire apparatus was constructed by the locomotive engineer of the line, and worked to the satisfaction of all who attended the trial.

ON Wednesday of last week, a Leicester paper says, an important series of experiments was made on the Midland Railway between Derby and Leicester with continuous brakes. There were two trains—one furnished by the London and North-Western Railway Company and the other by the Midland Railway Company—and there were present the Duke of Sutherland and other eminent persons, including the chief engineers and several directors of the London and North-Western, the Midland, the Caledonian, and the North Stafford Railway companies. The North-Western train was fitted with the Gresham brake, and the Midland with the Saunders and Bolitho, both being automatic brakes. The trials were made on widely varying gradients and at various rates of speed, the highest speed being a little over 60 miles per hour. The rails in some cases were damp and slippery with the rain. We were not present at these trials.

THE following particulars of the expenditure on the Connal Railway for the half year ending 31st December, 1881, are of interest :—Maintenance of way, works, and stations, £14,814 7s. 10d.; percentage on receipts, 20·28d.; per train mile, 1s. 1½d.; per mile open, £226 3s. 5¾d. Locomotive power, £8410 5s. 6d.; percentage on receipts, 11·51d.; per train mile, 7¾d.; per mile open, £128 8s. 0½d. Carriage and wagon repairs, £2066 16s.; percentage on receipts, 2·83d.; per train mile, 2d.; per mile open, £31 11s. 1d. Traffic expenses, £8371 9s. 5d.; percentage on receipts, 11·46d.; per train mile, 7½d.; per mile open, £127 16s. 1¾d. General charges, £1478 1s. 5d.; percentage on receipts, 2·02d.; per train mile, 1¼d.; per mile open, £22 11s. 4d. Law charges, £173 9s. 8d.; compensation, £359 8s. 10d.; rates and taxes, £840 8s. 10d.; Government duty, £1185 13s. 2d. Total working expenses, £37,700 0s. 8d.; percentage on receipts, 51·60d.; per train mile, 2s. 10¼d.; per mile open, £575 11s. 5½d.

A NEW viaduct is in course of construction over the Tees, near the viaduct built by Robert Stephenson in 1842, now carrying all the Cleveland goods and passenger traffic. To relieve this bridge the North-Eastern Company is building the new one from the designs of Mr. W. Cudworth and under the superintendence of Mr. T. E. Harrison. It is being built on the site of the suspension bridge erected in 1830 under a Captain Brown, which preceded the bridge built by Stephenson, and will be supported on a brick-work in circular iron cylinders carried 43ft. 6in. below the level of water. They are 7ft. diameter at the top and 8ft. at low-water mark. The part sunk beneath the bed of the river is increased to 10ft. 6in. The total weight of each is 33 tons 12 cwt. These large piers are built in pairs to receive the main girders. The total amount of iron in the bridge will be—cylinders, 420 tons ; girders, 490 tons ; and parapet, 8 tons. The total cost will be £15,405, and the whole of the wrought iron work, as well as the cast parapets, is being done by Messrs. Wilson Brothers, of 86, Cannon-street, London, and Alliance Works, Darlington. For sinking these piers the top of the cylinder is hermetically closed, forming an air lock, and an air pump worked by a steam engine on the neighbouring bank is connected to it. Air is pumped into it until the interior pressure is three atmospheres. The water is kept out by this pressure and excavation as the bottom proceeds.

THE sixteenth half-yearly meeting of the Forth Bridge Railway Company was held on the 17th inst. On the motion of Sir James Falshaw, the meeting adopted the directors' report, with annexed accounts, for the half-year ending 31st December, 1881. The report stated that Messrs. Harrison, Barlow, and Fowler had submitted the design of a bridge, which they recommended for adoption, and the board had decided, subject to parliamentary sanction, to proceed with its construction, and had appointed Mr. Fowler engineer of the undertaking. The cost of the new bridge and the approach lines of railway was estimated at £1,730,000. A formal agreement, based on the memorandum of agreement referred to in the circular letter of 28th June, and in the last half-yearly report, had, it was also stated, been concluded between the company and the guaranteeing companies, and its provisions were embodied in a bill which would be submitted for the approval of the proprietors at the Wharncliffe meeting. On the motion of the chairman, the meeting resolved that the sum of £750 should be paid as fees to the directors for services up to 31st December last ; and that, in future, £1000 per annum should be paid them. The chairman said he thought they were going on in the right direction. At a special meeting of the company which followed, approval was given to the bill entitled "A Bill to enable the Forth Bridge Railway Company to construct a substitute railway across the Firth of Forth, to amend the Acts relating to the company, and for other purposes."

A STEP has been taken by the superintendent of the London, Chatham, and Dover Railway, which will no doubt tend to the prevention of accidents, bring out a great many practically valuable suggestions for the working of the trains, and will at the same time give the guards great encouragement in the most effective discharge of their duties. He has issued forms on which twelve important questions are to be answered monthly by the guards in the employment of the company. They are as follows :—1. What is the average number of hours on duty each day? How many Sundays during the month have you been off duty? 2. Have you a book of the company's rules and regulations, and a service time-book for the month, in your possession? 3. Are you regularly supplied with all special notices issued from time to time? 4. Give the number of your watch, and say if it keeps good time. 5. Have your trains proper time allowed for the journey throughout? If not, give particulars of the times you consider would be an improvement. 6. Can you suggest any alteration in the formation of the trains whereby any vehicle can be dispensed with, or the working of the trains improved? 7. Have you observed any irregularity or defect in the working of the signals at any station, junction, &c.? 8. Have your brakes always been efficient? 9. Are you aware of any irregular or dangerous practice in the working of the line? The 10th, 11th, and 12th questions refer to whether the platelayers exhibit proper signals ; whether the guards notice the trains run unsteadily ; and whether they have anything to report or suggest relative to the working of their trains.

NOTES AND MEMORANDA.

THE reporters of the Lightning Rod Conference "are of opinion that a corona or copper band, with stout copper points, each about 1ft. long, at intervals of 2ft. or 3ft. throughout the circumference, will make the most durable and generally useful protector for a factory chimney, but these points should be gilded or otherwise protected against corrosion."

THE 50,000 miles of telegraph wire which we had in our island in 1870 have increased to considerably more than 100,000 in 1882 ; and the 2200 instruments worked by the old private companies have increased to 9000 since possessed by the Post-office. There are now more than 5500 offices, and the 4000 persons of all classes employed by the companies have increased to nearly 12,000 employed by the Post-office. Of these about 1600 are women, of whom 600 are employed in the Central Telegraph office alone.

THE Metropolitan Board of Works have just published a new specification for cement. Briefly, the conditions are, not more than 10 per cent. residue on sieve of 5800 meshes—76 per lineal inch ; to be gauged with three times its weight of dry sand which has passed through a 400-mesh sieve, and retained by a 900, and 10 per cent. of their weight of water. Briquettes from this, kept in damp atmosphere, and put in water twenty-four hours after made, are then kept for test by board. The neat cement at any time of year must not set in less than an hour, and must bear 200 lb. per square inch twenty-eight days after briquettes are made.

A PAPER was recently read before the Chemical Society by A. P. Smith and W. B. Lowe, "On the Dissociation of Chlorine." In 1879 Meyer showed that the vapour density of chlorine at 1200—1500 deg. was two-thirds of its vapour density at 600 deg. It occurred to one of the authors that if chlorine was passed through a tube into potassium iodide, less iodine might be liberated when the tube was heated than when cold. The authors have tested this point, and conclude that less iodine is liberated by chlorine after heating to 1030 deg. than by chlorine which has not been so heated, or to use their own phraseology, 1 gramme of chlorine at 6 deg. becomes ·744 gramme Cl at 1030 deg. What becomes of the rest is not stated.

ON the size for lightning rod the writers of the Lightning Rod Conference report recently published by Messrs. Spon say, "This is perhaps the most difficult subject which has to be determined, but we think that it must be assumed that lightning has fused a copper rod 0·10in. ($\frac{1}{10}$in.) in area, *i.e.*, weighing 6 oz. to the foot. We have also the Caterham case, where a copper tube weighing 5¾ oz. per foot. was heated to redness. The saving of cost which might be effected by using for very low building rather slighter rods than for ordinary edifices is not worth considering. In a 30ft. rod it would hardly amount to 10s. We therefore recommend as the minimum to be used :—If of copper rope, ½in. diameter ; if of round copper rod, $\frac{3}{8}$in. diameter ; if of copper tape, $\frac{3}{4}$in. by ⅛in. diameter ; if of round iron rod, $\frac{5}{10}$in. diameter."

AT the meeting of the Meteorological Society on the 15th instant, a paper was read entitled "Notes of Experiments on the Distribution of Pressure upon Flat Surfaces perpendicularly exposed to the Wind," by Mr. C. E. Burton, B.A., and Mr. R. H. Curtis, F.M.S. In the present state of aero-dynamics it seems to be impossible to make an *a priori* investigation of the distribution of pressure on a surface exposed to the impact of the fluid in motion, without introducing such limitations as render the solutions arrived at widely divergent from the results obtained by the experiments hitherto made. The authors therefore proposed to themselves to attack the problem from the experimental side only by a method which, as far as they know, has not been applied in the case of air, viz., the application of Pitot's tube, suitably modified in form to the simultaneous measurement of the pressures at the centre, and at any en-centrically situated point of a pressure plate of known dimensions. The results of the preliminary experiments are given in the paper. The electrical thermometer, lent by Messrs. Siemens Brothers, for observing the temperature of the air at the summit of Boston Church Tower, was also exhibited.

POTASH soft-soap for engineers' and lubricating purposes may be very easily and simply made as follows :—Take 20 lb. of pure caustic potash. Dissolve it in any iron or earthenware vessel, with 2 gallons of soft water. Now add this strong caustic lye to 9 gallons of oil, heated to about 140 deg. Fah., and pouring it in a small stream and stirring continually, until the two are combined and smooth in appearance ; about ten minutes is all that is necessary. The mixing may be done in a wooden vessel ; half an old oil barrel does well. Wrap it up with blankets, to keep in the heat that is generated by the mixture itself slowly combining and turning into soap. Put in a warm room, and leave for three days. The result will be 120 lb. of the finest concentrated potash soft-soap, pure and free from adulterations. Any vegetable or animal oil will do. Pale seal oil for wire-drawing and lubricating is the best. For ordinary washing, when made with cotton-seed oil, the soap is both cheap and good, and besides being useful for machinery purposes, produces a very superior soap for washing flannels, greasy and stained articles, in cold water. The above process absolutely depends on the use of a fine strong caustic potash lye. If impure, imperfectly causticised, or of a less strength, soft-soap cannot be made in this manner. The Greenbank Alkali Company, of St. Helens, make a fair article for this purpose, and also put it up for small consumers in 20 lb. canisters, just sufficient for one operation, which is a convenience, as caustic potash when exposed to the air is very deliquescent. Caustic soda is sometimes sold for caustic potash, but this will not do, as it makes a hard soap of a totally different character.

AN interesting paper, by Dr. Flight, was read before the Chemical Society on the 16th inst., entitled, "Contributions to our Knowledge of the Composition of Alloys and Metal Work for the most part Ancient." This paper consists of a series of analyses of various ancient coins, &c. :—(1) Facts relating to the history of copper-nickel coinage : The author has analysed some old Bactrian coins, about 230 B.C. They contain about 77 per cent. of copper, 20 per cent. nickel, with cobalt and iron in small quantities. (2) Some curious square coins of ancient India, 500 B.C., were examined. These contained 89 per cent. silver, ·4 per cent. copper, 4 per cent. lead, with silver chloride, gold, and graphite. (3) A figure of Buddha contained 57 per cent. Ag, 4 per cent. Ag Cl, 37 per cent. Cu, with gold and graphite. (4) Bidrai ware, India, from Secunderabad : This consists of boxes, or bottles, or bowls of an alloy, containing 94 per cent. Zn, 4 per cent. Cu, 1·5 per cent. Pb, into the surface of which thin sheet silver is inlaid. (5) Koft Gari work from the Punjab, near Cashmere : The groundwork consists of iron blued by heat, and with a design of gold and silver. (6) A sickle found at the foot of a Sphinx at Karnak : Its composition was—$Si O_2$, 11·9 per cent. ; $Fe_3 O_4$, 5·1 per cent. ; $Ca C O_3$, 0·1 ; $Fe_2 O_3$, 64·6 ; water, 18·2 ; nickel, trace. This was supposed to be one of the oldest pieces of iron in existence. (7) A piece of iron found in the air passages of the Great Pyramid : The interest of these two specimens of old iron is that, from their analyses, they appear not to be of meteoric origin, but to have been manufactured. (8) Double hook, of bronze, found in an air passage of the Great Pyramid : It contained 99·5 per cent. Cu. (9) Bronze figures brought from Egypt by Mr. John Dixon, supposed to be of Ptolemaic origin : A figure of Isis contained 68·4 per cent. Cu, 4·7 per cent. Fe, 22·7 per cent. Pb, 1·5 As, traces Ni and Sb, and 0·9 per cent. Sn. Another bronze contained 82·2 per cent. Cu, 15·8 per cent. Pb, 2 per cent. Sn. (10) Copper spear-heads from Cyprus contained Cu 97 to 99 per cent.; Fe, ·4 to 1·3 per cent.; As, trace to 1·3 per cent. ; &c. (11) Copper axe-heads, from near Bethlehem, contained 99·5 per cent. Cu. (12) Hebrew shekel weighed 14·27 grms., contained 97·6 per cent. Ag, ·6 per cent. Au, ·6 per cent. Cu. (13) Various Cypriote, Roman, and Greek bronzes contained 78 to 87 per cent. Cu, 8·5 to 10·9 per cent. Sn, 1·5 to 9 per cent. Pb. (14) Inca's pin, from a mummy at Arica : 82 per cent. Ag, 1·4 per cent. Ag Cl, 16·1 Cu. (15) Bronze bar, from a temple in Bolivia : Cu, 93·27 per cent.; Sn, 6·5 per cent.

MISCELLANEA.

ARRANGEMENTS are being made for holding a Sanitary Congress and Exhibition to be opened on Tuesday, September 26th, 1882, in Newcastle.

A PAMPHLET entitled "Notes on the Lithology of Gas Coals, with List of Commercial Analyses," by Mr. James Paterson, F.G.S., has been published at the Warrington *Guardian* Office.

IT is stated that a contract for building a tunnel under the St. Lawrence, at Montreal, has been let to Mr. J. B. Louilliard, the amount of the contract being £700,000, including drainage and lighting. The tunnel is to be completed by 1885.

WE have received a copy of May's "Press Manual" for 1882, containing a list, and other information relating to, all daily and weekly papers, arranged in order of names and of counties, and also of the magazines and other periodicals published in London and the counties.

A PAMPHLET on "The Water Question" has been published by Mr. W. T. Wiseman, which condemns the expenditure of the enormous sum of 35 millions for the purchase of the London waterworks, which cost 12 millions ; but it repeats the oft-asserted, unsupported dogmas about necessary impurity of river supplies.

THE recent "Transactions" of the Chesterfield and Derbyshire Institute of Mining, Civil, and Mechanical Engineers contain an interesting and instructive paper on "Draining and Ventilating," with a short description of the haulage in the deep soft seam at the Staveley Collieries, by Mr. Joseph Humble, the mining engineer of the extensive collieries of the Staveley Company. The paper is very fully illustrated, and gives some figures useful as comparisons between the cost of work done by Cornish and direct-acting differential pumping engines.

THOSE interested in cooking and heating by gas will be interested in a very useful paper on the subject, recently read before the Dumbarton Philosophical and Literary Society by Mr. W. Denny, M.I.C.E. It is a clearly written paper on the subject, and clear descriptive particulars are accompanied by ample illustrations. Mr. Denny describes a number of experiments on a rather large scale, and gives the cost of gas heating throughout his own house, using more than 1000 cubic feet per day last winter. The cost then was considerably more than for coal, but he had to pay 4s. 2d. per 1000 for gas and only 12s. 6d. for coal.

THE water and gas undertakings of the Birmingham Town Council are resulting in a large municipal profit. The water committee in its report to the council on Tuesday showed that after deductions from the water rents to the amount of £4989, the surplus profit of the past year amounted to £7362, and the balance added made £10,322. The committee proposed to increase the reserve fund to the statutory limit of £50,000 and use the remainder in the reduction of water rents. As the result of the year's undertaking the gas committee find themselves able to appropriate £27,500 towards to Borough Improvement Rate of 1881.

A COURSE of lectures has been commenced at the Crystal Palace by Professor Silvanus P. Thompson, B.A., D.Sc. The first, on "Electric Currents—what are they?" was given on Wednesday. Three others will be given as follows :—(1) "Electric Currents—how to make them by steam," Wednesday, March 1st, at 8 p.m. (2) "Electric arc lights," Wednesday, March 8th, at 8 p.m. (3) "Electric incandescent lamps," Wednesday, March, 15th, at 8 p.m. The lectures will be illustrated by diagrams in the magic-lantern, by experiments on the large scale, and by experiments in the magic-lantern. Other lectures on the various systems of electric lighting are being arranged.

THE "Journal" of the British Society of Mining Students for February contains papers :—(1) On the "Ashford" litter, as especially adapted for use in cases of accident in mines ; (2) on engine sets, reversing the air current, describing the reversal of ventilating currents by the motion of the underground sets of tubs as a cause of explosions ; (3) on the Electrical Exhibition at Paris, in which the Swan miners' lamps are described, and the use of Dowson gas referred to. Here the author follows Professor Ayrton's unfair comparison with steam engine economy by assuming that an ordinary engine consumes 6 lb. of coal per horse-power per hour. Some figures relating to the cost of the electric light in Chesterfield are given.

THE Ohio Commissioner of Statistics has prepared the following table showing the average daily wages paid in different departments of labour. It shows that among the building trades stonecutters receive an average of 3·04 dols. per day ; stonemasons, 2·92½ dols. ; bricklayers, 3·31 dols. ; carpenters, 2·25 dols. ; plasterers, 2·80 dols. ; painters, 2·14 dols. ; plumbers, 3·42 dols. ; labourers, 1·54 dols. In machine shops and foundries machinists receive 2·05 dols. ; moulders, 2 dols. ; pattern makers, 2·11 dols. ; blacksmiths, 2·05 dols. ; boiler-makers, 2·35 dols. ; wood-workers, 1·90 dols. ; painters, 1·80 dols. ; labourers, 1·39 dols. ; apprentices, 84 cents. In tanneries wages are paid as follows :—Curriers, 2·11 dols. ; finishers, 2 dols. ; rollers, 2·18 dols. ; beam hands, 1·61 dols. ; yard hands, 1·45 dols. ; engineers, 1·93 dols. ; hide salters, 1·39 dols. ; labourers, 1·54 dols.

THE following, on sectional boilers, is from an American paper :—"The sectional safety boilers, so much in favour ten years ago, have, with some few notable exceptions, proved an expensive failure ; probably not 10 per cent. of the number put in at that time are in use to-day. Cast iron principally used in their construction, was one of the earliest materials used in steam boiler construction, but it had to be abandoned. Its great danger of cracking under change of temperature to which steam boilers are peculiarly exposed, the want of uniformity in its strength owing to defective castings through honeycombing and blow holes, the varying expansion between cast and wrought iron, the use of rubber grummets in making joints, contracted and tortuous passage through which the steam bubbles must force their way to the steam drum, insufficient arrangements for cleaning out, &c., were some of the many causes that led to their condemnation."

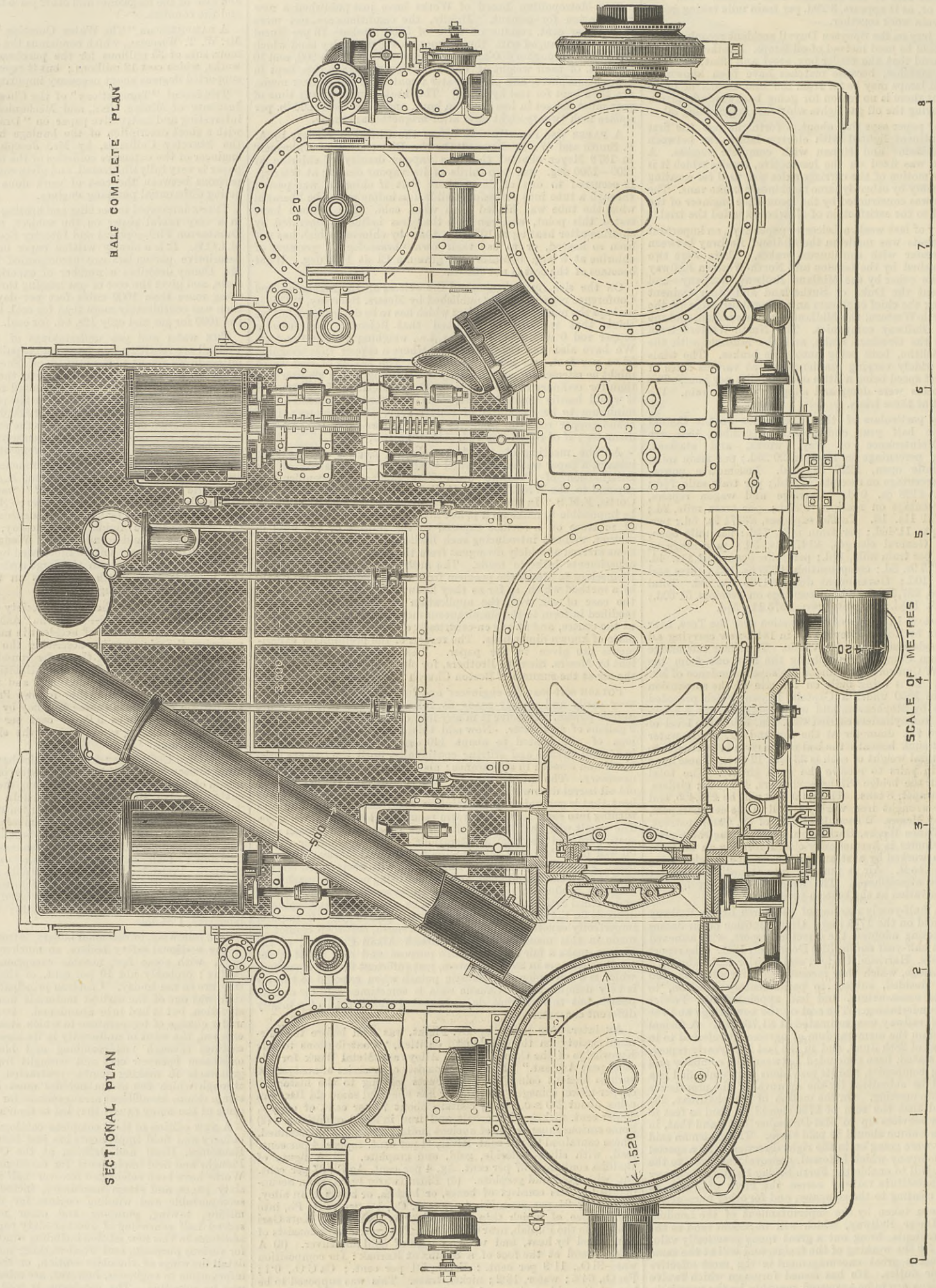
A NEW edition of their complete catalogue of engines and machinery and field implements has just been published by Messrs. Ransomes, Head and Jeffries, at the Orwell Works, Ipswich. Ploughs and field implements, for excellence in which the Orwell Works have been celebrated for over half a century, occupy over sixty pages, and steam machinery, including portable, fixed and semi-portable and winding engines for driving the threshing, milling, sawing, pumping and other machinery, occupy the second half consisting of another sixty pages. There are several additions in this new edition including winding and hoisting engines for various purposes, and wood-working machinery. Some of the detail drawings of the older edition, or those which supply most information to engineers, however, are missing, an omission which may be regretted. The catalogue is well got up and is octavo size, a size which it would be to the advantage of all makers to adopt so as to get their catalogues preserved.

A NEW patent hopper dredger of 500 tons, built and engined by Messrs. W. Simons and Co., was launched on the 20th inst. complete from their works at Renfrew. It is named Alexandra, and is the property of the Manchester, Sheffield, and Lincolnshire Railway, and has been constructed under the direction of Mr. Sacre, C.E., their engineer. It is the second hopper dredger supplied to them by this firm. It is fitted with twin screws and two sets of separate compound engines and two boilers of 80-horse power. Its bucket girder traverses beyond the bow for the purpose of cutting shoals or dry banks, and thus dredge its own floatation down to 25ft. depth of water. It will carry 500 tons of its own dredgings at a speed of seven miles per hour, and on board are fitted steam appliances for mooring, lifting, traversing, and measuring. A duplicate dredger to the above, named Neptune, has, during the last six months of winter weather, removed 80,000 tons of soil from Newhaven, Sussex, with eight men and without barges, punts, or tug steamers.

THREE CYLINDER COMPOUND ENGINES OF THE S. S. LA FRANCE.

LA SOCIÉTÉ NOUVELLE DES FORGES ET CHANTIERS DE LA MÉDITERRANÉE, MARSEILLES, ENGINEERS.

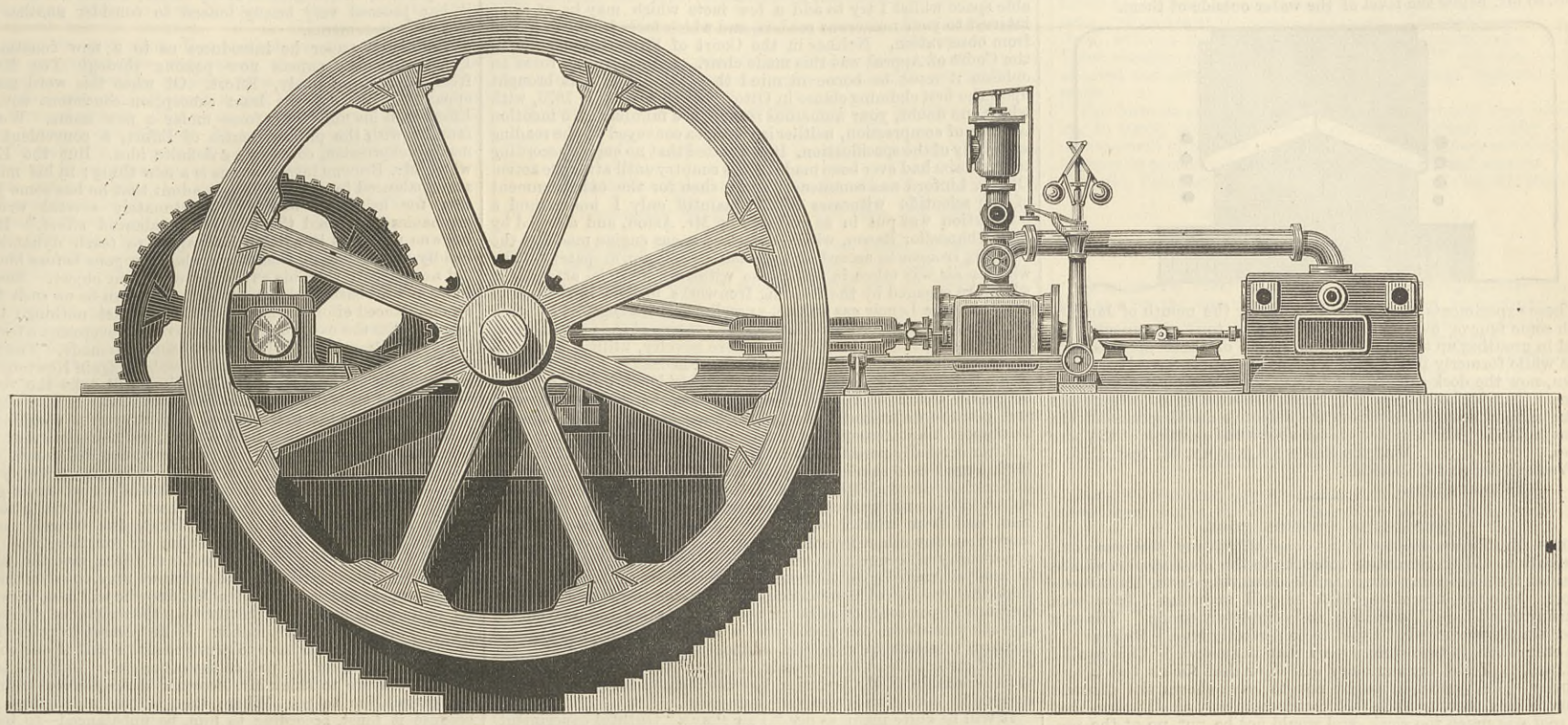
(For description see page 134.)

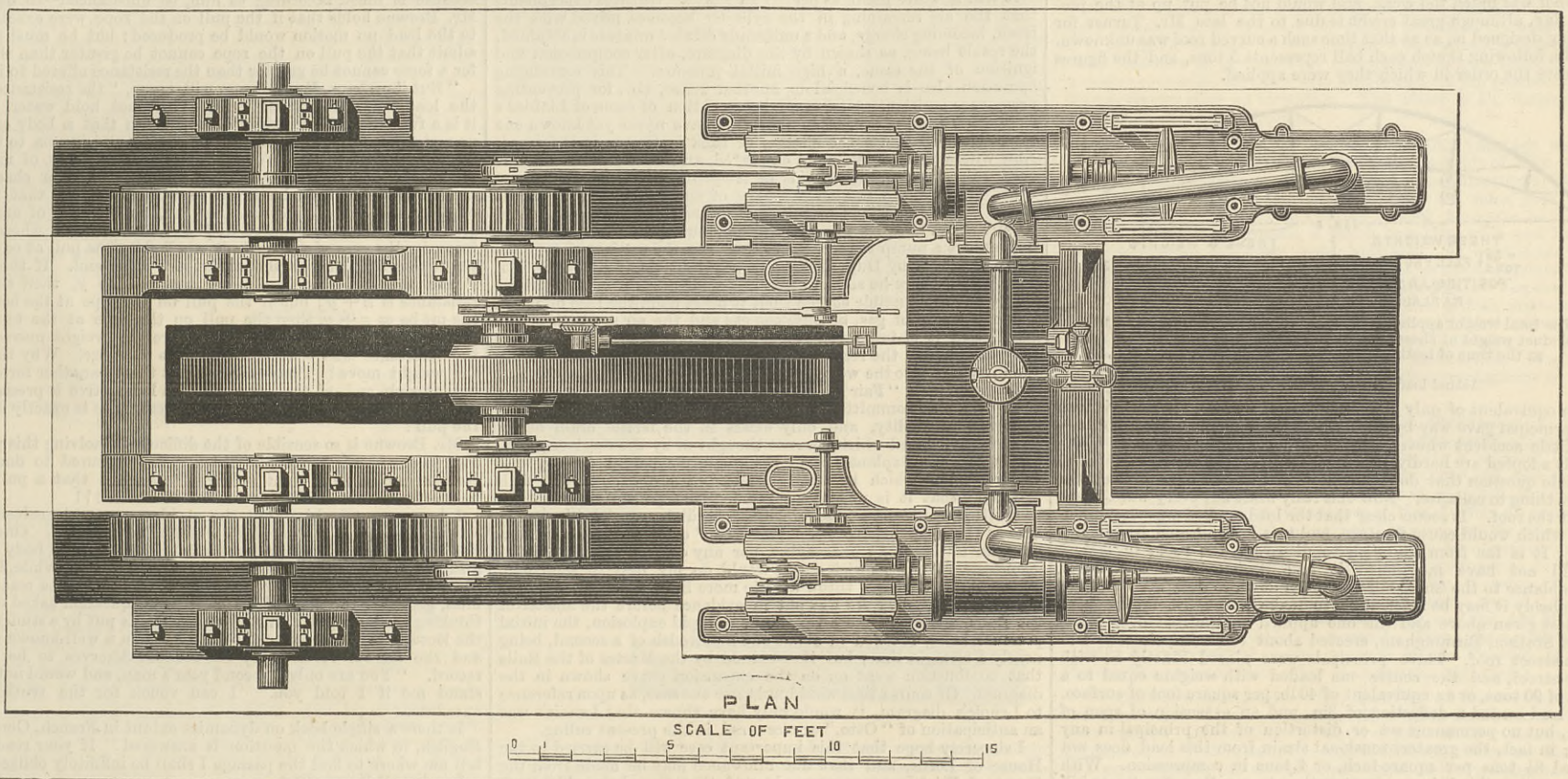


SHEET MILL ENGINES, WOODFORD IRONWORKS, SOHO.

MESSRS. DAVY BROTHERS, SHEFFIELD, ENGINEERS.

(*For description see page* 133.)





PLAN

SCALE OF FEET

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LETTERS TO THE EDITOR.

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

THE EDUCATION OF ENGINEERS.

SIR,—I have received a pamphlet entitled "Engineering College Tracts No. 1," purporting to be a letter written by a student named E. Mitchell at the College (!) of Practical Engineering, Muswell Hill, to a friend addressed as "dear Bamford," advising him as to the education of an engineer, and the prospects of success. Such a production would probably not call for further notice, unless, as in the present case, issued apparently with the approval of persons who are more qualified to write on such topics than a student whose experience is summed up on page 11 by the remark, "The college has been only recently opened, and we have not yet had any surveying or outdoor work to do." On the first page occurs an attack upon the Royal Engineers, as vulgar as it is undeserved. That profession does not only attract men of "weak minds," but men of the highest degree of intellect, and although their conspicuous failures when acting as civil engineers, especially in India, are so well known, it is admitted universally that in their proper capacity they are highly skilled.

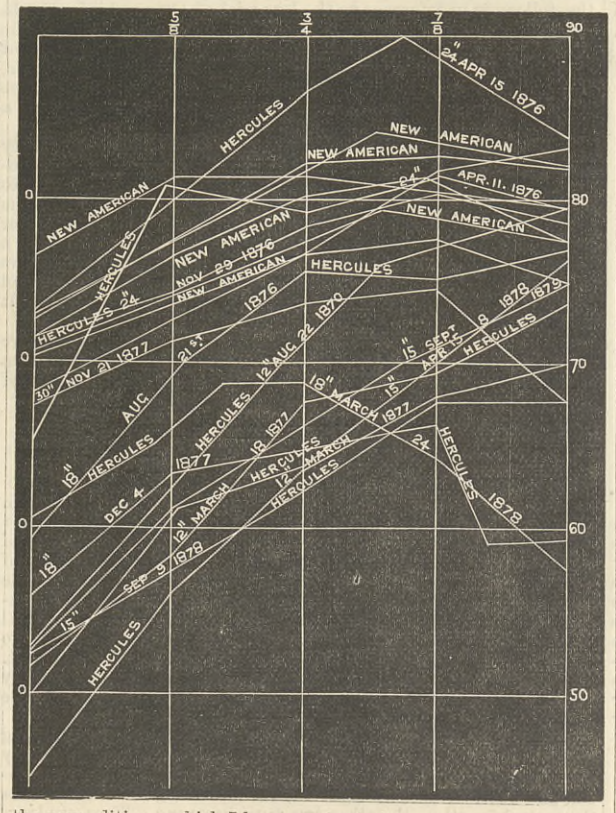
Then the pamphlet leads up to the definition of an ideal engineer, "not the civil engineer pure and simple, or the mechanical engineer pure and simple," but the engineer who "understands all these departments." Then follow the very valuable conclusions. From the large experience of the writer we are naturally quite prepared to have the merits of the various places of technical education weighed, and to hear that all are found wanting, excepting, of course, the College (!) of Practical Engineering, Muswell Hill; though it is with a certain sense of relief that we learn that once Glasgow University was qualified to teach, but is not now.

It is almost impossible to treat an advertisement such as this "tract" seriously, but as the copy sent me purports to be one of the tenth thousand, though only dated this month, it must be assumed that large numbers have been spread abroad, and as it is accompanied by an official letter from the secretary to the undertaking, it may be taken for granted that it is issued with the approval, to say the least of it, of the principal, Mr. Bourne, whose praises are not by any means omitted from its pages. M.I.C.E.

February 15th.

EFFICIENCY OF TURBINES.

SIR,—I quite agree with Mr. Turnbull that "the tests published in Mr. Emerson's treatise were made in the most careful manner, and without fear or favour;" and therefore do not scruple to give the enclosed diagram, comparing the performance of the Hercules and the new American turbines. That of the Hercules will be found on page 120, and that of the new American on page 123 of



the new edition—which I have received since writing my last. It will be seen that the average is greatly in favour of the new American, which I think is the best representative of modern American practice.

I would also quote from page 121, where Mr. Emerson writes with reference to the Hercules:—"I have tested about eighty of these wheels, and, as may be seen by the diagram, the variations have been great, and there are no good reasons for believing that they will be less so in future. Many of them are sent to purchasers without flanges on gate. In such case, in my opinion, the Victor would be preferable." Then follows a reference to an offer of the makers to test all their wheels, after which Mr. Emerson continues:—"The constant variations of the wheels, and a lack of appreciation by purchasers, caused an abandonment of the plan suggested by the card, and now the wheels are sent away without any knowledge of their efficiency."

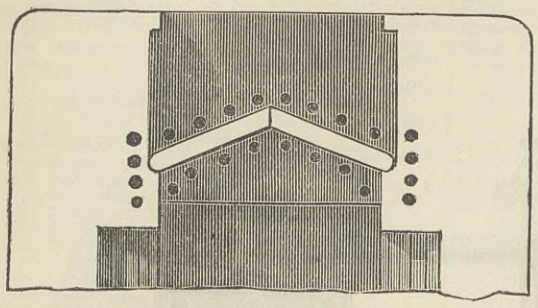
Mr. Turnbull's remark that most turbines fall off considerably at part gate is quite true with regard to turbines fitted with register gates, but does not apply to those fitted with the fly-trap gate, which originated with the vortex wheel of Prof. Thompson. If we look for the reason of the difference in the results given by the Hercules, I think it will be found in the gate, which is practically the same as that used in the Fourneyron. From its construction it is difficult to make in *fac simile*. One word with regard to Messrs. Gwynne and Co.'s letter, the Gerard turbine was patented in 1856, and the term of years must therefore have expired long ago. CHARLES L. HETT.

Ancholme Foundry, Brigg, February 13th.

GREENOCK HARBOUR.

SIR,—The following description of some experimental work made on the old graving dock in the west harbour at Greenock may be interesting to your readers. For some years past, owing to the very leaky condition of the entrance works, a question has been pending whether to reconstruct the entrance works of this dock at a cost of £4000 or to remove the dock altogether. The dock is a small one of 223ft. in length by 50ft. in breadth, having an entrance of 34ft. in width, with about 10ft. of water on the cill at high water spring tides, and I believe was constructed from the designs of James Watt about the year 1785. Before determining whether to reconstruct the entrance or remove the dock, I tried what could be done by putting down 3in. bore holes at from 1ft. to 2ft. apart through the masonry behind the heel posts down into the sand for several feet below the foundations, and had similar bore holes put down through the outer and inner aprons close to and at a few feet from the pointing cill. All the holes were sunk well down into the foundations, so that when a thick grout of neat Portland cement was poured down the holes it would permeate through the various fissures and open joints, and

virtually join the bore holes together, forming, in fact, a watertight sheeting of neat Portland cement. Stand pipes were set up in the various holes about the aprons, and the grout run into them only when the gates were open, or when the water was at the same level inside and outside of the dock, which prevented any disturbance of the cement grout by runs of water until it was set. The thick grout carried down the level of the water in the stand pipes to 6ft. below the level of the water outside of them.



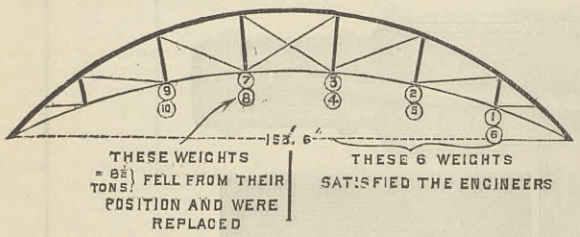
These experiments were carried on during the month of January with some four or five men, and about five tons of cement were used in grouting up the holes. The result of these operations is that while formerly it required an 18in. pump to keep the leaks down, now the dock can stand for forty hours without the necessity of more than one hour's pumping during the same period, the present leaks being almost entirely from the defective meeting faces of the gates and cill. The annexed sketch shows the position of the bore holes.

Walter Robert Kinipple, M. Inst. C.E.

Westminster and Greenock,
February 10th.

SNOW HILL STATION ROOF.

Sir,—Mr. Turner's letter in no way affects my previous communication. My information referring to the Lime-street roof was obtained from the same source as his own, viz., from his father's report. I do not, therefore, think he will maintain I have been "misinformed" and "decidedly and completely wrong." His own letter simply proves what I said to be perfectly true. He says "it was only when 48 tons were put on that it yielded." This is all I said, and the following summary will show that such a test is very ordinary. The principal ought not to have shown the slightest injury in any part, and the fact that it gave way at all proves that the roof was much too weak, and would not be put up at the present day, although great credit is due to the late Mr. Turner for having designed it, as at that time such a curved roof was unknown. In the following sketch each ball represents 5 tons, and the figures indicate the order in which they were applied.



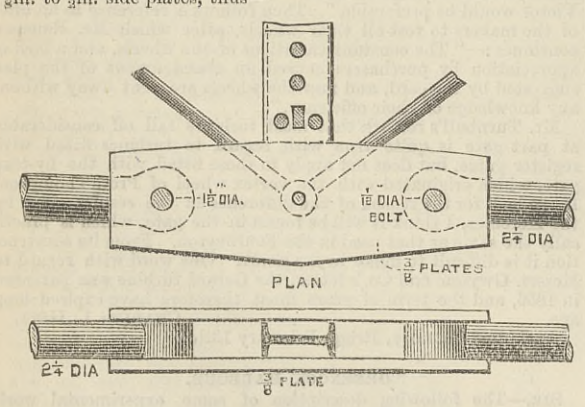
The total weight applied	48 tons.
Deduct weight of sheets, glass, &c., which were not on at the time of testing	5 ,,
Actual load	43 tons,

or an equivalent of only 27 lb. per foot of surface. With this load the principal gave way by buckling laterally to the extent of 9in.—the little accident which occurred and slight modifications afterwards adopted are hardly worth notice—so that there can be no possible question that double this weight would have caused the whole thing to collapse. Now this fully bears out every word I said about the roof. It seems clear that the load applied was close upon that which would cause fracture, and this is confirmed by calculation. It is far from my wish to disparage the roof; in fact, I should not have mentioned it had it not borne a fatherly resemblance to the Snow-hill roof even down to details.

Probably it may be interesting to make a rough comparison of the test given above and the one applied to the roof over New-street Station, Birmingham, erected about the same time as Old Lime-street roof. Three principals were placed exactly as with Lime-street, and the centre one loaded with weights equal to a total of 90 tons, or an equivalent of 40 lb. per square foot of surface. This load caused a deflection of 3in. and an extension of span of $2\frac{5}{8}$in., but no permanent set or distortion of the principal in any way; in fact, the greatest tensional strain from this load does not exceed $8\frac{1}{2}$ tons per square inch, or 4 tons in compression. With such a test as this it is no exaggeration to say that the Snow-hill roof would be in ruins.

Another very serious defect in the Snow-hill roof lies in the details. The joints have been designed in a manner defying all method, and which can only be accounted for by absolute ignorance. Disregarding the large number of welds, all of which should have been avoided in a roof with such a low factor of safety, I will take the following joint as an example:—

The tie rod is $2\frac{1}{4}$in. diameter, and is connected by $1\frac{1}{2}$in. bolts and $\frac{3}{8}$in. to $\frac{1}{2}$in. side plates, thus—



and the shoe by $\frac{3}{8}$in. plates or thereabouts. The bearing area of the connecting plates—$\frac{3}{8}$in. and $\frac{1}{2}$in. thick, when the ties are strained to 10 tons per square inch, supports a pressure of 26 and 35 tons per square inch respectively. The sketch given will enable anyone to test the accuracy of this statement. The shoe plates I believe are still more alarming, but the details have not yet reached me. The $1\frac{1}{2}$in. bolts are by no means large enough for the purpose. The connections are, therefore, weaker than the main rods. A comparison with the neighbouring roof above mentioned, in all respects puts this in the shade. The one will be "as good as new" long after the other is in the "scrap heap"—unless something is speedily done to put matters right.

Thomas Timmins.

28, King's-road, Peckham.
February 6th.

OTTO *v.* LINFORD.

Sir,—Though not interested in the manufacture of gas engines, I am in the manufacture of other specialities, and am at the present time making a patent article. I have read your report of the patent case Otto *v.* Linford, as also the dissertations of your two able correspondents "Nemo" and "Fair Play," but I must beg your correspondents to throw more light upon what seems to me a new departure in patent law. Neither of your before-named correspondents has informed us what is the nature of Linford's invention. I therefore beg you to grant me a little of your valuable space whilst I try to add a few facts which may be of some interest to your numerous readers, and which facts I have gathered from observation. Neither in the Court of First Instance nor in the Court of Appeal was this made clear. Before we can form an opinion it must be borne in mind that the action was brought upon the first claiming clause in Otto's patent, No. 2081, 1876, with which, no doubt, your numerous readers are familiar. No mention is made of compression, neither is that idea conveyed by the reading and study of the specification. It was stated that no engine according to this claim had ever been made in this country until after the action Otto *v.* Linford was commenced; and then for the enlightenment of the scientific witnesses of the plaintiff only I understand a publication was put in as evidence by Mr. Aston, and allowed by Vice-Chancellor Bacon, which describes a gas engine made by the Reading Ironworks according to Lenoir's—Johnson's—patent, 1860, wherein air was taken in first; also witnesses were in attendance who were engaged by the Reading Ironworks in 1864 in the manufacture of the Lenoir gas engine, as well as others engaged by other firms in the manufacture of Lenoir's gas engine at the present time; but on account of Otto failing to prove novelty, utility, and sufficiency of specification, it was not deemed necessary by Vice-Chancellor Bacon to call them, so that their evidence did not appear before the Court of Appeal, also the publication was not allowed, and yet the defendant is charged with non-production of evidence to support his statements.

After carefully perusing the defendant's specification, No. 330, 1880, I am led to think that his invention is more an infringement of Lenoir's patent, 1860, than of Otto's, for he distinctly states his object to be to neutralise or destroy or expel the residue of combustion, and from what I can gather he succeeds in this particular more than any other inventor whose specification I have had the opportunity of comparing with his idea put into practice. From an analysis made by an eminent analytical chemist I am informed that the residue of combustion or explosion in Linford's engine contains 11 per cent. of carbonic acid, whilst after the scavenging operation has been completed and a fresh charge of combustible mixture is about to enter the cylinder, there remain only 2 per cent of carbonic acid, thus plainly indicating that a fair combustion of the contents of the cylinder has been obtained, and that the scavenging operation is also very successful.

It will be quite plain, as per "Fair Play's" truthful experiment, that the air remaining in the cylinder becomes mixed with the fresh, incoming charge, and a uniformly diluted mixture is obtained, the result being, as shown by the diagram, after compression and ignition of the same, a high initial pressure. This scavenging operation also is beneficial in another sense, viz., for preventing premature ignition. After careful observation of some of Linford's engines, extending over some months, I have never yet known one to prematurely ignite the charge, or back ignite, as it is termed. Now where this system is not employed, and where compression is used, this premature ignition is of frequent occurrence, and sometimes involves the sudden stoppage of the engine with a violent shock. This important feature in Linford's engine is recognised by Mr. F. W. Crossley in a patent taken out by him in 1881, where he employs a pump to force air to drive out the residue of combustion; and also by Dugald Clark in a patent granted to him, No. 1089, 1881, where he seeks to pass a current of air into the cylinder before the combustible charge; but it bears upon the face of it the risk of a waste of gas, because the gas and the air are both in one vessel, and it is impossible to separate them, owing to the speed they travel, and the recoil or reverse of motion imparted during the discharge into the working cylinder under pressure.

I think, with "Fair Play," it is the most unscientific blunder that ever was committed to give a man something which has no existence in reality, and only exists in the fertile brain of an eminent Q.C., and which was not thought of by the receiver; and, indeed, all the explanation in the plaintiff's patent destroys the cushion upon which he now reposes. I am of opinion, with "Nemo," that it is not fair or just to give a person more than he is entitled to in order to secure him a verdict, especially in such a case as this. If "Nemo" or "Fair Play" cannot oblige us with a diagram of Linford's gas engine, nor any of your scientific correspondents favour us with one, I would do my best to send one, which would, perhaps, throw a little more light upon this interesting subject. A diagram was put in evidence before the Master of the Rolls, which showed a very quick or rapid explosion, the initial pressure being reached in about one-hundredth of a second, being nearly a straight line; but it was held by the Master of the Rolls that combustion went on on the expansion curve shown in the diagram. Of course that would not alter the case, as upon reference to Lenoir's diagram, it would only have shown that Lenoir's was an anticipation of "Otto," or *vice versâ*, in the present ruling.

I sincerely hope that this important case will be carried to the House of Lords, and that due allowance may be made from the Court of First Instance upwards, and that the chain which now binds Great Britain in her march of improvement may be broken.

Birmingham, February 16th. Lux.

Sir,—Will you kindly allow me space in your valuable paper for the following in reference to the late trial of Otto *v.* Linford? In the judgment given by the Court of Appeal it states that the scheme of the plaintiff Otto was for a gradual expansion, and not an explosion. I have carefully studied the action of gas and air, both under pressure and otherwise, and have also made some experiments, and I find that as soon as a light is applied to a mixture of gas and air, there is a sudden explosion.

In carefully working out the diagram given by Messrs. Crossley Bros., in their extracts from scientific papers, I consider it quite endorses my opinion. I find that the pressure is raised from 30 lb. to 155 lb. per square inch in 1in. of the stroke, or thereabouts, with the piston travelling at the time of explosion at the rate of 30in. per second, the pressure being raised 125 lb. in $\frac{1}{10}$ of a second; and as a proof that all the gases are burned or exploded, the diagram shows a sudden fall of about 25 lb. in the next $\frac{1}{4}$in. of the stroke, and then a gradual fall the remainder of the stroke, averaging about 10 lb. per inch.

The result of the trial is, in my opinion, to give an entire monopoly to the makers of the Otto engine, and to restrain others from making improvements, which is most undesirable in the interest of the users of gas motors.

Arthur J. Donald.

39, Hazel-street, Leicester, February 20th.

THE FOUNDATIONS OF MECHANICS.

Sir,—In the letters which you have done me the honour to publish, I have endeavoured to maintain the thesis that in the system of teaching mechanics which has hitherto prevailed grave errors have been perpetrated, which have led to nothing but confusion of thought. Mr. Browne's last paper, on the "Foundations of Mechanics," seems to have been written to supply unanswerable arguments in my favour. Mr. Browne, so long as he confines himself to the mathematical investigation of certain dynamical problems, is perfectly accurate. The moment he attempts to reason on his mathematical methods he becomes hopelessly lost. The confusion of thought existing in his own mind finds its way to his pen, and instead of lucid argument we have involved surmise and gratuitous assumption.

No clearer proof of the soundness of my strictures on existing methods of teaching dynamics can be found than that supplied by his own disquisition on the statements of Rankine, and of Thomson and Tait. If one be right on the operation of inertia as a dynamical function, the other two must be wrong. Thus, students who have learned Rankine's method, must be in error if Thomson and Tait are right. Again, if Rankine is right what becomes of Messrs. Thomson and Tait's students? Does Mr. Browne help the would-be student to determine which school he should follow? Not a whit; he does not know which is right; he inclines to Rankine; he follows Thomson and Tait, looking back regretfully at the path which the great Scotch mathematician would have him tread. It is sufficient for my purpose to call attention to this remarkable proof of the soundness of my thesis; I shall not now dwell on it, but proceed very briefly indeed to consider another of Mr. Browne's statements.

In his last paper he introduces us to a new function—new, I mean in the papers now passing through The Engineer from his pen—namely, Effort. Of what this word means he apparently has not the least conception consistent with truth. Effort is in his mind only force under a new name. We are all familiar with the phrase Centre of Effort, a convenient mathematical expression, conveying a definite idea. But the Effort to which Mr. Browne introduces us is a new thing; in his mind it is an unbalanced force. I willingly admit that he has some justification for using it, because unfortunately several writers on mechanics have used the words "unbalanced effort." But Mr. Browne purposed in writing his papers to teach dynamics more lucidly and rationally than those who have gone before him; if he did not purpose this, his writings are without object. Now it is a fundamental basis of dynamics that there can be no such thing as an unbalanced effort—we cannot push against nothing; the very word implies the overcoming or endeavour to overcome a resistance; if no opposition is offered an effort cannot be made. The measure of the effort is the resistance. Here we have again Newton, "action and reaction are equal and opposite." I will take the very illustration used by Mr. Browne, and show the utter fatuity of the way in which he uses the word effort. Mr. Browne is speaking of the hoisting of a load of coals from a mine, and he asserts that the coal is caused to move by an effort overcoming resistance. Now I challenge Mr. Browne to prove that there is any such effort.

In order to prove the existence of this effort we must give it a location—we must place it somewhere. We have a complete sequence of localities of action: First, the furnace; secondly, the boiler; thirdly, the steam cylinder; fourthly, the winding drum; fifthly, the rope. With none of them, save the last, need we concern ourselves much; for do what we may, the effort must ultimately appear at the load. Thus Mr. Browne will have to prove that the pull on the pit rope is greater than the resistance offered by the load. This is simply impossible. If he pleases to refer the effort to the engine, he will have to prove that the pull at one end of the rope is greater than the pull at the other end. This is a length to which I venture to think Mr. Browne's mathematical training will not permit him to go. Where then is this unbalanced effort—because it must, according to him, be unbalanced—to be found? Mr. Browne holds that if the pull on the rope were exactly equal to the load no motion would be produced; but he must perforce admit that the pull on the rope cannot be greater than the load, for a force cannot be greater than the resistance offered to it.

"But," perhaps Mr. Browne will argue, "the resistance equals the load and the motion." This will not hold water, because it is a fundamental principle of mechanics that a body can offer no resistance to motion. It will not do to cite inertia to the contrary. "Inertia," says Weisbach, "is that property of matter in virtue of which matter cannot move of itself nor change the motion that has been imparted to it." It is said that force is required to overcome inertia. Let me, for the sake of argument, grant this. Having granted it, I ask Mr. Browne where is this force, in the case of the coal pit, applied? The pull at one end of the rope is the same as the pull at the other end. If the load be x and the load due to motion imparted be y, then the gross resistance is $x + y$; but if the pull on the rope at the bottom of the pit be $= x + y$, then the pull on the rope at the top of the pit must also be $= x + y$. But before the weight moved at all the resistance was $= x$, and could be no more. Why then does the weight move? I have already put this in another form. The pull at each end of the draw-bar of a locomotive is precisely the same. Why does a train move? Its resistance is exactly equal to the pull?

Mr. Browne is so sensible of the difficulty of solving this problem that in one of his articles he has actually ventured to doubt that Newton is right, and went so far as to suggest that a pull might be greater at one end of a trace than the other!!!

I beg to assure him that the problem cannot be solved on the ordinary assumptions of those who teach dynamics. One day I shall, perhaps, with your permission, show why a body moves, although the resistance (?) is equal to the pull (?). Meanwhile, I confess I want to see how Mr. Browne, who has undertaken to teach dynamics, gets over the difficulty, and solves a question asked daily by thinking students. But the other day it was put by a student after the lecture to a professor of engineering in a well-known college, and the answer received by the student deserves to be put on record. "You are only a second year's man, and would not understand me if I told you." I can vouch for the truth of this anecdote.

Is there a single book on dynamics extant in French, German, or English, in which the question is answered? If your readers can tell me where to find the passage I shall be infinitely obliged.

London, February 21st. Φ. Π.

THE TURBINE PROPELLER.

Sir,—During the discussion on Mr. Thornycroft's paper on torpedo boats and light yachts, read before the Institution of Civil Engineers on the 10th of last May, mention was made by Mr. Yarrow and other speakers of a new kind of propeller. It may seem late to refer at the present time to this subject, but as for the last two years I have been travelling abroad where the "Minutes of Proceedings" were not accessible, I have only just now on my return to England become acquainted with their contents, and being much interested in the success of this propeller, I trust you will grant me space for a few remarks about it. It was in November, 1879, when I submitted to Messrs. Yarrow and Co. my turbine propeller, and upon their deciding to give it a trial I designed one for a small boat, and furnished them with the necessary working drawings. Messrs. Yarrow and Co. subsequently made the turbine and fitted it to the boat. In 1880 they made those experiments with it which were mentioned by Mr. Yarrow at the Institution. The turbine was tried against different screws, and as it gave results only about equal but not better than a good screw, it could not be called a decided success. But if it be remembered that this turbine was the first designed and made, without the aid of any experimental data to work upon, whilst the screw was the outcome of many years of development and previous experiments, it is only reasonable to assume that the turbine could be made to surpass in efficiency even the best screw, and I have no doubt had we persevered in the matter we should at the present time have a very efficient turbine propeller. Messrs. Yarrow and Co. allowed the matter to drop as far as its development goes, and the meagre description of it given by Mr. Yarrow at the Institution would make it appear to be nothing else than a copy of Mr. Rigg's or the Hon. R. C. Parsons' propeller. This is not the case, and although Mr. Yarrow omitted to say that I was the designer of the turbine, I have all the same an interest in seeing it fairly represented and not called an imitation when it is entirely original. I beg, therefore, you will grant me space for explaining more fully than Mr. Yarrow has done the principle upon which the "turbine propeller" acts.

If you wish to produce a forward thrust upon a vessel, you can only do so by moving a certain mass of water astern. This might be done by paddles, screws, jets, or any other means for imparting a backward velocity to the water which traverses the propeller. Jets have been tried, but with poor results, probably owing to the fact that the vessel's progress is retarded on account of its having constantly to ship and carry forward that amount of water which is afterwards expelled astern. Moreover, to keep the pump and machinery generally within reasonable dimensions a high velocity of discharge must be allowed, which results in a considerable loss

of engine power carried away by the outflowing water. Applied in this way the pump is not an efficient propeller. Screws or paddles are also a kind of pump, for any apparatus intended to increase either the pressure or the velocity of a body of water passing through it must be called a pump; but they are very imperfect pumps. They act upon the water with more or less sudden violence, and not with equal intensity upon all the particles traversing them, and they propel part of the water in a direction more or less oblique to that in which only a useful thrust can be exerted. It is to regain part of the work spent in producing this lateral velocity that Mr. Rigg has first suggested the application of guide blades behind the propeller. Roughly speaking, the water is thrown against these guide blades, and being deflected astern reacts upon them with a forward thrust. But what becomes of the water passing midway between two blades? It can go pretty much where it likes. To make the apparatus effective every particle of water, no matter where it traverses the propeller, ought to follow a prescribed and well defined path. Herein lies the difference between my turbine propeller and the description given of it by Mr. Yarrow. My propeller aims at being a perfect pump or turbine, whilst Mr. Yarrow's description would make it appear an ordinary screw propeller with guide blades added. Originally I intended this style of pump for a different purpose—drainage of land—and I had some four and a-half years ago a large working model of it made, which I shall be glad to show to anyone interested. But as its great advantage consists in being able to deal with large quantities of water at low lifts, it occurred to me that it would be equally applicable for the propulsion of vessels and I proposed it for this purpose to Messrs. Yarrow and Co. That the propeller is really nothing else than a turbine pumping a large mass of water at a low lift. I will now endeavour to show. Call c the velocity of the vessel, and $g\ c$ the absolute backward velocity of the water on leaving the turbine, then is the thrust obtained from a mass of water in passing the propeller per second $l = m\ g\ c$. The useful work done is $l\ c = m\ g\ c^2$, and the total work represented by the water pumped is—

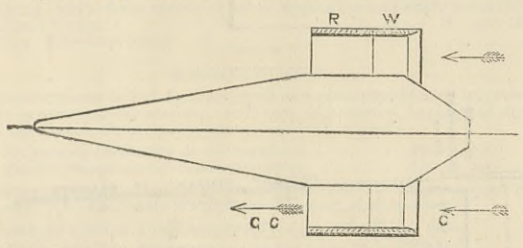
$$W = \frac{m}{2} g^2\ c^2 + m\ g\ c^2$$

Giving an efficiency of—

$$y = \frac{2}{2+g}$$

The water arrives at the turbine with a velocity c and leaves it with a velocity $c\ (1+g)$; the acceleration thus produced being equal to a lift of $\frac{c^2}{2\ g}\ g\ (2+g)$ feet. Now, take as an example a propeller of 10 square feet discharge area, advancing at the rate of 15 knots an hour, or c=25·3ft. per second, and allow g=20 per cent., then is y=91 per cent. In other words 9 per cent. of the work represented by the water pumped is lost in the energy of the outflowing water, and 91 per cent. is employed to overcome the resistance which vessel and propeller experience in advancing through the water. If the propeller were a perfect pump having no internal losses whatever, its total efficiency would therefore be 91 per cent.; but as no absolutely perfect pump can be made, we must allow for some loss of power in the pump itself. Thus, assuming its own efficiency—considered as a pump—to be between 75 and 80 per cent., then we find the total efficiency of the turbine propeller to be about 70 per cent. of the effective engine power.

The quantity of water passing per second would be about 300 cubic feet per second, pumped at a lift of 4·4ft. This example shows that the turbine propeller is really nothing else than a pump working at a very low lift. In the sketch w is the turbine wheel



and r the receiver. The water advances in the direction of the arrows. In order that all the water passing the turbine should be acted upon as much as possible in the same manner, there ought not to be too great a difference in the circumferential velocity at different points of the blades, and therefore it is advisable to make the boss rather large—say ½ to ⅔ of the total diameter. Through tapering the forward end of the boss a gradual reduction of the area of entrance is obtained, resulting in a gradual acceleration of the water, a point which Mr. Thornycroft justly considers to be of importance. But I cannot agree with that gentleman when he says that the acceleration must take place inside the propeller. I believe it to be quite immaterial where the acceleration occurs, as long as it is gradual, and as long as the velocity of the water on leaving the propeller is greater than before entering it. In my arrangement this is obtained, as the ring-shaped outlet area of the receiver is, of course, smaller than the full area ahead of the turbine out of which the water is drawn. The back end of the boss is brought to a point by an easy taper, so as to minimise its resistance in gliding through the water.

A propeller thus constructed can utilise a very large power; in the above example the propeller would have a diameter of about 4ft. 3in.; it would exert a thrust of 3000 lb. and utilise the 150-horse power in water pumped, or about 200-horse power developed by the engine. On account of its small diameter the turbine propeller can be placed lower than a screw, and will therefore be less affected by rough weather and pitching; it produces absolutely no vibration, and as it sends its own water astern in a compact column without eddies or whirlpools it will disturb only slightiy, if at all, the surrounding water. This is an important point, should the proposal now being made of introducing steam propulsion on canals be carried out; in this case the turbine propeller will be least likely to damage the banks.

GISBERT KAPP.

Grantham, February 21st.

WIND PRESSURE.

SIR,—In the review of the progress of engineering and kindred science for 1881, which appeared in THE ENGINEER of January 6, Mr. Hawksley's formula for wind pressure is referred to, and stated to be $\left(\frac{v}{20}\right)^2$; but how he arrived at this is not explained.

The following inquiry leads to the conclusion that it is nearly correct.

It is stated by writers on hydro-dynamics that the force of a fluid moving against a plane surface is equal to the weight of a column of the fluid whose base is the area of the plane, and height twice that due to the velocity. But this is on the hypothesis that the whole motion of the column is destroyed by the impact, which is not the case in an open stream.

Dr. Hutton gives as the result of his experiments on the resistance of air, that a plane of 32 square inches area moved directly at 12ft. per second in still air met with a resistance equal to ·84 oz. = ·0525 lb., which gives ·23625 lb. per square foot; and that it varies very nearly as the square of the velocity. But the pressure of the current of a fluid acting perpendicularly on a fixed plane, as compared with the resistance to a plane moved at the same velocity in a stagnant fluid, is, in the case of water, according to Du Buat's experiments quoted in D'Aubuison's "Hydraulics," as 1·86, 1·43, or nearly one-third more. Accordingly, the pressure of a current of air per square foot of surface would be $\cdot23625 + \frac{1\cdot86}{1\cdot43} = \cdot3073$ lb., which is equivalent to $\frac{v^2}{468}$. Dr. Hutton also observed that the pressure on a larger plane was somewhat greater than in proportion to the area. Allowing for this, his experiments indicate the probable correctness of Mr. Hawksley's formula.

Again, taking Beaufoy's experiments with planes moved directly in open water, and reducing in proportion to the relative density of air, doubling the result because of its elasticity, and correcting as above for the pressure of a current, the formula $\frac{v^2}{310}$ is obtained—thus: A plane of one square foot area moved directly at 8 knots per hour, or 13·527ft. per second, gave a resistance of 203·79 lb., then taking the mean density of dry air at $\frac{1}{900}$ we have $203\cdot79 \times \frac{1\cdot86}{1\cdot43} \times \frac{2}{900} = \frac{v^2}{310}$, and this is the most it is likely to be, because in our climate the vapour mixed with the air will probably make its density materially less than $\frac{1}{900}$; and thus this formula will be near that given by Mr. Hawksley, which seems to be as nearly correct as the case will admit. How then is it that the anemometers at Bidston, Glasgow, and Greenwich give so much greater pressures?

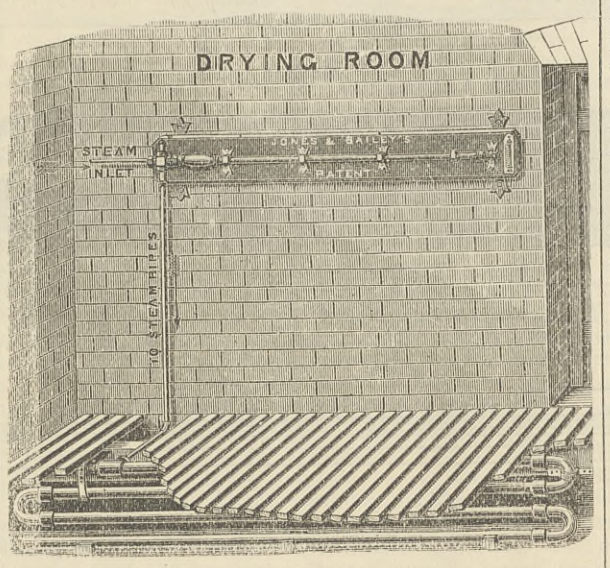
T. G.

Lewisham, February 14th.

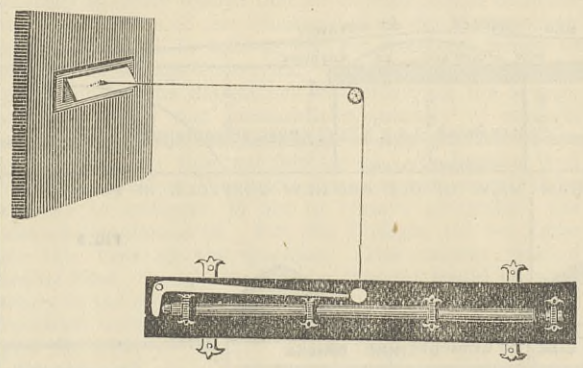
AN AUTOMATIC VENTILATOR.

SIR,—In reply to "E. J. S.," the above woodcut represents a thermostat made by my firm, which, although for regulating the opening and closing of a steam valve when rooms are warmed by steam, it can with ease be arranged to open and close a ventilator.

The instrument consists of a metallic thermometer about 4ft. long, fixed at one end by means of a screw and lock nuts. This screw is for adjusting the instrument to the temperature at which the valve must close when the room becomes of the required heat.



To apply this instrument to a ventilator will require little ingenuity, and this is one way which I venture to suggest for your correspondent's consideration:—



I have experimented with strips of different metals like those recommended by Dr. Ure, similar to the compensation balance wheels of a watch, and also to the metallic fire electrical alarms, but no power can be obtained out of such contrivances that will be serviceable for ventilating. I shall be glad to give your correspondent particulars of my experiments, which would occupy a great amount of your space and more of my time than I can afford just at present.

W. H. BAILEY.

Albion Works, Salford, Manchester,
February 10th.

COLD AIR MACHINES.

SIR,—Having been travelling on the Continent for the last three weeks, I have only just seen Mr. Lightfoot's letter on this subject. I should not have troubled to reply, only that, in spite of my explanation, he (1) persists in making the assertion that the air in my refrigerators can only be compressed to 30 lb. absolute. (2) Asserts without any warrant whatever that I do not even attempt to get rid of the assumed further amount of moisture dealt with in his and other apparatus. (3) Misrepresents and distorts the obvious meaning of my use of the expression "natural moisture," so as to work out an unintelligible conclusion. (4) Misrepresents me as making absurd and extravagant claims to the monopoly of the use of natural laws.

There is something very unfair in this style of argument, and it is not often met with in your columns. As regards (1)—I must again repeat that I am not tied to any pressure of any temperature, but can go as high in the one and as low in the other as anyone else, possibly more so. If it is required to produce ice, or a freezing temperature, I can work to any required pressure and obtain as low temperatures, and quite as effectually get rid of the moisture as others may be able to do, and with less complication of apparatus. For cooling alone, where a temperature of only 35 deg. to 40 deg. Fah. is required, by working at a lower pressure, and not touching freezing point, all trouble with ice in the expansion cylinder is avoided, and sufficient moisture discharged to render the air fit for use; the air is more frequently changed, the expenditure of power is less, and there are many collateral advantages in the avoidance of unnecessary and elaborate complication, wasteful expenditure of power for a trivial and very doubtful gain, &c. (2) This I have answered in (1). (3) It must have been obvious to anybody that I used the expression "natural moisture" as a convenient one to distinguish between the moisture in the surrounding air, which varies in quantity in different states of the weather, and must be taken into the machine, and that moisture specially and artificially injected by force pump or otherwise. Mr. Lightfoot's extreme hypercriticism compels me to enter into explanations the necessity for which it was my object to avoid. (4) I have never set up any claim to the monopoly of the use of a natural law. Prior to my patent there was not a single maker or patentee of cold air machines who recognised the necessity of or provided for the carrying off of what I must still, for convenience, call the natural moisture discharged by compression. They only dealt with injected moisture or water, and this is remarkably exhibited in the specifications of some of the patents, where methods of both wet and dry compression are shown, and in the former case means for discharging or draining off the water are provided, and in the latter not. I claim monopoly only for an apparatus, not for natural laws, which are at the service of anyone, provided they can apply them without using my apparatus or any modification thereof. These remarks also apply to the "high speed" question, which I adopted and advocated long before Mr. Lightfoot appeared on the scene.

The formula given by Mr. Lightfoot is no doubt very interesting in itself, and might prove of some practical utility in the management of cold air machines, if the atmosphere could only be induced to accommodate itself to it at all times and seasons.

Berlin, February 9th.

JOHN STURGEON.

TENDERS.

TENDERS for making, metalling, and sewering private streets, and also for the sewering and draining of land, both situate in the parish of Evington, near Leicester. Frederick Jackson, C.E., 18, Low-pavement, Nottingham. Quantities supplied.

	Roads. £ s. d.	Land drainage. £ s. d.
Gibbins and Osborne	646 11 2	81 0 5
Wm. Cordon	504 4 9	74 0 0
Thos. Smart	478 3 0	93 10 0
Jno. Lea and Co.—accepted	458 5 0	76 17 0

NAVAL ENGINEER APPOINTMENTS.—The following appointments have been made at the Admiralty:—John Bannatyne, chief engineer, to the Polyphemus, commissioned; William W. Wootton, John S. Watch, John W. Bennington, and William M'Carte, engineers, to the Polyphemus; and William J. Brown and John Kerr, assistant-engineers, to the Polyphemus.

GERMAN ASSOCIATION FOR THE PROMOTION OF AERONAUTICS.—In August last a few persons interested in the science of aerostation founded the German Association for the Promotion of aeronautics, the headquarters of the society being at Berlin. They determined to publish a monthly journal, the first number of which is now before us. Its title is, *Zeitschrift des deutschen Vereines zur Förderung der Luftschiffsahrt*. No. 1, 1882. Berlin: A. Seydel. It is of octavo size, and consists of 32 pp. The contents include a short sketch of the history of ballooning, an account of a navigable balloon by Maximilian Wolff, a long article on the use of balloons in geographical explorations in high latitudes and in desert countries, together with an abstract of the proceedings of the association since its formation. The editor is Dr. Angerstein, 134, Alt Jacob-strasse, Berlin.

LARGE LEATHER DRIVING BELT.—About four years ago we had occasion to notice some large leather belts, upwards of 60in. wide, made by Messrs. Sampson and Co., belting manufacturers, Stroud and Manchester. We are informed that the same firm have recently supplied, to the order of the Société Anonyme de Loth—woollen mills—near Brussels, a double belt 75in. wide and 153½ft. long, to transmit 650-horse power indicated. It is made on their patent system, without cross joints. The power is obtained from a Corliss engine, 800-horse power, constructed by P. Van den Kerchove, of Ghent. From the fly-wheel, which is 28ft. diameter by 6ft. 9in. wide, the force is transmitted direct to the weaving shed, which contains 1000 looms, and spinning mill adjoining. The belt runs perfectly straight, and gives entire satisfaction. The mills are the largest of the kind in Belgium, giving employment to over 3000 workpeople.

OTTO *v.* LINFORD.—At a meeting on Wednesday of those interested in the manufacture of gas engines about thirty were present. It was explained on what grounds a reversal in the House of Lords of the decision of the Court of Appeal was expected, and a resolution was finally moved, seconded, and carried unanimously:—"That in the opinion of this meeting an appeal to the House of Lords would be successful in reversing the decision of the Court of Appeal, which appeared to have been formed upon a misconception of the evidence." For better guidance as to future action it was decided to take the opinion of Mr. Webster, Q.C., as to how far the decision of the Court of Appeal would interfere with the general manufacture of gas motor engines, and if there were substantial grounds for its reversal. There was a general disclaimer of any personal feeling towards Messrs. Crossley, or that the meeting resulted from other than commercial reasons.

GOVERNMENT CONTRACTS.—The question of Government contracts has received much attention this week in the South Staffordshire centres. Responding to the invitation of the Chambers of Commerce of Wolverhampton and Walsall, Mr. Nepean, director of army contracts, has attended two days in Wolverhampton and one day in Walsall, to receive representations from manufacturers touching certain requirements of the Government to which the manufacturers object. Mr. Nepean had also himself sought by circular, interviews with the Staffordshire manufacturers whom he did not see during his recent visit to Birmingham. In all but times of great urgency the army and the navy alike display what manufacturers believe to be unnecessary criticism before they pass the commodities sent up in fulfillment of contracts, and the navy, and in a few instances the army authorities also, require the manufactures to be stamped, or they stamp them themselves, even before they have been submitted to criticism. As it is an offence for a civilian to be possessed of goods initialled with the broad arrow unless he can show good reason for the possession, all rejected goods are very difficult to sell, even though they may be not otherwise unsaleable. Upon this much stress was laid by the manufacturers in their conversation with Mr. Nepean. The Government authorities have also an uncourtly habit when they have rejected goods of requiring the manufacturers to fetch them away within what the manufacturers hold to be much too brief an interval. Moreover, the goods must, by the manufacturer or his agent, be collected from where the examiner leaves them, and be packed up for return to the works. To this the manufacturers very naturally object. They require that the rejected articles remain out, say a fortnight, and that if in that interval the manufacturer does not appear to render an explanation of the alleged departure from sample, then that they should be repacked by the authorities, and returned to the manufactory, the back freight only being a charge upon the manufacturer. The manufacturers likewise desired that the period over which supplying under a Government contract extends should be less than the customary three years. But Mr. Nepean explained that after the first year any contract might be terminated upon the giving of three months' notice by either side. Certain anomalies in the charges of the railway companies to Woolwich were pointed out, since they operated to the disadvantage of Birmingham, though the cost fell in the first place upon the Government. Upon a class of metal wares, required in largest quantities from the workshops of the district for the use of one or other branch of the service, the railway companies charge more by 7s. per ton if they are consigned direct to Woolwich from, it may be, Wolverhampton, than they charge if the goods are consigned first to London and then to Woolwich. Mr. Nepean terminates his visit on Saturday. He believes that he has already largely accomplished the object of his visit by having removed certain of the objections entertained by manufacturers against tendering direct for Government work; but he expresses some surprise at not having received so hearty a response to his invitation as he had expected from manufacturers in a less conspicuous way of business.

WEYMOUTH HARBOUR BRIDGE.

MR. EWING MATHESON, M.I.C.E., LONDON, ENGINEER.

(*For description see page* 144.)

FIG. 1

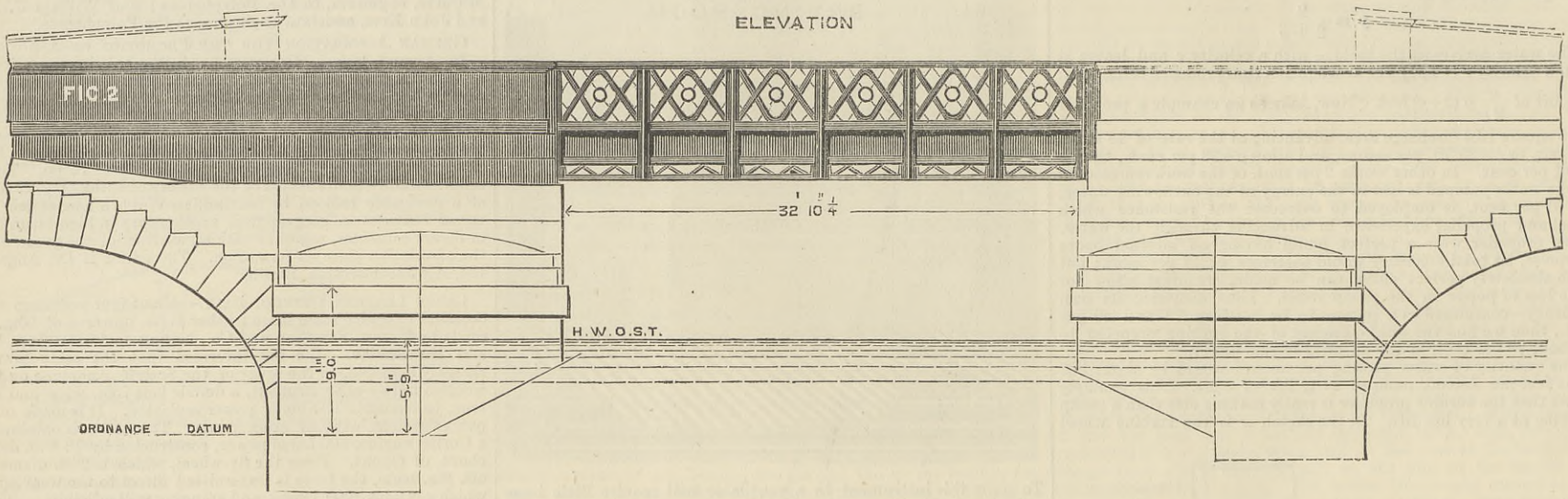


FIG. 2

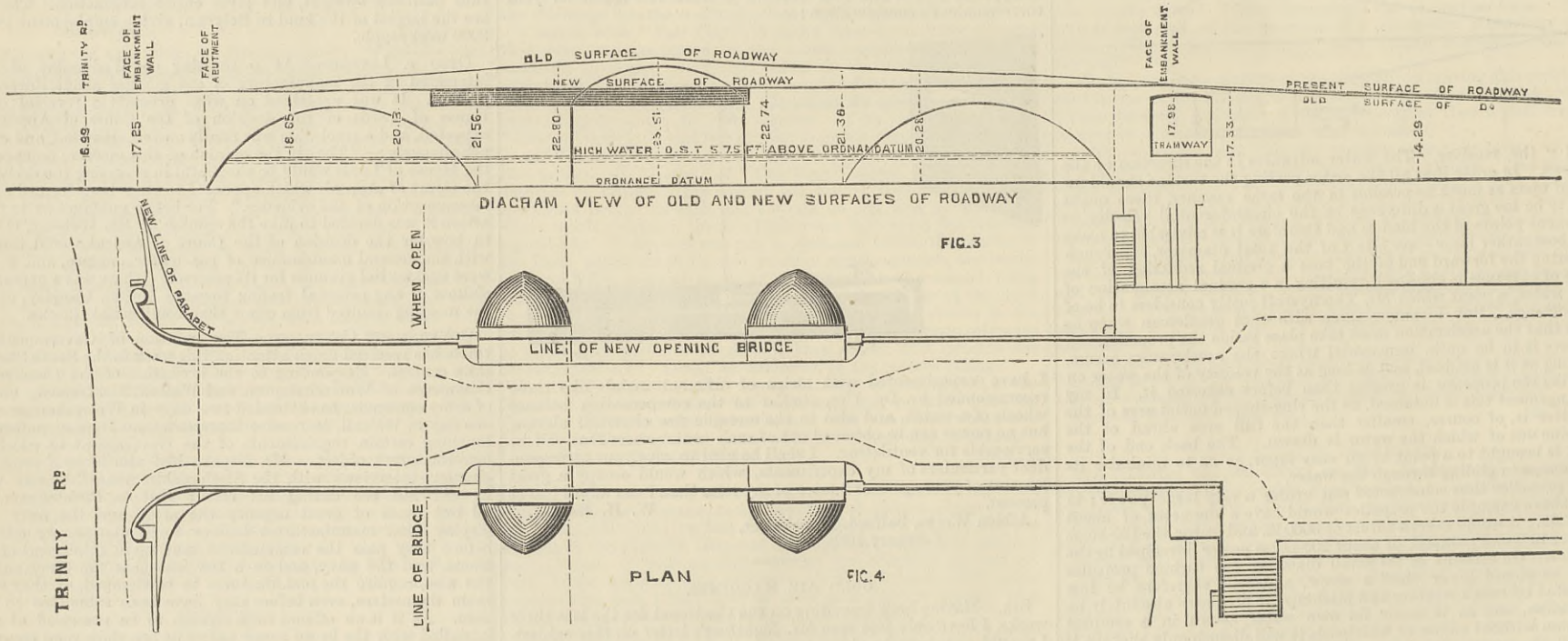


FIG. 3

FIG. 4

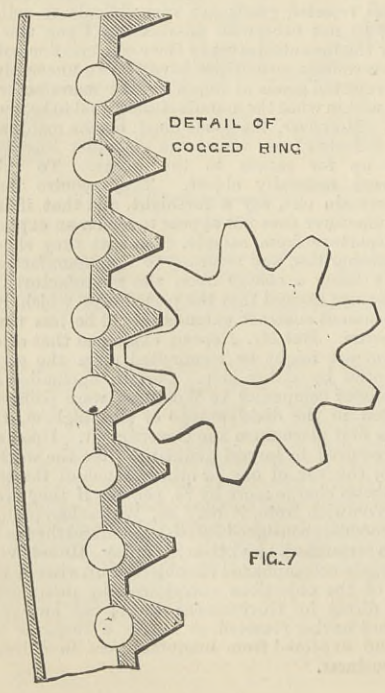


FIG. 7

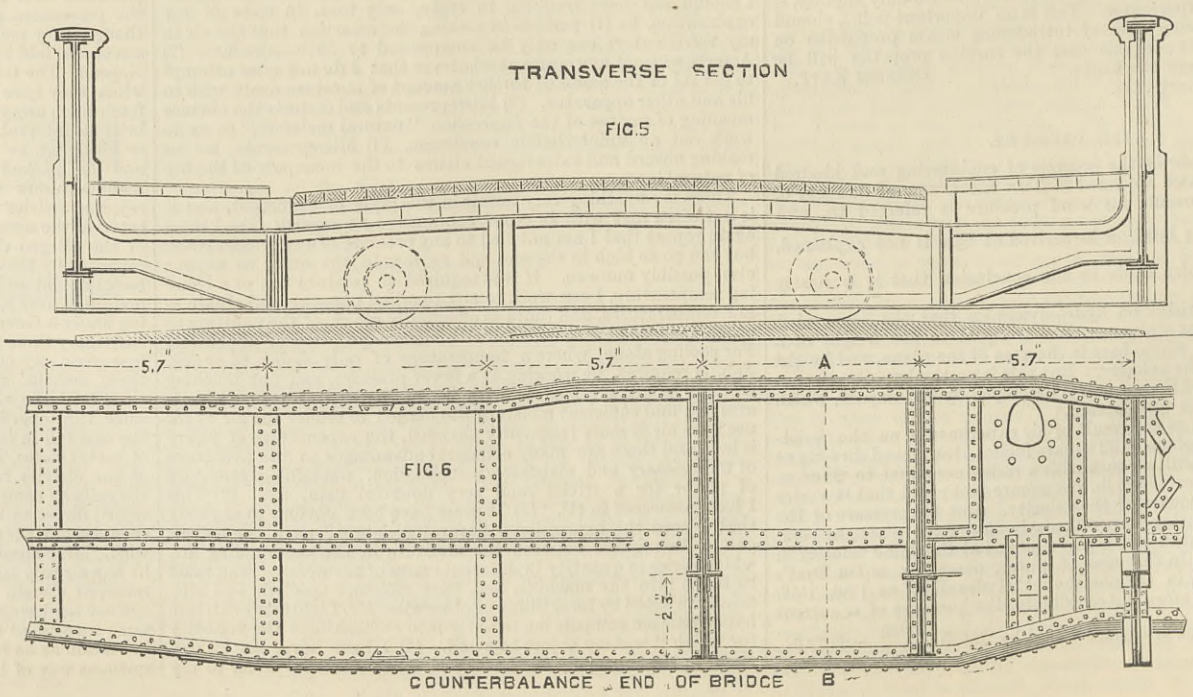
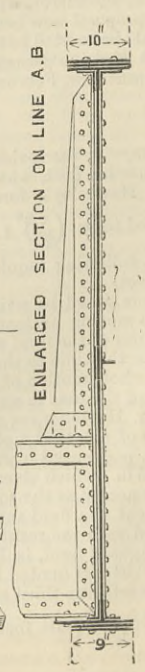


FIG. 5

FIG. 6



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TO CORRESPONDENTS.

*** *In order to avoid trouble and confusion, we find it necessary to inform correspondents that letters of inquiry addressed to the public, and intended for insertion in this column, must, in all cases, be accompanied by a large envelope legibly directed by the writer to himself, and bearing a* 1d. *postage stamp, in order that answers received by us may be forwarded to their destination. No notice will be taken of communications which do not comply with these instructions.*

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J. A. (Ashlea).—*If you will say, in confidence, what your machine is like and how it works, we will endeavour to advise you.*

W. R. AND CO.—*Apply to Messrs. Pontifex and Wood, London; Messrs. Fawcett, Preston, and Co., Liverpool; Messrs. Mirrlees, Tait, and Watson, Glasgow.*

J. G. L. (Westbourne-terrace).—*No account of the apparatus to which you refer in your note of the 13th inst. has yet been published. We shall publish one at an early date.*

SLIDE VALVE.—*Find the coefficient of friction between the brass ring and iron sheave; probably this will amount to* $\frac{1}{10}$ *of the pressure. Then find the pressure on the sheave caused by the resistance of the valve; multiply these into each other; find the distance in feet traversed per minute by the rubbing surface of the sheave; multiply this by the number obtained as above stated; divide by* 33,000, *and you have the horse-power lost in friction.*

AN IMPROVER.—*To case-harden links, &c., pack them in an iron box with bone charcoal, parings of horses' hoofs, leather cuttings, and a little salt. Lute the box with clay, and heat the whole evenly for* 12 *to* 24 *hours to a cherry red. If this heat be not exceeded the chances are that warping will not take place. Let the box and its contents cool gradually. Harden subsequently in the usual way by heating and quenching. Bone charcoal alone will answer, but the leather or hoof parings appear to expedite the process.*

C. F. C.—*The diameter of the shafts of portable engines has been arrived at not so much by calculation as by the results of experience. We cannot name a single rule which would give a shaft strong enough, and not only does the practice of different makers vary among themselves, but each maker varies his own practice. Thus, one eminent firm has recently increased the diameter of all its crank shafts. Again, much depends on the shape of the throw, and the form given to the journals. It is possible some of our readers may be disposed to take the subject up and supply you with information. We cannot do more than refer you to the numerous drawings of portable and traction engines which are to be found in our pages.*

THE GREAT EASTERN STEAMSHIP.

(*To the Editor of The Engineer.*)

SIR,—Would any reader kindly inform me what year the Great Eastern was on the gridiron at Rock Ferry? AN OLD SUBSCRIBER.

Birmingham, February 17th.

STARCH AND GLUCOSE MAKING PLANT.

(*To the Editor of The Engineer.*)

SIR,—Permit us to ask who are makers of machinery plant complete for making starch from maize; also of apparatus necessary for making glucose and syrups. M. AND B.

London, February 16th.

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*** *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, Feb. 28th, at 8 p.m.: Paper to be read and discussed, "Steel for Structures," by Mr. Ewing Matheson, M. Inst. C.E.

CHEMICAL SOCIETY.—Thursday, March 2nd, at 8 p.m.: (I.) "On the Luminous Incomplete Combustion of Ether and other Bodies at Temperatures Below Redness," by Mr. W. H. Perkin. (II.) "On the Action of Aldehyde on Phenanthraquinone in Presence of Ammonia," by Messrs. F. R. Japp and F. W. Streatfield. (III.) "Application of the Aldehyde and Ammonia Reaction in Determining the Constitution of Quinones," by Messrs. F. R. Japp and F. W. Streatfield.

SOCIETY OF ARTS.—Tuesday, Feb. 28th, at 8 p.m.: Foreign and Colonial Section, "Scientific and Technical Education in Russia," by Professor J. F. Hodgetts, of the Imperial College of Practical Science of Moscow. Alderman Sir Sidney H. Waterlow, Bart., M.P., will preside. Wednesday, March 1st, at 8 p.m.: Thirteenth ordinary meeting, "The Teaching of Forestry," by Colonel G. F. Pearson. Sir John Lubbock, Bart., M.P., F.R.S., will preside.

THE ENGINEER.

FEBRUARY 24, 1882.

THE PURIFICATION OF THE THAMES AND THE LEE.

WHILE the effect of the metropolitan drainage upon the river Thames is the subject of reiterated dispute, attention is also called to the state of the river Lee. The discharge of the London sewage in a part of the Thames several miles below London Bridge leaves the water supply untouched; but the sanitary arrangements which prevail in the Lee basin are matters of moment, as affecting the supply of drinking water to a large portion of the metropolis. Circumstances are now transpiring which relate to sewage pollution in the case of both these rivers; and although there is little of popular clamour with regard to the Lee, it will probably be found that this river requires certain measures for its protection quite as urgently as the Thames, and in some respects more so. Owing to the continual growth of the population in the Lee Valley, the water of that river is becoming increasingly impure, notwithstanding the means which have been adopted by the towns and villages of that extensive district in order to purify the local sewage. The results are serious, seeing that a large extra expense is thrown upon the East London and New River Companies for the construction of storage reservoirs and filter beds, the remedy, after all, being incomplete. It must not be supposed that the water derived from the Lee is more impure than that which is supplied by the companies drawing from the Thames. On the contrary, it is decidedly purer. But the misfortune is that the Lee water has been rapidly deteriorating, while that of the Thames has exhibited less positive marks of degeneracy. Taking the mean proportion of organic impurity in the Thames water supplied to London in 1868 as 1000, Dr. Frankland reports that the impurity of Lee water in that year was only 484. But while in 1880 the impurity of the Thames water had risen to 1263, that of the Lee water had become as much as 1143. Although the latter figure is absolutely less than the former, the ratio of increase which it exhibits is particularly high.

A scheme is now proposed for the purification of the Lee which has for its basis a plan suggested by Sir Joseph Bazalgette in 1867. The project is now much more fully developed, and is said to have been most carefully matured. It is necessarily connected with the Thames outfall question, seeing that it proposes a system of intercepting sewers having a point of discharge little more than half a mile below the present outfall of the northern main drainage of the metropolis. If raw sewage went in at this point, we might expect to hear a prodigious outcry against such an addition to the impurity already flowing into the Thames below Woolwich. However, it is not proposed to send the sewage into the river until it has been purified. The Thames, therefore, is not to be damaged for the sake of the Lee, however much London may be interested in having the water of the Lee as pure as possible. There is need to be cautious on this point, for there are powerful influences at work, seeking to bring about a change with regard to the disposal of the London sewage. The condition of the Thames, as affected by the metropolitan drainage outfalls, has just been the subject of complaint to the Home Secretary on the part of a deputation from the Woolwich Local Board of Health. The deputation was introduced by Mr. Boord, M.P., who explained that the gentlemen from Woolwich desired to draw attention to the nuisance which they believed was created by the drainage outfalls at Barking and Crossness, and they specially wished that an inquiry should be made into the condition of the Thames before the Metropolitan Board proceeded to take power for spending money to enlarge the sewage reservoirs. Sir W. Harcourt might have reminded the deputation that enlarging the sewage reservoirs would not increase the quantity of sewage, but would prevent the discharge of any portion of the sewage when the tide was flowing up. As Barking and Crossness are below Woolwich, this arrangement might be expected to mitigate, if not to remove altogether, the nuisance complained of. But Sir William did not enter into this view of the question. His answer was of another kind, though such as he thought would be satisfactory to the deputation. Whether the gentlemen from Woolwich were satisfied or not, would depend, we presume, upon the kind of inquiry which they wished to have instituted. All we can gather from the remarks of the Home Secretary is, that the Corporation and the Metropolitan Board will in some way or other—perhaps before a Select Committee on the Board's Bill—fight the question out between them, Sir William coming in at some juncture or other as adviser to the Government. Obviously the most direct course would be for the Home Secretary to exercise the powers vested in him by the Metropolis Local Management Act, 1858, and order an inquiry to be made into the effect of the discharged sewage upon the condition of the Thames. This is what he is asked to do by the Corporation of the City, acting in accordance with the recommendation of their Port Sanitary Committee. Sir W. Harcourt has referred the report of the Corporation to the Metropolitan Board, and has invited the latter to give him their answer on the subject. Sir William stated the case thus to the deputation, the gist of his reply being that, one way and the other, the subject was certain to receive "very careful consideration."

The statement of the Home Secretary as we find it reported, is not so full and explicit as could be desired. The Metropolitan Board have a clause in their Money Bill empowering them to raise £160,000 for the enlargement of the sewage reservoirs. The Corporation may appear in opposition to this clause, but its merit or demerit will depend upon facts on which a Select Committee can form no safe opinion. Neither is it customary to refer the Board's Money Bill to a Select Committee, seeing that it is first of all sifted and settled by the Treasury. In this instance, to decide whether or not the sewage reservoirs should be enlarged, demands a careful investigation as to the state of the river, and a calm analysis of scientific data. It is a matter for a Royal Commission rather than a Select Committee. But Parliament has devised another method, and that is for the Home Secretary, at his discretion, to order an inquiry, which may be conducted with the necessary amount of care and deliberation, after which he may direct such prosecutions or take such other proceedings as he may think fit, so as to insure the prevention or abatement of any nuisance proved to arise from the sewage works. All this will take time, just as the inquiry instituted by the Board of Trade at the request of the Conservators took time for its performance. The Select Committee, to whom we may suppose the Board's Money Bill to have been referred, might strike out the clause having reference to the enlargement of the sewage reservoirs, in order that the Home Secretary might have the subject duly investigated before a final decision was arrived at. If an inquiry were instituted by the Home Secretary, and the result was favourable to the continuance of the outfalls at the present points, the Board could ask for their money next year, and would doubtless get it. Supposing the inquiry to issue adversely to the Board, the question would assume an entirely altered aspect, and the metropolis would have to face a problem of serious magnitude.

A perusal of the report representing the views of the Corporation is not altogether discouraging, though we cannot say that the arguments are very logical, or that the composition is very lucid. The report admits that "taking the sewage down the river to Crossness and Barking Creek has materially benefited that part of the Thames immediately adjacent to London;" but the Committee go on to say that the river near the outfalls is all the worse for "the great outpouring of sewage," and it is asserted that "in times of drought and great heat its very prejudicial effect upon the public health is obvious." This, however, is begging the question, for there is no evidence adduced to show that the public health in any part of the Thames has at any time been one whit the worse for the change which has been made in the disposal of the sewage. A "prejudicial effect" may be inferred, and that is all. The Port Sanitary Committee, in forming their conclusions, had to rely on a report from their Medical Officer of Health, Dr. Collingridge, and on certain analyses of the Thames water made by that gentleman and by Professor Wanklyn, the latter appending a few remarks. These reports and analyses the Committee say they have "carefully considered." We have therefore to infer—though it is not quite "obvious" they did so—that they duly considered a paragraph in which Dr. Collingridge expresses his regret that the effect of the outfalls in polluting the stream "has been so much exaggerated, inasmuch as the mere exaggeration weakens any argument in support of this view." Concerning the offensive state of the river in hot weather, Dr. Collingridge says, "there is abundant evidence to show that at any rate some part—and that by no means a small one—of its offensiveness is due to the discharge of the sewage by the Metropolitan Board of Works." Looking at the analyses, we are struck by the fact that no sewage is detected in the river off Tilbury, and we may argue from this that the nuisance complained of near Woolwich is really due to the fact that the volume of the sewage has become too great at certain periods for the capacity of the reservoirs, so that some of it occasionally escapes on the flood tide. But whatever argument may be advanced on the subject, the persistent character of the complaints which are made with respect to the action of the outfalls appears to render it necessary that an independent official inquiry should be held, such as the Home Secretary has power to initiate, and which we presume must really come to pass. At the same time it is to be regretted that the former inquiry under the Board of Trade was not of such a nature as to set the whole question at rest.

Reverting now to the plan for the purification of the Lee, we observe that in its present form the scheme bears the names of Sir Joseph Bazalgette, C.B., Major Lamorock Flower, and Messrs. Law and Chatterton. Major Flower, as the sanitary engineer to the Lee Conservancy Board, is necessarily familiar with the district, and the fact that he is personally identified with the present plan goes far to recommend it. That the scheme is skilfully laid out, is assured by the reputation of Sir J. Bazalgette and his other colleagues. Thus the plan is well weighted with regard to names. The project includes a trunk line of sewer commencing at Hertford and proceeding along the valley of the Lee. It thus curves round towards Hoddesdon, where it is joined by a branch bringing the sewage from Sawbridgeworth, Harlow, Parndon, Roydon, and other places. From Hoddesdon the main intercepting sewer pursues almost a straight course down by Broxbourne, past Waltham Abbey, where it receives a branch from the Epping sewage outfall, and so on to Upper Edmonton, where there is a junction with a sewer from East Barnet, this latter sewer being itself joined a little below Southgate by a branch from the Hendon sewage outfall. Passing on from Upper Edmonton, the main sewer reaches Tottenham, whence it turns off to the south-east past Stratford, to a point of discharge a little to the east of Barking Creek, or about midway between the northern and southern outfalls of the metropolitan system. In the district thus traversed there are several spots where sewage works of some kind already exist. At the outset there are the Hertford Sewage Works, after which there is the sewage land of Ware, as well as that of Harlow, Roydon, Hoddesdon, Broxbourne, the proposed sewage land for Wormley, the Waltham Abbey sewage works, the Epping sewage land, and the sewage land of the Royal Small-arms Factory, followed by the sewage land of Enfield, Edmonton, East Barnet, Colney Hatch, Hendon, and Walthamstow, with sewage works at Tottenham and Leyton. All this area of land, now employed for the purification of sewage, would of course be set free if the intercepting sewers were brought into operation. So also the various sewage works might be discontinued. If West Ham were included in the scheme—which is quite practicable—the sewage appertaining to a population numbering 128,700 need no longer be pumped into the river Lee, as it now is. East Ham is already included in the scheme. The inclusion of West Ham would also reduce the rate, reckoned in that case at sixpence in the pound for fifty years instead of sevenpence. It is expected that the rate would become less as the value of the district increased. Independently of West Ham, the population comprehended in the project amounts to 240,000. The sewers are designed with a discharging capacity equal to three times the present population, and no pumping would be required unless West Ham was included, and even in that case the proposed main sewer would carry off a considerable portion of the sewage by

gravitation. Such are the main features of a scheme which we must presume is seriously entertained, or it would not be brought forward under its present auspices.

COLOMBO HARBOUR WORKS.

It was but recently that we described the fatal result to the Madras Harbour Works of a cyclonic storm, and now we learn that those at Colombo have sustained the shock of the earthquake which has been so extensively felt along the whole of the eastern coasts of India and those of Ceylon. Fortunately, however, the effects of this convulsion do not appear to have in any way injured the important operations now being carried out in that island by Sir John Coode. This is the greater matter for congratulation, because we read in the *Ceylon Observer* that "the earthquake experienced in Colombo the other day showed its effects to the divers working under water. A strong and most strange current played past the sea wall, and in its progress severely handled the divers and diving boats—so much so, that the latter were cast adrift and the moorings pulled away by the force of the currents. Fortunately, no damage was done, but as the men had been so severely handled, all further work was stopped for that day." Telegrams subsequently received report even a more severe shock at Trincomalee, on the opposite side of the island, at a later date. It appears, indeed, to have been of such violence—causing an extraordinary flow and ebb of 12ft. in the harbour at that place—that the Ceylonese may well be congratulated that its course avoided Colombo and its new breakwater, or the results might have proved serious to the latter. In such convulsions of nature as this and the cyclonic storm, there may be seen dangers to be apprehended to marine works wholly unknown in more temperate zones. Had the second earthquake chanced to develope its power below the sea-wall at Colombo, it is scarcely to be expected that even the ponderous blocks of bêton could have remained *in situ*, and had there been but the least disturbance of the bonding, so as to open a passage for the entrance of the sea into the work, the enterprise at Colombo might have come to as disastrous an end as did that at Madras.

Whilst Mr. Parkes at the latter place is busily engaged in devising what is best to be done to render available what remains of his piers, Mr. Kyle, at Colombo, is more fortunately able to report good progress. We have before us the official report by that gentleman for December last, which commences by the statement that the longshore winds which continued throughout the month have been found to hinder his operations considerably. This fact affords singularly strong confirmation of Sir John Coode's contention that the harbour must always be considered an incomplete work until a northern breakwater has been constructed. There were many old residents in Colombo, who perhaps believing what they wished, insisted that during the north-east monsoon no sea was ever raised in the Colombo harbour which could interfere with shipping operations; but it is evident from Mr. Kyle's statement that what is termed the longshore wind, which blows from almost due north to south, stirred up waves which even delayed block setting. Now for ships having berthage along quays, the stillness almost of a millpond is necessary, and it may therefore be accepted as perfectly certain that the wave action above referred to would wholly prevent vessels lying alongside quays or piers for the taking in of cargo. It seems to us certain, therefore, that the Ceylon people must make up their minds to incur the expenditure deemed necessary by Sir John Coode to overcome this difficulty; or must content themselves with a harbour, which, while affording a very considerable amount of shelter, cannot be said to be altogether perfect for shipping purposes.

In spite of the delay thus caused, Mr. Kyle is still able to report considerable progress. The number of three-shift days available during the month under review were 19⅔, of four men to each shift; the number of sections set was 21, and the length of wall advanced 128 lineal feet, making a gross total of 2815ft. from the junction line at the root of the breakwater. The quality of the work is said by Mr. Kyle to afford him perfect satisfaction. At this point in the report a curious accident to one of the divers employed is referred to:—"His foot got caught between two stones during a strong current of water, and the strain twisted the limb badly at the knee-joint. He is still in hospital, and I am afraid will be unfit for work again this season." This incident proves what unsuspected risks are attached to this class of work among men "who go down to the sea"—in diving dresses. The concrete skin was carried on during the month to a point only 200ft. in arrear of the blocksetting, and the roads for moving the Titan were completed so closely up to the rear of the sea-wall setting operations that there was no anxiety on the part of the resident engineer lest a sudden change to bad weather should necessitate the Titan being hauled in. Blockmaking progressed satisfactorily, and so admirable have been the arrangements for this, that at no time during the progress of the works have they been delayed by any insufficient provision of well set blocks. During the month, 234 of these were manufactured, and the whole reserve in hand numbered 996. This ample provision has been rendered possible by the comparative proximity of the quarry at Mahara, to which a special line of railway has been laid; but even with this aid the output from the quarry has not been so large as was estimated, although great pressure has been put upon those in charge of the work. The block-making for the curved portion of the pier was commenced on the 6th December last, and as regards these blocks, Mr. Kyle states that "the thickness of the harbour side-blocks in each section remains at the normal dimensions, but the outer and intermediate blocks are radiated from the centre of the curve."

Rubble mound tipping was carried on in 39½ft. of water, and the large amount of stone required in this depth caused the lineal distance accomplished to be somewhat below that of previous months. Still, 9616 tons were deposited, advancing the mound to a total distance of 3300ft. The seaside berms were being rapidly proceeded with, and they would be made up to the full section in preparation for the setting in of the South-west monsoon, when all progress is, of course, stayed. Dredging had proceeded but slowly, owing to an unfortunate delay caused by the breaking of the spur wheel of the steam dredger. This has, however, been now replaced by a new casting from England, and every precaution is taken against the recurrence of delay by such an accident. The expenditure to the close of last year was 5,849,593 rupees out of the total sum of 8,000,000 rupees voted. The recent failure of the Madras works will cause the progress of their rival at Colombo to be watched with much interest, affording, as they will do, much useful experience, enabling similar disasters to be guarded against in future constructions exposed to the casualties of a tropical country such as we have above referred to.

EAST LONDON BRIDGES.

A vigorous movement is now being made with a view to the erection of at least one bridge below or east of London Bridge, and a tunnel under the river between the most eastward parts of East London for the traffic of West Ham and Victoria Docks districts, is spoken of. There is urgent necessity for a great increase in the means of crossing the Thames at points east of London Bridge, and it is remarkable that the great commercial interests of East London and South have not long since settled the question in favour at least of one bridge on Tower Hill. On the 9th inst. an influential meeting took place. The Court of the East and West India Dock Company lent their room for the purpose, and a good deal of the obviously sufficient evidence of the necessity for a new bridge, and various questions relating to the Corporation of London and the existing bridge and estate funds were discussed, and two resolutions were passed. The first was:—"That efficient means of free communication for vehicles and pedestrians between the north and south of the Thames, at points below London Bridge, is absolutely necessitated by the past growth and prospective increase of the population and trade of the metropolis; the more so as this increase is chiefly taking place in that large half of the metropolitan area eastward of the City bridges." The second resolution was to the effect that public meetings should be held for the discussion of this subject, and memorials be prepared for signature by the principal ratepayers in the eastern districts, and be presented to the City Corporation, the Metropolitan Board of Works, and other authorities, asking that immediate steps be taken to provide the required accommodation. When it is remembered that 56 per cent. of the area, 43 per cent. of the number of houses, 40 per cent. of the population, and about one-third of the gross annual value of the Metropolitan Board of Works area, are to be found north and south of the Thames east of London Bridge, where also all the docks, most of the wharves, factories, and large depôts of London exist, besides the important suburbs of West Ham and Victoria Dock district, which are not included in these calculations, it needs little argument to show the dire necessity for bridge communication. The port of London, included in this eastern portion, registers one-fourth of the entire shipping tonnage of the United Kingdom, and returns more than one-half of the gross British Customs Revenue. The mere collection and distribution of such exported and imported merchandise is no little matter. But this is only a small part of the business transactions carried on eastward of London Bridge, and much of which has to cross the Thames; hence the enormous crowding of London Bridge. To meet the requirements of the 2,324,000 people west of the Monument, no less than twelve free bridges exist over the river; but for the 1,509,000 eastward of this mark, to which should be added the 296,290 of West Ham and neighbourhood, no bridge or other road communication exists.

THE PUMPING POWER OF COAL.

Some months ago we referred in The Engineer to some of the experiments that had been undertaken by the managers of the Stockton and Middlesbrough Water Board with a view to ascertain the pumping power of certain qualities of coal—that is to say, the quantity of water that could be pumped a certain height with one or two different qualities of coal. These experiments have been continued, and a further report has been issued, some of the facts in which are very interesting. Two engines have used—for instance, for four months—one quality of Durham coal, and have consumed 4·05 lb. of coal per 1000 gallons of water pumped, whilst another pair of engines over the same period have used 4·55 lb. of coal for the pumping of every 1000 gallons of water. Again, over a shorter period, in the present year, the same two kinds of coal have been used. Of one it took 3·95 lb. to raise 1000 gallons, and of the other it needed 4·65 lb. to pump the same quantity. The cost of coal, allowing for a slight difference in the price, is, for the first kind of coal, 1067d. for the quantity needed to pump one million gallons of water, and for the second quality 1266d., so that there is a difference of over 18 per cent. in the value of the two kinds for pumping purposes. For the week ending January 28th last there is an elaborate table given of the working of these engines and of the coals used, which may be thus summarised:—The first two engines using coal (A) made average revolutions of 11·30 and 11·31 per minute, and used 42 tons 4½ cwt. of coal in the pumping of 24,213,000 gallons of water=3·90 lb. of coal per thousand. The second pair of engines, making 12·59 and 1256 revolutions per minute on the average, used 68 tons 2¾ cwt. of coal (B) in the pumping of 33,045,000 gallons of water—4·61 lb. of coal per 1000 gallons. It is the contention of the manager of the works that very little of the reduced consumption of coal in the case of the first pair of engines is due to the smaller head of water against which they are working; but it would be more satisfactory, perhaps—as the average steam pressure is 30¼ lb. in the first two engines and 28½ lb. in the second—if experiments were tried with the same coal and different engines, for however little may be the change in the circumstances, that little may materially affect the comparison. The test that has been made opens out a much wider question, and that is the value of different kinds of fuel for pumping purposes; and it would be interesting if the experiments could be continued to test the values not only of two or three kinds of coal, but of several.

THE MIDLAND RAILWAY COMPANY AND THE TONNAGE RATES FOR COAL.

It is some years since so much interest was taken in the tonnage rates for coal from South Yorkshire to Hull and elsewhere as is just now being excited by the action taken by the Midland Company with regard to three of the largest collieries in South Yorkshire, from which alone the Midland derives a revenue of something like £9000 per month. The action taken by the officials of the Midland Company is creating all the greater interest from the fact that they might have enforced their claim for payment in the ordinary way as a debt due, rather than have resorted to the withdrawal of their ledger accounts and demanded prepayment for all coal sent from the colliery sidings. Judging from the large failures which during the past year or two have taken place in the Yorkshire coal trade, and the unenviable position of some of those engaged in the trade at the present time, it must be admitted that had the measures adopted been applied to some of the district collieries, it would have amounted to the closing of the entire business. Fortunately, however, the companies named are in a different position, and payment is tendered in cash several times per day. A good deal of inconvenience is being caused both to the collieries and the railway company; but the former are diverting all possible traffic to the canal to the loss of the railway company. It is worthy of remark that all the collieries are dependent on the Midland only for their outlet, and seeing that each company has expended from £100,000 to £150,000 upon its collieries, it will doubtless hereafter cause firms to pause ere they invest capital in a district monopolised by one railway.

LITERATURE.

Katechismus der Stationaeren Dampfkessel und Dampfmaschinen. Ein Lehr und Nachschlagebuechlein fuer Praktiker Techniker und Industrielle. Von. Th. Schwartze. Leipzig: J. J. Weber. 1882.

This book forms one of a series of scientific catechisms, which have lately issued from the press of its publishers—a series which has already reached considerable dimensions, since the present volume is No. 110. It naturally comes into comparison with Bourne's "Catechism of the Steam Engine," and Forney's "Catechism of the Locomotive"—which latter was founded, we believe, on a work of the same series. The comparison is not to its disadvantage; and this is high praise. In fact, we do not know any work in English offering to the student so clear, concise, and practical an exposition of the facts of the steam engine as will be found here. With regard to its particular form, that of a catechism, the popularity of the two works we have mentioned, and of others of the same type, is sufficient to show that it does not meet with disfavour; and, in fact, as Mr. Forney points out in his preface, the form has a great—we might almost say an overwhelming—advantage, namely, that the student always knows beforehand the precise question to which the book is giving him an answer. If we compare with this the method of most books that are professedly scientific, and of all books that are not; how we have to wander through sentence after sentence, often through paragraph after paragraph, in the faith and hope—how often disappointed!—that somewhere at the end we shall find a clear statement of what we are supposed to have been learning, then no associations of childhood will lead us to say one word against the catechetical form of such handbooks as these. In fact, it merely carries out the great principle of clearness—to state your proposition before you prove it; a principle which, so far as we know, was first adopted by Euclid, and probably has assisted greatly to make his Elements the only text-book which can reckon its life by centuries, not to say millenniums.

Next to its stating beforehand what it means to prove, the most important quality of a text-book—apart of course from its correctness and style—is a good arrangement and subdivision into parts. In this particular the book before us is very superior to Bourne's, and is at least equal to Forney's. After a short historical introduction, we have Part I., on "Heat and Steam," divided into Chapter 1—Main Principles of Thermodynamics—and Chapter 2—Nature and Laws of Steam. Part II. is on "The Boiler," and comprises chapters on fuel, heating arrangements, main properties, construction, attachments, &c. Part III. is on "The Engine," with chapters on classification of engines, general description, valve gear, action of steam, rules for calculating efficiency, &c. Practical examples of calculation, indicating, and so on, follow, and lastly comes an account of certain selected types of engines, with illustrative plates. We do not see much room for improvement in this arrangement; and the questions put under each head are equally well chosen. We will take as an example the chapter on thermodynamics. Here the questions asked are, in substance, as follows:—What is meant by the mechanical theory of heat? Can the conversion of heat into work be made evident to the senses? How are heat and work measured and compared with each other? By what experiments has the mechanical equivalent of heat been determined? What is the most important law of heat for the steam engine? What is to be said as to the law of Mariotte? of Gay-Lussac? What relations are expressed by the combination of these two laws? What is the specific heat of a gas? What is absolute temperature, and its relation to the theory of heat? What are internal and external work? What are adiabatic and isothermal curves? What is meant by a cyclical process?

A special point in the book is the amount of space given to the treatment of the compound engine, which in English books on the subject is apt to be more or less neglected. The Woolf and receiver forms are clearly distinguished from each other, and the different modes of compounding existing engines are also described—all being illustrated by rough but effective skeleton diagrams. At the end, moreover, are eight examples of actual engines, both drawings and descriptions, and half of these are compound engines of various types. We know no similar source of information on this subject in English, unless it be Mr. Marshall's recent paper before the Institution of Mechanical Engineers, which, however, dealt only with marine engines. It will thus be seen that the catechism is not only well done in itself, but also brought well up to date; and we think that good service might be done by anyone willing to reproduce it in an English dress.

BOOKS RECEIVED.

The Law Relating to Building Leases and Building Contracts, the Improvement of Land by and the Construction of Buildings, with a full Collection of Precedents. By Alfred Emden. London: Stevens and Haynes. 1882.

The British Navy; its Strength, Resources, and Administration. By Sir Thomas Brassey, K.C.B., M.P., M.A. Vol. I. Part I. Shipbuilding for the Purposes of War. Longmans, Green, and Co., London. 1882.

Revista General de Marina. Tomo X., Cuadermo 1 and 2. Madrid: Direccion de Hidrografia.

Revista Maritima Brazileira. September, October, and November, 1881. Rio de Janeiro: Lombaerts and Co. 1881.

Art and Letters. An Illustrated Monthly Magazine. By J. Comyns Carr. London: Remington and Co. No. 1, 2, 3, 4, and 5.

The Practice of Commercial Organic Analysis. By Alfred H. Allen, F.I.C., F.C.S. Vol. II. London: J. and A. Churchill. 1882.

Lessons in Form. By R. P. Wright. London: Longmans and Co. 1882.

The Preservation of Life and Property from Fire. By J. H. Heathman. London: Simpkin, Marshall, and Co. 1882.

Household Boiler Explosions; their Cause and Prevention. By W. Ingham. Paper. London: Crosby Lockwood and Co. 1882.

Useful Information on Electric Lighting. By K. Hedges. London: E. and F. N. Spon. 1882.

A Handy Book on Reclaiming Waste Lands—Ireland. By G. H. Kinahan and A. McHenry. Dublin: Hodges, Figgis, and Co. 1882.

Railways and Locomotives. By John Wolfe Barry, M.I.C.E., and F. J. Bramwell, M.I.C.E. London: Longmans and Co. 1882.

THE CHANNEL TUNNEL.

WE have so recently referred to the tunnel scheme, chiefly known as that of the Submarine Continental Railway Company, and identified with the name of Sir E. Watkin, that there is only one reason for returning to it, namely, that the company, apparently represented by the South-Eastern Railway Company, has recently invited a large number of persons to visit the works which have been carried out chiefly at the instigation of Sir E. W. Watkin, by Mr. Francis Brady, of the South-Eastern Railway, and Colonel Beaumont, under the advice, it is said, of a scientific committee. Of this committee we know nothing; but as Sir John Hawkshaw was until recently connected with the South-Eastern Railway, and as he for some time pursued the study of the various geological and engineering questions involved in its construction, it is to be presumed that much of the information resulting from his labours has been at the disposal of those who have carried on the work which is now spoken of as the property of the Submarine Continental Railway Company. On Tuesday a large number of visitors, chiefly representatives of newspapers of all classes, was conveyed by special train on the South-Eastern Railway to the site of the tunnel shafts and to Dover. Having passed Folkestone and reached the site of the main shaft, which is about midway between Abbot's Cliff tunnel and Shakespear's Cliff tunnel, the party visited the engine and machinery sheds and the tipping place, where all that has been brought up from below has been heaved into the sea. The machinery here fixed consists of two double-cylinder horizontal engines with air compressing cylinders, by Messrs. Greenwood and Batley, and one horizontal engine connected to two compressing cylinders. The last-mentioned engine is not now at work, but is kept as a reserve. Steam is supplied to these engines by two Lancashire Galloway boilers, and the compressed air obtained is conveyed to the machine in the tunnel heading by 4in. pipes, the mean pressure at the engine being about 35, and at the machine it is about 20 lb. per square inch, a pressure which is found to be sufficiently high. It may be here remarked that the fall of pressure thus experienced is apparently greater than that experienced at the Mont Cenis tunnel works, where, in a length of just over a mile, the initial pressure of 5·70 atmospheres was reduced to 5·50 atmospheres, and in the middle of the tunnel, through 3·8 miles of 7·625in. pipe, the pressure only fell from 6 atmospheres to 5·75 atmospheres, or less than in the case of the shorter pipe, probably due to the higher temperature in the inner parts of the tunnel. The difference in the loss in the Cenis tunnel and at Dover is undoubtedly due to the difference in the size of the pipes, for in a pipe 3280ft. in length, according to M. Cornut, the loss of pressure in a 4in. pipe would be 4·446 lb., as compared with 2·223 lb. in an 8in. pipe, the resistance not being varied by the density, but only as the perimeter and length. The shaft is covered with simple pit gear, the winding engine being an adapted locomotive, connected by gearing to a winding drum. In the same shed is a portable engine of about 6-horse power, working a Siemens machine for 60 Swan 20-candle incandescent lights and an exciter for that machine. After visiting these things above ground, the party went below, from four to six at a time, in a small cage suspended from a steel wire rope of about 3in. circumference, the cage being free to swing about, but it went down very steadily. The shaft is about 9ft. in diameter, and is tubbed with planks about 2½in. in thickness. The shaft is almost free from water, what there is showing itself at the bottom of the shaft being apparently land water trickling down behind the tubbing. From the bottom of the shaft, which is 160ft. in depth from the surface and 100ft. below low water, a drift is entered, which has been cut out to about 12ft. by 10ft., and for about 50ft. is very strongly supported with whole balk timbers. From here the 7ft. circular heading cut by the Beaumont air boring machine is entered, the whole distance now bored being about 1100 yards. At about half this distance the heading is opened out to about 12ft. in width and 10ft. in height, and heavily timbered. Another place has, however, been squared out to about 8ft. 6in. wide and 8ft. high, and same length, which is left unsupported, and seems to be quite sound. The whole boring is in the same material, namely, what is called gray chalk—a strongly aluminous material, cutting much like soapstone, or something between chalk, soapstone, and gault. In the tunnel, where the material is still damp with absorbed moisture, it has a greenish colour, but on drying it becomes hard and a true gray. When soaked in water, however, it behaves more like clay than chalk, and when damp has an unguentous character. Throughout the length of the heading there seems to be no water, though the moisture in some places amounts to wetness. There seems to be little doubt, however, that this is where the material is softest, and thus most hygroscopic, for upon cutting under the wet surface the normally dry hard material was soon reached. The heading is, as we have previously said, parallel with, though close under, the foreshore, the boring machine being now probably under high-water mark. It is thus near enough to the sea for the infiltration of sea-water if fissures exist in that part which has been bored through. In the heading there is little appearance of dislocation or faults, though there is evidence of stratification, considerable quantities having fallen at what we must call the ceiling angles, in some places where the soffit of the boring just cuts into the underside of a bed, the appearance of the horizontal plane of separation being somewhat that of a slate cleavage plane. There are to be seen, however, a few places where a slip has taken place in the beds. They may not be evidence of true faults, but of very local subsidence. These places are shown by the fall of angular lumps from the sides and near the ceiling of the heading, one of the surfaces of the plane of separation having a slightly grooved and polished or *glissée* surface.

There are also to be found at different parts in the length of the heading some cast iron lining rings, in some places in single, and in others double, rows. So far as the boring has been carried, however, the material in which it is made, though not absolutely free from stratification and evidence of slight hypogeal disturbance, is practically homogeneous, though it is not, as its much-speaking advocate asserts, capable of "standing on its own legs" throughout. The gradient of the heading is about one per cent., so that the machine is now about 133ft. below low water. So far the work promises well, and the evidence gained by it is confirmatory of the observations made by Sir J. Hawkshaw. The heading, according to a geological map, or Carte Geologique Detaillé, of this part of the Channel, specially published by the French Minister of Public Works with a view to the Channel tunnel projects, is in a narrow strip of the gray chalk running along under that part of the coast, and which broadens out and then runs across the Channel, becoming again very narrow near Sangatte. There does not seem to be much reason to expect that this main body of the bed of this material should be less sound than the narrow strip in which the heading is made. In the tunnel few fossils or flints present themselves, but there are patches of harder and dryer chalk here and there which sometimes break off the heavy steel boring tools fixed in the head of Colonel Beaumont's compressed air boring machine. Some few fossils have been found, and Mr. Lewis Nebel, the practical electrician for Messrs. Siemens, who have carried out the lighting of the tunnel, has found a few crystals of *schwefelkies*, or a bisulphate of iron. In the tunnel there are forty-eight lamps, and nowhere is the great advantage of the system better shown than for work in such places. The operators of the boring machine are as well off for light as if in daylight. The lamps, forty-eight in number, are placed alternately, six in series, and then one on branches from the cables, forming a combination of connections in series and in parallel arc.

Two pairs of narrow gauge rails are laid from the bottom of the tunnel shaft to the boring machine, and the borings from the machine are raised by a cup elevator into square iron tubs holding about one-third of a cubic yard, which run on hand-pushed trolleys to the shaft bottom. A small Beaumont air locomotive is soon to be employed on this work. The machine at present makes about three revolutions per inch advance, and when working makes about three revolutions per minute. Colonel Beaumont expects to do more than this. The tunnel air is damp but clear, owing to the quantity of air exhausted into it by the machine and the absence of candles and oil lamps. Respecting the working of the tunnel when completed, Colonel Beaumont proposes to do this, and to ventilate at the same time, by compressed air locomotives having receivers capable of holding 1200 cubic feet of air at a pressure of 70 atmospheres, or about 1000 lb. per square inch, and equal to 80,000 cubic feet of free air, which, he says, while travelling at the rate of 30 miles per hour, and giving out 4000 cubic feet per mile, would supply 2000 cubic feet of fresh air per minute. According to the accounts of the experiments made with the Beaumont air engine running between Stratford and Leytonstone, 23 lb. of fuel were used by the compressing engines per train mile made by the engine and its car, weighing thirteen tons, or 1·77 lb. of fuel per ton per mile; but as the compressing engine was only working for one quarter of each hour, it was estimated that the consumption would drop to 10 lb. if the compressing engines were fully employed. It is difficult to see why the drop should be so much as from 23 lb. to 10 lb., or from 1·77 lb. to 0·77 lb. per ton per mile, as a consequence of working the compressing engine continuously. This is equivalent to making a reduction of 57 per cent. in the fuel, because an engine is made to run 100 per cent. of its time instead of from 25 to 30 per cent. At the luncheon after the visit to the tunnel on Tuesday, however, Colonel Beaumont said he expected to work the traffic for 0·25 lb. of fuel per ton per mile, which is, to say the least, considerably less than 0·77 lb., even on the above assumption of improved efficiency. However, it is not our intention to go into this question here or any of the questions relating to the propriety of making a tunnel. We have here given only a brief account of what was seen on Tuesday, and for the present refrain from further remarks. A good deal might be said on the nature of many of the statements made in the speeches of the leader of this new company, and which were distributed in pamphlet form to the visitors, that they might "learn the facts as they went down to Dover," but this is not necessary.

CRYSTAL PALACE ELECTRICAL EXHIBITION.

No. II.

So much has been done at the Crystal Palace within the last two weeks, that those who intend to visit the Palace may do so at once in the certainty that they will gain little or nothing by further delay. The Crystal Palace authorities have not been idle, and a much-needed work of renovation is going on in various directions. The effect of the brilliant light at night does much to enhance the beauty of the building, and lovers of art will find in the Alhambra Court something equivalent to a new sensation, the charming effect produced there by the system of lighting adopted leaving, we think, nothing to be desired. A notice of the contents of the Exhibition written without special reference to the motive power would be very unsatisfactory, and we propose, before saying much about the electric light or the telegraph and other apparatus exhibited, to deal with the engines employed in driving the multitude of dynamo electric machines at work. For convenience of reference we shall speak of the engines as No. 1, 2, 3, and so on.

The engines may be regarded as roughly divided into groups or sections. Beginning at the tropical end of the Palace, we find one group; half way down on the north side is a second group; on the south side on the basement, near the ivory turning department, with which all visitors to the Palace have long been familiar, is a third group; and at the side of the long covered way leading from the Palace to the London, Brighton, and South Coast Railway station, is a fourth group. Besides these there are certain single and more or less isolated engines at work in several places. We shall begin with the group at the tropical end. Here a large galvanised iron shed has been erected by Messrs. Humphreys, of the Borough. This house closely adjoins the Palace, from which, indeed, it can be entered through swing doors. A platform or gallery railed off from the rest of the house runs round three sides for the accommodation of visitors. The house is divided longitudinally into two nearly equal parts by a line of shafting 4in. in diameter and about 70ft. long. On that side of the shaft next the Palace are fixed the various dynamo machines driven by the engines which stand on the other side of the shaft. With one exception all the engines in this house are by Messrs. Robey and Co., of Lincoln, and of their well-known semi-portable type. That is to say, they resemble railway locomotives taken off their wheels. The boilers are of the locomotive type, and two cylinders placed under the smoke-box drive a crank shaft near the fire-box end of the framing on which the engine is supported. Messrs. Robey have here five engines of various power, and as they stand in a row they make a very attractive exhibit.

No. 1 is a 50-horse power, nominal, engine, with two cylinders, 17¼in. by 24in. stroke. The engine has two fly-wheels, one at each side, 7ft. 6in. in diameter and 12in. wide. Two belts, each 12in. wide, transmit the power from the engine to two 30in. pulleys on the line shafting before referred to, which makes 256 revolutions per minute. The shafting is divided into sections, any two of which can be coupled together, so that one engine can drive the whole, or all five engines can drive together on it. No. 1 engine is now running its own section of the shaft, which is fitted with 53in. pulleys, from which belts are taken to one No. 8, nominal forty arc lights, Brush dynamo-electric machine, making 700 revolutions per minute, and to a No. 7 Brush dynamo, making 960 revolutions per minute.

No. 2 engine is similar in type to No. 1. It is 20-horse power nominal, with two cylinders 10¼in. diameter and 14in. stroke. It has one fly-wheel, 6ft. in diameter. The belt is 8in. wide, and drives a 36in. pulley on its length of countershaft, on which are fitted other pulleys 45½in. diameter, driving two nominal seven arc light Brush machines.

No. 3 is a 30-horse engine, with cylinders 12½in. diameter and 18in. stroke. The single fly-wheel is 7ft. in diameter; the belt is 12in. wide; the countershaft engine pulley is 36in. diameter, and the pulleys for the dynamo electric machines 53in. This drives one No. 8 machine, to supply a single arc light said to be equal to 150,000 candles, in the tropical department.

No. 4 engine is identical with No. 2, save that it has a large fire-box for burning wood.

No. 5 engine is 25-horse power nominal, cylinders 11½in. by 16in. The fly-wheel is 6ft. in diameter; the belt 9in. wide; the engine pulley on the line shaft is 34¼in. diameter; the dynamo pulleys 45½in., driving two No. 7 Brush machines at 900 revolutions per minute.

No. 6 is a little engine—Hodgson's patent rotary, provided with steam by a small launch boiler made by the Thames Ironworks Company. The engine, concerning which we shall say more presently, drives a small dynamo direct, which is used for testing purposes.

On the line shaft are fitted three friction clutches of American invention. They are of the knee joint type, two drivers being forced into grooves in the inside of a ring when coupling is to be effected. The large engine, No. 1, can be coupled up only by a flange coupling of the normal type. By the use of the friction clutches, should any accident happen to an engine, it can be cut out and its length of line driven by the remaining engines without a moment's delay. This is a very excellent arrangement, worthy of extended adoption. Messrs. Robey and Co. have had much trouble with the water supply; an old 3in. main in this part of the ground was placed at their disposal by the Palace authorities, but it burst several times, and had at last to be replaced by a new 2in. main. All the engines draw from their own bed-plate tanks, and are fitted with a feed pump and an injector.

Leaving the tropical department and proceeding half way down the length of the Palace near to the entrance from the High Level station, we find engine No. 7, a 20-H.P., by Messrs. Robey and Co., similar to No. 2 already described. This engine stands in a shed in a corner outside the Palace, and up to Monday last it had been found impossible to work it. Steam could not be got up because of the smoke which rushed into the Palace whenever the fire was lighted. All kinds of cowls and shields were fitted to the top of the chimney where it came through the shed roof, but in vain. On one occasion, when the day was calm, steam was got up, but the wind began to blow soon afterwards, and in spite of the draught due to the exhaust steam could not be kept up. We believe the difficulty has been got over by lengthening the chimney. The engine is intended to drive a Gramme machine and its feeder, the one making 750 and the other 700 revolutions per minute, supplying Gerard's arc lights. A countershaft and cotton belting are used.

Engines No. 8, 9, and 10 are by Messrs. Robey and Co. They are all alike of 25-horse power, similar in dimensions to No. 5. They are situated in the basement close to the

central entrance from the terrace. They drive Edison's machines. Each engine has two fly-wheels; each fly-wheel drives a short length of countershafting, with pulleys 24in. in diameter. The inside of each pulley is bored out and fitted with a cone clutch, so that the six lengths of shafting can all be coupled up, or any one engine can drive any one section or all the sections. Each fly-wheel drives two vertical Edison dynamos, similar to those illustrated in The Engineer for Nov. 4th, 1881. All the twelve dynamos are connected on to one circuit or line wire, but by the clutch arrangement to which we have referred any two dynamos can be cut out of the group at will without stopping the others. Messrs. Robey and Co.'s arrangements will be found well worth careful examination, very great pains being taken by the firm to adapt them to the special and often peculiar requirements of electric light engines. The engines are all fitted with equilibrium governors, and run with great regularity. The working pressure is about 80 lb.

No. 11 engine will be found close to those we have just described. It is a portable double-cylinder engine, with automatic expansion gear, by Messrs. Ransomes, Head, and Jefferies, and is practically identical with that used on the Thames Embankment to work the Jablochkoff system along the river side. The cylinders are 10in. diameter and 13in. stroke. The fly-wheel is 6ft. 1½in. diameter, and the belt is 9in. wide. The countershaft is fitted with five pulleys of various sizes, driving two Weston nominal 10-light dynamos, two Maxim "distributors," each equal to 100 Maxim lamps of thirty candles each, and one "feeder." These machines all make about 900 revolutions per minute.

No. 12 is a portable 6-horse power engine, by Messrs. Ransomes, Head, and Jefferies, carrying a small Gramme machine on a shelf in front of the smoke-box. It is a well-known type of electric light plant principally intended for contractors' use.

No. 13 is a Hodgson rotary engine, supplied with steam by a launch boiler. This is nearly the same as No. 6, but larger.

Nos. 14 and 15 are two double-cylinder portable 16-H.P. engines by Messrs. Marshall, Sons, and Co., Gainsborough. They have 6ft. 6in. fly-wheels with 9in. belts, and they drive 52ft. of line shafting in two sections, interchangeable; that is to say, either engine can drive the whole line. From pulleys on the one section of shaft belts lead off to three "H" Gramme machines, and three "A" Gramme machines. Two spare machines are provided, but not in use. The other section drives two "E" Gramme and four "B" Gramme dymanos for the incandescent light. There are three spare "A" machines provided. The machines make about 1050 revolutions and the engines 120 revolutions per minute.

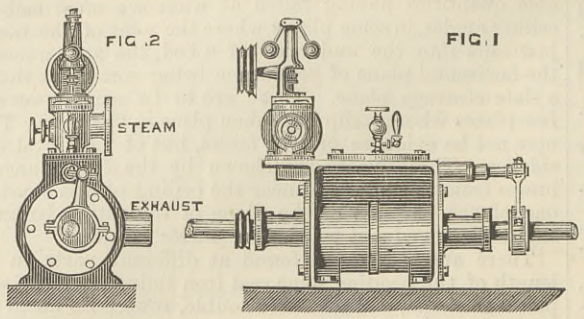
No. 16 is the first compound engine ever built by Messrs. Marshall, Sons, and Co. It is of the semi-portable locomotive type, with the cylinders under the smoke-box. It is nominally 8-H.P., and can be coupled up with No. 15 engine. It is able to drive four "B" Gramme machines. Steam will be taken from its boiler to drive one of Hodgson's engines driving an E Gramme machine.

Returning upstairs to the main building, we have next engine No. 17, Galloway's large fixed compound, put down to drive woollen machinery during the exhibition last year, and already described and illustrated in our pages. This engine drives a large number of dynamos, among which may be mentioned five Burgen machines—two "C," one "C 2," and two "C 1"—for Mr. Crompton, and several others which have hardly yet been got into full work. Not far from this engine will be found two, one vertical the other horizontal, by Mr. Hindley, of Bourton, Dorset. Neither of these was at work at the time of our last visit to the Palace, and we have therefore not numbered the engines for the moment.

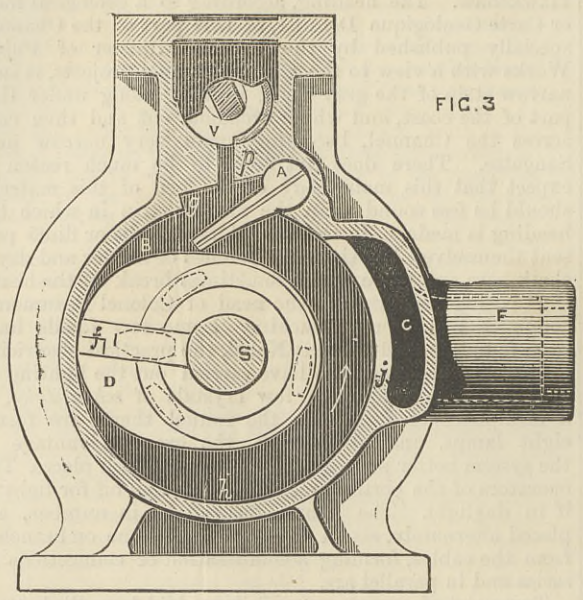
The most remarkable group of engines in the exhibition is that shown by Messrs. John and Henry Gwynne, of Hammersmith. They have adapted their well-known centrifugal pump engines with great success to drive dynamos. No. 18 is a vertical engine, 9½in. cylinder, 8in. stroke, intended to run at 200 revolutions per minute, and drive through a 6in. belt on a 3ft. 8in. fly-wheel. No. 19 is a similar engine but horizontal. It is fixed at one end of a heavy plank, and drives a "W 1" alternate current Siemens machine, with a "D 7" exciter. The last is driven by a curious belt made up of a vast number of small strips of leather secured together with wire pins, so as to resemble a very wide flat link pitch chain.

Engine No. 20 cannot fail to attract the attention of engineers. It has a horizontal cylinder 5½in. diameter and 4in. stroke, and its crank shaft is coupled direct to a Siemens "W 2" machine on one side, and a "D 7" exciter on the other. The whole arrangement is very compact. This engine will run up to 800 revolutions per minute, and we have seen it making 650.

Engine No. 21 is the same class of engine but vertical. It drives direct a Siemens' "D 2" dynamo, and a "D 8" exciter. At the time we saw it it was making 615 revolutions per minute, and it had only just been started. Steam is supplied to all Messrs. Gwynne's engines by two semi-portable 12-horse power boilers standing in a shed abutting on the Palace. In this shed will also be found engine No. 22, a 12-horse power single-cylinder portable engine, by Messrs. Marshall, Sons, and Co. This engine has a cylinder 9in. by 12in.; is fitted with horizontal automatic expansion, and with two 4ft. fly-wheels, each carrying a 5in. belt. It drives a Siemens' "W 1" machine and No. 7 exciter. In the same shed is a Thames Ironworks built boiler to supply a group of Hodgson's engines, Nos. 23, 24, 25, 26, 27, 28, and 29, all driving A Gramme machines, and exhibited by Mr. Norwood Earle, of Cannon-street. We have already alluded to the Hodgson engines, and we may say here that they are the best rotary engines we have yet seen, and appear to be very well adapted for moderate powers, running at very high velocities without noise. They owe their success to the workmanship, which is very good indeed, and reflects much credit on the Thames Ironworks and Shipbuilding Company, by whom they have been constructed. We shall in due time illustrate all the types of engines to be found at the Crystal Palace. We begin with Mr. Hodgson's, shown in Figs. 1, 2, and 3. It is thus described by the inventor:



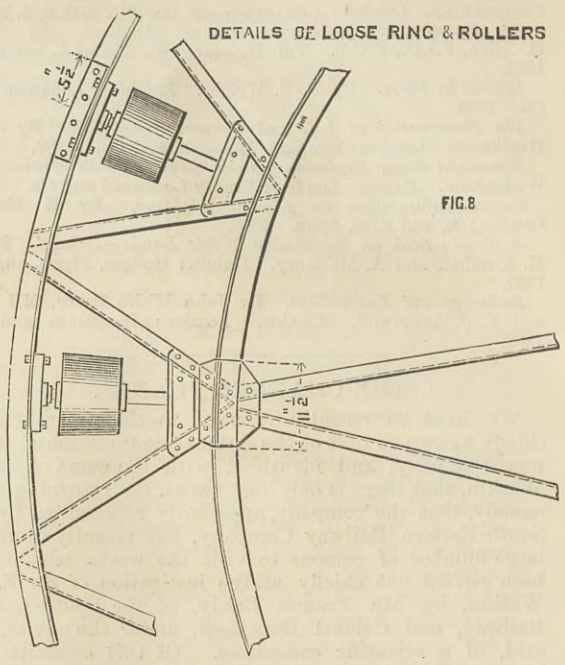
The cylinder is divided lengthways by a diaphragm, two piston cams D being feather keyed on the shaft S, one on each side of the diaphragm, and rotating in the direction of the arrow. These pistons are placed on the shaft in opposite positions to each other, by which arrangement the engine is perfectly balanced, and when the steam is exerting full power upon the one, the other is open to the exhaust; nearly equal pressure is maintained throughout the revolution of the shaft, and great regularity and steadiness ensured. A is an abutment valve fitting into a recess in the cylinder; the tail of this valve rests on the surface of this cam as shown, and rises and falls as the piston rotates. The pressure of steam on top of the valve ensures its always working tight, and a cushion of steam is arranged at *g* to prevent it striking the top of the cylinder. There is a steam port on each side of the diaphragm, by which steam is admitted to the two pistons by an oscillating valve V. This valve is worked from an excentric—Fig 2.—on the shaft, and admits steam to each piston alternately. The excentric is set on the shaft, so that the steam is admitted by the valve V at the moment the point *f* in the cam arrives at the point *g* in the cylinder, and cut off when F arrives at *h*. The steam enclosed in the space B is then allowed to expand until *f* arrives at *j*, when the steam commences to escape into the exhaust cavity C, and thence through the branch F. Thus it will be seen that the steam is cut off at about half stroke, that is to say, the capacity of that part of the cylinder filled with steam at the moment of cutting off is doubled before the steam is allowed to exhaust. One of the important features of the engine is an absence of other than metallic packings—glands and stuffing-boxes being entirely dispensed with. The rotating shaft bearings in the cylinder are kept steam-tight by the pistons working closely against the cover; the pistons are packed at the diaphragm end by rings made of phosphor bronze, and there seems to be very little wear on these packings, and from their appearance after running for some years it is quite evident they keep practically steam-tight.



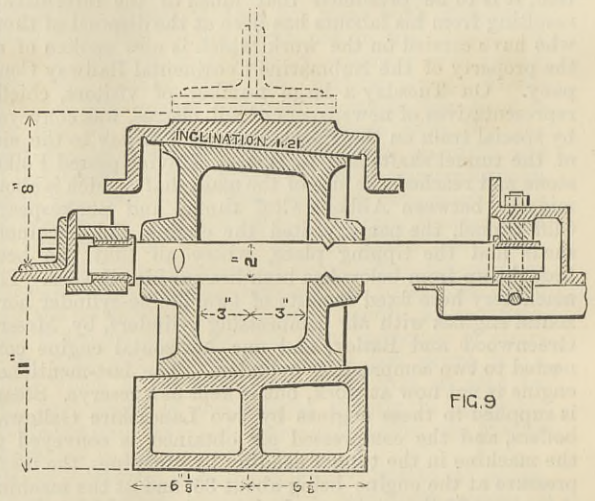
We have yet to describe the engines in the shed at the side of the covered way to the Low Level station. Our notice of these we must reserve for another article.

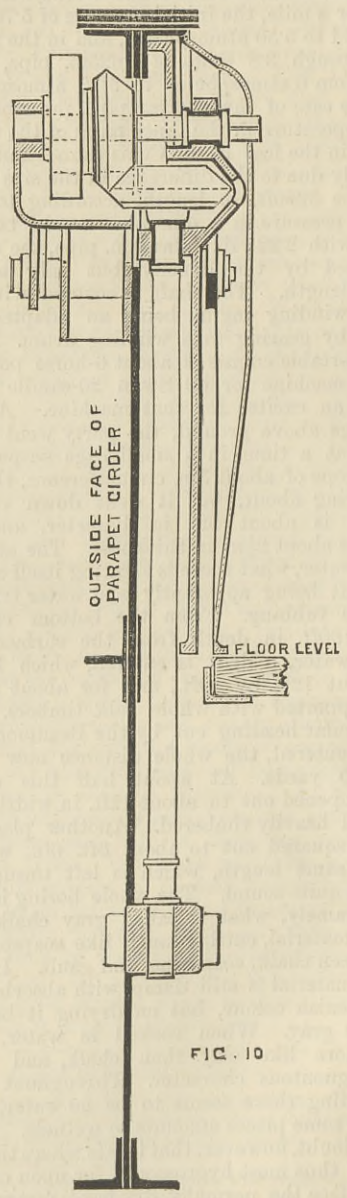
WEYMOUTH BRIDGE.

This bridge, which crosses the harbour, joins Weymouth proper to the Melcombe Regis part of the borough, and with the exception of a decrepit wooden structure in the neighbourhood, forms the only road connection between the island of Portland and the main land. The bridge as it stood in 1878 dates from about the year 1820, and was strongly built of Portland stone, as shown in Fig. 1. To allow of vessels passing in and out of the inner harbour or back-water an opening was necessary, and the authorities of that day having at considerable cost built the side arches of masonry, wide enough for a double line of vehicles, fixed an iron opening bridge wide enough only for one line. Thus narrowed, the bridge proved quite inadequate for the traffic of recent years, and the steep gradients of 1 in 10 were not only difficult of ascent with heavy loads but caused a continuous wearing away of the road surface by the wheel drags in the descent. Besides this the gearing worked with difficulty, and the two leaves of the opening bridge became so loose at their junction at the crown of the bridge as to render the opening and shutting difficult and unsafe. These inconveniences at last became unbearable, and the corporation asked Mr. Ewing Matheson, M. Inst. C.E., to advise as to the repair of the old bridge and as to the cost of a new one. Mr. Matheson reported that though the old iron structure might last a little longer before it became unworkable, it was so worn and corroded that it could not be taken to pieces and repaired with any hope of being put together again. On this report an alteration of the old bridge and the construction of a new opening span was decided on, and parliamentary powers were obtained in the session of 1879, the necessary funds being borrowed on the security of the tolls for vehicles—foot passengers going free—with the collateral security of the borough rates.



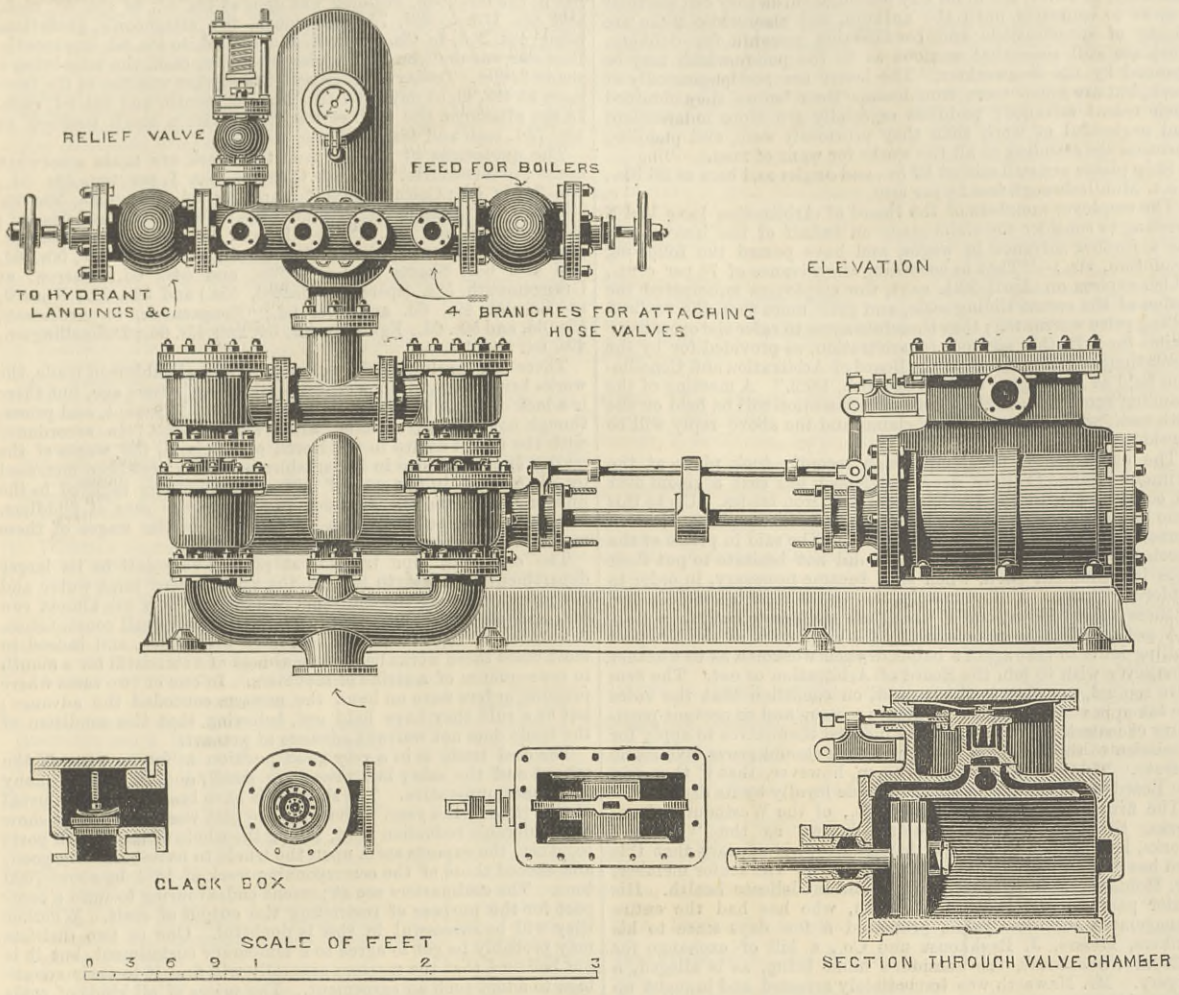
The scheme as carried out comprises the widening of the south approach, the lowering of the gradients, and the erection of a new opening span of the full width of the stone arches. The plan—Fig. 4—shows the widening of the south approach, the footpath and parapet at the curve being carried on iron girders spanning from the shore arch to the quay wall. The dotted lines indicate the narrow roadway, and the black lines the new opening bridge. As the opening span was much wider than the one it was to replace, a wider space on which to turn was necessary for it, but by removing the upper course of masonry on the south pier, a sufficient and solid base for the ironwork





STEAM FIRE PUMP.

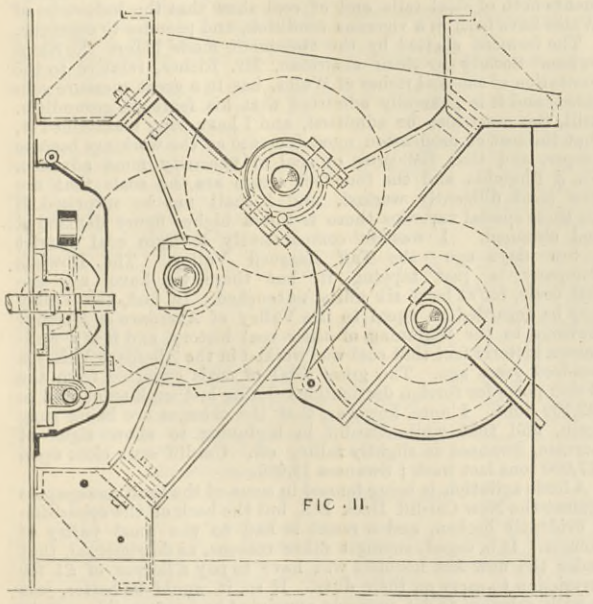
MR. JOHN WOLSTENHOLME, RADCLIFFE, MANCHESTER, ENGINEER.



WE illustrate above a steam fire-pump manufactured specially for cotton mills. The pump requires no particular description, for the engraving clearly illustrates its construction.

A trial of one of these engines recently took place at the mills of Messrs. Kershaw and Bamford, Oldham The mill is situated between the mills of the North Moor and Coldhurst Spinning Companies, and the three mills are now each supplied with the same Wolstenholme pumps, with 8in. pump barrels and 16in. steam cylinders. In case of fire the hose pipes from the three mills can be coupled together immediately and the engines set to work, and in a few minutes from the alarm being given twenty jets could be thrown on either of the mills. The trial commenced with playing a 1in. jet, which was thrown, according to an Oldham contemporary, a height of about 50ft. over the mill chimney, which is 150ft. high. Another jet being coupled, the two were thrown over the chimney about 30ft. Four jets were then coupled and thrown considerably higher than the mill tower, maintaining 150 lb. pressure on pump. When the pump was working at the highest pressure it was noiseless. This engine may be worked at any speed from one to fifty strokes per minute, and against any pressure from 1 lb. to 300 lb. pressure on pump.

was provided, and in this was placed the roller-path and gearing, the opening span being in one piece and not in two leaves as before. The roadway of the bridge could now be made horizontal, enough masonry being removed from the haunches of the arches without touching the arch stones themselves. On the north approach, however, it was impossible to lower the road because of the headway necessary over the tramway by which the railway traffic has access to the steamer quay seaward. The turntable of the bridge rests on twenty-four cast iron rollers 12in. diameter—Fig. 9—the upper and lower roller paths being also of cast iron. The rollers are held in a light wrought iron framework, being purposely left thus free. The main girders are as shown in the elevation, and are of plate iron except where they form the parapet over the opening, they there being lattice. The roadway is carried on cross girders, on which, for the overhanging portion are placed longitudinal planks,



cross planks and wooden blocks, while for the heel or balance weight portion are iron plates, concrete, and granite setts. The weight of iron in the movable part of the bridge is 79 tons, including the machinery, and the total weight, including concrete and paving, is 207 tons. The centre of gravity of this weight coincides exactly with the centre of the roller path, and as there are twenty-four rollers the weight on each is 8·6 tons. The bridge when closed is calculated to carry a moving load of 100 lb. per superficial foot. The moving mechanism is double, *i.e.*, there is a pinion under each footpath working into the same fixed rack—Fig. 11—and operated by crank handles and gear, single and double, compactly arranged in the two parapets—Fig. 10—so as not to obstruct the traffic on the bridge, the workmen standing on the footpaths. The two sets of wheels can be worked separately or together, each being arranged on the planet principle to move in or out of gear.

It was first intended to utilise the water pressure in the town mains for turning the bridge, but as the opening takes place only about once a day, the expense of hydraulic apparatus was avoided, and the hand gear alone provided. The bridge was ready for traffic on May 14th last year, and the accommodation it provides, and the easier traction for vehicles, give great satisfaction. Mr. J. T. Whettam was the contractor, the ironwork being made by Messrs. Handyside, of Derby, and the opening gear by Messrs. Brinjes and Goodwin, of London. The total cost was £5000.

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

(*From our own Correspondent.*)

THE week's mails from the Cape, and from Sydney, Melbourne, and Adelaide, have brought forward a little more business in light samples of finished iron, but generally the week does not show much improvement in the extent of new business offered. Marked bars remain firm where £7 10s. has been the quotation, or, indeed, where £8 or £8 2s. 6d. has been the standard quotation of firms of note; and it was impossible to-day—Thursday—in Birmingham to get at under £7 10s. certain excellent bars that, though at that time priced at £7, I yet intimated that £7 10s. was soon to be the figure required. Common bars are scarcely so firm, £6 15s. being now frequently required where £6 17s. 6d. was before being asked. Yesterday in Wolverhampton, and to-day in Birmingham, the demand for this commodity was not brisk; and more, proportionally, was done in a better quality, for which £7 was asked.

Hoop and strip orders were sought after upon both Exchanges, and the makers showed a slight tendency to a little more weakness than was last week noticeable.

Sheets were variable in price. It might have been possible to buy some kinds from one or two makers who have overstood the market, and are now beginning to need work, at 10s. under the prices which they refused at the quarterly meeting, but the experience was not general. Nevertheless specifications are being still inconveniently withheld chiefly by the galvanisers.

Plates were very strong of branded qualities for boiler making. £9 and upwards was freely asked, and only small lots would be booked at £8 10s. for "Wright" quality.

The works keep well employed in most of the departments, but more new orders must be soon distributed if the prevailing full time is to be continued.

Pig iron was easy to buy to-day of common qualities. Cinder quality was to be had at £2 2s. 6d. easy; but all-mine was unchanged at from £3 5s. to £3 10s.; and the users of best hematites were complaining at the tardiness of deliveries.

Coal was weak. The house coal collieries are pressing supplies upon the proprietors of mills and forges, and were prepared to book considerable quantities at well under 6s. per ton. This weakened the market, and manufacturing coal not of the first order was easy to buy at a drop upon the week of from 3d. to 6d. per ton.

The Shropshire finished ironmasters have fixed March 13th as the date upon which the advance in wages of 9d. per ton to puddlers and 7½ per cent. to millmen, granted by the Mill and Forge Wages' Board, is to come into operation in their district.

The North Staffordshire men are showing some little dissatisfaction that the advance is not larger than the board have awarded. They assert that iron has risen in price over 50 per cent. during the last twelve months, and they urge that the advance conceded to them does not represent their fair share of such increase. Their objections are not, however, taking any serious form.

The Hill Top Colliery, near Wellington, Shropshire, which has been inactive for a long time, is shortly to be re-opened. Work will thus be given to about 300 hands.

The Leigh's Wood Colliery, near Walsall, liquidated some time back, and since then consequently vacant, has just been bought by Mr. John Marshall, Tamworth.

The bill I mentioned some time back as having been promoted by the South Staffordshire Mines' Drainage Commissioners to give them powers to levy, as a maximum, a rate of 9d. instead of 6d. as now, has passed its second reading, and will soon become an Act. The bill was promoted to facilitate pumping operations in the Tipton district, but a wrong impression seems to have obtained there that it is an indication that the commission is about to leave its work unfinished and liquidate. This feeling resulted in a proposal at a monthly meeting of the commission on Wednesday to introduce a clause in the Bill altering the rate back to 9d. "in the event of a prospect of liquidation." Only one supporter was found, the groundlessness of the idea was shown, and the proposition was withdrawn.

The masters in the chain trade having expressed their willingness to concede from 10 to 15 per cent. advance on the hammered and country work, the operatives met on Tuesday to consider the proposal. The offer hardly meets their requirements, but they have decided to accept it, with the strict understanding that in the event of any attempt on the part of the masters to draw back a strike will be at once resorted to.

The Wolverhampton Chamber of Commerce will be celebrating their quarter-of-a-century existence at an annual meeting to-morrow—Friday—with the mayor of Wolverhampton presiding.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—There is very little material change to notice in the condition of the iron market here since last week. Buyers are still giving out new orders very sparingly, whilst the pressure to secure orders which is shown by a good many second-hand holders of iron tends to weaken the market. The effect of this is felt not only in raw materials, but also in finished work, and generally it may be said that the new inquiries coming in are just now fewer in number than they have been during the last five or six months. Trade itself, however, can scarcely be said to be actually worse, and the present depression is looked upon as only temporary.

Lancashire makers of pig iron are still kept busy with deliveries under contracts; but as these are being rapidly worked off without being replaced, more anxiety is being shown to secure new orders. Nominally, the list quotations for delivery equal to Manchester remain at 52s. 6d. per ton less 2½ per cent.; but if anything like good offers were made for delivery up to the end of June, local makers would be open to entertain them at under 50s. per ton. In fact, I have good grounds for stating that local and district brands, such as some of the Lincolnshire irons, could now be bought at prices ranging from 48s. to 50s., less 2½ per cent. for forge and foundry qualities, delivered equal to Manchester. Middlesbrough iron has been quoted at 49s. 10d. to 50s. 1d. per ton net cash, but no business of any importance has been done at these figures.

Makers of finished iron in this district also continue well employed with orders in hand, but there is a falling off in the amount of new business coming in, and the promptness with which specications can now be completed is an indication that there is not the pressure upon makers as was the case a month or so back. In view, however, of the upward movement in wages which in this district will have to follow the advance of 7½ per cent. conceded in Staffordshire, and in one or two cases has already been granted, manufactured iron makers cannot very well entertain the question of a reduction in prices, although the market just now is decidedly against them. The minimum quotation for bars delivered into the Manchester district is consequently being maintained by makers at £7 per ton, but there is a good deal of underselling amongst merchants.

In the engineering trades works generally are kept well employed, and the principal local firms have, as a rule, orders in hand which will keep them going for some time to come. Complaints, however, are still made that the prices at which work has to be taken are very low, and that even the new orders coming in are not so numerous as they were. The reports sent in from the various districts connected with the workmen's societies are, however, generally of an encouraging character. The returns issued this month by the Ironfounder's Society report trade as good in Salford, Rochdale, and Crewe, as moderate or improving in Manchester, Liverpool, Birkenhead, Bolton, Barrow, Oldham, St. Helens, Warrington, Preston, Burnley, Blackburn, and Stockport, changeable at Accrington, not so good at Staleybridge, and bad at Wigan, Darwen, Heywood, and Lancaster. As to the general state of trade throughout the country, the returns show a decrease of 115 men in receipt of out-of-work donation, as compared with last month. The returns of the Amalgamated Society of Engineers also show equally satisfactory results, the number of districts in which trade is good is increasing, and the number of members in receipt of out-of-work benefit is steadily decreasing.

The wages question has not yet got to the final stage. Following the concession of an advance of 2s. per week by the Iron Trades' Employers' Association in the Manchester and Salford districts, the agitation has extended to several other districts, and a second circular has been sent out by the district committee of the Amalgamated Society of Engineers, stating that the employers of labour at mills, factories, dye works, print works, or works of a miscellaneous character, where members of the society are employed, and where they have been reduced, will be required to restore the amount of such reduction from the 1st March next. The committee add the hope that this request may meet with cordial approval, and that it may be considered in the same spirit as was displayed by the Iron Trades' Employers' Association in dealing with their recent demands, which had been so honourably conceded. This good example the committee trust will be followed, and thus still further strengthen the good feeling which has existed for so long a period, and which they hope may long continue. With regard to wages, the Ironfounders' Society report that in some of their branches the members had realised an advance in wages, bringing up the amount to what it was prior to the depression, and this had been done, they were glad to say, without the disagreeable consequence of strikes.

Messrs. De Bergue and Co., Limited, engineers, of Manchester, have just constructed for a marine engine works in Holland a special combined mechanical and hydraulic rivetting machine, which has been designed to obviate the many objections to machines working with falling hydraulic accumulators. The machine is driven by belt and double gearing actuating the heading ram by an ordinary excentric shaft. By the arrangement adopted in this machine the holding-up pillar instead of being cast with the frame, or otherwise firmly fixed to it, passes through a planed gap in the frame, and extending downwards is pivotted at the foot, and is held in its upright position by two strong tension bolts, which are drawn tight by the action of water under compression in a hydraulic cylinder fixed to the back of the machine. The only outlet from this cylinder is in direct communication with a smaller cylinder loaded like an ordinary accumulator, and the actual pressure, which is common to both cylinders, is determined by the load upon the vertical cylinder. When the heading ram in the machine presses the head home, the holding-up pillar yields, and the water displaced from the large cylinder lifts the weighted one, which resumes its first position as soon as the pressure upon the head is withdrawn and the water returns to the large cylinder ready for the next stroke. By this arrangement all valves and pumps are dispensed with, whilst a self-adjustment to all thicknesses is retained. The machine, which is the first of the kind made by Messrs. De Bergue, is constructed to work up to a pressure of seventy tons.

In the coal trade business continues very depressed, with stocks accumulating and prices tending downward. Best coals average 9s.; seconds, 7s.; common, 5s. to 6s.; burgy, 4s. 6d. to 5s.; best

slack, 3s. 9d. to 4s. 3d.; and inferior sorts, 3s. to 3s. 6d. per ton at the pit.

Shipping has been rather more active, but Lancashire steam coal, delivered either at the Garston Docks or at the high level, Liverpool, can still be bought at 7s. to 7s. 6d. per ton.

Barrow.—My notes for some time back will have shown that the position of the hematite pig iron trade in this district has been in a very satisfactory condition, and the business done on the market this week has very materially strengthened that position. The demand is very fully maintained, and heavy as is the output of metal, it is nothing like sufficient to meet demands; and if the output could be largely and heavily increased there is plenty of call for it. In the district two additional furnaces have been put into blast. Prices are quoted a little easier than last week, and No. 1 Bessemer is now selling at 64s. 6d.; No. 3 forge, 62s. 6d.; and inferior qualities, 59s. per ton. Stocks of iron are almost *nil*. Shipments of metal abroad have not commenced yet, the shipping being scarcely open; but a very heavy tonnage is being prepared for shipment. The requirements of American users of steel are very considerable, especially in blooms. Steel mills are very busy, and a very large number of orders are in hand. Iron ore selling well. A great development is taking place with regard to the raising of iron ore; new veins are being opened up with all the haste possible, with a view of being in a position to meet the demand. Spanish and Irish ore is exported to this district and a good business is done. Iron shipbuilders, engineers, ironfounders, and other industries in steady work. Good business doing in coal.

On Monday last the Whitehaven Shipbuilding Company launched from their yard a steamer of the following dimensions:—Length, 193ft.; breadth, 28ft. 3in.; depth of hold, 15ft. 4in.; and gross tonnage, 650 tons. The new steamer has been built to the order of the new steamship company recently inaugurated in West Cumberland, and is the fifty-second vessel launched from the Whitehaven Shipyard, and the tenth since the new company took the yard.

The Parton Hematite Iron Company blew in its No. 1 furnace on Saturday last after a new bed had been supplied and the floor re-laid.

Another discovery of ore has recently been made on the south side of the railway station at Lindal, and brisk work is being carried on there by the Wigan Iron and Coal Company.

An advance of wages has been given to the puddlers in the employ of Messrs. Kirk Brothers and Company at the new yard, Derwent, and Marsh Side Rolling Mills, equivalent to 11 per cent. In the other departments of their works an advance of 7½ per cent. has been granted.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

In the railway wagon department, Messrs. Craven Brothers, carriage builders, Darnall, have again been successful. A fortnight ago I mentioned that they had succeeded in securing the contract for the Great Northern Railway Company's 9-ton goods wagons—550 in all. They have now obtained an order for 500 pairs of wheels and axles for the North British Railway Company. There has been some competition for 170 goods wagons for the Caledonian Railway Company. Mr. S. J. Claye, of Barrow, has obtained the work.

For some six or seven years past it has almost invariably occurred that in the middle weeks of February there has been a slight hesitation in the iron market with respect to forward sales. This is occasioned by two reasons, the first the partial fulfilment of orders placed at the close of October last, and secondly, because of anticipations of orders which undoubtedly will be placed in the spring for summer delivery. The last six months have indicated a great improvement in the iron trade, and this has led to an increase of the output. The amount of raw material coming into the market exceeds that required for finished purposes, and therefore a meeting has been called between the ironsmelters of certain portions of the North of England and those in the Midlands for the purpose of restricting the output. This, however, though it might stiffen the market for a time, would only lead to a maintenance of present rates at an artificial value. But in Sheffield the leading iron houses are engaged upon contracts which will last throughout the whole of this year, so that they will not be affected to any great extent by outside movements in the trade, as their contracts for the supply to themselves of raw material and their prices of delivery are obedient to extensive contracts completed at the commencement of the first quarter of last year.

In the Bessemer steel department there has been a slight lull, owing to over-speculation in the trade, but though business is this week comparatively dull as compared with that which has obtained since January, there are no indications of a decline in quotations; and before June next, it is the opinion of those engaged in the trade, rates must certainly advance.

There is a large amount of steel scrap on offer, clearly pointing to an increase in the demand for the manufactured article from which this is obtained.

Quotations for guaranteed temper Bessemer billets No. 1 are £7 per ton at Sheffield. Extra qualities with admixtures of foreign irons varying from £9 for common cutlery to £13 per ton for saw and file purposes. These latter brands of course are only used for goods intended for export to cheap markets.

Another deplorable outrage has occurred in the sickle trade at Hackenthorpe. Messrs. Thos. Staniforth and Co., scythe and sickle manufacturers, &c., determined eighteen months ago to secure a reduction of wages, and with that view took steps to have their work done by non-unionists only. A series of frightful outrages were attempted. A canister containing powder was exploded in a non-unionist's bedroom; a piece of piping, filled with powder, was inserted near the door of another, and fired by means of a fuse, with great force. Then the employers were threatened by letters signed "Grinder Joe from Stafford," that something would happen to them as they came over the Moor some dark night. A partially successful attempt was made to blow up the premises, and shortly after the police, acting on a hint they received, caught three men in the very act of firing a fuse attached to a train leading to a gallon jar of gunpowder placed in the fire-hole of the boiler. Two of these men are now undergoing five years' penal servitude. Undeterred by this severe sentence, another attempt was made last Saturday morning to blow up three non-union grinders and a lad by exploding gunpowder in their bedroom. The attempt was clumsily concocted, and failed to injure any one, though some damage was done to the dwelling. No one was arrested. The cause for the outrage in this instance is given as the employment of an apprentice against the rules of "the trade"—*i.e.*, the Union.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

The Cleveland iron market, held at Middlesbrough on Tuesday, was decidedly flat in tone, and very little business was done. The report from Glasgow, which was anything but reassuring, tended to aggravate this result. Smelters to a great extent kept aloof, but second-hand holders of iron were anxious to sell, though they rarely succeeded in finding buyers. The selling price for No. 3 g.m.b., for prompt f.o.b. delivery, was 41s. 9d. at the beginning, but settled down to about 41s. 6d. by the end of the market. In some cases that price was accepted for delivery over the next three months, or even up to the end of June. For warrants 42s. was the general figure, but scarcely any changed hands. The stock in Connal's Middlesbrough stores is now 172,619 tons, being an increase of 118 tons over the previous week's return. In Glasgow their stock is 630,945 tons.

A committee of Cleveland ironmasters was to meet a similar committee from Glasgow at Carlisle on the 22nd inst., in order to discuss whether or not the restriction of output should be continued after the expiration of the present agreement; and if so on what terms. It is generally thought that some terms will be agreed upon, the present ones rather than none; strenuous efforts, however, will probably be made to induce the Scotchmen to increase the percentage of their restriction.

The finished iron trade continues quiet and steady. As usual buyers are holding off because they observe from the daily market reports that Glasgow pig is easier in price. Finished iron manufacturers, however, are in no way discouraged, as they can see their way as to contracts until the autumn, and meanwhile there are plenty of specifications and considerable pressure for delivery. They are still somewhat anxious as to the policy which may be pursued by the ironworkers. The latter are pretty generally at work, but are much more troublesome than before they obtained their recent advance; puddlers especially are more independent and neglectful of work than they previously were, and puddling furnaces are standing at all the works for want of men.

Ship plates are still sold at £7 5s., and angles and bars at £6 10s., f.o.t. Middlesbrough less 2½ per cent.

The employer members of the Board of Arbitration have had a meeting to consider the claim made on behalf of the ironworkers for a further advance in wages, and have passed the following resolution, viz.:—"That in conceding the advance of 7½ per cent., which expires on April 29th next, the employers anticipated the action of the recent sliding scale, and gave more than the realised selling price warranted; they therefore agree to refer the operatives' claims for a further advance to arbitration, as provided for by the resolutions of the meeting of the Board of Arbitration and Conciliation held at Darlington on February 6th, 1882." A meeting of the standing committee of the Board of Arbitration will be held on the 24th inst., when the operatives' claims and the above reply will be considered.

The explosion of fire-damp which recently took place at the Trimdon Grange Colliery, near Hartlepool, has cast a gloom over all connected with the Durham coal and iron trades. Up to this time seventy-four deaths are known to have taken place. Eleven horses were also killed. Too much cannot be said in praise of the heroism of those gallant men who did not hesitate to put their lives in imminent peril, when that became necessary, in order to explore the mine. Unfortunately, the deaths reported include two of these noble fellows, one of whom was the under-viewer.

A petition has been received by the employers at the Newport Rolling Mills to take again a ballot of their workmen as to whether a majority wish to join the Board of Arbitration or not. The firm have replied, acceding to the request, on condition that the votes are taken in such a way as to secure secrecy and to prevent possibility of intimidation. They have pledged themselves to apply for admission to the Board in case the voting should prove favourable thereto. They caution their workmen, however, that if they join the Board they will expect them to abide loyally by its decisions.

The firm of J. Holdsworth and Co., of the Westbourne Ironworks, Stockton-on-Tees, popularly known as the "Needle" Works, has filed a petition in bankruptcy. It appears that this firm has been in difficulties for some time. The senior member, Mr. Holdsworth, is advanced in age and in delicate health. His junior partner, Mr. Edward Hawarth, who has had the entire management for some years, presented a few days since to his bankers, Messrs. J. Backhouse and Co., a bill of exchange for £420 or thereabouts, the acceptor's name being, as is alleged, a forgery. Mr. Hawarth was immediately arrested and brought up before the magistrates. The case has not yet been fully heard, and in the meantime the accused is released on bail. It is said that several other forged acceptances have been paid away to various parties by this firm. On hearing of the arrest of the managing partner, the workmen employed ceased work, and the place is now standing.

The reconstruction scheme proposed by Messrs. Edwin Waterhouse and W. Peat, liquidators to the Darlington Iron Company, has been accepted by the shareholders. The principal features of the scheme are as follows, viz.:—The raising of additional capital by issuing 5 per cent. preference shares bearing a cumulative dividend of 7 per cent. These shares are to be taken up partly by shareholders and partly by creditors; the money realised thereby will be used to pay off the liabilities of the company, and will enable them to pay their creditors 20s. in the pound, with enough to spare for working the business. It was reported that the company had made profits during the liquidation which had enabled it to improve its position considerably, and to restore confidence among all concerned.

Messrs. Bolckow, Vaughan, and Co. are erecting extensive blacksmiths' and fitters' shops at Middlesbrough, utilising for that purpose the site of their old iron rail mills which were dismantled some years since, on the building of their works at Eston. The new shops are nearly finished, and when they are filled with machinery some 400 or 500 artisans will be needed to occupy them. Messrs. Bolckow, Vaughan, and Co. intend to manufacture their own locomotives, machinery, and tools for their steel and iron-works, collieries, and mines.

The boilersmiths employed by Messrs. Cochrane, Grove, and Co. are out on strike for an increase of wages. Their fitters and patternmakers have given notice to leave unless they also obtain an advance.

The strike of moulders at Messrs. Head, Wrightson, and Co.'s works at Stockton has terminated, and so has the strike of bricklayers at the Linthorpe Ironworks, Middlesbrough. In the two latter cases the men have been beaten, and have gone to work at the old rates.

At the Normanby ironworks, Mr. Edwin Jones has now got into operation his new and elaborate arrangements for removing, breaking-up and tipping into hopper-barges slag from his blast furnaces. Under the new system Mr. Jones believes that the cost of depositing six miles out at sea will actually be less than that of laying down by the old method at any place on land, however near the works. Mr. Jones intends to invite the leading members of the trade to inspect his apparatus before long.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

The iron market has been very dull during the greater part of the week. The alterations in prices have been small, and the tendency on the whole has been downward. A lower point has been touched than at any time since the beginning of the year. A considerable number of holders of warrants have been desirous of selling out, and as there is at present little demand on the part of the outside public, the market has been very flat. The probability of the ironmasters of Scotland and Cleveland agreeing upon an extension of the time for restricting the output of pig iron has so far failed to have any improving effect upon the market. This is somewhat remarkable, as it is considered that the shipments are very good for the season, the past week's exports of pig iron amounting to 10,933 tons, as compared with 7409 in the corresponding week of last year. Altogether the amount of iron consigned abroad during February has been much larger than usual. This very fact, however, helps to lend an uncertainty to the trade, some merchants being of opinion that the spring business will not likely be so large as it would have been had the weather of the present month been more wintry and prevented such a large export of iron taking place. The market also continues to feel the effects of the high price of money and the financial and political unrest on the Continent. Orders for iron from Germany have during the past week or two become very limited, neither have those from France come up to expectation. The home trade too, which has been very good, is at present rather quieter. Since last report a slight reduction has taken place in the amount of pig iron in the public stores, but it is believed that the stock in the hands of makers is still increasing to the extent of about 2000 tons per week.

Business was done in the warrant market on Friday morning at from 49s. 5½d. to 49s. 1½d. cash and from 49s. 8d. to 49s. 4d. one month, the afternoon's quotations being 49s. ½d. to 48s. 11½d. cash, and 49s. 4d. to 49s. 5d. one month. On Monday the market opened strong, but subsequently declined, business being done in the forenoon at from 49s. 6d. to 49s. cash, and 49s. 4½d. to 49s. 3½d. one month; in the afternoon the quotations were 49s. to 48s. 7½d. cash, and 49s. 3d. to 49s. 1d. one month. On Tuesday the market was flat in the forenoon, business was done at 48s. 8d. to 48s. 4d. cash, and 48s. 11d. to 48s. 7d. one month, the afternoon's quotations being 48s. 3½d. to 48s. 6d. cash, and 48s. 7d. to 48s. 8d. one month. Business was done on Wednesday up to 49s. cash, the tone being a shade firmer. To-day—Thursday—the market was flat in the forenoon at 49s. eight days and 49s. 2d. one month, and 48s. 6d. cash. In the afternoon the market was quiet with a small business at 48s. 7½d. cash and 48s. 10½d. one month.

The quotations of makers' iron this week are again somewhat easier:—Gartsherrie, f.o.b. at Glasgow, No. 1, per ton, 58s. 6d., No. 3, 51s. 6d.; Coltness, 58s. 6d. and 52s. 6d.; Langloan, 59s. 6d. and 54s. 6d.; Summerlee, 58s. and 50s.; Calder, 58s. and 51s. 6d.; Carnbroe, 54s. and 50s.; Clyde, 51s. and 49s.; Monkland, 49s. 6d. and 47s. 6d.; Quarter, ditto ditto; Govan at Broomielaw, 50s. 6d. and 48s. 6d.; Shotts at Leith, 59s. and 54s. 6d.; Carron, at Grangemouth, 52s. (specially selected, 55s.) and 51s. 6d.; Kinneil, at Bo'ness, 49s. 6d. and 47s. 6d.; Glengarnock, at Ardrossan, 53s. 6d. and 50s. 6d.; Eglinton, 49s. 6d. and 47s. 6d.; Dalmellington, 49s. 6d. and 48s. 6d.

There is a continuance of activity in the malleable iron trade, the works being engaged upon orders received some time ago, but there is a lack of fresh work coming to hand just at present, and prices, though not officially altered, are a shade easier. In accordance with the recent award in the North of England, the wages of the malleable ironworkers in Lanarkshire have this week been increased by 7½ per cent. in the case of millmen and others engaged in the finishing departments, and 9d. per ton in the case of puddlers. This is the first substantial advance made in the wages of these men since the great decline in prices in 1874.

The cast iron pipe trade is at present very dull in its larger departments, that is to say, at the works where large water and gas pipes are made, the contracts in hand just now are almost run out, and those presently in the market are of small consequence. A number of light founders, too, have been slack, and indeed in most cases these works have been almost at a standstill for a month in consequence of a strike of moulders. In one or two cases where pressing orders were on hand the masters conceded the advance; but as a rule they have held out, believing that the condition of the trade does not warrant advance at present.

The coal trade is in a very good position as far as regards the output and the sale; but prices are small, and in a great many cases unremunerative. The shipments have been larger than usual at this time of the year. Those for the past week at Glasgow show a considerable reduction; but, taking the whole of the Scotch ports together, the exports seem upon the whole to have been very good, and exceed those of the corresponding week of 1881 by about 7000 tons. The coalmasters are at present endeavouring to form a compact for the purpose of restricting the output of coals. Whether they will be successful in this is doubtful. One or two districts may probably be got to agree to a temporary curtailment, but it is not believed that the masters generally will find it to their advantage to adopt such an agreement. The prices of all kinds of coals are nominally unchanged.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

A good deal of interest has been aroused in the district by the action of a Rhondda door boy against colliery owners. The case has been taken up by the Association of Miners against Messrs. Burnyeat, Brown, and Co., Abergorky Colliery, and the claim made is for £150 for injuries caused in the pit owing, it is alleged, to the neglect of the defendants. The case was tried this week at Pontypridd under the provision of the Employers' Liability Act, and after a patient hearing judgment has been deferred. The case is regarded as most important in the district, and upon the decision of the county court will hang a number, it is anticipated, of similar cases.

The inquiry into the fatality at Caedcoe has been adjourned. The pit has been under the charge of Mr. Kirkhouse and the usual management, and repairs have been so briskly carried on that an early resumption of work is certain. The loss entailed will be considerable, as the falls were heavy in the pit. It was most fortunate that the loss of life was so limited, the force which was exerted even in a margin around the pit's mouth showing what vast power for evil slumbers in these Rhondda pits, only awaiting an act of neglect or rashness to come into operation.

I am glad to learn that Mr. W. T. Lewis, general manager of the Bute Docks, has been unanimously elected president of the Mining Association of Great Britain. The object of the association principally is to watch all parliamentary movements appertaining to the mining interests of this country, and though Mr. Lewis is already overburdened with duties, it is thoroughly admitted that he is the best man for the duty.

Another good week's work has been accomplished, and the shipments both of steel rails and of coal show that the industries of Wales have been in a vigorous condition, and promise to continue.

The ferment elicited by the statement made before the Shipowners' Society by their chairman, Mr. Riches, relative to the limitation of the coal riches of Wales, has in a great measure subsided, and it is generally admitted that his fears are groundless. Still, this must also be admitted, and I have long maintained it, that the cost of production must increase as the workings become deeper, and that the price of coal of necessity must advance. No. 3 Rhondda and the four-feet steam are the coals that are now most diligently worked, and I shall not be surprised if for these special varieties there is not a higher figure demanded and obtained. I was in comparatively a virgin coal district a few days ago—the Taff Bargoed Valley. The Dowlais Company is just tapping it, but there we have all the best coals, for at least six miles, untouched. In fact, the Valley may be regarded as equal to the Valley of Aberdare or Merthyr previous to the beginning of their coal history, and it is a well-known historic fact that coal was worked in the Aberdare Valley a hundred years ago. The gross total of coals exported from the Welsh ports for foreign destinations during last week amounted to 162,199 tons. I note, however, that the changes are being rung again, and that while Cardiff in beginning to show signs of increase, Swansea is slightly falling off. Cardiff sent close upon 117,000 tons last week; Swansea 19,000.

A little agitation is being fanned in some of the local newspapers against the New Cardiff Dock Bill, but the back of the opposition is evidently broken, and a resort is had to the most paltry of excuses. It is urged, amongst other reasons, as detrimental, that under the new Act hobblers will have to pay a licence of £1 for permission to carry on their duty. If so, it would be better, just as with cabmen, to get properly appointed and responsible men to do the work.

The Taff Vale half-yearly meeting was held this week, and the dividend of 10 per cent. with 7 per cent. bonus confirmed. It was also agreed to increase the allowance to the ten directors to £3000 annually.

An interesting case to tin-plate manufacturers and ironmasters was decided this week at the Cardiff Assizes. Mr. Pontardulais claimed £120 from the Blaina Co. for non-delivery of coke bar. The plea set up was that the tin-plate company had not adhered to custom in tendering weight and specification of coke bars that were wanted, and this the court affirmed. The tin-plate is not in the best of conditions. Several mills are closed of late. The Gadlys Works, put up for auction, did not realise even a bid.

The iron and steel works are buoyant. Swansea tin-plate works are beginning to use steel bars.

Mr. Menelaus still remains at Tenby, and his general health is stated to be improving.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

*** *It has come to our notice that some applicants at the Patent-office Sales Department, for Patent Specifications, have caused much unnecessary trouble and annoyance, both to themselves and to the Patent-office officials, by giving the number of the page of* THE ENGINEER *at which the Specification they require is referred to, instead of giving the proper number of the Specification. The mistake has been made by looking at* THE ENGINEER *Index and giving the numbers there found, which only refer to the pages, in place of turning to those pages and finding the numbers of the Specification.*

Applications for Letters Patent.

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

14th February, 1882.

703. GAS ENGINES, C. T. Wordsworth, Leeds, and H. Lindley, Salford.
704. UMBRELLA FURNITURE, J. Knott, Sheffield.
705. MATCH-BOXES, J. Darling, Glasgow.
706. FASTENING NECKTIES, F. Valpy, Regent's Park.
707. ROLLING PAMPHLET COVERS, W. P. Thompson.—(*E. L. Miller and W. H. Rohrer, Washington, U.S.*)
708. SIGNALLING, W. Dredge and W. Cordner, London.
709. SHOES for HORSES, J. Camp, Lowestoft.
710. CONTROLLING STEAM, J. McCammon, Belfast.
711. DIMINISHING VIBRATIONS of SOUND, W. J. J. Robinson, Limerick, Ireland.
712. REPEATING MECHANISM, G. E. Vaughan. — (*J. Werndl, Steyr, Austria.*)
713. VALVE-COCK, W. R. Lake.—(*A. Bénoist, Paris.*)
714. LAMP-WICK, W. R. Lake.—(*G. Beck, Waco, U.S.*)
715. VENETIAN BLINDS, R. M. Chevalier, London.
716. PURIFYING GAS, E. Jones, Tottenham.
717. PRESERVING MILK, J. Bibo.—(*E. Scherff, Berlin.*)
718. CAUSING NAPS TO ADHERE TO HAT BODIES, E. K. Dutton.—(*G. Atherton, Stockport.*)
719. STEERING SHIPS, J. Cooke, Richmond, York.
720. OVENS, C. D. Abel.—(*W. Lorenz, Vienna.*)
721. TRAP for VERMIN, W. Burgess, Malvern Wells.
722. ARTICLE of FURNITURE, J. W. Randall, Chatham.

15th February, 1882.

723. REGULATING SPEED of STEAM ENGINES, G. B. Goodfellow and R. Matthews, Hyde, Chester.
724. GLASS GOBLETS, T. G. Webb, Miles Platting.
725. FEEDING SAWING MACHINES, R. Pope, Dumbarton.
726. BLOCKING BOOTS, S. Hudson, Belgrave.
727. VERTICAL STEAM BOILERS, A. Verey, Dover.
728. INDELIBLE INK, W. Reissig, Munich.
729. PACKING CASES, E. I. Billing, Cheltenham.
730. MEASURING ELECTRIC CURRENTS, C. Faure, Strand.
731. WHITE LEAD, &c., E. V. Gardner, London.
732. SULPHATE of ALUMINA, W. Gentles, Widnes.
733. SPINNING MACHINERY, C. H. Maxted, Galgate.
734. LOOMS, W. H. Hacking and E. Grube, Bury.
735. WARPING, &c., MACHINES, R. Hall and J. Walmsley, Bury, Lancaster.
736. PROPELLING TORPEDOES, J. H. Johnson.—(*W. F., A. K., M. M., and W. A. Johnston, New York, U.S.*)
737. FURNACES, J. H. Johnson.—(*E. Mallet, jun., N.Y.*)
738. CASES for LIQUIDS, J. Ferguson, Ashton Keynes.
739. ORNAMENTATION of METALS, G. Bower, St. Neots.
740. ELECTRIC LAMPS, A. M. Clark. — (*Solignac and Company, Paris.*)
741. URETHRAL SYRINGES, A. Clark.—(*F. Wilhöft, U.S.*)
742. REVOLVING SHOW STANDS, W. J. Lloyd, Harborne.
743. UTILISATION of SEWAGE, G. H. Gerson, Berlin.
744. CASES of SOCKET BOLTS, W. Randle, Birmingham.
745. REGULATING SPEED of WARP BEAMS, H. H. Lake. —(*Messieurs Tassigny frères et Compagnie, Paris.*)

16th February, 1882.

746. VENTILATING APPARATUS, T. Wintour, London.
747. REVOLVING CUTTER, A. H. Pear, Exeter.
748. WIRE TRAMWAYS, J. Brown, London.
749. TELEPHONIC EXCHANGE, G. L. Anders, London.
750. TRANSMITTING MOTION, W. Spence, London.
751. MOTIVE POWER, J. B. Howie, Glasgow.
752. GAS GOVERNORS, G. E. Webster, Nottingham.
753. TRAVELLING BUILDING, C. H. Keith, Bradford.
754. HOOKS for FASTENING PIPING, M. Benson, London. —(*J. N. Doremus, New Jersey, U.S.*)
755. APPLIANCES for WATER-CLOSETS, R. Weaver, London.
756. PRODUCING ELECTRIC CURRENTS, J. Brockie, Brixton, Surrey.
757. DYEING COTTON YARNS, G. W. von Nawrocki.—(*G. Fagenburg, jun., Rydboholm, Sweden.*)
758. TELEGRAPH INSTRUMENT, F. J. Cheesbrough.—(*W. A. Shaw, Brooklyn, U.S.*)
759. PURIFYING ANTHRACHINONE, J. A. Dixon.—(*J. Brönner, Frankfort-on-the-Main.*)
760. DYNAMO-ELECTRIC MACHINE, C. W. Siemens.—(*E. W. Siemens, Berlin.*)
761. DYNAMO-ELECTRIC MACHINES, C. J. Chubb, Clifton.
762. MAKING UP STRAW, &c., G. Kearsley and E. Whitworth, Ripon.
763. NUTS for SCREW BOLTS, R. Harrington, Wolverhampton.
764. OBTAINING MOTIVE POWER, H. H. Fanshawe, East Dulwich, and C. J. Griffith, Islington.
765. WORKING FERRIES, W. May, London.
766. GENERATION, &c., of ELECTRICITY, J. S. Williams, London.
767. CANS for PROVISIONS, J. S. Gates.—(*H. K. and F. B. Thurber and Co., New York, U.S.*)

17th February, 1882.

768. RAILS, &c., H. T. Grainger, Camberwell, London.
769. ATTACHING DOOR-KNOBS to SPINDLES, T. Weston. —(*B. H. Lockwood, Stamford, U.S.*)
770. BOLT FASTENINGS, E. Latham, Birkenhead.
771. PUNCHING HOLES, J. Tushaw, London.
772. LOCK-UP STANDS for BOTTLES, J. Ridge, Sheffield.
773. KNITTING MACHINES, J. Poole, Bradford.
774. PROTECTING WIRES, J. C. Mewburn.—(*A. M. Jarriant, jun., Paris.*)
775. PHOTOGRAPHY, R. T. Wall, Longfleet.
776. MARINE ENGINES, G. A. P. H. Duncan, London.
777. RECOVERING TIN, C. Abel.—(*Dr. Schulte, Germany.*)
778. FISH-JOINTS, F. C. Winby, Westminster.
779. PIANOFORTES, E. Outram, Greetland.
780. BRASSES, B. Greig and M. Eyth, Leeds.
781. DOOR FASTENINGS, A. Ashwell, West Dulwich.
782. WINDING YARNS, W. T. Stubbs, Manchester.
783. FOUNTAIN INK-HOLDERS, F. Benvenuti, Swansea.
784. MOWING MACHINES, W. Lake.—(*C. Levalley, U.S.*)

18th February, 1882.

785. TREATING TEXTILE FABRICS, J. B. Hutcheson and J. J. Dobbie, Glasgow.
786. VENTILATORS, J. M. Lamb, South Hampstead.
787. GUARDING SHIPS, W. H. Duncan, Coalbrook Dale.
788. HOOPS, T. Brown, Sheffield.
789. POTATO-PLANTING MACHINES, G. Murray, Banff.
790. ILLUMINATING LIGHTHOUSES, J. Wigham, Dublin.
791. EXHIBITING BUTTONS, W. Willeringhaus, London.
792. PLOUGHS, E. G. Lakeman, Modbury.
793. CONDENSERS, A. Craven, Bradford, and G. J. Warburton, Heckmondwike.
794. COLOURING LEATHER, W. A. Barlow.—(*E. Fernbach, Nancy, France.*)
795. PRODUCING WHITE PIGMENT, H. Knight, Liverpool.
796. TRICYCLES, J. Harrington, Coventry.
797. DISTRIBUTING MANURES, F. Robinson, Bradley.
798. RECOVERING SODA, H. C. F. Störmer, Paris.
799. ORGANS, &c , J. B. Hamilton, Greenwich.
800. CANDLESTICKS, J. Johnson.—(*J. Engelson, Naples.*)
801. WOODEN PACKING CASES, W. Crookes, York.
802. REFRIGERATORS, W. Morton and P. Robinson, Burton-on-Trent.
803. EXTINGUISHING FIRES, J. K. J. Foster, Bolton.
804. COMPOSITIONS for SHIPS' BOTTOMS, W. C. D. Holzapfel, Newcastle-on-Tyne.

20th February, 1882.

805. FORM of MINERAL TEETH, B. J. Bing, Paris.
806. STEAM BOILERS, J. Rapieff, London.
807. DRYING WOOL, J., C., and W. Whiteley, Lockwood.
808. ANIMAL CHARCOAL, J. G. Macfarlan, Richmond.
809. WATER FILTERS, F. Ross and A. Buxton, London.
810. VENTILATING VALVE, A. Buxton & F. Ross, London.
811. LUBRICATORS, J. Lumb, Elland.
812. SOLID LYE COMPOSITION, W. H. Beck.—(*C. M. Lévy and G. Alexandre, Paris.*)
813. CONNECTING BOATS to SHIPS, E. Evans, Sudbury.
814. COLOURING MATTER, C. Abel.—(*E. Jacobsen, Berlin.*)
815. DRILLING APPARATUS, F. J. Rowan, Glasgow.
816. CIGARETTE MACHINES, F. Davis, London.
817. STEREOTYPING, C. Parsonage, Liverpool.
818. REAPING MACHINES, W. P. Thompson.—(*W. F. Cochrane and J. L. Mothershead, Indianopolis, U.S.*)
819. ELECTRIC LIGHTING APPARATUS, S. Pitt.—(*E. T. Starr, Philadelphia, U.S.*)
820. CAMERA SHUTTERS, T. Vickers, Scarborough.
821. ELECTRIC TELEGRAPH, C. N. Talbot, New York.
822. CASTING INGOTS of STEEL, J. Ellis, Rotherham.
823. CASE for HOLDING PAINT, W. Lake.—(*F. Grout, U.S.*)
824. DRIVING STAPLES in PAPER, W. R. Lake.—(*I. W. Heysinger, Philadelphia, U.S.*)

Inventions Protected for Six Months on Deposit of Complete Specifications.

741. URETHRAL SYRINGES, A. M. Clark, Chancery-lane, London.—A communication from F. Wilhöft, New York, U.S.—*15th February*, 1882.

Patents on which the Stamp Duty of £50 has been paid.

593. CONTINUOUS BRAKES, T. G. Clayton, Derby.—*14th February*, 1879.
596. SHAFTS of ROLLERS for WASHING, &c., H. L. Wilson and J. Clegg, Clayton-le-Moors.—*14th February*, 1879.
612. ENDLESS BAND SAW FRAMES, H. Aylesbury, Bristol.—*15th February*, 1879.
633. VACUUM BRAKES, J. A. F. Aspinall, Dublin.—*17th February*, 1879.
728. SOAP SUBSTITUTE, J. Scharr, Bradford.—*22nd February*, 1879.
778. COOLING LIQUIDS, J. C. Mewburn, London.—*26th February*, 1879.
863. ELECTRIC LAMPS, C. D. Abel, London.—*4th March*, 1879.
1175. ELECTRIC CANDLES, J. Imray, London.—*24th March*, 1879.
584. LOOMS, J. Hollingsworth, Dobcross.—*14th February*, 1879.
608. WHEELS, G. D. Owen and R. Dyson, Rotherham. —*15th February*, 1879.
616. PNEUMATIC BRAKE, F. W. Eames, Leeds.—*15th February*, 1879.
693. LUBRICATING STRANDS, J. T. Wright and W. H. Laidler, Poplar.—*20th February*, 1879.
618. VENTILATING BUILDINGS, B. J. B. Mills, London. —*15th February*, 1879.
635. CUTTING MORTICES, J. Phillips, London.—*17th February*, 1879.
668. LAMPS, &c., E. A. Rippingille, London.—*19th February*, 1879.
687. COLLECTING WASTE FUMES, W. R. Lake, London. —*20th February*, 1879.
723. CARD-SETTING, W. Morgan-Brown, London.—*22nd February*, 1879.
813. BEDSTEADS, &c., E, Lawson and G. Hogetts, Birmingham.—*28th February*, 1879.
630. OBTAINING MOTIVE POWER, G. Tellier, Paris.— *17th February*, 1879.
632. LITHOGRAPHING, G. Newsum, Leeds.—*17th February*, 1879.
659. FEEDING FURNACES, W. O. Johnston, Seghill, and W. S. Vaughan, Newcastle-upon-Tyne.—*19th February*, 1879.
679. MARINERS' COMPASS, W. Thomson, Glasgow.—*20th February*, 1879.
1096. PATTERNS, T. Butler, Smethwick.—*19th March*, 1879.
1933. GAS ENGINES, C. M. Sombart, Magdeburg.—*14th May*, 1879.
625. COMBING WOOL, W. Terry and J. Scott, Bradford. —*17th February*, 1879.
640. BARS of GRATES, C. Hill, Poplar.—*18th February*, 1879.
785. BUTTONS, R. Gottheil, Berlin.—*26th February*, 1879.
682. HANSOM CABS, &c., J. Spencer, London.—*20th February*, 1879.

Patents on which the Stamp Duty of £100 has been paid.

876. DRAWING HEMP, &c., A. V. Newton, London.—*9th March*, 1875.
559. TRANSFERRING GRAIN, W. Goodwin, Liverpool.— *16th February*, 1875.
730. VENTILATING APPARATUS, J. Currall, Birmingham. —*27th February*. 1875.
599. PERMANENT WAY, J. Livesey, London.—*18th February*, 1875.
569. MOTIVE POWER ENGINES, J. T. King, Liverpool. —*17th February*, 1875.
608. LITHOGRAPHIC, &c., MACHINES, W. Thomson, Edinburgh.—*19th February*, 1875.

Notices of Intention to Proceed with Applications.

Last day for filing opposition 10*th March*, 1882.

4248. PETROLEUM LAMP BURNERS, B. Schwarz and R. Huppertsberg, Berlin.—*1st October*, 1881.
4423. SLATES, W. A. Barlow, London.—A communication from T. Finger.—*11th October*, 1881.
4429. PRESERVING HAY, &c., G. W. F. Swarbrick, Tottenham.—*11th October*, 1881.
4440. INDICATORS, A. Budenberg, Manchester.—A com. from C. Budenberg & B. Schaeffer.—*12th October*, 1881.
4446. OBSERVING the WORKING of PUMPS, S. Lees and T. Allison, Huddersfield.—*12th October*, 1881.
4460. TENTERING FABRICS, J. L. Norton, Piccadilly, London.—*13th October*, 1881.
4465. STRETCHING WOVEN FABRICS, J. Lodge, Huddersfield, and M. Oldroyd, Dewsbury.—*13th October*, 1881.
4477. GYMNASTIC APPARATUS, A. W. Turner, Birmingham.—*14th October*, 1881.
4479. ELLIPTICAL SPRINGS, F. Joynes, Sheffield.—*14th October*, 1881.
4481. ROTARY PUMP, L. A. Groth, London.—A communication from H. Himmelman.—*14th October*, 1881.
4487. LAMPS. J. Bennett, King's Heath, and J. Herd and B. Walker, Edgbaston.—*14th October*, 1881.
4491. SODA, J. Imray, London.—A communication from La Société Anonyme des Produits Chimiques du Sud-Ouest.—*14th October*, 1881.
4492. VELOCIPEDES, W. Harrison, Manchester.—*14th October*, 1881.
4497. MANGLING MACHINES, H. J. Haddan, London.— A com. from J. Kinleyside.—*15th October*, 1881.
4499. LOOMS for WEAVING, S. O'Neill, Castleton.—*15th October*, 1881.
4501. SACCHARIFICATION of RAW GRAIN, A. Manbré, Finsbury, London.—*15th October*, 1881.
4517. PROPELLING VESSELS, M. Hedicke, London.—A communication from H. Grauel.—*17th October*, 1881.
4533. ELECTRIC LAMPS, R. R. Gibbs, Liverpool.—*18th October*, 1881.
4557. WATER-CLOSETS, J. A. Hornby, Anglesea.—*19th October*, 1881.
4641. TARGETS, W. R. Lake, London.—A communication from A. Boivin.—*22nd October*, 1881.
4644. CLEANING BRUSHES, E. S. Norcombe, Birmingham.—*25th October*, 1881.
4715. WAX PAPER, W. R. Lake, London.—A communication from W. B. H. Dowse.—*27th October*, 1881.
4747. WIGS, &c., J. H. Johnson, London.—A communication from G. Petit.—*29th October*, 1881.
4748. GALVANIC BATTERIES, W. R. Lake, London.—A com. from J. F. Aymonnet.—*29th October*, 1881.
4899. COLOURING MATTERS, J. Imray, London.—A com. from H. Koechlin.—*9th November*, 1881.
4911. CARDING ENGINES, W. T. Cheetham, Manchester. —A communication from J. Konshin and W. Charnock.—*9th November*, 1881.
5283. CLEANSING, G. F. Redfern, London.—A communication from H. Buczkowski.—*2nd December*, 1881.
5390. PURIFYING SEWAGE, F. Petri, Berlin.—*9th December*, 1881.
5430. TELEPHONES, A. W. Rose, Kirby-street, London. —*12th December*, 1881.
5550. ODOMETERS, W. P. Thompson, London.—A communication from P. McDonnell.—*19th December*, 1881.
5553. PACKING for STEAM ENGINES, J. Chapman, Forest Gate, and R. Harper, London.—*19th December*, 1881.
5648. WROUGHT NAILS, J. Grimshaw, Leeds.—*24th December*, 1881.
5744. MARINE GOVERNORS, J. G. H. Batchelor, Liverpool.—*31st December*, 1881.
200. MULTIPLYING COPIES, H. E. Tyler, Edmonton.— *14th January*, 1882.
257. OBTAINING MOTIVE-POWER, A. J. Lehmann, West Hartlepool.—*18th January*, 1882.
262. WAX-THREAD SEWING MACHINES, H. Lake, London. —A com. from D. H. Campbell.—*19th January*, 1882.
268. EXTRACTING SOLIDS from REFUSE WATER, P. Lowe, Darwen.—*19th January*, 1882.
277. STEAM PUMPING ENGINES, &c., W. D. Hooker, St. Louis, U.S.—*19th January*, 1882.
281. SELF-ACTING GRABS, J. H. Johnson, London.—A com. from C. W. Maclean.—*18th January*, 1882.
284. VESSELS for SUBMARINE PURPOSES, T. Teodoresco, Galatz, Roumania.—*19th January*, 1882.
288. BLEACHING and DYEING COTTON, &c., J. Auchinvole, Glasgow.—*20th January*, 1882.
309. BOXES, H. Stevenson, Manchester.—*21st January*, 1882.
333. ELECTRIC CABLES, T. J. Handford, London.—A com. from P. B. Delany.—*23rd January*, 1882.
373. SHUTTLES, J. R. Richards, Kirkham, near Preston. —*25th January*, 1882.
416. BLAST FURNACES, J. Cliff, Frodingham, and J. H. Dawes, Messingham.—*27th January*, 1882.
650. VELOCIPEDES, H. A. Dufrené, London.—A communication from A. Mange.—*10th February*, 1882.

Last day for filing opposition, 14*th March*, 1882.

4503. SAFETY APPARATUS, &c., C. Gall, Halifax, York. —*15th October*, 1881.
4506. VENTILATING, &c., FIRES, J. Onions and W. H. Tooth, London.—*15th October*, 1881.
4516. BOTTLES, &c., B. Azulay, London.—*17th October*, 1881.
4528. CORKING MACHINES, F. H. F. Engel, Hamburg. —A com. from Boldt and Vogel—*17th October*, 1881.
4529. REVOLUTION INDICATORS, F. H. F. Engel, Hamburg.—A com. from J. Eggers.—*17th October*, 1881.
4530. ATTACHING VALANCES, M. A. Deardon, Doncaster.—*18th October*, 1881.
4534. RINSING BOTTLES, J. Dollheiser, Cologne.—*18th October*, 1881.
4536. HOT-BLAST, H. H. Lake, London.—A communication from J. C. Long.—*18th October*, 1881.
4539. TIRES for WHEELS, W. H. Carmont, Manchester. —*18th October*, 1881.
4543. BOOTS and SHOES, H. Ovans, Dublin.—*18th October*, 1881.
4545. STEAM BOILERS, G. Hill, Liverpool.—*18th October*, 1881.
4558. REGISTERING DYNAMOMETERS, W. P. Thompson, London.—A communication from The Transmitting Dynamometer Company.—*19th October*, 1881.
4560. STEAM BOILERS, S. Fox, New Wortley, Leeds.— *19th October*, 1881.
4574. HEATING TUBES, S. Fox, New Wortley, Leeds.— *19th October*, 1881.
4575. TESTING STRENGTH, S. Fox, New Wortley, Leeds. —*19th October*, 1881.
4585. FOWLING PIECES, L. Gye, Middlesex.—*20th October*, 1881.
4655. REGENERATIVE STOVES, J. Hartley, Barrow-in-Furness.—*24th October*, 1881.
4767. FURNACES, W. P. Thompson, London.—A communication from E. A. Prevost.—*1st November*, 1881.
4819. MOTORS, W. L. Wise, London.—A communication from E. Bürgin.—*3rd November*, 1881.
4820. ELECTRIC LAMPS, W. L. Wise, London.—A communication from E. Bürgin.—*3rd November*, 1881.
4876. VENTILATING, W. Teague, Illogan.—*8th November*, 1881.
4938. STOPPING CARS, C. E. Davidson, Stamford Hill. —*11th November*, 1881.
4997. LUBRICATOR, T. Allison and G. Senior, Milnsbridge.—*15th November*, 1881.
5049. SELF-LUBRICATING BEARINGS, W. Lake, London. —A com. from P. Decauville.—*17th November*, 1881.
5419. LOCKS, G. H. Chubb, London, and H. W. Chubb, Chislehurst.—*10th December*, 1881.
5599. INSULATED CONDUCTORS, W. Smith, London.— *21st December*, 1881.
5645. PREPARING COTTON, &c., J. Walker, Hyde.—*24th December*, 1881.
5674. TYPE-PRINTING TELEGRAPHS, S. Pitt, Sutton.—A com. from H. V. Hoevenbergh.—*27th December*, 1881.
5740. HOISTS, &c., J. and J. T. Pickering, Stockton-on-Tees.—*31st December*, 1881.
129. LIGHTING TRAINS, W. H. Preece and J. James, London.—*10th January*, 1882.
160. FASTENING STAY BUSKS, J. E. Salisbury, Sheffield.—*12th January*, 1882.
180. GAS BURNERS, F. Siemens, London.—*12th January*, 1882.
190. GAS KILNS, D. T. and W. H. Thompson, Leeds.— *13th January*, 1882.
238. LUBRICATING SPINDLES, J. Dodd and J. Little, Oldham.—*17th January*, 1882.
276. VENTILATING URINALS, &c., T. Rowan, London.— *19th January*, 1882.
287. EARTHENWARE, W. Boulton, Burslem.—*20th January*, 1882.
303. STEREOTYPE PLATES, T. Sowler and W. Ward, Manchester.—*21st January*, 1882.
310. GOVERNORS, W. Knowles, Bolton.—*21st January*, 1882.
334. VACUUM PUMPS, C. D. Abel, London.—A communication from J. Patrick.—*23rd January*, 1882.
361. CONDUCTORS, W. R. Lake, London.—A communication from H. A. Clark.—*24th January*, 1882.
366. POWER LOOMS, S. C. Lister and J. Reixach.—*24th January*, 1882.
388. TRANSFERRING DESIGNS, J. M. Moss, Patricroft.— *26th January*, 1882.
398. MAKING SUGAR, C. Scheiber, Berlin.—*26th January*, 1882.
400. PROPELLER, C. Corneby, Poplar.—*26th January*, 1882.
402. SAWING WOOD, T. N. Robinson, Rochdale.—*26th January*, 1882.
409. STEAM BOILERS, M. Ashworth, Stacksteads.—*27th January*, 1882.
482. LATCHES, &c., E. R. Wethered, Woolwich.—*31st January*, 1882.
488. PACKING PARTS of ENGINES, W. R. Lake.—A communication from the Matthews Steam Spring Packing Company.—*31st January*, 1882.
490. SPRING MOTOR, W. R. Lake, London.—A communication from W. T. Larimore.—*31st January*, 1882.
616. PURIFYING MIDDLINGS, W. R. Lake, London.—A communication from The Electric Purifier Company, Incorporated.—*8th February*, 1882.

Patents Sealed.

(*List of Patent Letters which passed the Great Seal on the 17th February*, 1881.)

3647. STEERING APPARATUS, J. Walker, W. Thompson, jun., and T. Thompson, jun., Seaham Harbour, Durham.—*22nd August*, 1881.
3648. HEATING APPARATUS, W. H. Stephenson, Blackburn.—*22nd August*, 1881.
3687. SLIDE VALVES, C. de Lucia, Naples, Italy.—*24th August*, 1881.
3698. TUYERES, C. J. Brock, London.—*25th August*, 1881.
3699. SEWING MACHINES, J. Sefton, Belfast. — *25th August*, 1881
3705. EXTRACTING, &c., PARAFFIN WAX, O. Herrlich, London.—*25th August*, 1881.
3737. RAMMING ASPHALT, H. Knoblauch, Berlin.—*27th August*, 1881.
3766. PREVENTING WASTE of WATER, W. H. Cutler and J. Chapman, Eton.—*30th August*, 1881.
3785. OBTAINING PRODUCTS from GASES, J. Alexander and A. K. McCosh, Lanark.—*31st August*, 1881.
3815. STAY BUSKS, H. and B. G. Simpson.—*2nd September*, 1881.
3842. SHUTTLES for WEAVING, S. Tweedale, Accrington.—*3rd September*, 1881.
3855. LUBRICANTS, W. J. L. Hollis, London.—*5th September*, 1881.
4036. CIGAR LIGHTERS, W. Clark, Chancery-lane, London.—*19th September*, 1881.
4062. SHREDDING SUGAR CANE, W. P. Thompson, London.—*21st September*, 1881.
4350. SHOVELS, &c., T. Titley, Leeds. — *6th October*, 1881.
4381. INDIGO PRINTING, F. Wirth, Frankfort-on-the-Main.—*8th October*, 1881.
4596. WASHING BOTTLES, J. J. Harvey, Kidderminster. —*20th October*, 1881.
5098. HEATING BLAST, T. F. Harvey, Dowlais.—*22nd November*, 1881.
5257. PURIFYING METALS, S. Pitt, Sutton.—*1st December*, 1881.
5380. DETACHING BOATS, E. J. Hill and J. L. Clark, London—*9th December*, 1881.
5584. EXPLOSIVE COMPOUND, H. H. Lake, Southampton-buildings, London.—*21st December*, 1881.
5590. PREVENTING SLAMMING of DOORS, H. H. Lake, London.— *21st December*, 1881.
5596. CARTRIDGES, H. H. Lake, Southampton-buildings, London.—*21st December*, 1881.
5670. TIMEPIECES, W. L. Wise, Westminster.—*27th December*, 1881.
5695. BACKS, &c., of BRUSHES, &c., H. J. Haddan, London.—*28th December*, 1881.

(*List of Letters Patent which passed the Great Seal on the 21st February*, 1882.)

3657. CASTS, COPIES, &c., J. J. Sachs, Sunbury.—*22nd August*, 1881.
3659. LOCOMOTIVE ENGINES, W. Morgan-Brown, Southampton-buildings, London.—*23rd August*, 1881.
3660. DRYING APPARATUS for SUGAR, &c., W. Morgan-Brown, London.—*23rd August*, 1881.
3661. VALVE STEM SUPPORTS, W. Morgan-Brown, London.—*23rd August*, 1881.
3663. FURNACE FIRE-BAR, J. G. Galley, Upton.—*23rd August*, 1881.
3676. VALVES, J. Smith, jun., and S. J. Johnson, Millwall, London.—*23rd August*, 1881.
3688. SEWING MACHINES, A. Watkins, London.—*24th August*, 1881.
3704. CRUSHING GOLD ORE, J. M. Stuart, Queen Victoria-street, London.—*25th August*, 1881.
3713. BATHS, C. D. Douglas, London.—*25th August*, 1881.
3719. RULING MACHINES, J. Wetter, New Wandsworth. —*25th August*, 1881.
3724. SHIPS, A. M. W. Samson, Northolt, near Southall. —*26th August*, 1881.
3729. RANGE-FINDERS, F. Charteris, London.—*26th August*, 1881.
3734. FISHING and other NETS, R. Balderston, Paisley. —*26th August*, 1881.
3738. HEATING by GAS, T. Haskell and J. P. Bayly, London.—*27th August*, 1881.
3739. RAILWAY BRAKES, J. Pilbrow, Tunbridge Wells. —*27th August*, 1881.
3752. EASEL, J. Kellett, Bradford.—*29th August*, 1881.
3762. AUTOGRAPHIC TRANSFERS, A. M. Clark, Chancery-lane, London.—*29th August*, 1881.
3767. STEAM ENGINE, J. H. Fox, Farnborough.—*30th August*, 1881.
3772. REMOVING TIN from TIN-PLATES, A. Gutensohn, London.—*30th August*, 1881.
3786. GAS-MOTOR ENGINES, J. J. Butcher, Gateshead. —*31st August*, 1881.
3797. BOTTLE-WASHING MACHINES, D. C. Foster, Hull. —*31st August*, 1881.
3827. RUCHED FABRICS, C. D. Abel, Southampton-buildings, London.—*2nd September*, 1881.
3841. MINCING MEAT, F. J. Gardner, Birmingham.— *3rd September*, 1881.
3925. LOCKING DEVICES for ROOFS of CARRIAGES, G. W. von Nawrocki, Berlin.—*10th September*, 1881.
3936. HARVESTING APPARATUS, H. K. Stone, Hull.— *12th September*, 1881.
3937. DIRECT-ACTING STEAM PUMPS, G. Heywood and S. Spencer, Radcliffe Bridge.—*12th September*, 1881.
3952. LIFEBOATS, J. Wetter, New Wandsworth, London. —*13th September*, 1881.
4117. SELF-FILLING BUCKETS, G. Allix, jun., Isle of Dogs, London.—*24th September*, 1881.
4125. COMBING WOOL, &c., J. F. Harrison, Bradford.— —*24th September*, 1881.
4284. DISTILLING SHALE, G. T. Beilby, Mid-Calder, N.B.—*3rd October*, 1881.
4515. APPLYING COLD AIR in ICE-MAKING, J. Sturgeon, Liverpool, and J. W. de V. Galwey, Warrington.— *17th October*, 1881.
4595. SASH FASTENERS, J. G. Chillingworth, London. —*20th October*, 1881.
4630. WIRE FENCES, F. C. Guilleaume, Cologne, Germany.—*22nd October*, 1881.
4813. TIN ROLLERS, W. Gledhill, Mossley.—*3rd November*, 1881.
4909. FLOATING APPARATUS, J. Webster, Solihull.—*9th November*, 1881.
5140. TELEGRAPHIC SIGNALLING, A. C. Brown and H. A. C. Saunders, London.—*24th November*, 1881.
5226. COUPLING BRANCH for CABLES, A. W. Brewtnall, London.—*29th November*, 1881.
5309. MATERIALS for ELECTRIC INSULATION, J. A. Fleming, Nottingham.—*5th December*, 1881.
5347. SCALES, J. Post, London.—*7th December*, 1881.
5469. GAS-MOTOR ENGINES, F. W. Crossley and H. P Holt, Manchester.—*14th December*, 1881.

List of Specifications published during the week ending February 18th, 1882

1472, 6d.; 2857, 1s. 4d.; 2885, 6d.; 2886, 6d.; 2905, 6d.; 2907, 6d.; 2911, 6d.; 2915, 8d.; 2917, 6d.; 2919, 6d.; 2920, 6d.; 2924, 8d.; 2926, 6d.; 2927, 6d.; 2928, 6d.; 2931, 8d.; 2938, 8d.; 2941, 6d.; 2953, 6d.; 2954, 6d.; 2955, 6d.; 2958, 6d.; 2961, 8d.; 2962, 8d.; 2968, 6d.; 2962, 6d.; 2970, 6d.; 2977, 6d.; 2981, 6d.; 2982, 6d.; 2986, 6d.; 2988, 8d.; 2989, 6d.; 2990, 8d.; 2992, 6d.; 2994, 6d.; 2995, 6d.; 2996, 6d.; 2999, 4d.; 3000, 6d.; 3003, 6d.; 3009, 8d.; 3014, 6d.; 3018, 4d.; 3020, 6d.; 3021, 6d.; 3022, 6d.; 3024, 6d.; 3027, 6d.; 3028, 6d.; 3030, 8d.; 3034, 4d.; 3036, 4d.; 3037, 6d.; 3038, 4d.; 3042, 6d.; 3043, 2d ; 3046, 6d.; 3049, 6d.; 3050, 6d.; 3051, 8d.; 3052, 6d.; 3053, 6d.; 3054, 6d.; 3055, 6d.; 3056, 6d.; 3064, 6d.; 3067, 6d.; 3068, 6d.; 3078, 6d.; 3079, 6d.; 3080, 6d.; 3081, 6d.; 3089, 6d.; 3090, 6d.; 3091, 6d.; 3094, 6d.; 3095, 10d.; 3099, 8d.; 3101, 2d.; 3104, 2d.; 3105, 2d.; 3107, 2d.; 3108, 2d.; 3109, 2d.; 3110, 2d.; 3112, 2d.; 3113, 6d.; 3115, 2d.; 3117, 2d.; 3118, 2d.; 3120, 2d.; 3121, 2d.; 3122, 2d.; 3124, 2d.; 3129, 2d.; 3133, 2d.; 3136, 2d.; 3138, 2d.; 3144, 2d.; 3146, 4d.; 3153, 2d.; 3154, 2d.; 3168, 4d.; 3169, 4d.; 3172, 2d.; 3174, 2d.; 3177, 4d.; 3183, 2d.; 3185, 2d.; 3197, 2d.; 3198, 2d.; 3205, 2d.; 3209, 6d.; 3250, 6d.; 3275, 6d.; 3304, 6d.; 4154, 4d.; 4249, 4d.; 4093, 4d.

*** Specifications will be forwarded by post from the Patent-office on receipt of the amount of price and postage. Sums exceeding 1s. must be remitted by Post-office order, made payable at the Post-office, 5, High Holborn, to Mr. H. Reader Lack, her Majesty's Patent-office, Southampton-buildings, Chancery-lane, London.

TIMBER for posts is rendered almost proof against rot by thorough seasoning, charring, and immersion in hot coal tar.

ABSTRACTS OF SPECIFICATIONS.

Prepared by ourselves expressly for THE ENGINEER *at the office of Her Majesty's Commissioners of Patents.*

1472. STEAM STEERING GEAR, &c., *G. W. Robertson, Glasgow.—5th April*, 1881. 6*d.*

This consists of an engine with three oscillating cylinders, the pistons of which are all connected to one crank. The cylinders are formed with trunnions mounted in bearings between two vertical standards or frames, and one of the trunnions of each cylinder is constructed hollow and connected to a pipe leading to a chest wherein a slide valve is situated. The pipe is divided into two parts by a diaphragm or web, extending throughout its length, and its inner end, which is closed, bears against a valve face in the hollow trunnion. In the said face and in the end of the pipe six ports or passages are preferably made, three of the said ports or passages in the pipe communicating with the space on one side of the longitudinal diaphragm, and three with the space on the opposite side. In the hollow trunnion the ports in like manner communicate with two other ports leading into one end of the cylinder, and separated from each other by a diaphragm or web. The engine is caused to steer the ship by keying on the crank shaft a spur pinion, which is geared with a corresponding wheel placed loosely upon a sleeve, also loosely surrounding the steering shaft, and having a pinion formed on one end of it, which gears with a wheel running loosely on a sleeve surrounding the crank shaft. To the said wheel the "gipsy" or actuating pulley for the steering chain is secured.

2857. PUMPS, VENTILATORS, &c., *K. W. A. Leverkus, Manchester.—30th June*, 1881. 1*s.* 4*d.*

This relates to the use of a new form of ladle in centrifugal pumps, &c., whereby the water is caused to leave the wheel of the pump in a direction nearly tangential, say in an angle of 1 to 2 or at the outside 5 deg. The ladle is in the form of a varying archimedean spiral, that is a line in the polar equator of which $r = a \times w$; the factor a is variable, r being the radius vector and w the polar angle. In the case of low lifts the sides for the discs or wheels are made divergent.

2885. CRANES OR HOISTS FOR WORKING EXCAVATORS, &c., *W. D. Bruce, Calcutta.—2nd July*, 1881. 6*d.*

This relates to cranes for working excavators, skips, or other appliances in which the blades are opened and closed to deposit or excavate the materials. To the crane winch a barrel is fitted consisting of two drums, one fixed and the other loose on its spindle, the latter being provided with a friction brake, and the former with keys to lock the loose drum when necessary to raise the excavator with the blades open, the keys being thrown in or out of gear with the loose drum by a sliding disc on the shaft worked by a forked lever. The two drums are formed with swings on their inner ends for limiting the rotation of the loose drum in either direction, independent of the fixed drum, to the extent required to open or close the blades of the excavator. The opening and lowering rope is coiled on to the loose drum, and the lifting and closing rope on the fixed drum.

2886. MAKING CASKS, &c., *F. McC. Scott, Liverpool.—2nd July*, 1881.—(*A communication from J. Stark, Ontario, Canada.*) 6*d.*

This relates to machines for making casks, and in one form it consists of a barrel drum arranged so that by actuating a single lever fixed on the machine, and coupled to other levers, toggles, &c., the drum can be collapsed when the barrel rim is finished.

2905. PURIFYING FEATHERS, *J. Martin, Liverpool.—4th July*, 1881. 6*d.*

The object is to cleanse, scald, and bake feathers, &c., in a single machine, which consists of a fixed cylindrical drum with an opening at top to admit the feathers, and another at the bottom to allow them to leave the machine. A central revolving axle carries a wire gauze barrel, so that air can pass freely through it, and on its outer surface are teeth or beaters to act on the feathers. The drum is composed partly of plates heated by steam and partly of sieves to allow the escape of dust and steam.

2907. CUT NAILS AND TACKS, *B. J. B. Mills, London.—4th July*, 1881.—(*A communication from D. J., J. P., and S. Farmer, New York, U.S.*) 6*d.*

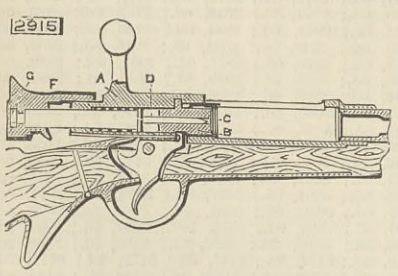
This consists in part in rolling sheets with a succession of transverse ridges forming inclined planes, cutting them up into nail plates converging from side to side in a direction longitudinal to the fibre of the metal, cutting up the plates into tapered nail or tack blanks with the fibre lengthwise of the blank, and heading such blanks with suitable cut nail or tack machinery.

2911. MECHANICAL STOKERS, *T. B. Kay, Bolton-le-Moors, and R. Heywood, Salford.—4th July*, 1881. 6*d.*

This relates to that class of mechanical stokers in which the fire-bars are caused to move automatically, and consists in the application of an intermittent lock motion between the driving pulley and the main cam or excentric shaft, consisting of a spur wheel provided with a snug, an extra segment of teeth and a lock-rim actuating a pinion provided with a tappet-finger and a lock plate, whereby the fire-bars may be alternately moved and held stationary with their upper surfaces in the same plane, instead of being moved continuously as hitherto. A cam surface on the spur wheel actuating a lever on the reciprocating shaft or a supplementary toothed pinion connected with the feed plate and actuated by the segment on the spur wheel may be employed to effect the feed.

2915. BREECH-LOADING FIRE-ARMS, *C. D. Abel, London.—4th July*, 1881.—(*A communication from F. Mannlicher, Vienna.*) 8*d.*

According to the arrangement shown in the drawing, the breech bolt consists of a hollow locking bolt A sliding in the slotted extension of the breech, and containing in its front end the breech plug B, into a central hole C of which enters the pin of the striker D, which is situated in the locking bolt at the rear of the breech plug, where it is urged forward by a helical spring. The striker bolt D passes through the rear end of the locking bolt A, and is connected to a cocking trigger F by means of two side lugs G that pass through corresponding slots in the trigger block F, so that if the latter is then turned partly round on the striker bolt it is held on the latter between the said lugs, and a shoulder formed thereon at a short distance from the lugs. Other improvements are described.



2917. THREAD BOBBINS OR WINDERS FOR SEWING MACHINES, &c., *G. W. von Nawrocki, Berlin.—4th July*, 1881—(*A communication from A. Engisch, Switzerland.*) 6*d.*

Two pieces of flat cardboard are stamped to a configuration presenting a middle part with straight parallel sides, and provided with projections on either side at each end, and each piece is then stamped in a die so as to form a semi-cylindrical groove extending along its middle parallel with the straight sides. The two pieces are secured together so that the grooves form together a cylindrical hole, by means of which the flat bobbin can be mounted on a spindle to have thread wound on it, and then placed on the pin of the sewing machine.

2919. EXPLODING GASES IN GAS ENGINES, *W. Watson.—4th July*, 1881. 6*d.*

The gases are exploded by intermittently introducing into the explosion chamber a piece of metal or other suitable material in a state of incandescence. The metal or other piece has a reciprocating movement imparted to it, and fits the opening in the explosion chamber so that no gas can escape.

2920. SCREW APPARATUS FOR CONVEYING CEMENT, &c., FROM PLACE TO PLACE, *W. W. Hewitt, Swanscombe, Kent.—4th July*, 1881. 6*d.*

A metal trough of U form contains an axis with two, three, or more blades. The trough is cast in lengths and joined together by flanges, a cross piece being formed across one end of each length to form a bearing for the axis. The axis is also in lengths and of square section, except at the bearings. The screw is in sections, consisting of a boss with an opening for the axis and two or more blades on opposite sides.

2924. COMBINED STEAM AND HAND STEERING ENGINES, *G. W. Robertson, Glasgow, and I. Beck, Sheffield.—5th July*, 1881. 8*d.*

This consists, First, in a three-cylinder oscillating steam engine of the arrangement and combination of parts whereby steam is admitted and exhausted from the cylinder; Secondly, in the arrangement and combination of parts constituting the connection between the slide valve and the steering shaft, and consisting of a screwed spindle, rack, and wheel, bevel gearing and, sleeve.

2926. METALLURGIC FURNACES, *H. A. Bonneville, Paris.—5th July*, 1881.—(*A communication from W. Moller, New York, U.S.*)—(*Complete.*)—(*Void.*) 6*d.*

This consists in the combination in a metallurgic furnace of a retort placed in and surrounded by the wall of the furnace, a smoke flue extending from the fireplace round the retort to the smoke stack, and an air flue formed in the wall, and open at one end to the atmosphere, and communicating at the other with the retort, also in the combination with the furnace of two pairs of retorts.

2927. PROPELLING AND STEERING ROAD VEHICLES BY THE HANDS AND FEET, *J. Simmons, Brixton.—5th July*, 1881. 6*d.*

A rectangular frame mounted between two large driving wheels on a double cranked axle has across it on each side of the axle a seat opposite each crank, a small steering wheel supporting the frame behind. On the crank pins are reels over which pass bands, carrying at their other ends treadles attached by cords to the seats. The riders take hold of the reels and place the feet on the treadles. The steering wheel, as well as being capable of being worked by hand, can also be worked by the feet.

2928. ATTACHING AND DETACHING HORSES' HARNESS TO OR FROM CARRIAGES, *C. D. Abel, London.—5th July*, 1881.—(*A communication from H. Fleischhauer, Berlin.*) 6*d.*

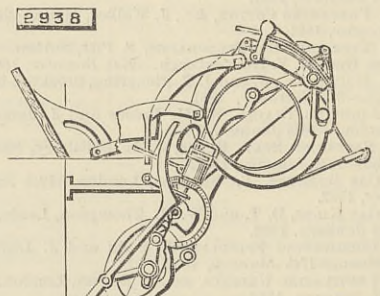
At each end of the splinter bar there is a bracket with a horizontal slot to receive the flat end of the trace, and above which is a vertical pin capable of sliding up and down within the casing, so as to pass through or be withdrawn from a hole in the trace, and enter or leave a recess in the slot below it. The pin is raised by cams actuated by suitable levers, worked either by hand or foot, its return being effected by a spring.

2931. GAS ENGINES, *E. de Pass, London.—5th July*, 1881.—(*A communication from E. Körting, Hanover.*) 8*d.*

The engine is characterised by a special mixing valve for the explosive gases; a particular method of igniting such gases; a particular method of regulating the quantity of gases to be exploded according to the desired power; and lastly, by a special automatic apparatus to lubricate the working parts.

2938. AUTOMATIC OR SELF-BINDING ATTACHMENTS TO HARVESTING MACHINES, *W. P. Thompson, Liverpool.—5th July*, 1881.—(*A communication from H. D. Blakemore, Cincinnati, U.S.*) 8*d.*

The invention consists in mounting the binder arm or needle upon a rocking frame or support, and causing it to rock inward toward or over the grain table, descend, carrying the band around the gavel, which it separates from the incoming stream of grain, and then rock outward and discharge the bound bundle; in mounting the binding arm and band-securing mechanism to rock or oscillate in unison, and so actuating them that the gavel is gathered and encircled by the descent of the binder arm at the end of inward traverse, and the ends of the band united by the operation of the band-securing mechanism as the arm is pushing the gavel before it, and towards the discharging point on the outward traverse in a compressor to compress it and give form to the bundle, and to relieve the board and band-applying devices of this duty of the strain incident thereto.



2941. BOXES OR CASES, *C. R. E. Bell, London.—5th July*, 1881. 6*d.*

To produce boxes for wax vestas, &c., the sheets of cardboard are covered with cloth or coloured paper, and then cut and stamped to form the sides of the box lid or body. The edge of one side of the box is formed with a groove, while those of the other side are formed to fit such groove, the two parts being united by a press that turns the edges one into the other, thereby forming a box having the appearance of being in one piece without joints.

2953. THERMOMETER, *M. Immisch, London.—5th July*, 1881. 6*d.*

This relates to a thermometer for clinical purposes, and consists essentially of a volute tube either filled with a highly expansive fluid, or exhausted of air, and the surrounding space of the case filled with a highly expansive and heat-absorbing vapour, the expansion and contraction of which tube is caused by suitable mechanism to move a hand or pointer over a suitably divided dial. Means are provided for fixing the hand or pointer after a temperature has been taken.

2954. IMPROVEMENTS IN MAGNETO OR DYNAMO-ELECTRIC MACHINES OR ELECTRIC ENGINES, *P. Jensen, London.—(A communication from T. A. Edison, Menlo Park, N.J.)—6th July*, 1881. 6*d.*

The object of this invention is to do away with the iron core of the armature, and the loss of power through the heating thereof, also to generate continuous currents of high electromotive force in the same direction without using pole chargers. This is accomplished by constructing the armature in the shape of a disc, but divided into radial sections. These sections are naked copper bars joined edgwise by a non-conducting material, so that they form a rigid disc, and rigidly attached to the driving shaft by means of an insulating hub.

2955. LAMPS FOR BURNING LIGHT OR VOLATILE OILS, *F. R. Baker, Birmingham.—6th July*, 1881. 6*d.*

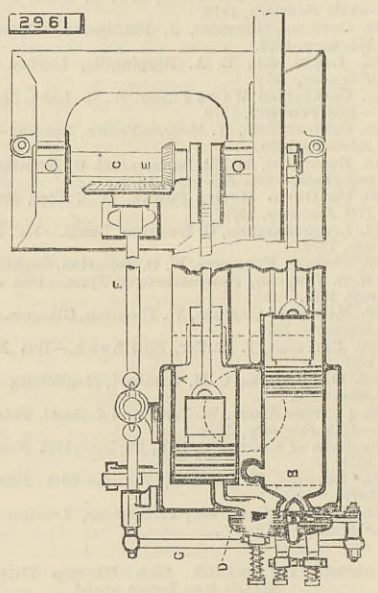
This relates to the burners and to the manner of arranging the wicks of the lamps, and it consists in fixing at the top of the wick case a roller turning freely in bearings and fluted with fine flutes. In the lower part of the wick case is an axis with toothed wheels to raise the wick, and which in single-wick lamps is prolonged to the exterior, and provided with a knob to turn it, while for double-wick lamps the axis is caused to gear with an axis midway between the two wicks, and which operates both wicks simultaneously. The wick passes up the inner side of the case, over the roller at top, and descends in the wick case at its outer side.

2958. LOOMS, *J. Bullough and E. and S. Tweedale, Accrington.—6th July*, 1881. 6*d.*

This consists of means for preventing floats by stopping the loom whenever the healds are not properly raised or the shed is imperfectly formed, and according to one arrangement elastic loops form the upper parts of the healds, and through them a lath is passed, and supports insulated wires. Attached to the lower part of the loops are metal inverted cones, the lesser diameter of which is in contact with one of the wires during the ordinary working of the loom. When a heald is not properly lifted the loops permit the larger diameter of the cone to come in contact with and touch both wires, and so complete an electric circuit, whereon a catch or stop is brought into position to act on the "hammer-head" or the weft fork, and stops the loom. Each cone serves about four heald cords.

2961. GAS MOTOR ENGINES, *C. G. Beechey, Liverpool.—6th July*, 1881. 8*d.*

This relates more particularly to gas engines which in addition to the power cylinder in which the explosion takes place, have a second cylinder into which the gas and air are drawn and compressed and afterwards forced into the power cylinder. A is the compression and B the power cylinder, the piston of the former following that of the latter at a distance equivalent to about 30 deg. of the crank's travel. D is the slide valve working at half the time of the piston and actuated from crank shaft C by gearing E and shaft F and rod G. The cylinder has two inlet ports, and an explosion light is placed in the valve, and in the valve cover is a hole to open communication with a master burner. So as to get a greater pressure upon the light in the valve, the latter is caused to close a little before the piston in the compression pump has completed its stroke, thereby increasing the pressure of the remaining gases, from which source the light gets its supply. The opening and closing of the gas inlet valve is regulated by means of an ordinary governor and a tapered or stepped cam.



2962. RAILWAY VEHICLES, *W. R. Lake, London.—6th July*, 1881.—(*A communication from W. Robinson, Boston, U.S.*) 8*d.*

This relates partly to railway trucks in which the axles when passing over curves adjust themselves in positions radial to the axis of the curve, and also partly to constructing vehicles to run on tramways, so that they may have the same facilities for turning round curves. As applied to the latter, each of the axles is mounted in a toggle swivelling truck, the two trucks being connected by a link, and each pivotted to the carriage body. The pole or draught bar is attached to one or other of the trucks. For railway trucks each main truck has two swivelling trucks pivotted to the main truck. A pin is placed on the underside of the body of the carriage directly in front of the pivot connecting the main truck to the vehicle, such pin being, so to speak, excentric to the pivot, and it passes through an opening in the main truck and engages a slot in the supplemental trucks.

2968. VEHICLES FOR COMMON ROADS, *R. Brabyn, Bodmin.—7th July*, 1881. 6*d.*

On each side of the body of the vehicles, and at each end thereof, project horizontal bars, to which the ends of low springs are connected, there being two such springs on each side, situated far enough apart to receive the road wheel between them. The wheel has a short axle fixed in a metal nave fitted with bearings in brasses fixed to the middles of the springs on each side of the wheel.

2969. VENTILATING BUILDINGS, *E. Aldous, Peckham.—7th July*, 1881. 6*d.*

The ventilator consists of two concentric shafts, the inner one having a conical shaped bottom, formed so as to prevent air being compressed. Over the top of it a hood with a number of openings is fixed, and connected to each opening is a tube leading down inside the tube. Above the bottom are apertures opening into the space between the two tubes, aprons being placed over and under such apertures to prevent wind travelling up and the foul air getting into the inner tube. The bottom of the space between the tubes opens into the room to be ventilated, while the top of the space is closed by a cap, below which an opening is left all round.

2970. NAILS, *H. Booth, Bilston.—7th July*, 1881. 6*d.*

This relates specially to machinery for cutting off nail blanks from metal strip rolled tapering in thickness in cross section, the blanks being afterwards headed by the usual machinery, and it consists of a cam, which gives a forward motion for cutting alternately to two horizontal slides or heads which carry the cutting tools. The slides work on opposite sides of the cam shaft, and are alternately drawn back after cutting the blanks by springs. Friction rollers in the inner ends of the moving heads receive the pressure of the cam. The fixed tools are carried by heads fixed to the bed of the machine. The metal strips feed themselves to the machine by passing, by their own gravity, through vertical guides.

2977. MILL FOR GRINDING PAINT, *W. and F. Hawley, Derby.—7th July*, 1881. 6*d.*

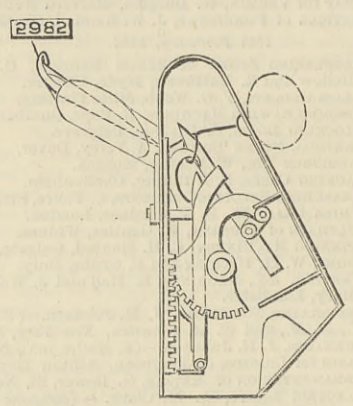
An outer casing of cast iron strong enough to carry the stones is provided with a hopper at its upper end, and through the centre passes the vertical shaft which carries and rotates the lower grinding stone. The lower end of the shaft runs in a toe-step adjustable by means of a hand wheel and screw, so as to raise or lower the bottom running stone. The upper surface of the lower stone is formed at an angle of about 22 deg., and the under surface of the upper stone is formed at an angle of about 23 deg., so that the space between the two is wider near the centre or feeding part.

2981. MIDDLINGS PURIFIERS, *E. G. Brewer, London.—7th July*, 1881.—(*A communication from K. Smith, Minnesota, U.S.*) 6*d.*

An electrified surface is used to attract the particles of bran, which are removed from its surface, the flour not being attracted, and the inertia of the material as it falls is made use of to separate the middlings and bran to a certain extent, allowing the bran to fall near to the electrified surface and the middlings to be more remote. The middlings pass from a hopper and fall through the air on to an incline or cant board that partially arrests the velocity, and the material rebounds against the cant boards and then slides off and falls, the meal or flour falling further off than the bran. An electrified surface such as a roller or band of vulcanite acted upon by rubbers is placed as close to the line in which the bran falls as is convenient, and the particles of bran are attracted and removed by scrapers.

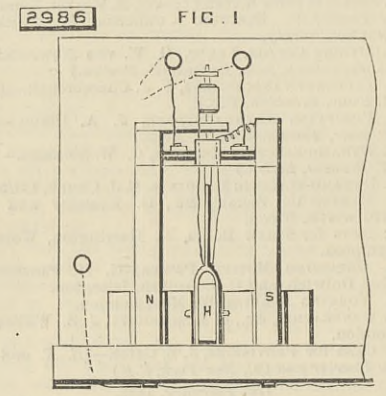
2982. MACHINERY FOR GATHERING AND BINDING CUT CROPS INTO SHEAVES, *W. Woolnough and C. Kingsford, Kingston.—7th July*, 1881. 6*d.*

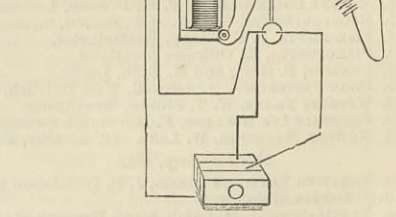
This relates to improvements on patents No. 4155, dated 18th October, 1878, and No. 1417, dated 7th April, 1880, and refers, First, to improvements in the tying or knotting apparatus. The ends of the string or other binding material are held between plates or clamps acted upon by an adjustable spring, which allows as much of the string to be drawn through them as the knot requires. The fork for twisting is in the form of a pair of hooks. The Second part refers to the manner of attaching a machine for binding corn or other cut crops to a self-delivery reaper, and consists mainly in fixing the binder in the position ordinarily occupied by the table or platform of a reaper, said table or platform having been removed, so that the corn when cut falls direct upon the platform of said binder, instead of having to gather the corn when delivered to it in sheaf quantities by the rakes of a self-delivering reaper.



2986. IMPROVEMENTS IN TELEPHONIC SIGNALLING AND COMMUTATING APPARATUS, *J. Imray, London.—7th July*, 1881.—(*A communication from C. Ader, Paris.*) 6*d.*

For signalling the inventor employs a solenoid coil without a core H, Fig. 1, suspended between the poles of a permanent magnet N S, and kept in position by an adjustable counterweight. When a current passes from a local battery, the coil moves to one side or the other, making contact by means of platinum studs on it, with other fixed studs on either side, and so causing a signal to be operated indicating the subscriber who calls. To effect communication between two subscribers, the inventor uses two keys connected by conductors, and a commutator. The latter consists of three metal plates insulated from each other, and connected up as shown in the diagram, Fig. 2. Holes run through these plates, into which the keys are inserted. The keys present two split sockets $c\,c^1$, Fig. 3, insulated from each other, and connected to two conducting cords. When one key is put in, it connects the hinder to the front plate, and the other connects the middle to the front





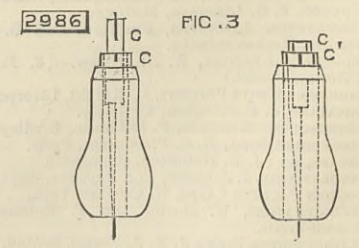


plate. By this means the exchange can communicate with a subscriber, excluding the relays, or two or more subscribers can communicate with each other by a circuit including the relays.

2988. IMPROVEMENTS IN TELEPHONIC APPARATUS, &c., *G. L. Anders, Boston, Mass.—7th July*, 1881. 8*d*.

The drawing shows a section of the inventor's combined transmitter and receiver, the first-named being of the Hunning's type, in which both are in circuit. By this

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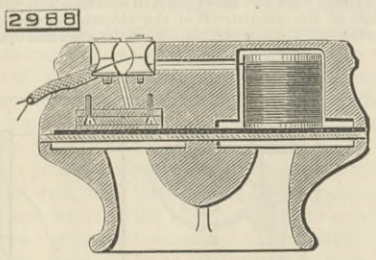

means the inventor claims that the sound waves during transmission act equally on the receiver and practically eliminate its resistance besides conducing to clearness of articulation. The invention also relates to a method of operating signal bells, which is an improvement on a previous patent granted to S. Pitt, commissioned by G. L Anders, and numbered 2674, 2nd July, 1879; also to an improved telephonic switch board, both of which are illustrated by drawings.

2989. IMPROVEMENTS IN APPARATUS FOR THE TRANSMISSION OF POWER BY ELECTRICITY, *J. Hopkinson, Westminster.—7th July*, 1881. 6*d*.

This relates to the utilisation of a dynamo or magneto-electric machine, in combination with a pulley fitted with a Meston friction clutch, and suitable toothed gearing and tackle, as a means of hoisting and lowering heavy bodies. The dynamo or other electric machine is fitted with the inventor's device for reversing the direction of rotation of the armature which was patented by him on the 21st June, 1879, No. 2481, and 14th November, 1879, No. 4653. This electrical hoist was illustrated and described in our recent articles on the Paris Electrical Exhibition.

2990. GAS ENGINES, *C. and C. T. Linford, Leicester.—7th July*, 1881. 8*d*.

This relates to appliances for effecting the feed of gaseous mixture used in a compressed state in the motive cylinder, also to effecting the ignition of the gases and exhausting the residual gases after combustion through the same valve as that through which the feed and scavenging charges pass; also to a

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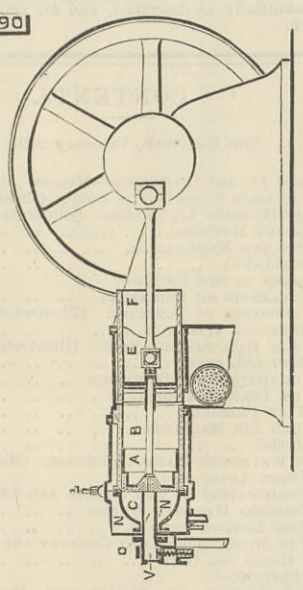

tappet motion in conjunction with the governor for regulating the gas supply, and to an arrangement of gear for reversible motion from one continuous motion suitable for tramcars and hoists, &c. The working of the engine is as follows: Supposing piston A has reached the end of its instroke and completed exhaustion, upon moving outwards a charge flows into cylinder B, while atmospheric air is drawn into cylinder F by the forward movement of piston E, and the charge being mixed in a special valve passes through a second valve to the cylinder by port N, where it delivers itself in an annular form round the exhaust tube O. After the piston has made its outstroke its return compresses the charge into space C, and on its next outstroke it is ignited. The scavenging piston E drives air through a valve and into the cylinder. The exhaust valve V is actuated in the ordinary manner, while the gas feed valve is controlled by a tappet motion operated by the governor.

2992. STEAM ENGINES, *J. E. Outridge, Egham.—7th July*, 1881. 6*d*.

This relates to an arrangement whereby rotary motion is obtained from a reciprocating motion without the use of a connecting rod or crank. To the piston rod of the cylinder is attached a pump plunger working in a second cylinder, so as to draw in and eject a liquid or fluid. The fluid passes to a casing and acts upon two pistons, which it causes to rotate. These pistons are formed with a series of vanes and apertures, and have shafts attached, at the outer ends of which are toothed wheels, by throwing a pinion into gear with either one of which the direction of rotation will be governed.

2994. POTTING UP AND PRESERVING ARTICLES OF FOOD, &c., *T. Pool, Charleston, U.S.—7th July*, 1881. 6*d*.

The bottle, jar, or case to contain the articles is made in two parts, which can fit one on to the other, so as to facilitate the introduction of the articles, the joint being afterwards covered over by a band of paper or other substance, so as to exclude air.

2995. IMPROVEMENTS IN TELEPHONIC AND TELEGRAPHIC SIGNALLING APPARATUS, *A. C. Brown and H. A. C. Saunders, London.—7th July*, 1881. 6*d*.

The object of this invention is to facilitate intercommunication between several telephone stations on one wire. The apparatus is so arranged that not only can any station call up and place itself in direct communication with any other station on the same wire without having to go through a central office, but also so that none of the other stations can interrupt or hear what is passing. The instruments and mode of arrangement were illustrated and described in our issue for the 17th inst.

2996. PROPULSION AND CONSTRUCTION OF VESSELS, *W. Coppin, jun., Londonderry.—7th July*, 1881. 6*d*.

The propeller is arranged so as to operate exclusively upon the deep solid water at the bottom of the vessel, either wheel propellers with the axis lying transversely to the vessel, or screw propellers with the axis lying longitudinal to the vessel being employed. Two separate chambers are formed in the bottom of the vessel large enough to contain either wheel or screw propeller, such chamber being open at bottom and kept charged with compressed air by pumps, so as to maintain the water at the level required for the proper working of the propeller.

2999. CLEANING AND POLISHING KNIVES, *H. H. Lake, London.—7th July*, 1881.—(*A communication from P. V. Godard, Paris.*)—(*Not proceeded with.*) 4*d*.

The knives are held down on a flat plate and rubbed with brushes, each handle being passed through a hole in a pinion, all of which pinions gear together, so that by turning one the whole of them will revolve, and so present the other side of the knives to the action of the brushes.

3000. SELF-CLOSING TAPS, VALVES, &c., *G. Crawford, Port Glasgow.—8th July*, 1881. 6*d*.

The apparatus is self-closing, and of such a nature that when the required amount of water or other fluid is drawn off and the hand of the operator removed

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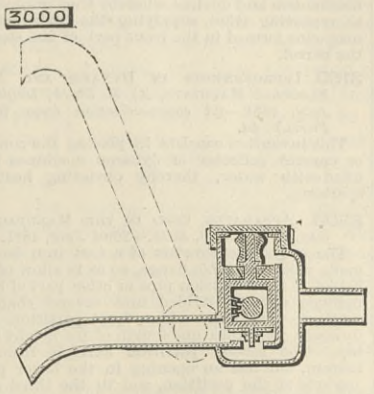

from the spindle or handle which opens the water-way, it becomes immediately closed, and the flow of water or other fluid at once stopped. The drawing shows a longitudinal sectional elevation of the tap.

3003. TAPS, *G. Furness and J. Robertshaw, Manchester.—8th July*, 1881. 6*d*.

This consists in the substitution of a plug of lignum vitæ or other suitable material for the washers of leather or other flexible material usually employed for the valves of taps.

3009. MONEY TILLS, *B. W. Webb, London.—8th July*, 1881. 8*d*.

The object is to prevent fraud, and consists of a series of toothed wheels and indexes operating to indicate on dials any sum paid, and to simultaneously cause the ringing of electric bells, which tell the amount registered by striking as many times as there are pounds, shillings, or pence in the amount received.

3014. PHOTOGRAPHIC CAMERAS, *G. Smith, London.—8th July*, 1881. 6*d*.

This relates to that part of the camera in which are carried the glass for focussing and the sensitive plate on which the picture is to be obtained; and also to the stand upon which the camera is supported. The back of the camera is made so that it can be inclined to any desired angle and fixed in that position. The legs of the stand are made so as to fold up into a small parcel.

3018. SPINNING MACHINE ROLLERS, *H. J. Haddan, Westminster.—9th July*, 1881.—(*A communication from J. B. William, Germany.*) 4*d*.

This consists in a tubular web of textile material forming a seamless covering for spinning rollers and to be used as a substitute for the leather and india-rubber coverings generally employed.

3020. SASH-BAR FOR HORTICULTURAL BUILDINGS, &c., *W. Howitt, Ilford.—9th July*, 1881. 6*d*.

Two half cylindrical metal pieces are secured one to either edge of a strip of wood, leaving a small space between the edges of the two half cylinders, so as to allow of the edges of the sheets of glass passing into such space.

3021. AUTOMATIC CUT-OFF AND ENGINE REGULATOR, *R. M. Marchant, Clerkenwell.—9th July*, 1881. 6*d*.

The interior and working arrangement consists of a sliding drum A, a bar or rod on which the drum works A^1, the fixtures carrying such bar or rod A^2, the slotted spindles connecting the valves B, the slot B^1, the equilibrium valves B^2, the link connecting the

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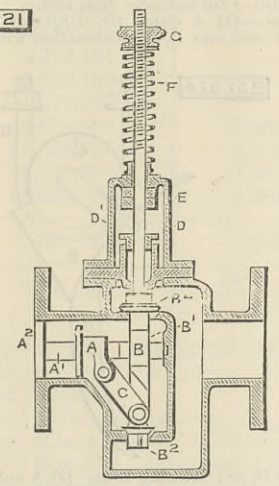

sliding drum and the spindle, the stuffing-box D. The exterior and adjusting arrangement consists of the bridge D^1, the stop nuts below the bridge E, the spiral spring F, the washer and thumb-screw G.

3022. WAGON OR CARRIAGE WHEELS, *W. F. Lotz, London.—9th July*, 1881.—(*A communication from A. Wilké, Germany.*) 6*d*.

The nave is made in three parts of cast iron, steel, or brass, and connected with spokes of iron or steel tubing. The felloes are formed either of a ring or of segments of wrought iron, malleable cast iron, or cast steel, over which the hoop is drawn heated, or the felloes are wedged into the hoop by screws.

3024. GRINDERS, &c., *R. R. Gubbins, New Cross.—9th July*, 1881. 6*d*.

This relates to the use of an annular grinding surface driven by three or more frictional wheels arranged around its circumference and bearing on its periphery. The annular form of grinder presents by its inner working edge or face greater facilities for grinding articles of irregular contour.

3027. HAMMERLESS BREECH-LOADING FIRE-ARMS, &c., *T. and T. Woodward, Birmingham.—9th July*, 1881. 6*d*.

This relates to means for cocking hammerless guns, and also to the use of an improved safety bolt.

3028. AXLES FOR CARRIAGES, &c., *H. H. Lake, London.—9th July*, 1881.—(*A communication from A. Cohen, Poland.*) 6*d*.

The object is to provide means for lubricating cart axles without removing the wheels, and it consists in boring a longitudinal hole centrally in each end of the axle, and from the end of which two or more radial holes pass to the outside of the axle. The end of the hole is closed by a screw cap, but when necessary to supply fresh lubricating material, the cap is removed and the lubricant introduced into the longitudinal hole.

3030. MAKING CIGARETTES, *A. M. Clark, London.—9th July*, 1881.—(*A communication from J. A. Bonsack, Virginia, U.S.*) 8*d*.

This relates to improvements on cigarette-making machines, and it consists principally in means for ensuring the more uniform passage of the tobacco under the concaves in a brush mounted upon the frame, and combined with a reciprocating spreading belt for positively clearing it of the tobacco shreds, which have a tendency to adhere and interfere with the uniformity of the spreading and distributing action; also in a presser roller for co-operating with the concaves, and a toothed belt to prevent the tobacco from piling up in front of said concave; also in the novel construction and arrangement of filler forming devices, for which three steel belts are arranged to form a converging trough, and all of them travel in the same direction, and co-operate with a wheel which presses the filler into an approximately square shape; also in improved means for cutting off the cigarette roll into definite lengths.

3034. MOVABLE WINDOW SHOW CASES, *R. Laws, Hackney.—11th July*, 1881.—(*Not proceeded with.*) 4*d*.

The show case is mounted on rollers to run in a groove or tramway, and it is capable of being revolved on a central pivot.

3036. RAKING HAY, *H. J. Macey, Wootton Bassett, Wilts.—11th July*, 1881. 4*d*.

This relates to a machine for raking hay and delivering it on one side as the machine advances. To a frame a bar is attached obliquely, and on it the rakes are hinged. Parallel to the rake bar is a spindle driven by toothed gearing from one of the wheels of the machine, and on it is a series of cams, fixed spirally thereon and at intervals between the teeth of the rake. When the hay is thrown up by the rake it is carried by the cams along the machine and delivered on one side.

3037. SECURING THE JOINTS OF EARTHENWARE PIPING, &c., *J. Gooddy, Wombwell, Yorkshire.—11th July*, 1881. 6*d*.

The opening in the socket tapers from the mouth inwards till it terminates in a shoulder, the other end of the pipe being shaped to fit the socket of the next pipe parallel, leaving a space between it and the socket, which is filled in with an elastic washer, so that when the end of the pipe is pressed home the washer is compressed and makes a tight joint.

3038. FIRE-LIGHTERS, *J. F. Wiles, Old Charlton.—11th July*, 1881. 4*d*.

The lighter is made of sawdust and small chips of wood, spent tan, and other refuse, and it consists in forming flues or passages passing entirely through the lighter in various directions to facilitate the combustion, and thereby produce a more intense flame than when they are made solid.

3042. BAND SAW MACHINES, *A. Dodman, King's Lynn, and N. G. Kimberley, London.—12th July*, 1881. 6*d*.

So as to change the cutting angle of the saw without moving the table, the saw is made to pass over three pulleys, one above and one below the table, and one towards the back of the machine. The two front ones are mounted on spindles attached to a radial piece capable of sliding in the main frame, and having teeth with which a pinion driven by a hand wheel gears. The work is held between centres supported by arms sliding in grooves in the table, so as to enable circular pieces to be cut out. A template is fixed on a slide working in a groove in the table and through a guide fixed on cross slide, also working in a groove in the table, regulates the position of the work, so as to cut out curved or other forms.

3046 SPINNING AND DOUBLING COTTON, &c., *T. Coulthard, Preston.—12th July*, 1881. 6*d*.

This relates to means for removing dirty oil and sediment from the lower end of spindle apparatus, and consists in continuing the bolster tube below the footstep, where it is opened out so as to form a chamber to receive the dirt, which may be removed by taking out the screw plug closing the bottom of the chamber. The invention also relates to an adjustable sheet metal ring holder for double flange rings in ring and traveller frames.

3050. FURNACES OR TANKS USED IN THE MANUFACTURE OF GLASS, &c., *J. A. King and J. Little, Dublin.—12th July*, 1881. 6*d*.

This relates, First, to apparatus for continuous working, and consists in forming an open band which floats in the molten mass, and inside which is placed a bottomless pot with a cover and working-out hole, so arranged that the latter is presented to the working aperture of the tank. As the crude materials are melted in the tank the liquid, becoming denser, sinks to the bottom and passes into the outer ring, where, the liquid becoming more fined, it passes into the bottomless pot from which it is worked out. When desired to carry on the process intermittently, a second ring is placed within the open band, and allows the melted glass to flow underneath its sides free from foam and other impurities floating on the surface of the liquid outside and around the ring. The invention also consists in dividing the fire-box by a longitudinal partition provided with air spaces to keep it cool, and which forms two compartments, the passage of the flame therefrom into the tank being common to both.

3051. CAUSING FORCE TO ACT AND EFFECT MOTION TO BODIES, &c., *G. Wilson, Westminster.—12th July*, 1881. 8*d*.

This consists of apparatus by means of which force is caused to react on a mass of inelastic fluid within a tube or tubes, joined at one end to a cylinder, and at the other to a tank or tanks containing the inelastic fluid. Steam or any suitable force acts upon a piston in the cylinder.

3052. HAULING OR WINDING ENGINES AND WAGONS, *D. Grieg and R. H. Shaw, Leeds.—12th July*, 1881. 6*d*.

The improvements in hauling engines consist in mounting two drums C loosely on a stud fixed to the

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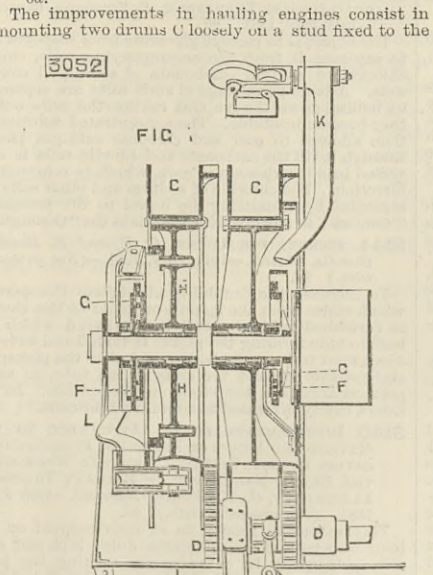
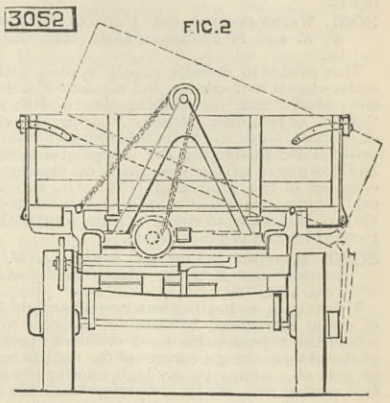


boiler, and driven by pinions D on an upright shaft. The coiling cams F are placed upon the axis above and below the drums, and have internal teeth gearing with the wheels G, which have a rolling motion imparted to them by excentric H, being prevented from revolving by a stop lever. K and L are the coiling levers, with pulleys for the top and bottom drums respectively, and may be turned on either side of the

3052 FIG.2



engine. Fig. 2 shows a wagon to be tipped by the tractive power of the engine drawing it. The body is placed low, and is jointed to the bed, so as to tip by means of a windlass arrangement, the pull of the engine causing a rope to be drawn off from a wheel or drum, thereby turning an axis and causing a chain attached to the body to be wound upon a barrel. Another arrangement consists in the use of an hydraulic jack.

3053. IMPROVEMENTS IN BATTERY TELEPHONES, TRANSMITTERS, OR MICROPHONES, *L. Jacobson, Berlin.—12th July*, 1881. 6*d*.

The inventor applies a tube to the frame of the transmitter, so that the sounds are concentrated on to the diaphragm If it is wished to modify the loud tones of the voice, slide F opens to any desired width and carries part of them off. The tube greatly

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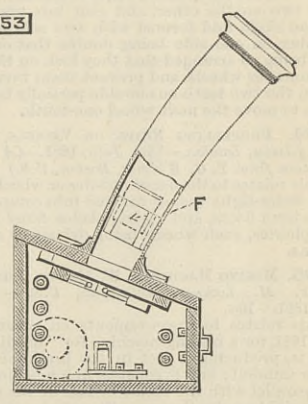


prevents the transmission of other sounds than those of the speaker's voice. Various modifications of the above form of speaking-tube are described and illustrated. The figure shows the ordinary form adopted by the inventor. The inside of the tube is lined with soft stuff to modify harsh tones, and a tube leads off the condensed breath.

3054. BROOMS AND BRUSHES, *A. Denjoy, Auch, France.—12th July*, 1881. 6*d*.

This consists in attaching the broom or brush to a forked handle, in which it can be adjustably secured at any desired angle.

3055. DISINFECTING APPARATUS, *C. M. Scott, Dalkey, Dublin.—12th July*, 1881. 6*d*.

This relates to hot air disinfecting chambers, and consists in forming the sides and top of the chamber of non-conducting composite slabs arranged to screw tightly together. The temperature of the air is raised to about 300 deg. Fah. by gas furnaces, and the foul consumed air is removed by a flue before the door is opened and the disinfected articles removed. An automatic arrangement shuts off the gas at a certain temperature.

3056. TREATING FLUID SLAG FROM IRON ORE SMELTING OR BLAST FURNACES, *A. M. Clark, London.—12th July*, 1881.—(*A communication from A. D. Elbers, Hoboken, U.S.*) 6*d*.

This consists in causing the slag to run into an annular trough revolving round a central shaft, so that it is built up in layers one over the other, by which means it forms a perfectly solid mass.

3064. DRYING SUGAR, &c., *A. and J. D. Scott and T. R. Ogilvie, Greenock.—13th July*, 1881. 6*d*.

The apparatus consists of a long chamber with a range of steam-heated pipes at the bottom, and a flue at top communicating with a fan, while a number of openings at bottom, fitted with valves, regulate the entrance of air. By these means a rapid current of heated air is caused to pass over the articles to be dried.

3067. INDUCING OR ACCELERATING AN OUTWARD DRAUGHT FROM CHIMNEYS, &c., *J. Gilmore, Lower Norwood, and W. R. Clark, Peckham.—13th July*, 1881. 6*d*.

This relates to an apparatus for chimney tops and ventilation shafts, and consists in the combination of two or more rings in an axial line and with an interval between each ring. The rings are tapered from the inner periphery outwards, so as to form a conical section, whereby the intervals between them narrow from the outside towards the centre, and the wind blowing in consequently increases in velocity and causes an upward draught.

3068. FLEXIBLE STRIPS FOR STRENGTHENING STAYS AND CORSETS, &c., *R. Auerbach, London.—13th July*, 1881. 6*d*.

This consists of flexible elastic strips made up of superposed thin elastic metal layers or plates united by shellac and enclosed in an envelope; or of metallic layers or plates with a fibrous substance interposed and bound by wires along the edges, the whole being united by shellac and covered with prepared paper or tinfoil.

3078. CAKES, BISCUITS, SWEETMEATS, &c., *W. R. Lake, London.—14th July*, 1881.—(*A communication from J. H. Mitchell, Philadelphia, U.S.*) 6*d*.

This relates to a machine with a dough or material box which has its nozzles elevated from the pan, mechanism being provided for intermittently advancing the pan, and also for separating the holder from the box, whereby the material leaves the nozzles in streams, and is deposited on the pan.

3079. OPEN FIREGRATES AND COOKING RANGES FOR SAME, *J. Cornforth and E. T. Burton, Birmingham.—14th July*, 1881. 6*d*.

The bars forming the bottom of the grate are tubular and open at front, while at the back they open into vertical channels rising to a height equal to that of the front of the grate, and being open at top, constitute a perforated bridge through which currents of hot air rise, mixing with the flame and volatile matter from the fuel and thoroughly consume the same, the products of consumption passing out at the back of the grate into a vertical flue in the chimney. In this flue an oven or cooking range is fixed.

3080. Looms, *J. Clayton and T. Richmond, Burnley.*—14*th July*, 1881. 6*d.*

This relates to a novel arrangement of shedding motion or index apparatus for changing the order of succession in which the healds are to be moved when producing various patterns of weaving in the same fabric.

3081. Water-closets and Urinals, *W. Daves and W. H. and D. Thompson, Leeds.*—14*th July*, 1881. 6*d.*

This relates to definite supply syphon actions for water-closets and urinals, and consists of a double or compound "boot" or flushing cistern with midway "clack" or retaining valves for "caging" the charging or priming water, an air cushioning and elastic compression for prolonging the charging, a loose-fitting and downward acting ram, float, or plunger in one chamber of the compound boat; and, Secondly, in oval, oblong, or other shaped cistern or boot with vertical staves placed round a plain level bottom and secured by iron or other bands.

3089. Heating Fluids by Steam, *J. H. Fraser, London, and E. J. C. Welch, Westminster.*—15*th July*, 1881. 6*d.*

This relates to heating water or other fluid by a jet of steam introduced by means of a special nozzle, in which the objectionable noise ordinarily produced is obviated by causing a current of the fluid to be heated to pass at a comparatively high velocity along and in free contact with the jet of issuing steam, the one surrounding the other, by which means the fluid derives its own motion.

3090. Ladies' Saddles, *W. F. D. Schreiber, Ipswich.*—15*th July*, 1881. 6*d.*

This relates to means for preventing the wringing of the saddle when in use, and also to obviate the necessity of employing balance straps. The off-side of the saddle tree is formed with an additional rib, so shaped and placed as to adjust itself to the side of the horse, and form an additional bearing against the wringing or twisting of the saddle from the weight of the rider acting on the near side.

3091. Fluid Meters, *T. R. and T. W. Harding, Leeds.*—15*th July*, 1881. 6*d.*

This relates to the counting and recording apparatus, and consists of two shafts mounted in a frame, and one carrying several wheels bearing numbers from 0 to 9. These wheels have each twenty teeth on one edge and only two on the other, and gear into pinions on the second shaft, and formed with two sets of teeth, the number on one side being double that on the other, and being so arranged that they lock on the surface of the number wheels, and prevent them turning, except when the two teeth on one side partially turn a pinion so as to move the next wheel one-tenth.

3094. Propelling Ships or Vessels, &c., *H. J. Allison, London.*—15*th July*, 1881.—(*A communication from T. G. Widmer, Boston, U.S.*) 6*d.*

This relates to the use of paddles or wheels consisting of a water-tight casing divided into compartments so as to form floats, and having blades fixed round their peripheries, such wheels being driven by any suitable means.

3095. Mining Machines, *W. Mather, Manchester, and F. M. Lechner, Columbus, U.S.* — 15*th July*, 1881. 10*d.*

This relates to improvements on patent No. 1469, A.D. 1881, for a mining machine for "heading" work—that is, producing a slot in the breast of the coal or other mineral; and it consists in a machine for working parallel with the breast or face of the coal instead of at right angles thereto. The revolving cutter shaft is extended to one side, preferably so that it can be coupled to either end of the cutter shaft, and this prolongation is fitted with removable cutters and forms the working portion of the shaft for under-cutting on the long wall system.

3099. Cutting Screw Threads on or in Metal Tubes, &c., *W. R. Lake, London.*—15*th July*, 1881. —(*A communication from F. Armstrong, Bridgeport, U.S.*) 8*d.*

One part of the invention is designed for use in lathes and all screw-thread cutting machines, and comprises an arrangement whereby the carriage may be longitudinally adjusted when the machine is properly geared, and the work is in progress, and whereby after the tool has been temporarily removed for any purpose, it may be reset in its former position, in the unfinished thread and the work resumed. A second part relates to a screw-threading apparatus consisting of die blocks, non-adjustable but interchangeable steel dies or cutters, and holder for same, this device being adapted to cut screw-threads on pipes or rods of different diameters, by interchanging the dies or cutters in the blocks or holders, which are all of the same size and diameter, the same having cutter recesses varying in distance from the centre, according to the size or diameter of the pipe or rod. It relates further to die stocks, operated by hand, for cutting screw-threads, and comprises a geared die stock operated by crank and pinion, whereby the cutter head is made to revolve; and lastly, to an attachment to the vice for holding the pipe to be cut, and to which the shaft having the pinion is attached.

3101. Automatic Railway Brakes, *W. Parsey, Brighton.*—15*th July*, 1881.—(*Not proceeded with.*) 2*d.*

The brake blocks are applied by means of springs always tending to force them in contact with the wheels, but, until required, kept out of action by fluid pressure acting upon a piston in a suitable cylinder.

3104. Making up Bread from Whole Meal, &c., *G. W. Simmons, London.*—16*th July*, 1881.—(*Not proceeded with.*) 2*d.*

The object is to prevent the outer surface of bread made from "whole meal" or coarsely ground wheat from becoming hard in baking, and it consists in coating the dough, when made up into loaves, with a layer of dough made from finer flour.

3105. Metallic Plates for the Soles of Boots and Shoes, *R. Jones, Abercarn, Monmouth.*—16*th July*, 1881.—(*Not proceeded with.*) 2*d.*

The object is to prevent the soles of boots of workmen exposed to great heat from being destroyed by treading on hot floors, cinders, &c., and it consists in securing to the soles a number of metallic plates with projections so as to keep the sole from touching the floor, and yet at the same time provide the desired flexibility of such part.

3107. Heating Apparatus, *H. J. Haddan, Westminster.*—16*th July*, 1881.—(*A communication from J. F. Lebreton, Besançon, France.*)—(*Not proceeded with.*) 2*d.*

This relates to apparatus for burning hydrogen gas, and its purpose is to utilise as much as possible the caloric resulting from the combustion of this gas and its compound gases by condensing the principal products of combustion.

3108. Scouring and Cleansing, *H. J. Haddan, Westminster.*—16*th July*, 1881.—(*A communication from L. Poitevin, Amfreville-sur-Iton, France.*)—(*Not proceeded with.*) 2*d.*

The machine consists of a frame and two superposed cylinders in contact with each other, and one covered with india-rubber so as to be well in contact. Two guides are fixed to the frame and serve to keep the stuff away, which runs off obliquely, a roller supporting it and a guide directing it to the middle of the cylinders, whilst an oblique board on the other side detaches the stuff as it leaves the cylinders. A box under the lower cylinder collects the liquid squeezed out.

3109. Fire-arms, *L. de la Bastide, Grignols, France.*—16*th July*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to repeating or magazine small-arms, and consists of a frame forming angles with two other small frames at its extremities, which are fastened at their other ends to a frame similar to the first, one with a hinge and the other with a clasp. The case thus formed receives the barrel.

3110. Propelling Tricycles, &c., *W. H. Howorth, Cleckheaton, Yorkshire.*—16*th July*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to means for increasing the speed of tricycles, and consists of a water reservoir attached to the vehicle and connected by pipes to a pump from which the water is delivered to a turbine, and then passes back to the reservoir.

3112. Packing Tea, &c., *E. Ormerod and J. Higson, Atherton, Lancaster.*—16*th July*, 1881.—(*Not proceeded with.*) 2*d.*

A box or mould in which the bag is placed is supported by a frame, and above it is an adjustable ram capable of being depressed and raised by means of a lever and link.

3113. Motive Power Engine Operated by Hydro-carburetted Air, *E. Etève and C. C. Lallement, Paris.*—16*th July*, 1881. 6*d.*

The hydro-carburetted fluid is generated by forcing air into a receiver containing a hydrocarbon, and mixing it with the air under the same pressure in the engine cylinder, so as to pulverise in some measure the distributed hydrocarbon, and to fill with this mixture the space swept through by the piston during a portion of its stroke, whether in front or behind the piston. An electric spark fires the mixture, and its instantaneous expansion produces a more or less powerful dynamic effect on the piston, according as the pressure of the air admitted is higher or lower, and the volume of the mixture admitted is greater or smaller.

3115. Flushing Water-closets, &c., *F. Wirth.*—16*th July*, 1881.—(*A communication from G. Mack, Germany.*—(*Not proceeded with.*) 2*d.*

A box contains a tube bent to form a syphon, the longer limb of which extends to the closet to be flushed. A float or displacer is actuated by the pull, and becoming immersed in the water raises its level above the syphon bend.

3117. Boots and Shoes, *A. Christophe, Belgium.*—18*th July*, 1881.—(*Not proceeded with.*) 2*d.*

This consists of a sheet steel sole attached to the upper, and to which a leather sole and heel are secured by rivets passing through holes in the steel sole.

3118. Carriage Lamps, &c., *C. Saunderson, Kilburn.*—18*th July*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to a lamp fitted to the back of the carriage near the roof, so as to serve both for lighting the interior of the carriage and to act as a signal or warning at the back of the same.

3120. Washing Machines and Kiers, *H. Brandes, Germany.*—18*th July*, 1881.—(*A communication from T. Harbeck and A. Hasperg, Prussia.*—(*Not proceeded with.*) 2*d.*

This relates to washing machines and kiers, in which a stream of boiling water passes permanently through the materials to be washed, and consists in providing inside the boiler a reciprocating basket to receive the materials, and also in mechanism for reciprocating the basket.

3121. Range-finder, *G. W. Hart, Portsea.*—18*th July*, 1881.—(*Not proceeded with.*) 2*d.*

The object is to enable distances to be determined with great accuracy by one operator. On a metal quadrant two wires are placed vertically, so that one can partially rotate round the other, which is stationary. A prism is employed to obtain a view of the object in an oblique direction, and then by comparing the object shown in this manner with the object seen direct, by means of the quadrant a chord of the circle may be measured, the distance of which is the radius, which is the distance sought for.

3122. Improvements in the Manufacture of Electric Bridges for Lamps, *St. George Lane Fox, Westminster.*—18*th July*, 1881. 2*d.*

The inventor uses the Italian grass (Andropogon Ischœmum), known as French whisk, for his electric bridges, or carbons, for incandescent lamps. He boils the grass in a solution of caustic soda (5 per cent.). The outer skin is then scraped off, and the fibre boiled in water. It is then straightened, bound on a block of carbon, buried in a crucible, and carbonised.

3124. Boots and Shoes, *J. Robertson, Kilburn.*—18*th July*, 1881.—(*Not proceeded with.*) 2*d.*

A piece of elastic webbing is inserted in the upper over the instep, and over it passes a flap secured by buttons on one side, the holes in the flap allowing a certain amount of play.

3129. Mechanical Reproduction of Sound, *J. J. Walker, Tottenham-court-road.*—18*th July*, 1881.—(*Not proceeded with.*) 2*d.*

A perforated band is caused to travel past an orifice from which a stream of air or other fluid issues, by which means sound vibrations are established in the air, and these are intensified by resonators.

3133. Aerated Beverage, &c., *C. Kempster, Nesscliffe.*—19*th July*, 1881.—(*Not proceeded with.*) 2*d.*

Malted barley is steeped in hot water long enough to extract the saccharine and other ingredients therein, when the water is withdrawn and boiled with sufficient hops to give it an agreeable bitter flavour, after which it is passed through a refrigerator, then a filter, and is finally pumped into a strong chamber, where it is subjected to the action of carbonic acid at a high pressure.

3136. Manufacture of Decanters, Bottles, &c., from Glass, *T. P. Richardson, Wordsley, Stafford.*—19*th July*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to the use of revolving slides, each of which bears one-half of the form required to be given to the decanter or other article, and into the mould formed by the revolving slides the article is blown by a blowing iron.

3138. Treatment of Soap Lyes for the Separation of Glycerine Therefrom, *F. Versmann, Charlton.*—19*th July*, 1881. 2*d.*

The object is to recover glycerine from soap lyes and to separate it from the accompanying salts, chiefly chloride of sodium, carbonate of soda, and caustic soda. A large percentage of such salts are separated by boiling down the lye and raking the salts out as they become insoluble. The concentrated solution is then allowed to cool and carbonic acid gas passed through it till the carbonate and caustic soda is converted into bicarbonate of soda, which is removed by filtration. The chloride of sodium and other salts are separated by submitting the liquid to the process of "Osmose" in an apparatus known as the "Osmogene.'

3144. Pickers for Looms, *C. F. and E. Burslem, Cheadle, Chester.*—19*th July*, 1881.—(*Not proceeded with.*) 2*d.*

To increase the durability of pickers the portion which slides upon the spindle or guide of the shuttle is furnished with a metal tube, around which the buffalo hide forming the picker is folded and extends downward to form the body and foot of the picker. It also extends beyond the ends of the tube, so as to prevent injury to the stops on the spindle. In the tube a cavity is formed to contain a lubricant.

3146. Improvements in or Applicable to the Method and Means of Effecting Intercommunication in the Lighting, and the Working of the Brake Mechanism of Railway Trains by Electricity, *G. K. Winter, Norwood.*—19*th July*, 1881.—(*Not proceeded with.*) 4*d.*

This invention relates to an improvement on the inventor's patent No. 2637, 28th July, 1874, and consists principally in a means for making the joint between the cable and the hook at the end of each side or safety chain more mechanically secure, and also making the electrical contact more perfect.

3153. Pneumatic Dispatch Tubes, &c., *T. J. Mayall, Reading, U.S.*—20*th July*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to a dispatch tube in which the dispatch-carrying box may move without appreciable friction, and it consists in making such tube of a compound of rubber and graphite combined with sufficient sulphur to insure the proper vulcanising of the tubes.

3154. Melting and Annealing Pots, *J. Brown, Worcester.*—20*th July*, 1881.—(*Not proceeded with.*) 2*d.*

This consists in making, melting and annealing pots of Bessemer or other steel.

3168. Breech-loading Fire-arms and Cartridge Boxes for Same, *H. Simon, Manchester.*—20*th July*, 1881.—(*A communication from F. Betterli, Paris.*)—(*Not proceeded with.*) 4*d.*

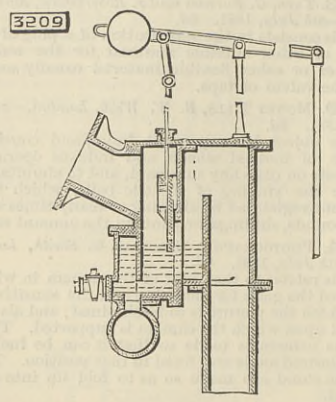
This relates to breech-loading fire-arms in which the breech is closed by a sliding breech bolt, and it consists mainly in the application to such fire-arms of mechanism and devices whereby they are made to act as repeating rifles, supplying the cartridges from a magazine formed in the front part of the stock under the barrel.

3169. Improvements in Dynamo and Magneto-Electric Machines, *A. M. Clark, London.*—20*th July*, 1881.—(*A communication from W. Laing, Paris.*) 4*d.*

This invention consists in placing the commutator or current collector of dynamo machines in a box filled with water, thereby obviating heating and sparking.

3209. Apparatus used in the Manufacture of Gas, *C. J. Ellery, Bath.*—22*nd July*, 1881. 6*d.*

The apparatus consists of a cast iron box or case made with a suitable flange, so as to allow of it being bolted to the ascension pipe or other part of the retort fittings, and is divided into several chambers by vertical partitions. The first partition extends upwards to within one-fourth of its height from the top. The second partition extends from top to bottom, but has an opening in the lower part. On one side of the partition, and in the third chamber, round the opening the surface is planed or otherwise made true, so as to permit of a sliding valve working gas-tight against it, the valve being kept in its place by a groove or fillet and spring. The valve has con-



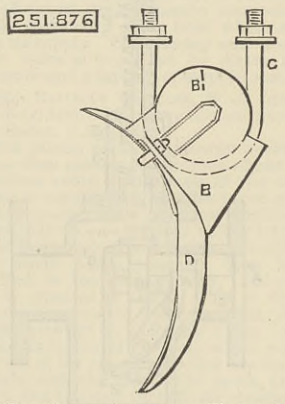
nected to it a spindle which passes through a stuffing-box in the cover of the outer case, and is pivotted to a lever, which is also pivotted to a fulcrum, and is at one end furnished with a weight, and at the other is provided with a rod, rope, or chain, which at its other extremity has some suitable appliance for attaching it to the cross bar of the retort mouthpiece. In the upper part of the third chamber is formed the outlet for the gas, and in the lower part there is an opening leading to a fourth and fifth chamber or tar seal box, which serves as an overflow inlet and outlet for tar and liquor, the bottom of the fifth chamber being connected to the tar main.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

251,976. Cultivator, *Daniel C. Van Brunt, Horicon, Wis.*—*Filed September 27th*, 1881.

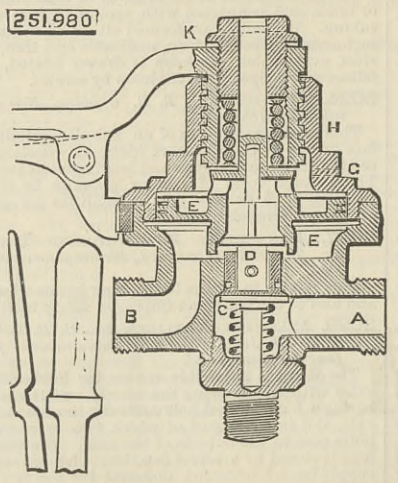
Claim.—(1) A clamp for cultivator teeth having hub B^1 and ears B, in combination with a tooth D,



staple D, and securing nuts. (2) A cultivator beam having concavity A, in combination with clamp having hub B^1, the staple C, and nuts, as set forth.

251,980. Regulating Valve for Railway Brakes, *George Westinghouse, jun., Pittsburg, Pa.*—*Filed August 27th*, 1881.

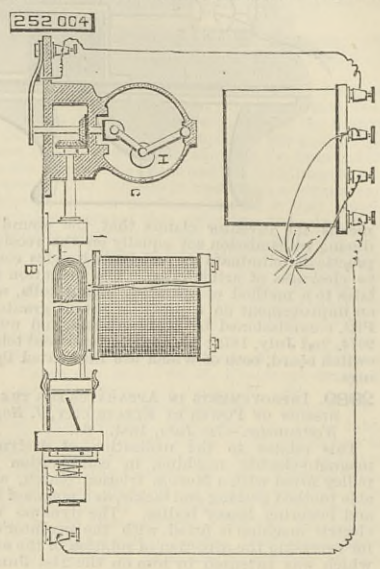
Claim.—A regulating valve for railway brakes, having in combination the nozzles A B, valves C D, hollow



piston E, having lateral ports E, escape port G, springs C and H, handle K, and screw plug K, substantially as set forth.

252,004. Automatic Circuit Breaker for Secondary Batteries, *James A. Maloney and Franz Burger, Washington, D.C., assignors to the American Electrophore Company, same place.*—*Filed September 19th*, 1881.

Brief.—Brakes charging circuit when dynamo-electric machine stops, to prevent discharge through the machine. *Claim.*—(1) An automatic circuit breaker, consisting of the ball H, with its arms, and the shaft, provided with the bevel gear, in combination with the shaft of the armature B of the electric generator, and spring and electric circuit, all constructed and operated



substantially as and for the purpose set forth. (2) In combination with an electrophore or secondary battery and dynamo-electric generator, with their circuits, a governor or regulator operated by the direct motion of said generator, in combination with the spring M, substantially as and for the purpose set forth. (3) In combination with a dynamo-electric generator and electrophore or secondary battery, a governor or regulator consisting of the ball H within a frame G, and its connections with shaft, spring, and contact point, substantially as described, and for the purpose set forth.

CONTENTS.

The Engineer, February 24th, 1882.

South Kensington Museum.—Visitors during the week ending Feb. 18th, 1882:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 10,105; mercantile marine, building materials, and other collections, 2896. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. till 4 p.m., Museum, 1218; mercantile marine, building materials, and other collections, 268. Total, 14,487. Average of corresponding week in former years, 14,109. Total from the opening of the Museum, 20,736,003.