TORPEDO BOATS.

On Friday, May 9th, Mr. Yarrow read a paper at the United Service Institution on "Torpedo Boats," and, as was naturally to be expected, the reading of a paper by so good an authority on this subject was very well attended. The question was taken up at the stage when torpedo boats had so far established their value that a large order for 100 was made suddenly by Russia. This was in 1877. These boats were to be capable of keeping the sea for a few days, but at the same time to be small enough for conveyance by rail from the Baltic to the Black Sea. With this view they were made 75ft. long and 10ft. beam. Five Russian and two English firms supplied them. Messrs. Yarrow supplied working drawings and as many sets of machinery as could be completed and delivered before the closing of the navigation of the Baltic. In November, 1877, the first boat was tried on the Neva, when it obtained a speed of 18 knots. Several boats were forwarded by rail to Sebastopol with the funnel only removed. The journey occupied a week, and they were found fit for immediate sea-going on arrival and gave entire satisfaction. About this time the English Government ordered our first boats of the "Lightning" type. A few months later, in 1878, some more were ordered from various firms. Messrs. Yarrow supplied one which obtained a speed of 21·94 knots at Long Reach, where it was tried under Admiralty conditions in the spring of 1879, beating its rivals by nearly two knots in speed. The load carried was 6¾ tons, consisting of torpedoes, gear, coal, &c. This boat had a forward rudder fitted to it to improve its steering powers, by which means it was enabled to turn in a very small circle. In 1878, two first-class torpedo boats were built for Russia, but not allowed to leave the country, and eventually purchased by the Admiralty. An accident with one of these led to the introduction of an important feature, namely, a system of light non-return valves, so arranged that any back rush of flame or steam closed them and cut off all communication between boiler and stokehole. This has proved its value since, and has become generally adopted.

In the end of 1879, a larger boat or torpedo cruiser was made for Russia called the Batoum. She carries coal for a run of 800 miles at moderate speed. She is 100ft. long and 12½ft. beam, with engines indicating 500-horse power. She carries four fish torpedoes discharged through two launching tubes placed parallel to the centre line of the boat and projecting just beyond the bow. Steering and discharging are effected from the conning tower. There are three short masts to supplement the steam propulsion if necessary. The Batoum ran from London to Nikolaief in about eighteen days—4800 miles—averaging 11 knots per hour. Her speed over the measured mile was 22 knots.

Many boats of this type were afterwards ordered by the Argentine, Greek, Brazilian, Austrian, Dutch, and Italian Governments. Those for the first named Power were rigged for sailing, and went to Buenos Ayres well, the quickest in seventy-two days. Their sea-going qualities were reported to be so good in rough weather, that there clearly is no need to increase size for the sake of safety. In 1879 and 1880, thirty-four second-class torpedo boats were made for the Admiralty to equip large ironclads, by Messrs. Thornycroft and also Yarrow and Co. At first the torpedoes were discharged while the boats were nearly at rest from cradles lowered into the water. Subsequently a steam impulse gear devised by Messrs. Yarrow was substituted. The maximum speed of these second-class boats is about 17·27 knots, continuing for two hours.

A collision occurring to a torpedo boat in Italy led to Messrs. Yarrow making a special arrangement to prevent water entering in such a way as to cut off the supply of air to the fire, which has worked admirably, and did not in any way tell against the boat's powers of moving, a mean speed being obtained with a boat so fitted of 22·4 knots. All torpedo boats have curved decks, which give the maximum strength against compression. No special improvements or new features have come in during the last year. A remarkable trial may be noticed, however, of two torpedo boats for Russia—one built by Messrs. Thornycroft and the other by M. Normand. The former boat was 113ft. long by 12½ft. beam; she had a speed of 18·96 knots per hour for three hours, burning 2 tons 19 cwt.—with 633 indicated horse-power—or 1 ton per hour. With 13·39 knots speed, 13 cwt. 3 qr. 8 lb. of coal was burnt in two hours, with 212 indicated horse-power. M. Normand's boat, which was 124ft. by 11⅞ft. beam, 18½ knots was obtained for three hours, with 1 ton 19 cwt. of coal and 574 indicated horse-power. During four and a-half hours 11·57 knots speed was kept up, with 240 lb. of coal per hour and 121 indicated horse-power. The relative value of the fuel is not known. The French boat was peculiarly steady and free from vibration.

Two first-class torpedo boats are being built for England with revolving torpedo guns. A drawing was submitted of a torpedo boat protected partially with steel plates on the sides 1½in. and on the decks 1in. thick; but Mr. Yarrow did not advocate it as a good arrangement. The present second-class torpedo boats Mr. Yarrow considers rather long, narrow, and unhandy, and he prefers boats 56ft. long by 9ft. beam, with a speed of 15 knots; the loss in this respect being, it is thought, more than compensated by the boat taking a machine gun, and being handy, seaworthy, and available as an ordinary fast steam launch. Mr. White, of Cowes, has recently designed a remarkably good boat deserving notice.

With regard to the behaviour of torpedo boats on service, it is not surprising to find that when they get at all out of order and in inexperienced hands, their performances should fall far short of those achieved on trial. In a recent test at Pola, boats 100ft. long and 12½ft. beam, supplied to Austria, obtained a speed of 20 knots when fully equipped with torpedoes, coals, and with a crew, just as for action. This shows what may be achieved when attention is given to the matter. In the Italian service a very complete system of training men has been introduced, as well as in the Austrian service. It is to be hoped that this subject may receive the attention of our own authorities. England, however, is far behind in the number of boats she possesses, as the following table shows. This deals only with boats 75ft. long and 10ft. beam fit for sea in all weathers:—

	Number of torpedo boats.	Position of coast.	Approximate extent of coast line in knots.
The Russian Government possesses	115	Finland Baltic Black Sea	2070
The French Government possesses	50	Channel Atlantic Mediterranean Corsica	1640
The Dutch Government possesses	22	North Sea	490
The English Government possesses	19	England Wales, Scotland Ireland	3740
The Italian Government possesses	18	Peninsula Sardinia, Sicily	2750
The Austrian Government possesses	17	Coast of Istra Dalmatia, and Islands	800

A statement of the extent of coast line possessed by these various nations is annexed. The figures must be taken as approximate only, but relatively, which is all that is necessary for comparison, they are fairly correct, from which it will be seen that—the Russian Government possesses one boat to 18 miles of coast line, the Dutch one boat to 22 miles of coast line; the French, one boat to 33 miles of coast line; the Austrians, one boat to 47 miles of coast line; the Italians, one boat to 153 miles of coast line; the English, comprising only England, Wales, Scotland, and Ireland, one boat to 197 miles of coast line; and if the colonies are included, at the highest possible estimate there is one torpedo boat to 800 miles of coast.

The turbine method of propulsion is favoured by some authorities. Messrs. Thornycroft recently carried out some exhaustive trials as to this with a boat whose performances are fully described in a paper by Mr. Barnaby, jun., contributed to the Institute of Civil Engineers. Mr. Yarrow observed that a maximum speed of 24 knots might be obtained by torpedo boats over the measured mile on trial, or 22 equipped for action. Torpedo boats may be divided into two classes:—(1) Those which depend on speed to strike and escape. (2) Those which in darkness or smoke trust to escape detection. For the latter, silence and absence of steam and smoke are more important than very high speed. Electricity may perhaps prove the best method of driving these latter. Last year Messrs. Siemens and Messrs. Yarrow together made a boat 40ft. long and 6ft. beam, which easily obtained a speed of eight miles per hour. The electricity was stored up in accumulators below the water-line, such as could be charged by the machines now carried on many men-of-war. Such a boat would move without noise, and would have no funnel or fire to betray it. It might either discharge Whitehead torpedoes or drive a spar torpedo, the electricity being available for ejection. Probably, however, torpedo boats driven by electricity will be the exception, not the rule.

In the discussion which followed Mr. Yarrow's paper, Admiral Sir Charles Elliot spoke of the importance of torpedo boat defence, on the ground not only of efficiency, but also of speed and economy. He believed that one million sterling would provide us with 100 torpedo boats in nine months' time. The expenditure of this money would give greater security, he thought, to England than a similar sum spent on armour-clad vessels—twenty-five torpedo boats costing only as much as one armour-clad ship. He spoke of the great advantage of hydraulic propulsion, comparing a boat which drew only 2½ft. of water with one drawing 6ft., which was recently tried against it. He considered draught of water a question of paramount importance. He attributed the failures in recent boats with hydraulic propulsion to the fact that new devices were constantly tried, instead of depending on the elements which had secured success in the Waterwitch. Electricity he thought more particularly suited to the propulsion of lifeboats; but he regretted to find that there was no saving of weight in that system.

Captain Curtis compared the lines of a torpedo boat with those of a shark as to speed. He spoke of the value of draught over the top of a furnace, of the position of the screw, and of Griffith's shield to prevent fouling, also of the prevention of ramming by impulse torpedoes.

Admiral Boys inquired the weight of the Russian boats sent by rail. He spoke of the advantage of being able to discharge torpedoes abeam, and of the gain in power in having the rudder abaft the screw. He specially dwelt on the need of training officers and seamen to torpedo boats. He admitted the evil of steam being visible at night, but questioned whether the charging of accumulators by electricity was not a very long process—in fact, whether for a run of six hours it would not need six hours to charge the boat's accumulators. He then spoke on the protection of screws and in-shore boats moving in shallow and obstructed water.

Admiral Selwyn dwelt on the disgraceful and dangerous neglect of this branch of defence. He hoped that England might not suffer from the torpedo boats she had supplied to other nations, and so be in the position of the goose shot by the arrow feathered from her own wing. He dwelt on the importance of rapid firing, of the advantage of rigidity in structure in favouring speed. He spoke of the great power of liquid fuel, which goes twice as far, weight for weight, as solid fuel, and is employed now by Russia.

Admiral Ryder thought great difficulty was felt in steering torpedo boats owing to the compasses being affected by the vibration of the boat. The turbine, he thought, had been unfairly discredited by a noisy, bad design.

Admiral Hamilton asked as to the carriage of small boats on board torpedo boats. The boats might be kept from fouling their screws more than was supposed. In the American war this had never happened in their operations. He supported what had been said on the importance of training crews to torpedo boats.

Mr. White, of Elswick, late of the Admiralty, considered torpedo boats the pioneers of high speed, but he looked for larger vessels and torpedo cruisers to come in. He did not endorse what had been claimed for rigidity in structure; the experiments on the Leander or Phaeton class did not support the conclusion that rigidity was necessarily advantageous. He congratulated the country on the leading place taken by Messrs. Yarrow and Thornycroft in manufacturing torpedoes. In time of war England would at all events have a great advantage in the possession of their factories. He expected to see cruisers able to support themselves and keep the sea come on. Lord Charles Beresford, the chairman, said that England, he, feared was a year behind Russia in torpedoes. He considered six or eight vessels of the second-class better than one 1700 ton ship. He considered also that torpedo boats must be met and encountered by torpedo boats. More tubes were needed to discharge torpedoes from each boat. He condemned the attempt to adapt armour to torpedo boats as an undesirable compromise. The training of men he specially thought necessary. This was only one way in which England showed lamentable apathy. Money was always supposed to be freely given to the needs of the Navy, but when it came to the point it was impossible to get it. This was an old story, and a most serious matter.

Mr. Yarrow said, in reply to the question raised, that 100 torpedo boats could certainly not be made in nine months. He endorsed Captain Curtis's opinion on the advantage of burning fuel downwards when practicable. The Russian torpedo boats transported by rail weighed 20 tons each. He thought a revolving gun for torpedoes had not been asked for, but it could be made when required. As to the position of the screw, the chief advantage in having it astern of the rudder was that it was easily removed when damaged. Liquid fuel doubtless effected a great saving, but was not suitable for low speeds. It would certainly take over six hours to impart enough electricity to give power to run for six hours. He said no difficulty had occurred to his knowledge by the compass suffering from vibration.

The whole paper was a valuable contribution to our knowledge of a subject concerning which not so much is known as is desirable.

THE HORSE-POWER OF MARINE ENGINES.

We publish on another page a letter calling attention to the definition of the words, "nominal horse-power," as applied to marine engines. The writer wishes to have some definite statement as to the meaning of the phrase, and he sets forth that certificated engineers labour under a grievance because such a definition does not exist. By a well-known rule of the Board of Trade, sea-going steamships must carry a chief engineer if the engines are over 100-horse power nominal. But the Board of Trade does not say how the power is to be calculated. The result is, that a shipowner may, within somewhat wide limits, rate his engines at any power he pleases, and thus dispense with the services of a chief engineer. Engines that are called by one man 120-horse power are called by another 99-horse power. That the grievance of which our correspondent complains does exist there can be no doubt, but it is extremely difficult to suggest any adequate remedy. In other words, who is to define what engines are and are not of 100-horse power nominal? It may be new, even to our correspondent,—who is the spokesman, we may add, of an influential society,—that there are no fewer than eighteen recognised ways of calculating the nominal horse-power of marine engines, and these vary so much in their results, that while an engine with, let us say, cylinders 33in. and 62in. in diameter and 45in. stroke, is rated by one rule at 149-horse power, by another it is rated at 249-horse power. The existence of such anomalies long since attracted the attention of Lloyd's, and Mr. Parker and Mr. Milton, the engineer surveyors to the body, were requested to report on the whole subject. This they did in 1878. The results of the inquiry were disheartening. After carefully considering the problem, they expressed the opinion that it is absolutely impossible to fix upon any rule whatever, based upon dimensions of engines or boilers, which would give a result with every variety of engine, or even with particular types of engines, at all proportional to their actual power, and they submitted for the consideration of the Committee, "seeing that the registered horse-power is so very misleading and worse than useless, and also that it does not come within the province of this Society to attempt to lay down a commercial standard for marine engines, whether it would not be advisable to leave it out altogether from the Register Book, and only insert the sizes of cylinders, length of stroke, and working pressure of steam."

The true difficulty of the whole subject lies in the fact that "100-horse power nominal" has no definite meaning of any kind now. In years gone past there was practically no scope for differences among engines. The greatest pressure that could be carried in box boilers using sea-water, was about 20 lb. on the square inch. The paddle engines in vogue were tied up in the matter of piston speed within narrow limits, and expansion never exceeded half the stroke. Under these conditions it was not difficult to prepare a rule which gave, roughly, the actual power exerted. Thus the Admiralty rule runs: multiply the square of the diameter of the piston in inches by the speed of the piston in feet per minute, and divide by 6000; the quotient is the horse-power. Thus an engine with a cylinder 42in. diameter and the same stroke, making 42½ revolutions per minute, would by this rule be 175-horse power. Not a word is said here about the pressure; but it was well known that the average effective pressure would not greatly exceed 15 lb. on the square inch. Calculating the true power on this basis, we have, $\frac{1385 \times 15 \times 297 \cdot 5}{33,000} =$ 187-horse power nearly, which is not far from the nominal power. It may be urged that this rule could be modified to suit existing practice; but those who argue in this way must overlook the fact that there is nothing approaching uniformity of practice in the matter of piston speed, boiler pressures, or ratios of expansion. It is difficult consequently to avoid agreeing with Mr. Parker, that nothing can be done. Various attempts have been made to devise a useful rule; the results of these experiments will be found set forth in the eighteen formulæ given by Mr. Parker in his report to Lloyd's. It may be instructive to give some of them here. The Merchant Shipping Act of 1862 uses the words "nominal horse-power" without defining the meaning; the proposed Merchant Shipping Act of 1871 contains the Admiralty rule modified to suit compound engines in which $\frac{D^2 + d^2 \times \text{speed of piston}}{6000}$ = N.H.P. Here D is the high and d the low-pressure cylinder. Six rules are based on the formula $\frac{D^2 + d^2}{c}$ where c is a constant varying between 26 and 33. Two rules have the form $\frac{(D^2 + d^2) \times \sqrt[3]{S}}{C}$ where S is the stroke in inches, and C is 100 in one case and 90 in another. Again, we have $\frac{(D^2 + d^2) \times \sqrt[3]{S}}{40}$ where S is the stroke in feet. Two others have the merit of simplicity; one allows 840 cubic inches of cylinder capacity per horse-power; the other takes the area of the high-pressure piston divided by 5; and so on. It is needless, we think, to say more to prove that the words "nominal horse-power" as applied to a marine engine really mean nothing.

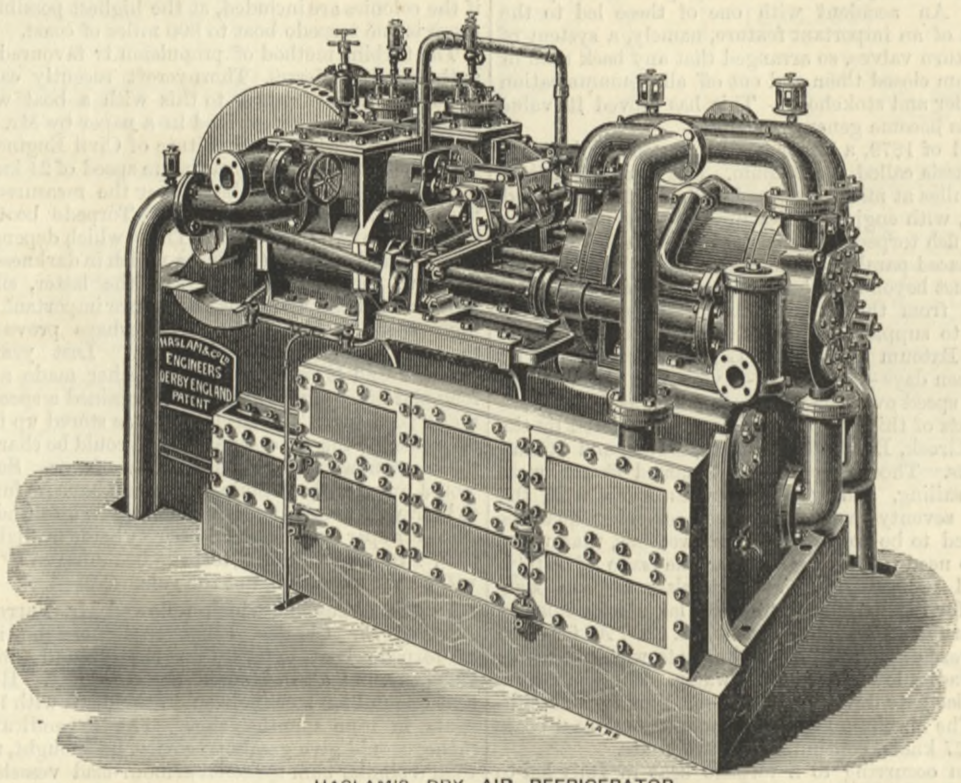
So far as the mere buying and selling of marine engines is concerned, the words nominal horse-power have long since lost all virtue; shipowners buy their engines now on a far more satisfactory and definite basis. But the grievance of which our correspondent complains remains to dealt with. We feel in a measure bound to suggest a remedy. We do not pretend that it can be satisfactory, but it is better in our opinion than any of the rules which we have quoted. Although there is very great room for diversity of practice in the matter of engines, there is very little in the construction of boilers. It would be far more easy to settle the nominal power of a boiler than that of an engine. The size which the grate area, again, bears to the rest of the boiler, even to its cubical displacement, is fixed pretty closely. The normal draught does not differ much between any two or three or two or three dozen well designed marine boilers, and it would not be difficult to prepare a rule based on some such figures as the following. Let it be assumed that $7\frac{1}{2}$ lb. of coal are required to produce one nominal horse-power for one hour, and that 15 lb. can be burned on a square foot of grate per hour. Then it is evident that the nominal horse-power of the boiler will be got by multiplying the grate area by 2. Thus a boiler with three grates each 7ft. long by 3ft. in diameter would be $(7 \times 3) 3 \times 2 = 126$-horse power nominal. In practice such a boiler would supply steam for about 500-H.P. indicated, or say five times the nominal power. It makes no difference what the size of the engines may be. There is this in common among all marine engines—that there is not any wide diversity in the consumption of fuel per horse-power indicated—of course we are speaking now of good compound engines, such as are put in the best cargo boats—or in the rate at which coals are burned on each square foot of their grates. The grates are, after all, the factors which decide how much power shall be exerted; and they therefore supply the only available basis on which to determine whether a certificated engineer shall or shall not be carried. We do not suppose for a moment that any such rule is perfect, but we do venture to say that a rule, based on the grate area of a boiler, must be more satisfactory all round than any one of the eighteen to which Mr. Parker refers. No matter what the pressure carried or the grade of expansion, or the piston speed, the power must ultimately depend on the grate area; and there is, perhaps, less difference between the practice of makers in this respect than in any other. If there is not grate surface enough, the fact tells its own tale, as in the case of the City of Rome. The engines in this fine vessel were not in fault, and the whole of the disappointment attending her first voyages was solely due to the fact that she had not boiler power—in other words, grate surface—enough to develope the required speed. We cannot conclude this article better than by quoting the words used by Mr. Parker and Mr. Milton in the report before referred to:—"Whether the question is looked at from the point of view of the power or the value, quite as important an element as the size of engines is the evaporative power of the boiler. Unless the boiler can supply as much steam at the full loaded pressure as the engine is capable of using, no more power will be obtained than would be developed by a smaller engine; yet it is absolutely impossible to lay down any rule for determining the evaporative power of different boilers, for not only does the relative efficiency of long and short, or small and large tubes—of which the heating surface largely consists—differ greatly, but the general arrangements of the boilers exercise a very great influence upon the evaporative power, and the estimation of these differences must always be a matter of judgment. For instance, it is a common experience for boilers which have originally been badly designed to steam better after many tubes are taken out and the heating surface largely reduced, owing to the circulation of the water being improved."

Here it will be seen that the influence of the boiler on the question being discussed is fully recognised. We admit the force of Mr. Parker's arguments as apparently bearing against what we suggest; but, as we have pointed out, there is very much more uniformity of practice in boilers as regards grate areas than there is in engines as regards cylinder capacities, and speeds, and pressures, and ratios of expansion; and for this reason we fail to see anything in the passage which we have just quoted to make us doubt that we are right, when we contend that the Board of Trade regulations concerning chief certificated engineers would be better based on grate area than on anything else.

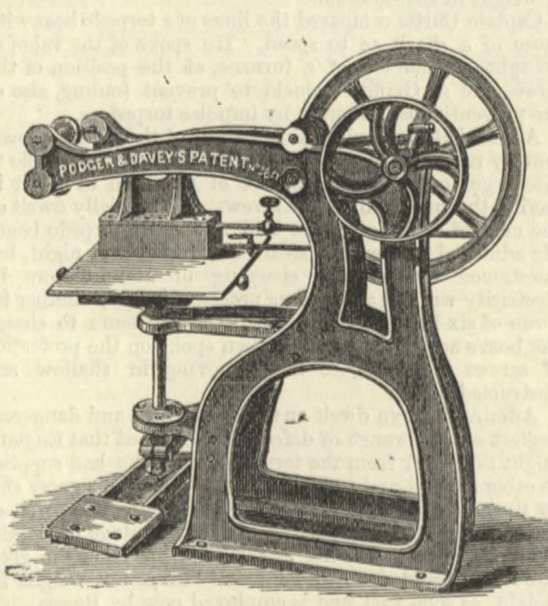
MACHINERY AND MECHANICAL APPLIANCES AT THE INTERNATIONAL HEALTH EXHIBITION.

No. III.

Messrs. J. and E. Hall, Dartford, exhibit, in connection with a cold storage room, two sizes of Ellis' patent air refrigerator, the larger one capable of delivering 5000 cubic feet of cold air per hour, when running at a speed of 150 revolutions per minute; and the smaller one 2000 cubic feet of cold air per hour, at 225 revolutions per minute. The special features in these machines are the arrangement of parts, by which great compactness is secured, and the adoption of flat slides for the compressor, instead of the ordinary beat valves, which permits of a high rate of revolution without the objectionable noise which is caused by clacks beating on their seats. The engraving on page 379, which is prepared from a photograph of the smaller machine, shows the general arrangement of the apparatus. Figs. 1 to 4 show details of the compression and expansion valves, which are ordinary flat slides, partly balanced and held up to their faces by strong springs from behind. The steam, compression, and expansion cylinders are severally bolted to the end of a strong frame, which, though attached to the cooler box, does not form part of it, the object being to meet the strains between the cylinders and shaft in as direct a manner as possible without allowing them to act on the cooler casting. Each cylinder is double-acting, the pistons being coupled to the shaft by three connecting rods, the two outer ones working upon crank pins fixed to overhung discs, and the centre one on a crank formed in the shaft. The slide valves for all the cylinders are driven from two weigh shafts, the main valve shaft being actuated by a follow crank, and the expansion and cut-off valves from the crosshead pin of the compressor. The machines may be used either in the vertical position as exhibited, or may be fixed horizontally; and it is stated that the construction is such as to admit of speeds of 200 and 300 revolutions per minute respectively for the larger and smaller machines, under which conditions the delivery of cold air may be taken at about 7000 and 2600 cubic feet per hour. Messrs. Hall also make this class of refrigerator without the steam cylinder, and arranged to be driven by a belt from a gas engine or any existing motive-power.



HASLAM'S DRY AIR REFRIGERATOR.



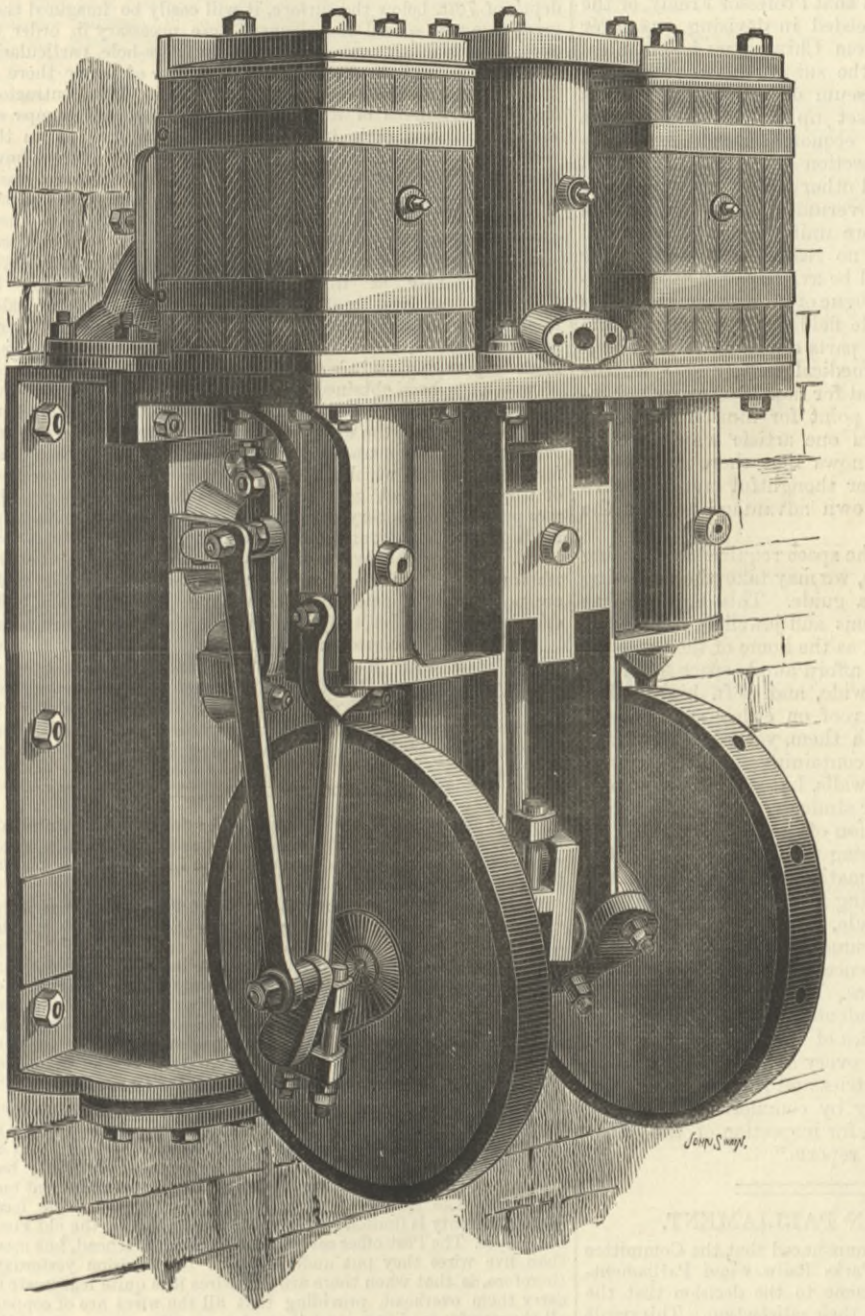
PODGER'S IRONING MACHINE.

We illustrate above, an exceedingly compact and well-made dry-air refrigerator, capable of delivering 18,000 cubic feet of cold air per hour, which is shown by the Haslam Foundry and Engineering Company, Derby, a firm well known for its success with this kind of apparatus. The principle on which the machine works is that common to all of its class, viz., by compressing air, cooling it by water when under compression, and finally expanding it behind a piston; and in the present case the chief novelty lies in the manner in which the various working parts have been arranged in order to secure economy of space. The base plate consists of a large casting forming the cooler, the arrangement being such that the compressed air is first cooled by passing it through tubes surrounded with water, and is afterwards still further reduced in temperature by subjecting it to the influence of the waste air returning from the cold storage chamber. At one end of this casting is fixed a double-acting compressor, and at the other are placed side by side the air expansion and steam cylinders. The piston-rods of all these work inwards and are connected to a long cross-head of cast steel guided at each end in slides, and having gudgeons formed on them for receiving the connecting rods, which pass outside the steam and expansion cylinders to cranks keyed to a shaft running in bearings formed on the cooler casting. A small fly-wheel, with turning gear for convenience in starting, is fixed to the shaft. It will be noticed that by this arrangement of parts great compactness has been secured, and we need hardly add that the workmanship seems all that could be desired. In connection with this refrigerator, freezing and chilling rooms have been erected by a committee of influential gentlemen connected with the Australasian colonies, the chairman being Sir F. D. Bell, Agent-General for New Zealand. In these rooms may be seen the whole operation of freezing and storing frozen meat, while at a butcher's stall visitors may select and purchase joints of Australasian mutton, which, if required, are despatched to their residences on payment of a small sum for carriage.

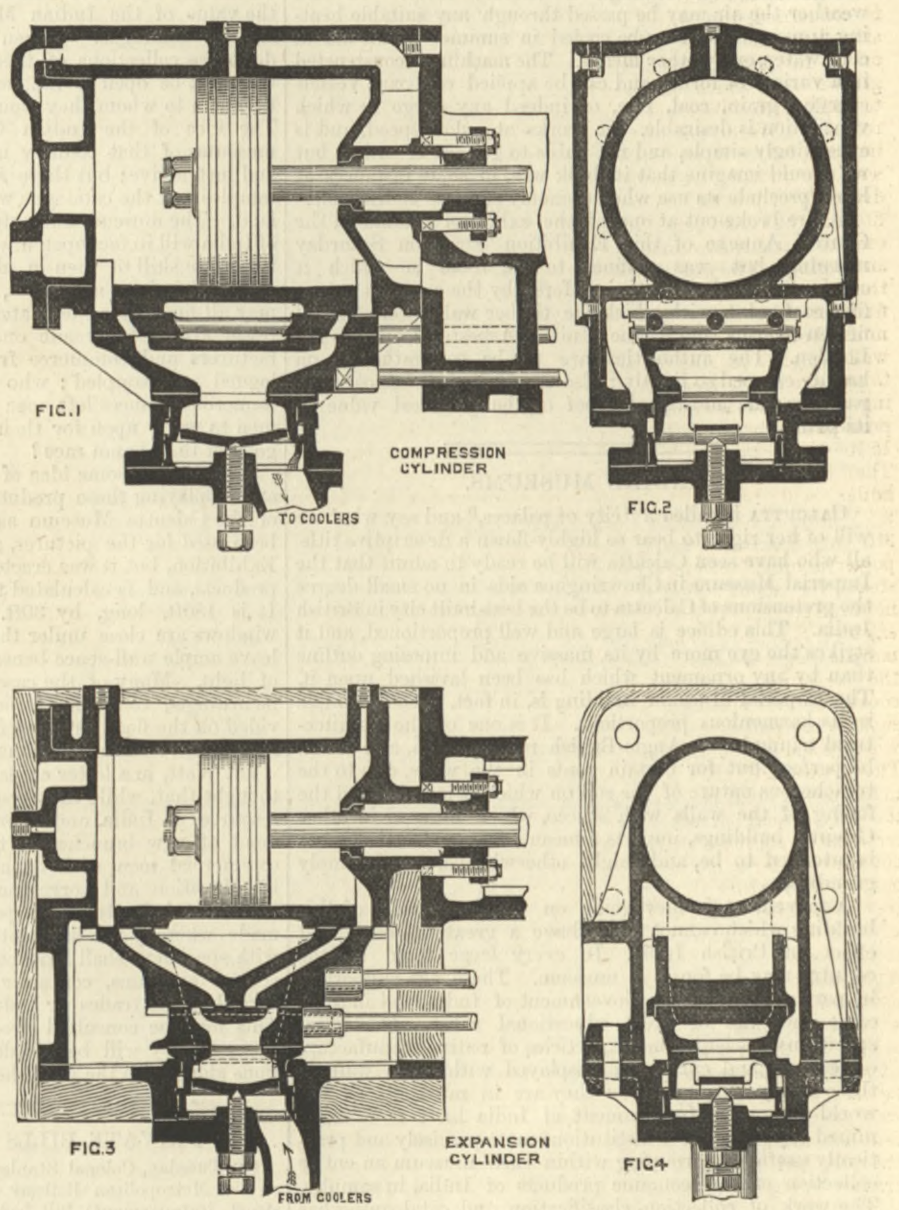
Messrs. Normandy's Patent Marine Aërated Fresh Water Company, Limited, exhibit in operation with salt water two of their well-known double distilling machines for producing good cold drinking water from sea water, which have been previously described in our columns. In this apparatus every 100 lb. of boiler steam consumed yields 175 lb. of distilled water; but larger machines are constructed for treble and quadruple distilling, which give respectively 225 lb. and 255 lb. of distilled water for the same expenditure of steam. Hence with a boiler evaporating 9 lb. of water per pound of fuel, each of the three classes will produce respectively $15\frac{1}{4}$, $20\frac{1}{4}$, and 23 tons, or 3400, 4500, and 5100 gallons of water for every ton of coal burnt. Many of the treble distilling machines have been erected at Aden for the Government, as well as for private firms, and the results of a twenty-four hours' trial made with one of these last year showed a yield of 12,110 gallons of cold fresh water for 2 tons 11 cwt. of coal. At the Exhibition, in order to fully demonstrate the action of the apparatus, the water produced by the condensation of the boiler steam is made to flow out in one stream, and the 75 per cent. of gained fresh water in another; the latter being quite cold and clear, and free from any peculiar taste. One advantage of these distilling machines is that by separating the condensed steam from the cold fresh water gained in the apparatus, the former, which is often impure, can be taken back into the boiler in place of having to supply sea water, thus preventing contamination of the drinking water, and to a large extent preventing the formation of scale. Machines of the smallest size shown are largely used in torpedo boats, partly to supply drinking water, but chiefly to keep the boilers fully charged with fresh water; the multitubular boilers employed in these boats being specially liable to lose water in various ways, and being likely to suffer injury if the loss is made up direct from the sea, owing to the deposition of non-conducting materials upon the heating surfaces. Meat-cutting and sausage-making machines are shown in operation by Messrs. W. and T. Ovens, London. The meat is cut in a metal bowl by means of knives fixed to a spindle, which is revolved at a speed of about 800 revolutions per minute, at the same time that the bowl is slowly turned round by gearing from below, a single set of knives being used in sausage machines, and a double set in those for fine mincing and for preparing fish paste. The knives are shaped like a scimitar, and are screwed up between discs, so that they can be easily adjusted or removed. They are arranged to work close to the pan, so as not to leave any meat uncut, and have an upward cut through inverted cutters placed in the cover, as well as a downward one, the inverted cutters being adjustable, and constructed so that there is just sufficient space for the knives to pass between them. A plough is fixed inside the bowl, by which the meat is turned over at each revolution, so as to ensure every portion being brought under the action of the knives. The machines are known as the "Eclipse." They seem well made, are almost silent in their action, and possess the advantage of cutting the meat instead of tearing it in pieces, and of keeping it much cooler than in the old process. The meat is fed in from above, and is under inspection of the attendant during the whole operation. At the same time, all the working parts are thoroughly protected, so as to preclude all chance of accident.

Messrs. T. Bradford and Co., High Holborn, show a complete steam laundry at work in the Western Gallery, all the table cloths, napkins, &c., used by the refreshment contractors in the buildings being washed here. There is a large selection of "Vowel" washing machines, which contain no internal moving parts, but have merely a series of fixed ribs, which gather up the clothes, and once in each revolution carry them up to the top, and then drop them to the bottom. In this way it is stated that such delicate materials as muslin and cambric can be washed without the slightest fear of injury in a much better manner than if done by hand. After washing, the clothes are passed through a double boiling process, and are then rinsed, a new apparatus being exhibited for this latter operation, by which the cold rinsing water is kept in violent agitation by means of a reciprocating plunger, which is contained in a separate compartment communicating with that in which the clothes are placed, and which receives its motion by connecting-rods from a couple of small cranks. The wringing machine connected with the apparatus is fitted with rollers made of discs of cloth compressed by hydraulic power and turned, which are stated to last longer and bear a much higher pressure than when made of wood or india-rubber. The hydro-extractor is over-driven by means of bevel friction gear, the wheel being made of iron, and the pinion of discs of leather tightly squeezed together. This makes a compact arrangement, and as the gearing is all in sight it is much more likely to be kept in proper order than when it is placed in the casing below. The basket is driven at a speed of 1000 revolutions per minute, and the machine works without noise or vibration. The drying arrangement consists of a well-ventilated closet with radial horse, having the arms placed in a spiral of such pitch that the linen on each arm hangs clear of that below. The stove is at one side, and is constructed for heating a large number of flat-irons as well as for maintaining a temperature of from 130 deg. to 140 deg. in the closet, so as to dry the heaviest linen in from fifteen to thirty minutes. Another form of closet suitable for large establishments, and arranged for heating by steam, is the "draw out," in which the clothes are hung upon horses supported by rollers running on rails, from ten to fifty horses being used in one closet. After drying comes the mangling and finishing, which is accomplished in a variety of ways according to the material and kind of article to be dealt with. An improved form of the ordinary box mangle is shown, in which rollers are introduced for guiding the box, as well as some novel arrangements in the driving and reversing gear, and there is also a great variety of hot calenders of different designs and sizes suited to almost every purpose. In this brief description we have only attempted to include some of the principal of Messrs. Bradford's exhibits, which comprise almost every requisite for hand and steam laundries of all sizes; but we must not omit to mention an apparatus, which though not strictly forming part of the appliances for washing, is at least an important, if not a necessary, adjunct to a public wash-house or laundry. We refer to the disinfecting apparatus. This is most frequently made portable, in order that it may be readily taken to the locality in which the infectious disease exists. It consists of a hollow base of wrought iron, mounted on wheels, and containing three compartments, of which the centre one forms the fireplace, the two side ones being utilised as ducts for conveying the air and vapour from the chamber to the fire to ensure their being raised to an extremely high temperature before being discharged into the atmosphere. On this base is placed a large sheet iron container, balanced like a gasholder by weights suspended from chains carried over pulleys at the top of cast iron pillars, and into which the articles to be disinfected are run on light wrought iron wagons made of various forms, according to the kind of article to be operated upon. The heat is either supplied by a coke or coal fire, or, in some cases, by gas, and an arrangement of tubes is made whereby as soon as the internal temperature reaches 212 deg. Fah., steam is generated and allowed to circulate in the container. The temperature is maintained between 212 deg. and 250 deg., pyrometers being inserted in various places to guide the attendant. Close to Messrs. Bradford's stand is a useful little machine for ironing cuffs and collars, exhibited by Messrs. Podger and Sons, Bromley, and which we illustrate on page 378. The iron, measuring 20in. by 9in., is hollow, and is heated internally by an atmospheric gas burner or by steam, the iron is hung from a flat bar, being supported on a couple of turned rollers, and receives a reciprocating motion from a crank driven by a strap. Below the iron is a table, which can be raised and lowered quickly by a treadle, and moved horizontally in either direction by hand. The operator has therefore complete control over the articles while being ironed. The machine will keep three women employed, and it is stated that by its means twelve dozen collars or cuffs can be turned out per hour at about half the cost of hand labour. The machine is noiseless in action, and can be used for ironing table napkins, &c., as well as collars and cuffs. It is made with one or two irons.

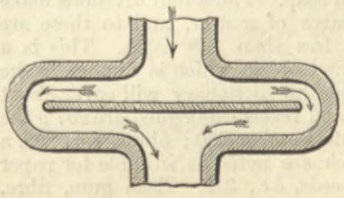
The Farquhar-Oldham Filter Company, Cornhill, E.C., show several of their patent apparatus for filtering rapidly and continuously liquid sewage, the effluent from sewage works, or any liquid containing quantities of solid matter in suspension. As a description of this filter has already been given in THE ENGINEER, we need only state here that it consists of an iron casing, containing the filtering medium, which is generally either ordinary or carbonised sawdust, on the top of which is a cutting plate, capable of being revolved by hand, or in large machines by power, in order to scrape the surface of the bed when it is considered that it requires cleansing. The liquid is introduced through the spindle, which is hollow, and is led into the cutter, which distributes it over the whole of the filtering surface. Since this filter was first noticed by us we understand it has been greatly simplified. It seems to have been proved by experience that a pressure of from 2 lb. to 5 lb. per square inch is sufficient for most liquids, and this pressure can be obtained by making the cylinder from 6ft. to 10ft. in height above the bed. In certain cases the cylinder is provided with a false bottom, which receives the inflowing liquid, the heavier matters in suspension gravitating to the bottom, while the clearer liquid is drawn off through the top by a fine perforated funnel attached to the central hollow spindle, the perforations being kept free from obstruction by means of rotating brushes. For sewage this combination of settling chamber and filter is doubtless of considerable importance, as the grosser impurities are prevented from passing on to the filter bed, which consequently will remain efficient for a much longer time. Various arrangements of steam-heating pipes are shown by Mr. R. B. Stirrat, Newcastle-on-Tyne. One of these is a radiator for direct warming in corridors, halls, &c., in which series of vertical pipes are screwed into a hollow cast iron base or box, and are joined together in pairs at their upper end by U-bends, the whole being surmounted by an ornamental casting. In this way expansion is provided for without straining the joints, and the discharge of air facilitated. We are informed that 200 of these radiators have just been supplied for warming the corridors at the new Holloway College at Egham, under the direction of the architect, Mr. W. H. Crossland. Another system, more suited to dwelling rooms, is a combined fresh and warm air ventilator, which consists of an exterior wood casing of any desired form containing the warming apparatus, and having a communication with the air outside the building. The steam is admitted into flat chambers of cast iron with external projections or feathers, and having internal baffle plates, as shown in the annexed sketch, which cause the steam to spread over the



J. AND E. HALL'S DRY AIR REFRIGERATOR.



DETAILS OF REFRIGERATOR VALVES.



whole extent of heating surface. The cold air, entering from the outside, passes up over the heating apparatus and is delivered to the room at any desired temperature. The same arrangement is used in connection with the induction system of ventilation, in which a small quantity of air at a pressure of about 5 lb. per square inch is caused to induce a local service of a very much larger volume, a plan which in many instances is extremely convenient, as a single compressing plant can be made to supply air at a great number of ventilating stations, a small pipe conveying the compressed air where required without serious loss from friction. Mr. Stirrat also exhibits an automatic apparatus for returning the hot water produced by the condensation of steam in the heaters to the boiler. It is placed at a slight elevation above the boiler, and consists of an exterior iron casing containing a hollow float which receives the hot water, and when full sinks and acts on suitable valves in such a manner as to admit boiler steam and place the water in equilibrium, so that it gravitates into the boiler.

In the Western Arcade the Norton Ventilator Company exhibit two of their displacement ventilators, one a double and the other a single machine. The apparatus consists essentially of a system of pipes connected with the apartmemts to be cleared of foul air, communicating by means of valves with a water bell or air chamber, to which a vertical reciprocating motion is imparted by a beam or other contrivance operated by steam, gas, or water power. The return or down stroke of the bell discharges the air through a delivery valve. In cold weather the air may be passed through any suitable heating apparatus, or may be cooled in summer by the aid of cold water, or by other means. The machine is constructed in a variety of forms, and can be applied on board vessels carrying grain, coal, rice, or indeed any cargo in which ventilation is desirable. It works at a slow speed, and is exceedingly simple, and not liable to get out of order; but we should imagine that its bulk will, in some instances at least, preclude its use when economy of space is desirable.

A fire broke out at one of the exhibitor's stands in the Central Annexe of this Exhibition early on Saturday morning, but was confined to the room in which it originated by the resistance offered by the asbestos patent fireproof paint, with which the timber walls were coated fifteen months ago by the United Asbestos Company, of London. The authorities are to be congratulated on having escaped so lightly; also the United Asbestos Company on this additional proof of the practical value of its paint.

INDIAN MUSEUMS.

CALCUTTA is called a "city of palaces," and say what we will of her right to bear so highly-flown a descriptive title all who have seen Calcutta will be ready to admit that the Imperial Museum in Chowringhee aids in no small degree the pretensions of Calcutta to be the best-built city in British India. This edifice is large and well proportioned, and it strikes the eye more by its massive and imposing outline than by any ornament which has been lavished upon it. The Imperial Museum building is, in fact, grandly simple in its harmonious proportions. It is one of the architectural triumphs of Anglo-British rule in India, and would be perfect but for certain rents in the walls, due to the treacherous nature of the soil on which it is built, and the facing of the walls with stucco, which here, as in other Calcutta buildings, imparts a mean effect, and makes what is intended to be, and might otherwise be, grand, simply grandiose.

A movement is now going on within the walls of this building which cannot fail to have a great and beneficent effect on British India. In every large town in the country may be found a museum. These are supported, in part at least, by the Government of India, and in some cases they are of great educational value. Geological specimens, ancient remains, articles of native manufacture or produce, and curios are displayed within the walls of these institutions much as they are in museums all the world over. The Government of India have now determined to render these institutions more precisely and practically useful by grouping within each museum an entire collection of the economic products of India, in samples. The work of collection, classification, and cataloguing has been entrusted to Dr. George Watt, M.B., C.M., F.L.S., and to the exertions of this gentleman are added the resources of the Indian Government. The catalogue, which is not yet completed for issue to the public, is a work of prodigious labour and research. In order to insure its perfect accuracy the Government of India had founts of type prepared, so that the whole work could be kept standing while it was under revision. The book has been prepared, in the first instance, in sections printed on large paper affording wide margins for notes. In this form it has been sent throughout the length and breadth of India to all medical men, civil and military, to men of science, and to others who may be supposed to be able to add a note to increase the value of the work. Scientific men in Europe have also been appealed to in all cases in which their aid could be of use in the elimination of errors of classification or description. At the Calcutta Exhibition Dr. Watt had set up a very large number of the samples of economic products, and one volume of the catalogue or dictionary was ready for the use of visitors. This volume is in four parts, viz., gums and resins; dyes, tans, and mordants; fibres and fibre-yielding plants; and oils and oil seeds, perfumery, and soap. These four divisions make collectively over 300 pages of matter, and to these are added an index of no less than 148 pages. This is a sample of the energy and spirit which is applied to the work. When completed the dictionary will cover about 3000 pages. The gums and resins catalogued are 297; the dyes, tans, and mordants number 280; fibres, &c., 298, a large proportion of which are noted as suitable for paper making; the oils, oil seeds, &c., 316. Each gum, fibre, dye, or oil has its scientific name, or that of the plant which produces it, its vernacular name, a brief description of the habitat of the plant, and a few lines, or in some cases a long essay, summarising what is known of the article. In a former paper on the Calcutta Exhibition we noted more than a dozen varieties of timber from the Andaman and Nicobar Islands, but here will be full descriptions—and in the Museums samples—of every kind of timber produced in India. In the Calcutta Exhibition they were shown to be between four and five thousand specimens, but that part of the dictionary was not ready for issue, and the logs were, so to speak, dumb. Some of these bear a good polish, and nearly all of them are useful in building, and in works where great strength is required. Attention has recently been drawn to paper-yielding fibres, in consequence of the great and ever-increasing demand for paper. No better example of the value of the work on which Dr. Watt is engaged can be found than in one example taken from this very copious list. It is well known to experts that the material known as China grass —Bæhmeria Nivea—yields a very beautiful fibre, suitable for weaving the finest textile fabrics. It is soft, glossy, and strong. The difficulty of separating the fibre from the coarser matter with which it is grown is, however, so great that the Indian Government in 1871 offered a reward of £5000 for a good extracting machine for China grass, or as it is called Rhea grass. In 1877 the offer was renewed, and a trial of seven machines was made at Saharunpore, but the result was not satisfactory, and the premium was withheld. Recently, we learn that Professor Frémy, of the Institute of France, has succeeded in devising a plan for the extraction of the fibre from China grass by chemical treatment, but we mention the subject here to illustrate the value of the Indian Museum of Economic Products and its catalogue. When set up in this country—as doubtless collections of these economic samples will be—they will be open to the inspection of hundreds of scientific men to whom they would otherwise be merely names. The idea of the Indian Government is to render the museums of that country more uniform, and more useful and instructive; but there is no reason to doubt that the samples and the catalogue will be available for use in England. The museum and catalogue of the economic products of India will in fact open a wide field for the exercise of the inventive skill of men in all parts of the Empire. Engineers, chemists, architects, medical men, and scientists may all find there the material for new enterprises. Professor Frémy has made one point for himself for manufacturers and commerce from one article which is catalogued and sampled; who knows that there may not be numerous chances left open for thoughtful and inventive men to work upon for their own advantage and for the good of the human race?

As affording some idea of the space required for housing and displaying these products, we may take the new wing of the Calcutta Museum as a guide. This building has been used for the pictures, gems and jewellery during the Exhibition, but it was erected as the home of the economic products, and is calculated to afford ample space for them. It is 180ft. long, by 30ft. wide, and 26ft. high. The windows are close under the roof on either side, so as to leave ample wall-space beneath them, yet affording plenty of light. Many of the cases containing the samples may be arranged conveniently on walls, but space must be provided on the floor for desks for students, and also for tables for the more minute examination of the specimens.

Dr. Watt, in a letter explaining the scheme, says: "It is thought that, while thus systematically making known the resources of India, and affording facilities for the development of new branches of trade, this system will supply commercial men with an accurate and reliable mode of identification and correspondence whenever inquiries are necessitated for trade purposes. Arrangements will be made whereby the superintendents of museums supplied with specimens shall have copies of the proceedings of the central museums, containing every available information regarding the trades or industries and resources of India. This may be consulted freely by commercial men, and every facility will be afforded for inspection of the collections along with the published reports."

PRIVATE BILLS IN PARLIAMENT.

ON Tuesday, Colonel Stanley announced that the Committee on the Metropolitan Railway (Parks Railway and Parliament-street Improvement) Bill had come to the decision that the preamble had not been proved to their satisfaction. This result was no doubt mainly brought about by the evidence of Colonel Yolland and Major-General Hutchinson, who, called by the Committee as independent witnesses, expressed very strong opinions against the breaking of the circle in the manner proposed by Sir John Hawkshaw, whose plans, by the way, met with very unkindly criticism at the hands of Colonel Yolland. One cannot help thinking that the impression created by this evidence might have been modified had the Committee borne in mind the fact that the Board of Trade invariably report against junctions or level crossings; and indeed Colonel Yolland stated, in answer to Mr. Littler, that every junction was more or less dangerous. However, in view of the possible inconvenience—not to put it higher than that—which might have been experienced in the working of the traffic, both on the Inner Circle proper and on to this new line, it is not a matter for much surprise that the Committee determined to reject the scheme.

Group A.—The Committee on this group determined that, subject to certain conditions for the protection of existing interests, the London—City—and Southwark Subway Bill might be allowed to proceed. The scheme, which was fully described in our last issue, is for a subway from the Elephant and Castle to King William-street. The subway will contain a tramway to be worked on the cable system of traction.

Group 2.—Tuesday was an unfortunate day for Sir Edward Watkin, for, after his Park Railway scheme had been thrown out by Col. Stanley's Committee, he sustained another reverse in the rejection of the East of London, Crystal Palace, and South-Eastern Junction Railway Bill. This was a project for constructing a line from the Crystal Palace to Ladywell, where a junction was to be made with the South-Eastern. By this means the Crystal Palace district would have been placed in direct communication with Charing-cross and Cannon-street, instead of, as now, being confined to the Brighton Company's termini at London Bridge and Victoria, and the Chatham and Dover Company's Ludgate-hill and Victoria stations.

The Select Committee to whom the Ennerdale Railway Bill scheme was referred, determined, after hearing the arguments *pro* and *con.*, that the Bill should not be allowed to proceed. The project was a revival of one rejected last year, and it was proposed to construct a railway from the joint line of the Furness and North-Western Company at Frizzington to Ennerdale. As the line in its course was to pass through an exceedingly fine part of the lake district, the cry of damage to the scenery was immediately raised, with what effect has been seen.

Group B.—The Select Committee on the Croydon Direct Railway Bill found that the preamble was not proved. This was one of the schemes, of which so much has been heard of late years, for extending the Chatham and Dover line. Commencing at Croydon, the railway was to be carried in a straight line to Dulwich, whence, a junction being made with the Chatham and Dover, access was easy to Holborn Viaduct and Victoria.

LEYLAND WATERWORKS.

AT the pumping station of the new Leyland Waterworks, Clayton Green, near Chorley, an important stage has been reached in the completion of the heading from the main well to the bore-hole, and in connecting this to the bore-hole, thus enabling the water to flow from the bore-hole into the main well. This work was satisfactorily completed some weeks since. The work all through was necessarily attended with risk. The bore-hole is 14in. diameter, and the water in it, standing as it does constantly at 20ft. from the surface, and the heading from the main well to it being driven through a mixed strata at a depth of 70ft. below the surface, it will easily be imagined that great care and special management were necessary in order to effect a satisfactory connection with the bore-hole, particularly also when taking into account the great force of water there is in the bore-hole which had to be dealt with. The contractor, Mr. H. E. Timmins of Runcorn, had two powerful pumps at work for a considerable time, one pump being fixed down the bore-hole, and the other in a main well. These pumps, however, were found at a late stage of the work to be quite inadequate to keep down the water, and it was subsequently considered necessary to bring into use, in addition, the two new permanent pumps belonging to the Local Board. One of these pumps, together with the two pumps of Mr. Timmins, have been constantly at work, day and night, working to their full capacity, and the other permanent pump also working as occasion required. There is, therefore, every reason to know, from the severetest which has thus been made in pumping, and also previously, that an abundant yield of water has been obtained. Mr. Wrennall, the engineer, went down to make a final inspection of the connection after completion, and found the work to be in every way satisfactory and successful. The contractor and his men received great praise for the manner in which they had carried out so difficult a piece of work. The work gave a good opportunity for testing the new pumping machinery, consisting of engines, boilers, and pumps in duplicate. This ran from the commencement without any hitch. Mr. Joseph Clayton, of Soho Foundry, Preston, is the contractor for this portion of the works. The whole of the works are now rapidly approaching completion. The large and substantial reservoir, built by Mr. William Crook, of Chorley, has been charged and tested, and is now supplying the district with water. The water mains also have been tested, the head of water varying from 150ft. to 250ft., and they are nearly ten miles in length. Not a single leak has happened, which is to the credit of the pipe manufacturers, the Staveley Iron Company, and the contractor for pipe laying, Mr. Edward Barber, of Preston.

NAVAL ENGINEER APPOINTMENTS.—The following appointments have been made at the Admiralty:—Richard T. Rundle, chief engineer, to the Indus, additional, for the Lily; William Waterfield, chief engineer, to the Asia.

LAXTON'S BUILDERS' PRICE BOOK FOR 1884.—This is the sixty-seventh edition of the well-known guide to the prices of everything that can very well be priced in a building, or in the work of any kind in a building. It was originally compiled by William Laxton, and now is published by Messrs. Kelly and Co. It contains over 72,000 prices, and is a book which others besides builders and contractors find indispensable. The letter-press on various subjects, including decisions in the law courts, bye-laws, headings for contracts, notes on work, timber, &c., have been extended, and for the first time contains a chapter on electric lighting with prices.

OVERHEAD WIRES.—The decision of the Railway Commissioners which has been given this week, concerning overhead wires in Wandsworth, is opposed to that of Mr. Justice Stephen, who in the Telephone Company case held that the local authority had absolute power over everything between the street pavement and the sky. The Railway Commissioners have decided the local board authority is limited by the powers conferred by the old Post-office Acts. The Post-office carry up to five wires overhead, but more than five wires they put underground. The decision yesterday, therefore, is that when there are few wires it is quite legitimate to carry them overhead, providing that all the wires are of copper, all the standards of iron, and that when a wire crosses a street the distance between the two supports does not exceed one hundred yards.

THRASHING MACHINE MANUFACTURE.—For many years the manufacturers of thrashing machines have looked upon this branch of their business as one which they would rather be without if they could give it up and retain the rest, but we notice that the prospectus has been issued of the company to be established for the manufacture of thrashing machines under Mantle's patent, described in our columns on the 6th July last. The proposed capital of the company is £100,000 in £1 shares, only 40,000 of which will be now offered. The manufacture of thrashing machines in the ordinary way is not, there is little doubt, a very profitable business; but there is so much less work and material in Mantle's thrasher than in others that the high cost price complained of by other makers will not affect the company, and by striking out of the beaten path and making a speciality of thrashing machine manufacture with special plant, the trade will be carried on under very favourable conditions.

COLLIERY LAW.—An important case, gravely affecting colliery proprietors, was decided at Worksop on the 21st inst. Mr. C. T. Wright, J.P., managing director of Shireoaks Colliery, was summoned, to put it briefly, for not having the ways and underground workings inspected two hours before the men went to work. The prosecution was at the instance of the Home Secretary, who has recently issued a circular fixing a time limit for the inspection of all collieries. Evidence was called to show that the Shireoaks Colliery was not inspected within two hours of the men commencing work on the day mentioned in the information, and that such inspections were practicable. For the defence it was contended that the Act of Parliament only required that an inspection of the workings should be made, but fixed no time limit. That time limit had been sought to be imposed under a circular issued by the Home Secretary, and with the circular the defendant refused to comply. In the refusal he was supported by the associated coalowners of the district. The Bench, after a brief consultation, dismissed the case, and allowed defendant his costs. This decision has given great satisfaction in colliery circles, as the Home Secretary's attempt to impose a law of his own, to over-ride the general law, would have had a vexatious and mischievous effect.

RAILWAY MATTERS.

THE Metropolitan Railway now issues 72,000,000 tickets yearly, of which 80 per cent. are third-class, averaging 1·8d. per ticket.

IN connection with the Scarborough and Whitby Railway, which has been recommenced, a fine viaduct over the river Esk at Whitby is making good progress.

IT is proposed to convoke an International Congress in Brussels to deliberate on the establishment of an International Railway Union similar to the International Postal Union.

THE report of the Prussian State railroads for the year ending with April, 1883, covers an average of 9001 miles of railroad. The passenger traffic of this system amounted to 2,197,317,000 carried one mile.

THE Bill proposing the construction of a railway from the Ladywell station of the South-Eastern Railway to the grounds of the Crystal Palace, so as to give a through route to the Palace from Waterloo, Charing-cross, and Cannon-street stations has been thrown out.

YESTERDAY the Postmaster-General received a deputation from Ulster in support of a scheme to establish a new direct mail route from London to Belfast by the Stranraer and Larne route, through which London and Belfast would be brought into closer contact by two and a-quarter hours than by the present route *viâ* Holyhead and Kingstown.

THIS is the order in which the 1.15 train from Waterloo was made up on Sunday. (1) Engine, (2) a very old van, (3) a second-class carriage, (4) a first-class carriage, (5) a third-class carriage, (6) a first-class carriage, (7) a third-class, (8) a first and second composite carriage, (9) a third-class carriage, (10) a composite first and second-class, (11) a first-class, (12) a third-class, (13) a brake van, (14) a first-class, (15) a composite first and second-class, and finally, three vans for milk, &c. Nicely arranged train. So easy for passengers to find the sort of carriages they want, first, second or third-class, very old, old, or recent.

IN the South Staffordshire, as well as the Birmingham district, our correspondent in that town writes, "Steam tramways are happily progressing. A trial trip has just been made over the new line which connects the towns of Dudley, Brierley hill, and Stourbridge. The trial was deemed very satisfactory, but the line will not be opened for traffic until after the official inspection. There are at present eight engines and eight cars, but the number will be increased if required. The engines are by Kitson and Company, of Leeds, and are of the locomotive type, with surface air condensers, and automatic brakes. The fuel used is burnt coke which gives off little or no smoke. The cars are of elegant design, with canopy tops, and rest on bogie frames which enables them to travel acute curves safely. They have been constructed by Messrs. Starbuck, of Birkenhead, and will accommodate thirty passengers inside, and thirty-two outside. The new line will be of much benefit to the district, since present railway service is far from satisfactory."

EXPERIMENTAL tests of iron sleepers of approved German patterns will be made this year on the Philadelphia and Reading Railroad. The *American Manufacturer* says: "Cost of such ties in this country is still great, and it is hardly to be expected that the movement will soon become general, but it is not impossible that our railroads will be eventually driven to their use, and there has heretofore been some discussion of their availability on parts of the Southern Pacific, which are very distant from any timber. In Germany they are in very wide and increasing use, but in England, for some reason, their introduction has not met with so great favour, though iron is cheaper there and wood probably dearer. It is not always remembered, in comparing the life of wooden ties in England and the United States, that the constantly moist climate and absence of our fierce summer heats there places a wooden tie under more favourable conditions for long life, independent of better drainage, which is another undoubted advantage over average conditions in the United States. As the iron supports cost much more than the wooden ties, and last much longer, the change would be equivalent to an improvement of the road, and the excess of cost over that of the ties renewed would be properly chargeable to capital, as in the case of a wooden bridge replaced by an iron or stone one." Our "constantly moist climate"—it is something for our contemporary to admit we have a climate at all—thus does something for us; but as it is not constantly moist, it may be that our sleepers are well creosoted and the lines well drained.

MR. J. S. FORBES, the chairman of the Metropolitan District Railway, has been in Paris during the last few days for the purpose of conferring with the promoters of the bill for constructing a "Metropolitan" Railway in that city. This work, which has so long been delayed, seems at last to be seriously entertained, as the Minister of Public Works will ask the Chamber of Deputies, in the course of the present session, to grant a concession of the line to a company, which is prepared to construct it without receiving any subsidy or guarantee of interest. The line, which would be ten miles in length, would start from the suburb of Puteaux, and, passing under the Bois de Boulogne to the Arc de Triomphe, would follow the course of the outer Boulevards to the Rue de Rome, where it would make a bend southwards to the Place de l'Opéra and the Bourse, and thence to the Place de la Bastille and the circular railway near the Gare de Lyon. Two-thirds of the line would be underground and the other third in deep cuttings, the estimated cost being £320,000 a mile, or £3,200,000 in all. A loop line would also be made from the Rue de Rome to the Chateau d'Eau, passing close to the termini of the Northern and Eastern railways, while the company would bind itself to construct a third line, from the north to the south of Paris—that is to say from La Chapelle to Montparnasse—as soon as the receipts of the two first returned 6 per cent. upon the capital invested. It is understood that the managing bodies of the great railway companies which have their termini in Paris are all favourable to the construction of the Metropolitan line, and have signified their intention of doing all in their power to help it forward.

TRAMCARS propelled by electricity are no novelty, as the successful installations caarried out by Messrs. Siemens, in Berlin, Paris, Saxony, and Ireland, amply prove. On a smaller scale we have Mr. Magnus Volk's electric railway at Brighton, and Mr. Holroyd Smith's line at Halifax, both of which have done good service in the cause of electric propulsion, by demonstrating in a practical way that it is not only possible, but also convenient, safe, and cheap. In all these cases the current is conveyed to the car by conductors laid along the road, a system which, however well it does for country roads, is clearly inadmissable in our crowded streets. For such traffic stored electrical energy seems the only possible means of propelling the cars by electricity at all. Tramcars have been exhibited in London, Paris, and Brussels, which were worked by means of accumulators, but for some reason or other nothing more has been heard of them since their experimental trips. The great weight of the accumulators, their uncertainty of action, and their short life were, no doubt, the main causes of their abandonment. Mr. Reckenzaun, we are informed, is endeavouring to overcome the various difficulties connected with the use of secondary batteries, and has worked out a system for working tramways, electrically, at a smaller cost per car-mile than is possible either with horses, steam, or compressed air. The rails laid down for horse traction are sufficiently strong for his car, and the load is distributed in such a way that with a car loaded to its maximum number of forty-six passengers, the pressure on any pair of wheels shall not exceed 2¼ tons. The motor, which was exhibited at the Society of Arts, is light in comparison to the power it developes, and should be suitable for such work. But the question is, has Mr. Reckenzaun an accumulator equally light and powerful?

NOTES AND MEMORANDA.

WHAT is said to be a very durable paint has been made of very finely powdered zinc mixed with oil and siccative. A varnish is thus formed, which may be applied with a brush in the ordinary manner.

FOR ascertaining whether a sample of petroleum is sufficiently volatile to be dangerous, Herr Montag points out a very simple and conclusive method. He fills a glass three parts full with the petroleum to be tested, and fills up the glass with boiling water, at the same time holding a flame over it. If the vapour disengaged becomes ignited, the petroleum should not be considered a safe liquid to leave exposed to the atmosphere.

PROFESSOR SCHEIBLER, of Berlin, has patented a process for utilising, for the production of phosphoric acid, the slag made in the Thomas-Gilchrist process. The slag is roasted by an oxidising flame, then pulverised and sifted. The powder is dissolved in hydrochloric acid, and the solution saturated with lime water. The resulting product contains from 35 to 37 per cent. of phosphoric acid in the form of bi-basic phosphate of lime, and a second roasting produces a substance in which the content of phosphoric acid is as high as 45 per cent.

FOR the week ending April 19th, 1884, in twenty-nine cities of the United States, having an aggregate population of 6,937,900, there died 2866 persons, which is equivalent to an annual death-rate of 21·5 per 1000, a slight increase over that of the preceding week. For the North Atlantic cities the rate was 20·9; for the Eastern cities, 22·8; for the Lake cities, 18·3; for the River cities, 18·7; and in the Southern cities, for the whites, 19·1, and for the coloured, 40·2 per 1000. Of all the deaths 37·7 per cent. were under five years of age, the proportion of this class being highest in the Lake cities, viz., 47·4 per cent.

DR. LECHER recently made an experiment to prove whether Faraday's famous experiment of rotating the plane of polarisation by an electric current could be inverted. He has attempted to generate currents by rotating the plane of polarisation of light. The arrangement was as follows:—A ray of plane-polarised light was sent through the interior of two powerful helices of wire situated at some distance from one another. Through the first of these a powerful alternate current was sent, which impressed upon the ray a rapid oscillation of its plane of polarisation. The second helix was connected to a sensitive receiving telephone in the hope that sounds might therein be heard, as would be the case if the rapid rotations in the plane of polarisation of the ray were capable of setting up currents in the surrounding wire. Absolutely nothing was, however, heard.

M. ED. LANDRIN, who had previously shown that when an intimate mixture, in certain proportions, of pure lime and quartz is raised to a white heat, the resulting cement sets slightly on contact with water but becomes very hard in the presence of carbonic acid, has lately submitted to the French Academy the results of some new experiments on the hydraulicity of cements. As the result of experiments with mixtures corresponding to various silicates of lime, M. Landrin has come to the conclusion that (1) silicates of lime raised to high temperatures set with difficulty, and in any case do not harden in water, according to M. Fremy's experiments; (2) for the calcination of cements to exert a maximum influence on the setting, in connection with water, of the compound obtained, the process must be carried sufficiently far for the lime to act on the silica so as to transform it into hydraulic silica and not into fused silica; and (3) carbonic acid is an indispensable factor in the setting of silicious cements, inasmuch as it is this substance which ultimately brings about their hardening.

AT the meeting of the Chemical Society on the 15th inst. Mr. Turner read a paper on "The Estimation of Silicon in Iron and Steel." The author has estimated the silicon in samples of iron and steel containing from 0·06 to ·22 per cent. of silica by the various methods usually employed, and comes to the conclusion that the method suggested by Watts is most generally applicable, and gives, when slightly modified, accurate results. The method —"Journal Chemical Society," Abstracts, XLII., 1134—consists in passing dry chlorine free from air over the iron borings at a low red heat. The chloride of iron volatilises and is condensed in the colder portion of the combustion tube, whilst the silicon chloride passes on and is decomposed by passing it through water, which on evaporation yields the silica. Any slag, and the silicon contained in it, remain behind in the porcelain boat unattacked. The improvement suggested by the author is the use of a Will and Varrentrapp's bulb to contain the water by which the silicon chloride is decomposed. The top of the silica which used to adhere to the delivery tube and the beaker is thus avoided, as the bulb can be dried and weighed after the experiment.

RESPECTING substitutes for india-rubber and gutta-percha, the *Scientific American* gives the following from a German source: —"In the first place, such a substitute must be cheaper than real india-rubber. There are many kinds of material that fulfil this requirement. Sulphur is one of the things that is unattacked by acids, alkalies, and salts. Its great brittleness gives place to a softness, pliability, and elasticity similar to rubber if it is poured into cold water while melted. It melts twice at different temperatures, and it is only after this second melting that it possesses this elasticity. It remains soft enough to be moulded for several days, and these qualities it retains permanently if it is mixed with more or less linseed oil varnish before it is poured into water. There is no doubt that sulphur is of importance in making artificial substitutes for india-rubber, and no less so as a substitute for gutta-percha. The first thing is to endeavour to discover some permanently elastic substance which shall destroy that crystalline structure which makes the sulphur brittle, and renders it impossible for it to return to this condition. Next after sulphur, alumina soap deserves consideration, for it is likewise a tenacious substance that can be stretched, and it undergoes many curious changes when melted with thick linseed varnish and resin. Zingler has, in fact, patented a composition of sulphur, copal, oil of turpentine, and albumen. Although substitutes for gutta-percha may be obtained with the aid of some of these substances, it will always be difficult to imitate the elasticity of india-rubber, so that its substitutes will find use only where its elastic property does not come into prominence."

PROFESSOR J. THOMSON recently read a paper before the Royal Society of Edinburgh, on the law of inertia, the principle of chronometry, and the principle of absolute clinural rest and of absolute rotation. In this paper the author proceeded to discriminate between what men can know, and what men cannot know, as to rest and motion in unmarked space. For example, men have no means of knowing or imagining whether a ball existing in space is in motion or at rest; nor have they any means, if it be in motion, of knowing or imagining any one direction, rather than another, as being the direction of the straight line from the place that was occupied by its centre at any past instant to the place occupied by that centre at present. There is then an essential difficulty as to our forming a distinct conception either of rest or of rectilinear motion through unmarked space. He discussed, in connection with this, the statement set forth by Sir Isaac Newton, under the designation of the first law of motion, that every body continues in its state of resting or of moving uniformly in a straight line, except in so much as, by applied forces, it is compelled to change that state. A most important truth in the nature of things, perceived with more or less clearness, was, he said, at the root of that enunciation. He gave, under the title of the law of inertia, an enunciation which he offered as setting forth, by a better expression, all the truth which is either explicitly stated, or is suggested by the first and second laws of motion in Sir Isaac Newton's arrangement. In connection with the law of inertia he gave further statements bringing out expressions of the principle of chronometry and the principle of "directional fixedness" and of absolute rotation.

MISCELLANEA.

A BED of good coal, nine metres thick and three kilometres in length, has been discovered near Mostar, Hungary.

THE annual show of the Bath and West of England Society and Southern Counties Association takes place at Maidstone, on the 2nd, 3rd, 4th, 5th, and 6th June.

THE report of the Council of the Inventors' Institute, Chancery-lane, states that an International Exhibition of Inventions is to take place at South Kensington in 1885.

THE steamship Oregon has been purchased by the Cunard Company, to run between Liverpool and New York, sailing from Liverpool for her first trip on Saturday, June 7th.

A MAP of the proposed city and county of London, showing the divisions into districts, with the number of representatives to each, has been published by Mr. A. Johnston, London.

A PROPOSAL to construct a canal from the Atlantic, the Gironde, past Toulouse, through Languedoc, and joining the Mediterranean, near Narbonne, is receiving a great deal of influential support.

THE reductions of wages are now general in the Glasgow shipyards, the employers, after considerable hesitation, having decided that they must reduce the pay of the engineers and boiler-makers as well as that of other workmen. The shipbuilders on the lower reaches of the Clyde are likewise reducing wages, and large numbers of workmen are being discharged.

THE Commission appointed by the Austrian Ministry of Commerce to devise, after studying the arrangements at Genoa and Marseilles, plans for the improvement of the port of Trieste, has nearly finished its task. It proposes the provision of large bonded warehouses and of hydraulic cranes. The cost of the works to be undertaken is estimated at 2,500,000 florins.

THE Electrical Power Storage Company has issued circulars announcing a very material reduction in the price of its accumulators. An ordinary cell contains fifteen plates per effective horse-power, the normal rate of charge being 20 ampères, and of discharge 30 ampères. Where rapid discharge and small weight are required, cells containing thirty-five small plates are made for 1 effective horse-power, and with seventeen plates for ½ effective horse-power.

A COMMENT without words on the action of the members of the Institution of Mechanical Engineers, at the recent meeting for the election of a secretary, is given in the fact that about ten of the most influential of the members of the council have sent in their resignations. These members of council having for some time carried on the administration of the society's affairs, may be supposed to know the nature of those affairs and to have reasons for their action. It is much to be regretted that the stability of the Institution has been so much endangered by recent internecine disputes.

ON the 14th inst. a deputation had an interview with Sir Thomas Farrer—Permanent Secretary to the Board of Trade—and Mr. T. W. Traill—the Engineer-Surveyor-in-Chief—at the Board of Trade, to lay before them a memorial extensively signed with regard to restrictions at the present time imposed upon steel in shipbuilding. Sir Thomas Farrer said that he could not see why steel did not find more favour with shipowners. The Board of Trade had no power in respect of the material used in constructing the hulls of vessels, their jurisdiction being confined to the boilers.

THE Council of the Birmingham Chamber of Commerce have determined to petition the House of Commons in favour of the Registration of Firms Bill, the Partnership Acts Consolidation Bill, the High Court of Justice Provincial Sittings Bill, and the Companies Acts Consolidation Bill. They have also decided to memorialise the Treasury, urging the immediate revocation of some of the general rules of the Bankruptcy Act, and the amendment of others. These resolutions have been come to as the result of a report by a special committee appointed to consider the commercial Bills now before Parliament.

MESSRS. HAYWARD TYLER AND CO., of London, who erected in 1879 the sewage pumping machinery for the Twickenham Local Board, to raise 1½ millions of gallons daily to a height of 60ft., or 100ft. if required, have now contracted to supply and erect a third large pumping engine at the same place, the rapid increase of population having rendered it needful to extend the works. The original pumping engines have worked to great satisfaction, having at times had to deal with much more sewage water than was at all anticipated. The work is under the superintendence of Mr. Ramsay, the Board's surveyor, and Mr. J. Mansergh, of Westminster.

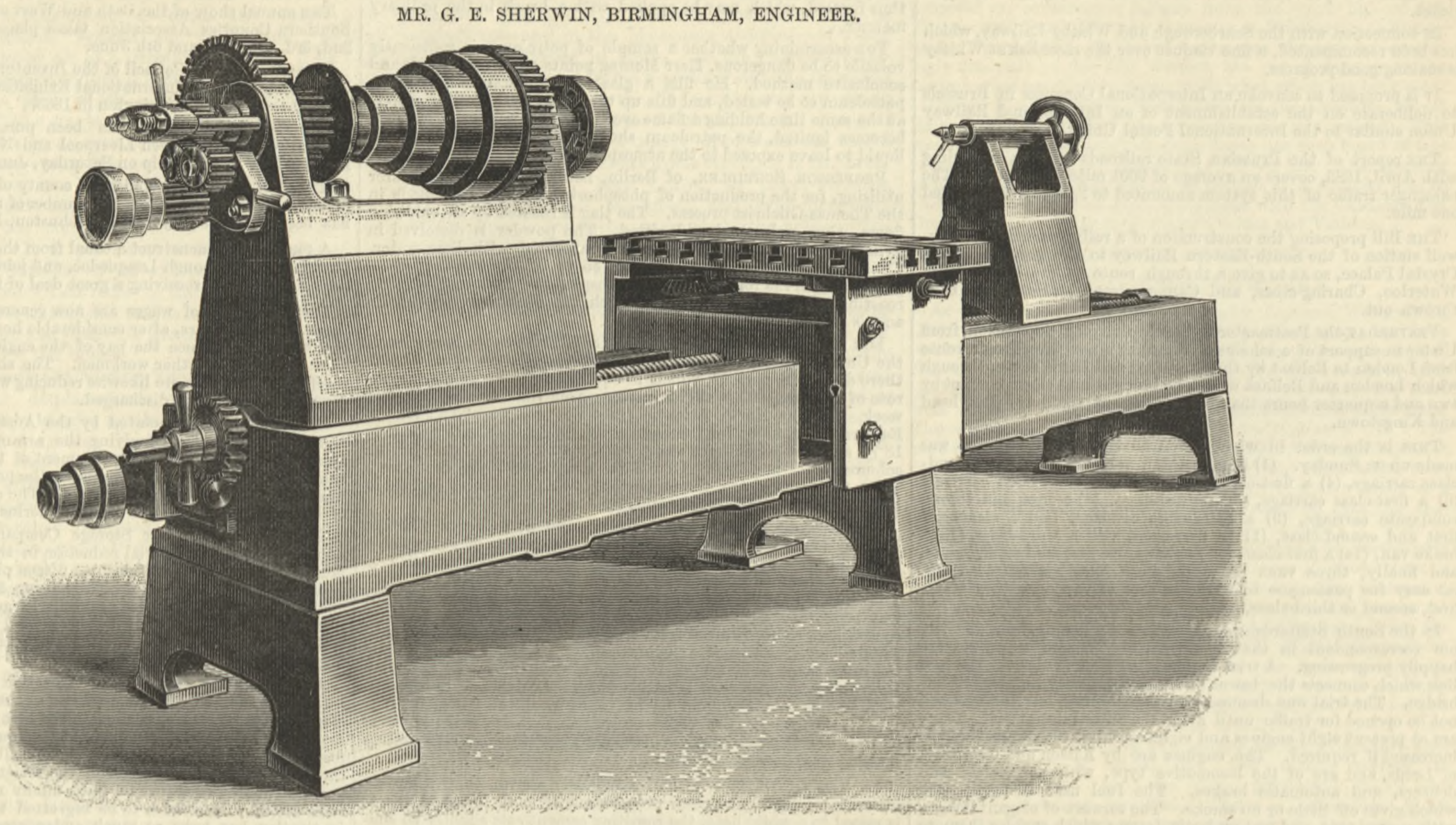
SAMPLES have been sent us by Mr. R. D. Stewart, of Tenter-street, West Mansell-street, London, E., of a quick drying colourless liquid for coating polished iron, steel, and brasswork. It is quickly applied with a brush, and effectually protects metals from oxidation, while it in no way affects, but in some cases improves, the appearance of the work. It is also used in preference to whiting and tallow, and is very much cleaner, and has the advantage of being readily removed with a little turpentine. A sample of an anti-corrosive paste has also been sent us, which is specially made for coating machinery for package. This also is applied with a brush.

THE report by Messrs. W. Crookes, W. Odling, and C. Meymott Tidy, on the water supplied to London during April, states that: "The general excellence in character of the water supplied during the previous quarter has been more than maintained by the supply of the past month. Of the 161 samples of water examined, the whole were, without exception, well filtered, clear, and bright. Their aëration was abundant; and in respect to degree of freedom both from colour and organic matter, their condition was wholly satisfactory. In no one sample was there found an excessive proportion of organic carbon; while the mean proportion amounted to ·126 part in 100,000 parts of water, corresponding to less than a quarter of a grain of organic matter per gallon."

THE Boiler Inspection Association of Munich has been carrying out a series of experiments as to the actual loss resulting from incrustations in boilers. Tests were made with purified water and a perfectly clean heating surface, as compared with the results obtained with ordinary feed-water, which had, however, been saturated with gypsum in order to abbreviate the duration of the trials. The principal experiment lasted day and night without intermission during a period of 195 hours. Eight observations were taken in order to find what change had occurred in the results by reason of the augmented thickness of the incrustation. Although the latter had attained a thickness ⅛in. to ⅓in., no decrease in the working power could be noticed. Unfortunately the principal trial had to be interrupted sooner than was intended, as there were indications of the fire-box being affected by the heat. The *Eisenzeitung*, in recording these trials, urges the advisability of their being carried out upon a more extensive scale with various descriptions of feed-water, different kinds of incrustations being thus produced. Trials made at Mulhouse would seem to have resulted in a diminution of effect only taking place at the commencement of the experiments, and to a small extent, there being no variation in the later period of the trials. The fact that there is a diminished production of steam when a boiler has been left a certain length of time without cleaning, is attributed by the journal in question to the heating surface being covered with soot and to the presence of ashes in the flue. The purification of feed-water is, however, still recommended on account of the avoidance by this means of the injury and danger arising from the deposit of incrustations or slime upon the fire-plate. These experiments confirm Peclect's conclusion that the relative conductivities of heating surfaces in boilers have little or no effect on their efficiency, which is a different thing from their economy. A copper boiler will not make more steam in a given time than an iron boiler of the same dimensions.

GENERAL PURPOSE BORING MACHINE.

MR. G. E. SHERWIN, BIRMINGHAM, ENGINEER.



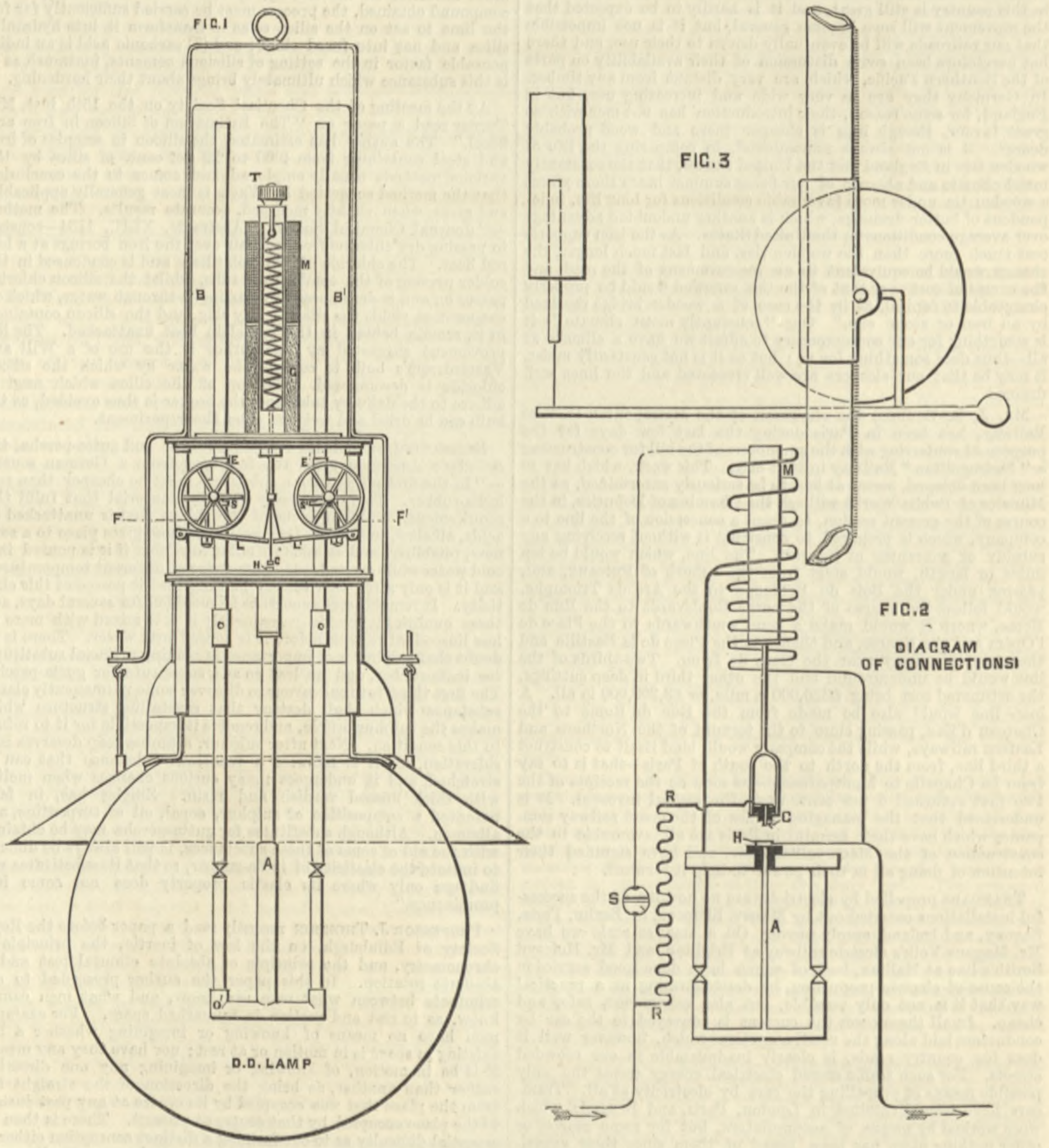
THE accompanying engraving, from a photograph, represents a boring machine, constructed by Mr. Geo. E. Sherwin, of the Central Works, Birmingham. The machine requires but little explanation, though it contains a few new features. The vee's of the bed for guiding the table are formed inside. They are thus protected from damage and from being knocked to pieces by lifting heavy castings on or off of the machine. The screw for the traversing table is also contained within the bed, the top of the screw being below the top of the bed, and thus protected from injury. The table has a traversing motion to and from the head, and also a rising and falling motion. The saddle contains at either end—that is, on either side of bed—a slide, the surfaces of which are all located within the table, but readily accessible for oiling or cleaning purposes. To the top of these slides the table is secured, this being provided with suitable recesses for holding-down bolts. The machine is of simple and of strong design, and is of the handy general purpose class.

MESSRS. CROMPTON AND CO.'S NEW ARC LAMP.

THOSE amongst the modern prophets who were of opinion that arc lighting has seen its day and will henceforth have only an insignificant importance as compared with the gigantic development hoped for from incandescent lighting, have not been quite correct in their prophecies. As a matter of fact, makers of arc lamps have gone on steadily improving them in detail, or cheapening their manufacture, and doing a very fair business, not only in arc lamps, but, as a necessary consequence, also in arc machines. A case in point is Messrs. R. E. Crompton and Co., of Chelmsford, who last November brought out a new arc lamp, their D D pattern, and which has been so successful that the orders received for this lamp have generally been in excess of what could conveniently be executed if working ordinary hours, thus compelling the firm to continuously work overtime. It is no small recommendation for the excellence of a lamp if the makers can state, as Messrs. Crompton and Co. do, that one customer of theirs, who alone has had sixty lamps since November last, has never had a circuit go out. The lamp, which is the joint invention of Mr. R. E. Crompton and Mr. T. Crabb, is illustrated in the annexed woodcut, Fig. 1; whilst Fig. 2 is a diagram showing the connection of the lamp with the circuit and a bye-pass resistance.

This lamp shows a marked improvement on the older forms of lamps manufactured by Messrs. Crompton and Co., and known respectively as the E differentials, the G pattern and the K pattern or Law Courts' lamp. These improvements are in the direction of greater simplicity in all details, and consequently smaller cost of manufacture, and in a more delicate regulation of the length of arc. B B[1], Fig. 1, are the two rack rods. Sliding on each of these is a light gun-metal sleeve S S[1] carrying a spindle to which is attached one of the large brake wheels E E[1], and the pinion which gears into the rack. To each side rod is pivotted a lever L L[1], at the other end of which a chain is fastened connecting it to the hollow core of the solenoid vertically above. This solenoid is differential, G being the shunt and M the main coil, and has its core partially supported by means of a spring whose tension can be regulated by the screw T. Projecting vertically downwards from each sleeve is a stout pin or finger F F[1], the use of which we will try to make clear. Suppose the rack rod drawn up, then if the lever be pulled by the solenoid above the horizontal position, the whole weight of the rods and carbons is supported on the edges of the brake wheels, and the friction of these on the surface of the lever is sufficient to prevent their revolution, hence the rack rod cannot run down, but if the lever be below the horizontal, the weight is carried by the finger as shown at F, the wheels are free to revolve, and the rack descends. Now, let the current be switched on by its passage through the main coils of the solenoid, the levers are raised, striking the arc, and at the same time applying the brake to the wheels. The shunt current then flows and the arc takes its proper length. If this become too great the increased current through the shunt draws down the core and levers, the brake wheels are left free to revolve, and the arc shortens; conversely, if the arc be too short the levers are raised. The simple expedient of making one finger longer than the other determines which pair of carbons shall begin to burn first, because on switching on, that pair which has the longer finger will be the last to break contact, and will therefore originate an arc in so doing. When these have burned low the rack B is prevented from falling lower by a stop; hence the arc will lengthen, the shunt current increase, and the other rod B, which can still feed, be allowed to descend until its carbons touch, starting a fresh arc, when everything goes on as before. When the second pair of carbons have burned low the arc lengthens and the shunt increases as before, and the core is drawn down, but lower than when the first pair were burned out, until a stud C attached to it makes contact with another, H, connected to the negative pole, cutting the lamp out of circuit and substituting an equivalent resistance. The connections of the lamp and its equivalent resistance coil are shown in Fig. 2. The current entering, as shown by the arrows, finds two paths, the one through the resistance coil R R and insulated contact piece C_1, which for the time being is resting upon H, and thus on the next lamp; the other through the switch S, which we suppose to be closed; the main solenoid coils M, the frame of the lamp, the positive and negative carbons, out by H and on to the next lamp. The latter portion of the current, in passing round the core of the solenoid, magnetises it, and draws it up, thereby breaking contact between C and H. At this moment the current has only one path open, namely, that through the switch S, main solenoid, and carbons; and since the whole of it must pass through the main solenoid, the core of the latter is definitely drawn up, establishing the arc between one pair of carbons, as explained above. Should the current be interrupted through the falling out or breaking of a carbon, or the hanging up of a rack rod, the core will fall, and by bringing C and H again into contact, open to the current its former path through the coil R R. The same result will follow if the current be interrupted through the opening of the switch S. In this manner an accident to or the switching out of one lamp does not affect the rest of the circuit.

A peculiarity of these lamps is that they can be burned in parallel connection from a compound dynamo. If used in this way, the shunt solenoid of each lamp is disconnected from the lamp terminals, so that the feeding is under the control of the main only. With the full length of 19½in. of carbon, 13 mm. diameter, this lamp will burn from twelve to fifteen hours, according to the current passing, which may vary from 28 to 6 ampères; the light varying from 6500 to 850 candles, measured at an angle of 30 deg. below the horizontal plane passing through the arc. The electro-motive force required is from 40 to 50 volts.



CROMPTON'S ARC LAMP.

THE ROUX HYDRAULIC PUMP.

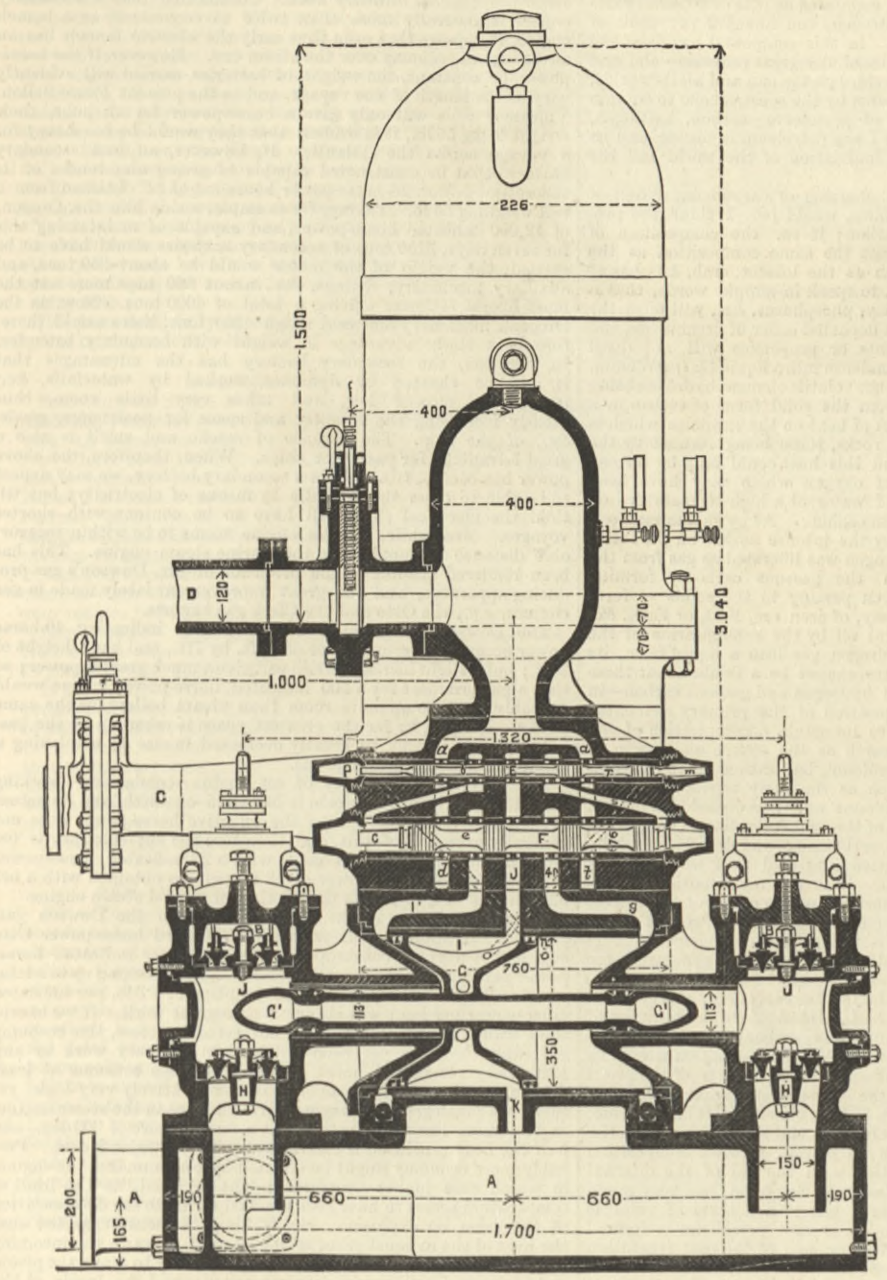


FIG. I.

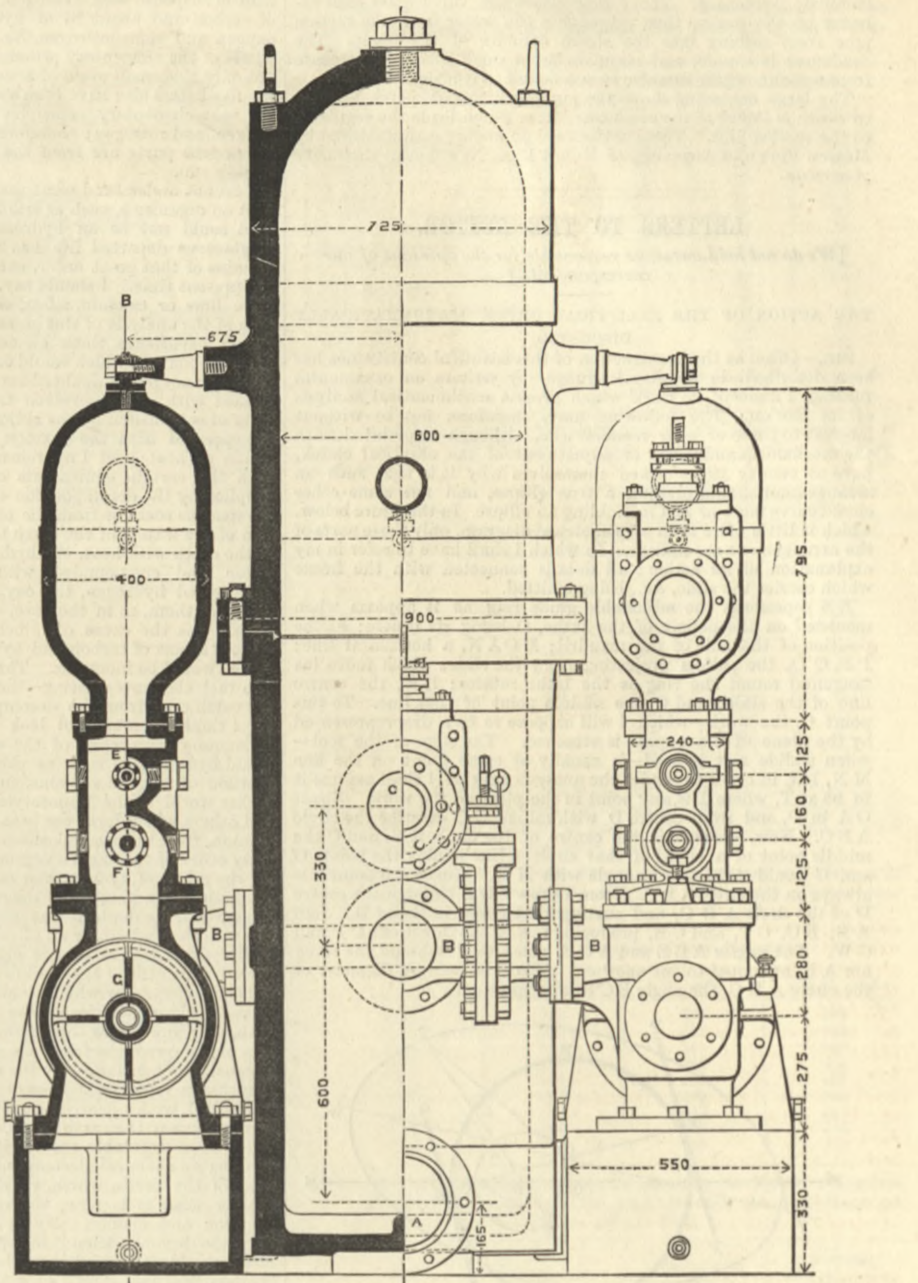


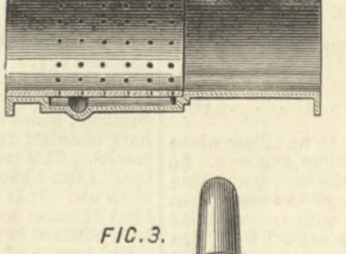
FIG. 2

M. ALBERT MARNIER has described in a recent issue of the *Revue Industrielle* an hydraulic pump, designed by M. C. Roux, an engineer at the works of MM. Schneider and Co., and built by MM. Crozet and Co. for the Saint Pierre pit, belonging to the Creusot Company. Our illustrations this week show the construction of this pump, the principal novel feature of which is the valve motion. The complete machine consists of two double-acting pumps, each of which is provided with two horizontal bronze plungers G^1 G^1, separated by a larger piston G, Fig. 1. A large valve F allows the water to flow alternately behind either end of the piston G, and a smaller piston valve E, which regulates the movements of the valve F. The water to be pumped enters through the suction pipe A, flows through the suction and discharge valves H and J, and is discharged through C. In the position shown in Fig. 1, the valves E and F have just completed their backward movement, and have cut off the communication through the channel shown in dotted lines between the pressure water and the right end of the piston G. At this moment the power water filling the channel *a* passes through the small openings in the cylinder of the distributing valve E, flowing through *b* and *c* into *d*, and passing through *e* and *f* before the driving piston G. The piston then moves backward, forcing the water out before it through *g h j k*. Just before reaching the end of its stroke, the piston G uncovers the small orifice *l*, and the water rises through *l m* to a point behind the valve E. The pressure causes the latter to move towards a position at the other end, and at the same time the communication between the piston E and F is, through the chamber *r*, re-established, and the pressure water forces the piston F to another position. No counter pressure disturbs the free movement of the valves, because, as soon as the piston G has passed one of the orifices *l* or *n*, the water in *m* or *p* flows off. The same is true of the valve F, one of the ends of which is always alternately open. The pump, therefore, works without any tappets, its moving parts are out of the reach of dust, and it may be drowned without effecting its motion.

The Saint Pierre pit of the Creusot Company, in which it is at work, is 267 metres deep. Into it from 1920 to 3000 cubic metres of water flow, which drop 85 metres into the sump of the great Saint Laurent pumping engine, so that the latter, therefore, has a lift of 85 + 267, or 352 metres. This head of 85 metres is utilised to force a part of the water to a height of 352 metres, and to that extent relieve the Saint Laurent pump. It was assumed at the start that under these conditions it would be possible to lift one-tenth of the water, and the useful effect, therefore, looked forward to was 41·4 per cent. It is now working very satisfactorily, and is started easily. M. Marnier states that MM. Crozet and Co. propose to use the same principle in designing water meters and steam pumps.

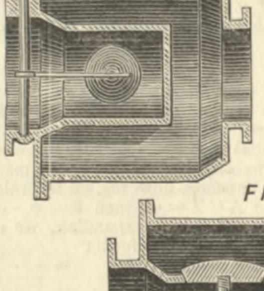
REGULATOR AND CONDENSER FOR STEAM PUMPS.

THE accompanying engraving represents a device for regulating the supply of water required to condense a certain quantity of steam, so that the quantity of water supplied will always be in proportion to the quantity of steam to be condensed; and also a device for condensing the exhaust steam from any steam pump or engine, so as to relieve the piston of back pressure. The regulator consists of a short pipe closed on top, and provided with a flange for coupling it to a suction pipe. A short distance above this flange is a larger flange, on which a large vessel, surrounding the pipe, is bolted. The top of this vessel is provided with a neck having a flange to which the condenser or suction pipe can be attached, so that the device will be interposed in the length of the suction pipe. Fig. 4 is a horizontal and Fig. 5 a vertical section through the regulator. The small pipe is provided with two opposite ports, one of which is larger than the other, in which fit valves connected by a rod having a slot in its middle, through which an arm passes, as shown in Fig. 5. The arm is attached to one end of a shaft which is journalled transversely in the bottom of the pipe, and passed through a tube provided with a stuffing-box. The outer end of the shaft has an arm—Fig. 4—on which is an adjustable balancing weight, which seats the valves. The position of the weight can be adjusted so as to admit a greater or less quantity of water into the injection pipe, according to the amount of steam to be condensed. The apparatus can be placed in any position, and can be attached to any injection pipe. It can be adjusted to maintain a high vacuum in the pump at all times.

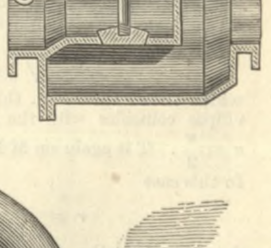


FIC. 2.

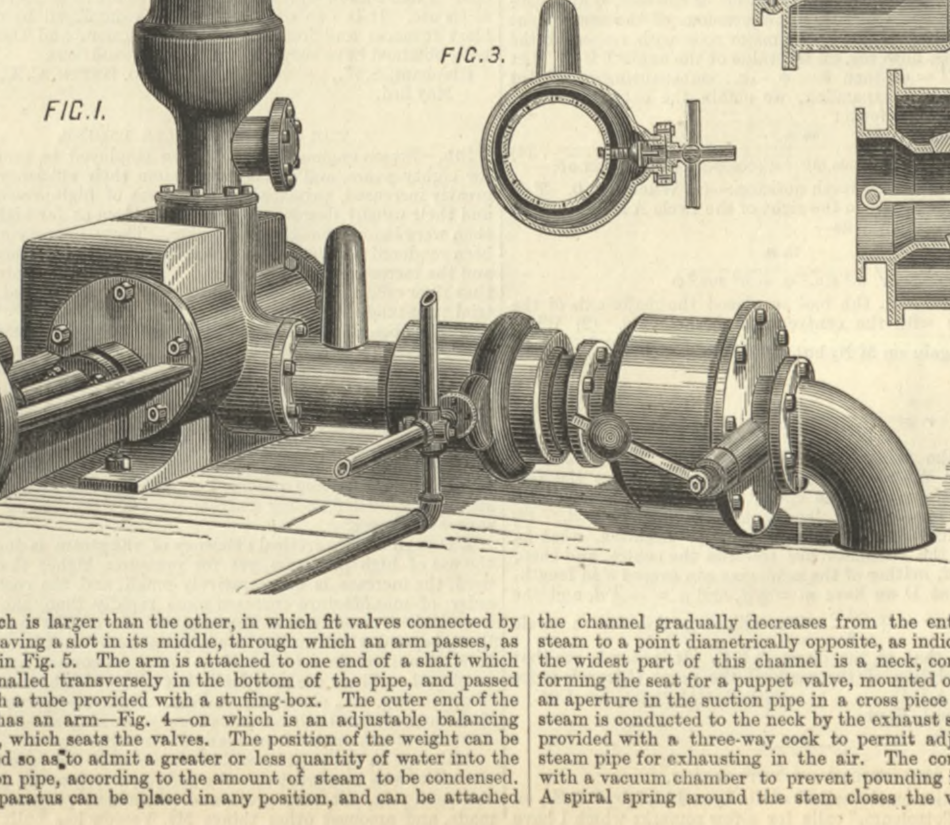
FIC. 3.



FIC. 4.



FIC. 5



FIC. I.

In the suction condenser, shown in longitudinal section in Fig. 2 and cross section in Fig. 3, the suction pipe of a steam pump is provided with a series of perforations, and the perforated portion is surrounded by a pipe forming a jacket. The inclosing pipe is furnished with an excentric channel—Fig. 2—for conducting the exhaust steam into the space between the two pipes; the depth of the channel gradually decreases from the entrance port for the steam to a point diametrically opposite, as indicated in Fig. 3. At the widest part of this channel is a neck, containing a bushing, forming the seat for a puppet valve, mounted on a stem guided in an aperture in the suction pipe in a cross piece in the neck. The steam is conducted to the neck by the exhaust steam pipe, which is provided with a three-way cock to permit adjusting the exhaust steam pipe for exhausting in the air. The condenser is provided with a vacuum chamber to prevent pounding in the suction pipe. A spiral spring around the stem closes the valve automatically.

When in operation, the steam is exhausted into the air until the water rises in the suction pipe to the perforated portion, when the steam issues in jets through the perforations into the water, and is instantly condensed. The spring closes the valve after each exhaust of the pump, thus preventing the water from the suction pipe from rushing into the steam cylinder of the pump. The condenser is simple, and occupies but a small space. The steam from a steam engine can also be conducted to it if desirable.

The large engraving shows the pump cylinder of a steam pump, to which is attached the condenser, from which leads the regulator to the suction pipe. These devices are now being manufactured by Messrs. Fink and Angevine, of Mount Riga, New York.—*Scientific American.*

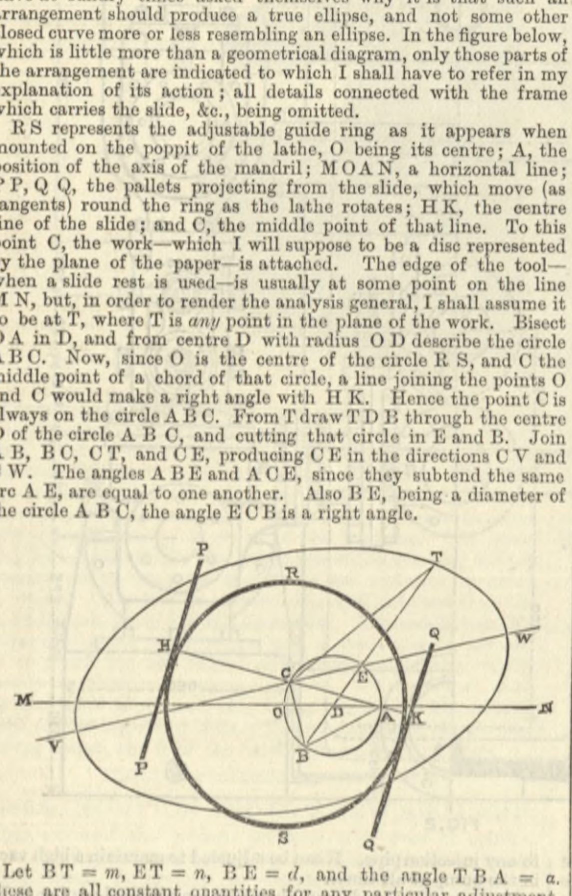
LETTERS TO THE EDITOR.

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

THE ACTION OF THE ELLIPTICAL CHUCK MATHEMATICALLY DISCUSSED.

SIR,—Often as the construction of this beautiful contrivance has been described—in popular language—by writers on ornamental turning, I know of no work which gives a mathematical analysis of its motion. The following may, therefore, not be without interest to those of your readers who, although acquainted with the mechanism and mode of adjustment of the elliptical chuck, have at sundry times asked themselves why it is that such an arrangement should produce a true ellipse, and not some other closed curve more or less resembling an ellipse. In the figure below, which is little more than a geometrical diagram, only those parts of the arrangement are indicated to which I shall have to refer in my explanation of its action; all details connected with the frame which carries the slide, &c., being omitted.

R S represents the adjustable guide ring as it appears when mounted on the poppit of the lathe, O being its centre; A, the position of the axis of the mandril; M O A N, a horizontal line; P P, Q Q, the pallets projecting from the slide, which move (as tangents) round the ring as the lathe rotates; H K, the centre line of the slide; and C, the middle point of that line. To this point C, the work—which I will suppose to be a disc represented by the plane of the paper—is attached. The edge of the tool—when a slide rest is used—is usually at some point on the line M N, but, in order to render the analysis general, I shall assume it to be at T, where T is *any* point in the plane of the work. Bisect O A in D, and from centre D with radius O D describe the circle A B C. Now, since O is the centre of the circle R S, and C the middle point of a chord of that circle, a line joining the points O and C would make a right angle with H K. Hence the point C is always on the circle A B C. From T draw T D B through the centre D of the circle A B C, and cutting that circle in E and B. Join A B, B C, C T, and C E, producing C E in the directions C V and C W. The angles A B E and A C E, since they subtend the same arc A E, are equal to one another. Also B E, being a diameter of the circle A B C, the angle E C B is a right angle.



Let B T = m, E T = n, B E = d, and the angle T B A = α. These are all constant quantities for any particular adjustment. Also let C T = r, C E = v, and the angle E C T = θ. What we have to determine is the relation between r and θ, the expression for which will be the polar equation to the curve cut by the tool; the point C being at any instant during its revolution round D the pole from which r, the radius vector, is measured. Observing that $\cos. BCT = \cos. \left(\frac{\pi}{2} + \theta\right) = - \sin. \theta$, we have at once the following equations, from which we must eliminate v:

$$\frac{r^2 + v^2 - n^2}{2rv} = \cos. \theta \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

$$\frac{(m-n)^2 - v^2 + r^2 - m^2}{2rv\sqrt{(m-n)^2 - v^2}} = - \sin. \theta \quad . \quad . \quad . \quad (2)$$

Equating the values of v^2 derived from (1) and (2), and arranging terms, &c., we have

$$r \cos. \theta \sqrt{n^2 - r^2 \sin.^2 \theta} = r \sin. \theta \sqrt{m^2 - r^2 \cos.^2 \theta} - m\,n,$$

an equation which ultimately reduces to

$$r = \frac{m\,n}{\sqrt{m^2 \sin.^2 \theta + n^2 \cos.^2 \theta}} \quad . \quad . \quad . \quad . \quad . \quad (3)$$

This, I need hardly remark, is the equation to an ellipse whose centre is C, semi-major axis = m, and semi-minor axis = n. So long, then, as T, the point of application of the tool, is at a constant radial distance from D, the dimensions of the axes do not vary. The angular position of the major axis with respect to the line H K depends, however, on the value of the angle T B A. Let the angle A C T = ϕ, then $\theta = \phi - \alpha$. Substituting in (3) for $\sin. \theta$ and $\cos. \theta$ and expanding, we obtain the equation to the curve in its completest form:

$$r = \frac{m\,n}{\sqrt{m^2(\sin.\phi\cos.\alpha - \sin.\alpha\cos.\phi)^2 + n^2(\cos.\phi\cos.\alpha + \sin.\phi\sin.\alpha)^2}} \,. \quad (4)$$

The following cases are worth noticing:—(1) When $\alpha = 0$. T is then on the line M N and to the right of the circle A B C. Putting $\alpha = 0$ in equation (4) gives us—

$$r = \frac{m\,n}{\sqrt{m^2 \sin.^2 \phi + n^2 \cos.^2 \phi}}$$

which shows that with the tool so placed the major axis of the ellipse coincides with the centre line of the slide. (2) When $\alpha = \frac{\pi}{2}$. T is again on M N, but to the left of the circle A B C. In this case

$$r = \frac{m\,n}{\sqrt{m^2 \cos.^2 \phi + n^2 \sin.^2 \phi}}$$

showing that the minor axis of the ellipse now coincides with H K. (3) When $n = 0$, $r = 0$. Hence, when the tool is on the circumference of the circle A B C the cut is reduced to a straight line, whose length is evidently = 2 d. (4) When T is within the circle A B C, n is negative, that is, measured from the circumference towards the centre, and then, since $m + n = d$, neither of the semi-axes can exceed d in length. (5) When T is at D we have $m = \frac{1}{2} d$, and $n = - \frac{1}{2} d$, and the equation becomes $r = \mp \frac{d}{2}$. The ellipse is therefore a circle whose radius is that of the circle A B C. It is easy to see that during each revolution of the mandril the point C travels twice round the circle A B C.

JOHN R. CAMPBELL, LT.-COL.

Charing, Ashford, Kent,
May 19th.

THE ORIGIN OF PETROLEUM.

SIR,—Your notice on the article of Sir Lyon Playfair, F.R.S., on "The Origin of Petroleum," calls for a few remarks which I have the pleasure to forward you. This highly scientific gentleman raises the question as to whether petroleum is cosmic. My humble opinion is that it is, formed as it is of infinitesimal atoms of carbon held in suspense with hydrogen, composed as it is of about 84 parts of carbon and about 14 of hydrogen, and about 2 per cent. of oxygen and some nitrogen, &c. In this compound are fixed the whole of the elementary principles of this great universe—ah! and not only this small atom of a world, but the sun and all its worlds, the fixed stars also have been shown by the spectroscope to contain the vast elementary principles of petroleum—carbon, hydrogen, oxygen, and nitrogen; therefore I say petroleum is cosmic, and its component parts are from the foundation of the world and the world's sun.

I cannot understand what the charring or carbonising action of heat on organisms, such as trilobites, would be. I think the product could not be an hydrocarbon; if so, the composition of crustaceous departed life has not the same composition as the remains of that great order, such as the lobster, crab, &c., has at the present time. I should say, to speak in simple words, that a little lime or calcium, silica, clay, phosphorus, &c., will form the base of the analysis of this great departed order of organic life, and in my experience these elements or properties will not distil hydrocarbon gas, which would condense into a liquid like petroleum. There cannot be any doubt about the volatile element hydrogen being formed with carbon evolved from the solid form of carbon in a state of combustion by the action of heat on the graphite which is incorporated with the granitic rocks, these being formed by the action of heat; and I apprehend this heat could only be formed with the certain equivalents of oxygen which may have been supplied by the decomposition of water at a high temperature on the igneous rocks or from the atmosphere. As by this decomposition of the waters of the earth by the intense action on the solids of the earth with heat, the hydrogen was liberated as gas from the water and compounded with the gaseous carbons, forming carburetted hydrogen, the oxygen passing to the solids to form oxides of them, as in the case, say, of iron ore, FeO_2 or FeO_3, &c. If this was the cause of mineral oil by the condensation of the various atoms of carbon and hydrogen gas into a liquid form, its source would be inorganic. There cannot be a doubt that these two vast elements existing—the hydrogen and gaseous carbon—in the earth even from the decomposition of the primary elements; but I think we must not look to inorganic decomposition of the elementary properties of the earth as the source and origin of liquid hydrocarbon such as petroleum, but rather to the decomposition of organic remains, such as the early vegetation of the earlier world of the Monocotyledonus and Diecotyledonus plants, and others which form the base of the coal formation. It is, in my opinion, from the decomposition, carbonising, and distillation of the early order of the earth's vegetation into coal that we must look for the origin of hydrocarbon oil. It is not my intention in this communication to open up the question of the origin of the coal of the earth. No doubt it was formed at the early dawn of time in the world's creation for an all-wise purpose, as demonstrated in its development and in its use and power in this our generation for the advancement of the world's civilisation and greatness.

The chemical law which would effect the early order of vegetation of the world which forms the coal formation we are acquainted with, and know how the decomposition, carbonising, and distillation of the products from the vegetable decomposition would be effected. For instance, by the distillation in retorts of the green branches or loppings of trees of the New Forest, hydrocarbon spirit is distilled, with a charred carbon base as charcoal left as a residue. In my opinion the earth has only done the same thing with the compressed vegetable matter in its bowels, its own composition forming its chemical decomposition with the aid of the internal heat of the earth, which, no doubt, in my mind, was very much greater than it is now, the earth being in a state of volcanic eruption and change. My opinion is that petroleum is formed from the decomposition into carbon or coal of the past vegetation of the world, it being first evolved as a gas more dense than our common coal gas, C_2H_4, as it contains more atoms of carbon, and then condensed into liquid oil, this holding in suspense all the elements decomposed which forms it, its condensation being caused by the gas traversing through the colder strata of the earth and also through water.

If the deposit of this past vegetable world was formed on a porous strata, such as grit, the gas would have a free exit. Thus it is that bituminous shale has been formed and the coal or carbon in its strata or seam is dry or free from volatile matter—for instance, the anthracite formations of America are nearly pure carbon. I have a paper now before me read by Mr. I. Lowthian Bell at the meeting of the Iron and Steel Institute, showing the analyses of this coal. I take one as follows:—Fixed carbon, 94 — 10; volatile matter, 1 — 40; ash water, &c., 4 = 50. I ask myself the question, where is the volatile matter gone which orginally existed in this anthracite formation? I say filtered away until it found an impervious basin such as clay, through which it could not filter, and is there deposited, and from the oil wells of that country I wonder where the volatile property of our Welsh coal has gone. I think it must have filtered away and deposited itself somewhere. I have carbonised Trinidad pitch, and have distilled from it all the elements of petroleum, also a high quality lubricating oil.

All the bye-products from the refining of petroleum point to a vegetable origin—they are wax, vaseline, &c. The shale works in Scotland, which are employed in distilling the porous shales which have absorbed the volatile matter from coal, produce the same results. This valuable compound, petroleum, is an important one. I don't know that its origin is of so much importance to us as its use. It is one of the compounds employed by myself for blast furnaces and iron and steel production, and the results I have obtained have surpassed my first expectations.

Clapham, S.W., SAMUEL RD. SMYTH, C.E., F.G.S.
May 3rd.

THE FUTURE MARINE ENGINE.

SIR,—Steam engines have now been employed to propel vessels for eighty years, and during that time their efficiency has been greatly increased, principally by the use of high-pressure steam, and their weight decreased by running them at far higher speeds than were before thought practicable. These improvements have been rendered possible by the introduction of the compound engine and the increased skill of workmen. But it must be borne in mind that their efficiency and power are generally calculated from the trial trips made when the engines and boilers are new, with picked stokers on board, and the vessel lighter than in working trim. The boiler pressure has also to be reduced in a few years, owing to deterioration. Both the efficiency and power are therefore higher than can be afterwards obtained in ordinary work. Besides, it is probable that the fast speed modern engine will not last so long as some of the old engines, *e.g.*, trunk engines, and is moreover, more likely to break down. The marine steam engine has also of late years become more complicated, especially in war ships, owing to the use of separate circulating pumps, &c., and the use of high-pressure steam, besides demanding a higher class of work and an increased source of danger.

Although the theoretical efficiency of the steam is increased by the use of high pressures, yet for pressures higher than are now used, the increase is comparatively small, and the cost and difficulty of manufacture increase more rapidly than the pressure, from which reasons it is evident that we are rapidly approaching a limit, beyond which an increase of pressure will not be economical. It is therefore time to see if no more economical agent can be employed. There are practically but two which have any chance of competing, viz., electricity and gas. Both are comparatively in their infancy, but both are advancing so quickly as to threaten to drive the steam engine from many of its present uses.

Although to the outside world it seems as if the practical use of electricity was to a great extent a failure, owing to the lull during the past year, yet very great and permanent progress has been made, and amongst other things Mr. Yarrow has built a launch which is propelled by electricity from secondary batteries. From data given by him, it appears that at least half the indicated power given by the stationary engine appears as effective work on the screw propeller in ordinary work. Considering that a stationary engine is generally more than twice as economical as a launch engine, it appears that even thus early the electric launch has an advantage in economy over the steam one. However, if the horse-power be constant, the weight of batteries carried will evidently vary as the length of the voyage, and as the present Faure-Sellon-Volckmar cells will only give a horse-power for an hour, their weight being 56 lb., it is evident that they would be too heavy for a voyage across the Atlantic. If, however, an iron secondary battery could be constructed capable of giving nine-tenths of its theoretical power, 16-horse power hours might be obtained from a cell weighing 56 lb. Taking, for example, a ship like the Oregon, of 12,000 indicated horse-power, and capable of maintaining this for seven days, 3150 tons of secondary batteries would have to be carried; the weight of the motor would be about 350 tons, and auxiliary machinery, fittings, &c., about 500 tons more—at the most liberal estimate—giving a total of 4000 tons. Now, as the Oregon's machinery and coal weigh 4200 tons, there would therefore be a slight advantage in weight with secondary batteries. In addition, the secondary battery has the advantages that it can be charged by dynamos worked by waterfalls, &c.; it can be stowed low, and takes very little room, thus greatly increasing the stability and space for passengers, goods, &c., of the ship. The absence of smoke and smell is also a great advantage for passenger ships. When, therefore, the above power has been obtained from a secondary battery, we may expect to be able to cross the Atlantic by means of electricity; but till then the electrical ships will have to be content with shorter voyages. Meanwhile, the gas engine seems to be within measurable distance of supplanting the marine steam engine. This has been rendered possible by the invention of Mr. Dowson's gas-producing apparatus, and the great improvement lately made in gas engines, *e.g.*, the Otto and the Clerk gas engines.

The Dowson gas-producer for an engine indicating 40-horse power occupies a ground space of 10ft. by 7ft., and has a height of 20ft.; but a slight increase in size will give a much greater power; so that a gas-producer for a 500 indicated horse-power engine would probably not take up more room than steam boilers for the same power. Besides, by far the greatest space is taken up by the gas-holder, which might be greatly decreased in size by employing a small pump to compress the gas.

The theoretical efficiency of an engine—condensing—working with 140 lb. pressure of steam is less than one-fifth, and its actual efficiency is about one-tenth; the effective horse-power does not generally exceed ·8 of this, and therefore the net efficiency is ·08. Now, in some experiments made with a 22 indicated horse-power gas engine an effective power of 18 horses was obtained with a net efficiency of ·14, or nearly double that of a good steam engine.

From some more recent experiments with the Dowson gas-producer, it appears that with a 40 indicated horse-power Otto engine the average consumption was 1·2 lb. per indicated horse-power per hour, and with several small engines working up to a total of 90 indicated horse-power, a consumption of 1·3 lb. per indicated horse-power per hour was obtained in regular work. If we except the Perkins' engine, which does not seem a success, this economy is greater than has yet been obtained in ordinary work by any marine engine; indeed, most of our war ships consume at least double. Although this economy is comparatively very high, yet there is a much greater margin than is the case in the steam engine, as the gases leave the cylinder at a temperature of 900 deg., and half the heat generated is carried away by the water jacket. Probably more economy might be effected by compounding the engine, in which case higher pressures might be used, as the limit of temperature seems to have been reached owing to the disassociation of the gases on explosion. Sir William Siemens suggested that the heat of the exhaust gases might be used to warm the incoming gas. With large engines, also, it would be easy to make the piston and piston-rod hollow and circulate water round the inside of the packing ring, in which case the water jacket might be dispensed with. A disadvantage of the Otto engine is the fact of its only having an explosion once every four strokes, and this would necessitate four cylinders, which could be placed in pairs, having their centre lines at right angles, so that only two cranks would be necessary. The Clerk engine has an explosion every two strokes, however, and is said to be equally economical.

As the pressure on the connecting rods would be always in one direction, the disadvantage of having four cylinders would be, to a great extent, balanced by the increased duration and smoother working of the engines; beside which the engines could, as I believe is at present the case, be made trunk, which would lessen the space required for them. The pipes for the gas could be made of thin sheet iron, and as there would be few needed, both the cost and weight would be very small compared with the present copper pipes. With regard to the weight, the additional two cylinders would not weigh so much as the present condensers, and the weight of the gas producer would be much less than that of steam boilers. The advantages of a marine gas engine over the steam engine are, therefore—greater economy, greater smoothness in working, and therefore greater durability, less weight for the same power, less first cost, absence of smoke, safety from shot if safety lamps are used during action.

Till lately only small gas engines have been made; but Messrs. Crossley have now made an 80 indicated horse-power engine, and are prepared to make larger ones. Although this letter is necessarily very incomplete, yet I venture to hope that I have shown that it is desirable for marine engineers to turn their thoughts to other fields, instead of trying to improve an engine which, though good in its time, becomes yearly more costly and complicated, and which must give way sooner or later to some more simple and economical agent for converting energy.

May 5th. S. A. HOUGHTON.

MAIN CAUSE OF THE FRACTURE OF SCREWS.

SIR,—We are all cognisant of the serious consequences which ensue from the fracture of a screw in a screw vessel, whereby she is left in a disabled state to the mercy of the elements. But I do not think we are equally conscious of the cause of the mortality in screws from which our nautical interests suffer so grievously, and some elucidation of this point may consequently be an acceptable service. The main cause of the fracture of screws is corrosion. Any one who examines a screw that has been a considerable time in use will discover that while that part of the surface which faces aft is perfectly sound and free from corrosion, and while the greater portion of the surface of the blade which faces forward is also sound, there will be a band of considerable breadth reaching from edge to edge of each blade, which is deeply corroded and eaten into holes, whereby the strength is so impaired that the blade finally gives way at that part. This band of corrosion is not at the end of each blade, nor is it near the middle of the screw; but its centre is about one-third of the blade from the end or two-thirds from the middle of the shaft. I will not at present offer any opinion as to the cause of this corrosion, and how it is to be prevented; and I leave it as an exercise to try the penetration of your readers. Should an adequate explanation not be given on the matter by your correspondents, I shall further endeavour to elucidate the subject if you afford me the necessary amount of space.

D. H. FARQUHARSON,
Student College of Practical Engineering.

Muswell-hill, London, N., May 9th.

THE NOMINAL POWER OF MARINE ENGINES.

SIR,—Will you or any of your numerous readers inform us through your valuable paper if there is any fixed rule for classing the nominal horse-power of ship engines? If so, how is it defined—is it compulsory—or can shipowners class at what power they think proper? This is a question that should be looked into by sea-going engineers, as we are of opinion that many steamships are classed under power that should be over. If such is the case, it is a great injustice to us. The Board of Trade issue and compel engineers to hold certificates, namely, first and second-class; which is quite right for the public safety. The first and second engineers of a ship over 100 nominal horse-power must hold first and second-class certificates; well, in a steamship under 100 nominal horse-power a second-class certificated man can act as chief engineer, the second engineer in such a boat not requiring a certificate. It is to the shipowners' interest to have their ships classed under power, as they save the expense of a certificated first engineer; by so doing they do a great injustice to a Board of Trade man. Should not the Board of Trade protect their engineers as well as shipowners and the public? and would it not be better for the Board of Trade to compel steamships above or below power in foreign trades to carry two certificated engineers? If you or any of your readers can give us any information we shall be glad. I should like the reply to pass through your paper, as engineers in other ports may have the same grievance, and would perhaps assist in bringing the matter before the proper parties.

May 19th. FAIR PLAY.

[We have dealt fully on another page with the question raised by our correspondent.—ED. E.]

HYDRAULIC LIFTS.

SIR,—In your notice of the machinery at the Health Exhibition, published yesterday, you mentioned a special hydraulic lift, fitted with an apparatus which someone has dubbed "Economiser." Now I have been looking at that apparatus, and have conceived just a suspicion that it may not be an "Economiser" at all—indeed I am rather inclined to the opinion that it may be just the reverse. Some friends of mine, to whom the matter has been mentioned, also fail to discover in what manner the "Economiser" justifies its name.

Will you therefore allow me to ask the makers to publish in your columns some data taken from actual practice which will enable your readers to form for themselves some idea of the utility of the "Economiser?" The amount of effective work to be obtained from a given amount of power with other types of lifts is on record in your columns, and is generally known.

If the makers of the lift in question will favour you with, say, the pressure of water which the pumps have to pump against, the volume of water actually wasted at each full ascent of the lift, and the maximum useful weight—excluding car—which the lift will raise throughout its journey, and the height of travel; the data to be taken from a lift fitted with the "Economiser," as exhibited, and with a travel of not less than, say, 60ft., a comparison might be made between the results obtained with and without the

Lavender Hill, May 17th. ECONOMISER.

THE CONTINUOUS BRAKE RETURNS—FAILURES.

SIR,—The publication of the Board of Trade returns appears now to be immediately followed by the circulation of a misleading statement, the object of which is undoubtedly to make the public believe that non-automatic vacuum brakes are the best. Instead of placing the three separate headings as given in the return, and estimating the value of each incident in accordance with the class to which it belongs, the "statement" in question simply gives the total number, without making any difference between an actual collision and one minute's delay. A "brake failure" is a failure to act when required, and such cases are placed under headings—(1) failure to act in case of accident; (2) failure to act under ordinary circumstances. Seventy-one such failures are reported for the half-year ending 31st December, 1883. One of these comes under Class 1, being an actual collision at Perth due to the failure of the chain brake. Of the seventy cases under Class 2, no less than fifty-seven were caused by non-automatic brakes, as shown by the following table:—

Failures to Act.

	Class No. 1.	Class No. 2.
Smith's vacuum, non-automatic	nil	39
Clark and Webb (chain), non-automatic	1	15
Wilkin and Clark (chain), non-automatic	nil	2
Fay, non-automatic	nil	1
Westinghouse, automatic	nil	10
Smith's vacuum, automatic	nil	2
Sanders-Bolitho vacuum, automatic	nil	1
Total	1	70
Non-automatic systems	1	57
Automatic systems	nil	13
Total	1	70

Thirteen instances only are recorded against automatic brakes, and of these nearly all are due to fault of those working them, not to the brake itself. For instance, six cases are given of neglect in not opening inch cocks in the Westinghouse pipe; another case states "want of judgment on the part of the driver in not applying the brake sooner," and two others "neglect of driver." The report of the London and South-Western records two instances of the "automatic vacuum" overrunning in consequence of leaking hose and train pipe; these appear to deserve special attention, as an automatic brake is supposed to go on in case of failure.

Thus far I have dealt with the return as it stands, but there are many very incorrect reports. The Manchester, Sheffield, and Lincolnshire Company places three actual failures of Smith's vacuum under the head of delay instead of "failure, Class 2." The Midland Company again neglects to record many of the failures of the Sanders-Clayton brake, yet there have been several "runs past stations," "breaking of couplings," and delays. The fact that on two occasions I was a passenger in the trains, and that no mention of either case appears in the return, proves that this company still continues to report only part of the failures.

CLEMENT E. STRETTON.

Saxe Coburg-street, Leicester, May 17th.

RAILWAY SIGNALS.

SIR,—Some of the questions raised in your article, page 368, require an explanation from me. At all stations and signal-boxes where there is a cross-over road it is necessary to have two home signals, one at each end, so as completely to protect any train shunting from one line to another or across into a siding. It is the general practice on many lines to place each home signal on the left-hand side of the line to which it refers, and engine-drivers wish this plan to be carried out in all cases.

In many instances the home signal from one box and the distant from the next are placed opposite to each other on each side of the road. In case of fog it is impossible for the driver to see both. He has therefore to trust to his fireman to see and report the state of the signal on his side of the line. Many mistakes have thus been caused, and drivers wish all signals placed so that they can always see them personally. On the Midland Railway a large number of distant signals are oblong boards. When all right, they turn edgeways; so that the "all right" is not a signal, but only the absence of one. Drivers also complain very much of the rule by which signalmen are required to give "line clear" on the block system at a time when an obstruction exists at, or a few feet beyond, the next home signal. The recent Skipton and Wincobank accidents were caused by it; yet the practice remains in force. Several mistakes have been made by drivers in consequence of signals being actually in use which are contrary to the rules. For instance, the Clearing House, also the Midland, rule-book, page 25, Rule 44, states that where distant and home or starting signals are placed on the same post, "the distant signal will be the lower and the starting or home the upper arm of that post." Now, there are many signals in use which have the distant signal at the top, or just opposite to the form stated in the rule-book. One of these exists half a mile south of Leicester, on the main line from St. Pancras, and for goods trains this distant signal is a "dummy," as it is never taken off for trains running to the goods lines at Leicester. Defective signalling is not quite such a serious matter if the drivers have control of a good continuous brake, but where they have only the "two-minute" vacuum to rely upon, mistakes and accidents may easily follow. CLEMENT E. STRETTON.

Saxe-Coburg-street, Leicester, May 17th.

THE TESTIMONIAL TO THE LATE SIR WILLIAM SIEMENS.

SIR,—I shall esteem it a favour if you will kindly state in your widely-circulated journal that I shall be glad to have the names and addresses of any subscribers who may now be abroad, as I have yet several unclaimed photographs of the late Sir William, which Lady Siemens is most desirous should be delivered to those who are entitled to them. F. J. R. CARULLA.

Landore Siemens Steel Works, Swansea.

TENDERS.

KENILWORTH WATERWORKS.

CONTRACT No. 2.—For the manufacture and erection in Kenilworth of two 12-horse power gas engines and two sets of three-throw pumps. E. Pritchard, M.I.C.E., engineer, London and Birmingham.

	Otto. £ s. d.	Clerk. £ s. d.
H. Young and Co., Pimlico, S.W.	3510 0 0	3510 0 0
J. Hatton, Coventry	no tender	1666 10 6
Pratchitt Bros., Carlisle	1500 0 0	1500 0 0
Crossley Bros., Manchester	1499 5 0	no tender
Glenfield and Co., Kilmarnock	1418 0 0	1355 0 0
*Piercy and Co., Birmingham	1260 0 0	*1200 0 0
W. Glover and Sons, Warwick	1161 10 0	1161 10 0

* Accepted.

CONTRACT No. 3.—For pumping station, pipe laying, and water tower. E. Pritchard, M.I.C.E., engineer, London and Birmingham. Quantities by E. J. Purnell, Coventry.

	£	s.	d.
C. Haywood, jun., Coventry	4700	0	0
S. Turner, Wolverhampton	4608	8	7
Currall and Lewis, Birmingham	4147	0	0
Evans Bros., Wolverhampton	4062	0	0
G. F. Smith, Leamington	3986	0	0
J. Fell, Leamington	3850	0	0
Stinson and Kellett, Leicester	3678	18	0
Holme and King, Kenilworth	3643	0	0
H. Hilton and Sons, Birmingham	3620	0	0
J. Biggs, Handsworth	3600	0	0
J. Dickson, St. Albans	3593	0	0
S. Law, Kidderminster	3537	0	0
*E. Smith and Son, Kenilworth	3378	0	0
C. J. Corrie, Lichfield	3221	0	0

* Accepted—lowest schedule of prices.

PRODUCTION AND STOCKS OF PIG IRON.

THE British Iron Trade Association has ascertained that the quantity of pig iron made in the United Kingdom in 1883 has been 8,490,224 tons, which is a decrease of 3063 tons on the production of 1882. This is the first decrease of production that has occurred since 1879, when the make of pig iron fell 290,566 tons below that of 1878. In 1880, however, the make rose to 1,712,399 tons, or 28·4 per cent. above that of 1879; in 1881 the make was 655,531 tons, or 8·4 per cent., in excess of that of 1880; and in 1882 the production was 115,923 tons, or 1·3 per cent., above that of 1881. Details are appended:—

No. I.—*Production of Pig Iron in different Districts, and in the United Kingdom as a whole, in* 1883 *and* 1882, *with Amount of Increase or Decrease in each District in the former Year.*

Name of district.	Total production of pig iron in 1883.	1882.	Increase or decrease in 1883.
	tons.	tons.	tons.
Cleveland	2,760,740	2,688,650	+ 72,090
Scotland	1,129,000	1,126,000	+ 3,000
West Cumberland (hematite)	876,410	1,001,181	−124,771
Lancashire (hematite)	820,633	782,739	+ 37,894
South Wales	887,259	883,305	+ 3,954
North Wales	39,377	48,713	− 9,336
South Staffordshire	394,000	398,443	− 4,443
North Staffordshire	285,357	317,117	− 31,760
Lincolnshire	236,578	201,561	+ 35,017
Northamptonshire	200,996	192,115	+ 8,881
West and South Yorkshire	284,810	279,253	+ 5,557
Derbyshire	371,664	372,650	− 986
Nottinghamshire and Leicestershire	85,400	73,085	+ 12,315
Shropshire	71,000	80,475	− 9,475
Gloucestershire, Wiltshire, &c.	47,000	48,000	− 1,000
Totals	8,490,224	8,493,287	− 3,063

An official return just received from the United States shows that in that country the make of pig iron in 1883 was 27,813 tons under that of 1882, the exact figures being 4,623,323 tons in 1882 and 4,595,510 tons in 1883. In Germany, on the other hand, the official returns show an increased production of pig iron to the extent of 209,831 tons in 1883, when the total make was 3,380,788 tons, against 3,170,957 tons in 1882. On an average of the three chief iron-producing countries of the world, therefore, the make of pig iron in 1883 has been only 78,955 tons over that of the previous year. This is the smallest annual advance that has taken place for a number of years.

No. II.—*Stocks of Pig Iron held by Makers and in Warrant Stores in the United Kingdom on* 31*st December*, 1883, *with Increase or Decrease compared with* 31*st December*, 1882.

District.	Stocks of pig iron at 31st Dec., 1883.	31st Dec., 1882.	Increase or decrease on 31st Dec., 1882.
	tons.	tons.	tons.
Cleveland	253,105	266,179	− 13,074
Scotland	835,000	837,000	− 1,000
West Cumberland*	132,796	142,582	− 9,786
Lancashire*	111,587	48,200	+ 63,387
South Wales	66,608	78,519	− 11,911
North Wales	6,382	3,740	+ 2,642
South Staffordshire	55,600	38,802	+ 16,798
North Staffordshire	52,495	47,523	+ 4,972
Lincolnshire	13,184	60,218	− 47,034
Northamptonshire	31,892	18,720	+ 13,172
West and South Yorkshire	56,027	54,180	+ 1,847
Derbyshire	23,000	33,000	− 10,000
Shropshire	22,000	21,500	+ 500
Nottingham and Leicestershire	3,200	4,757	− 1,557
Gloucestershire, Wiltshire, &c.	6,100	4,200	+ 1,900
Total	1,698,976	1,658,120	+ 40,856

* The returns for Lancashire and Cumberland include the stocks in the West Cumberland Storing Company's store at Workington, and in the Furness Railway Company's store at Barrow.

	Tons.
The stocks of pig iron throughout the country on 31st December, 1882, amounted to	1,658,120
The production of pig iron in 1883 was	8,490,224
Total	10,148,344
Deduct stocks on 31st December, 1883	1,698,976
Total consumption of pig iron in 1883	8,449,368
Against a consumption in 1882 of	8,652,655
Being a decrease of	203,287

The stocks of pig iron at 31st December, 1883, were equal to 20·1 per cent., or 10·4 weeks, of the consumption of that year, against 18·2 per cent., or 9·4 weeks, of the consumption of 1882, and 21·2 per cent., or 11 weeks, of the consumption of 1881, as represented by the stocks on the 31st December of each of these years.

Blast furnaces.—The condition of the blast furnaces in the United Kingdom on the 1st January, 1884, is shown in the following table:—

District.	Number of blast furnaces. In.	Out.	Total.
South Staffordshire	39	77	116
North Staffordshire	24	16	40
Shropshire	7	17	24
Cleveland	117	41	158
Yorkshire, West Riding	24	21	45
Derby, Notts, and Leicester	40	18	58
Northamptonshire	17	9	26
Lincolnshire	17	3	20
Lancashire and Cumberland	64	42	106
Gloucestershire	1	7	8
Hants, Wilts, and Somerset	2	6	8
North Wales	4	6	10
South Wales	49	92	141
Scotland	101	43	144
Totals	506	398	904

The condition of the blast furnaces at the commencement of each month throughout the year appears in the following figures:—

Date.	Number of blast furnaces. In.	Out.	Total.
February 1, 1883	556	362	918
March 1	556	362	918
April 1	553	363	916
May 1	549	367	916
June 1	548	370	918
July 1	540	375	915
August 1	545	367	912
September 1	537	371	908
October 1	535	374	909
November 1	524	386	910
December 1	514	395	909
January 1, 1884	506	398	904

It will be seen from the following additional statistics bearing on the condition of the blast furnaces, that with the exceptions of 1878 and 1879 the number of furnaces in blast at the end of 1883 was fewer than in any year since 1874:—

No. III.—*Number of Blast Furnaces Constructed, in Blast, and out of Blast in the United Kingdom, at the end of each Year from* 1875 *to* 1883, *inclusive.*

Year.	Number of blast furnaces. Erected.	In blast.	Out of blast.
1875	959	629	330
1876	927	585	342
1877	940	541	399
1878	948	498	450
1879	951	458	493
1880	959	590	369
1881	949	552	397
1882	926	565	361
1883	904	506	398

No. IV.—*Number of Furnaces in Blast in the United Kingdom, with Production of Pig Iron, and Average Annual Make per Furnace in each Year from* 1870 *to* 1883.

Year.	Production.	Furnaces in blast.	Average annual make per furnace.
	tons.		tons.
1870	5,962,180	664	8,979
1871	6,626.896	673	9,846
1872	6,741,642	702	9,603
1873	6,566,171	683	9,613
1874	5,991,152	649	9,231
1875	6,365,200	629	10,119
1876	6,505,575	585	11,120
1877	6,608,664	541	12,215
1878	6,381,051	498	12,813
1879	6,009,434	458	13,121
1880	7,721,833	590	13,087
1881	8,377,364	552	15,176
1882	8,493,287	565	15,032
1883	8,490,224	539	15,752

Make of hematite iron.—The diminished make of hematite in 1883 is shown alike in the reduced imports of foreign ores into the United Kingdom in that year, in the decreased make of pig iron in the districts of Cumberland and Lancashire, taking them together, and in the reduced production of Bessemer steel. The imports of iron ore in 1883, aggregating 3,178,310 tons, were 104,186 tons less than the imports for the previous year. This corresponds roughly to a diminished make of hematite iron to the extent of 52,000 tons. In Lancashire and Cumberland together the make of pig iron in 1883 has been 1,697,043 tons, or 86,877 tons under the make for the previous year. These two items unitedly show a decrease of 138,877 tons in the make of iron from hematite ores, the total of which for 1883 may be put at 3,287,000 tons.

No. V.—*Quantities of Hematite Ores used in the United Kingdom, and estimated Production of Hematite Pig Iron from* 1870 *to* 1883 (1=1000 *tons*).

Year.	Hematite ore raised in United Kingdom.	Hematite ores imported.	Estimated production of hematite iron.
	tons.	tons.	tons.
1870	2093	208	1211
1871	2233	324	1345
1872	1769	801	1352
1873	2156	967	1643
1874	2034	754	1467
1875	1982	458	1284
1876	2339	672	1584
1877	2344	1140	1833
1878	2342	1173	1850
1879	2203	1083	1729
1880	2759	2634	2838
1881	2805	2449	2765
1882	2944	3282	3425
1883	2774	3178	3287

Spiegeleisen.—The total make of spiegeleisen and ferro-manganese in the United Kingdom in 1883 was 179,500 tons, of which the following proportions were contributed by the districts named:—

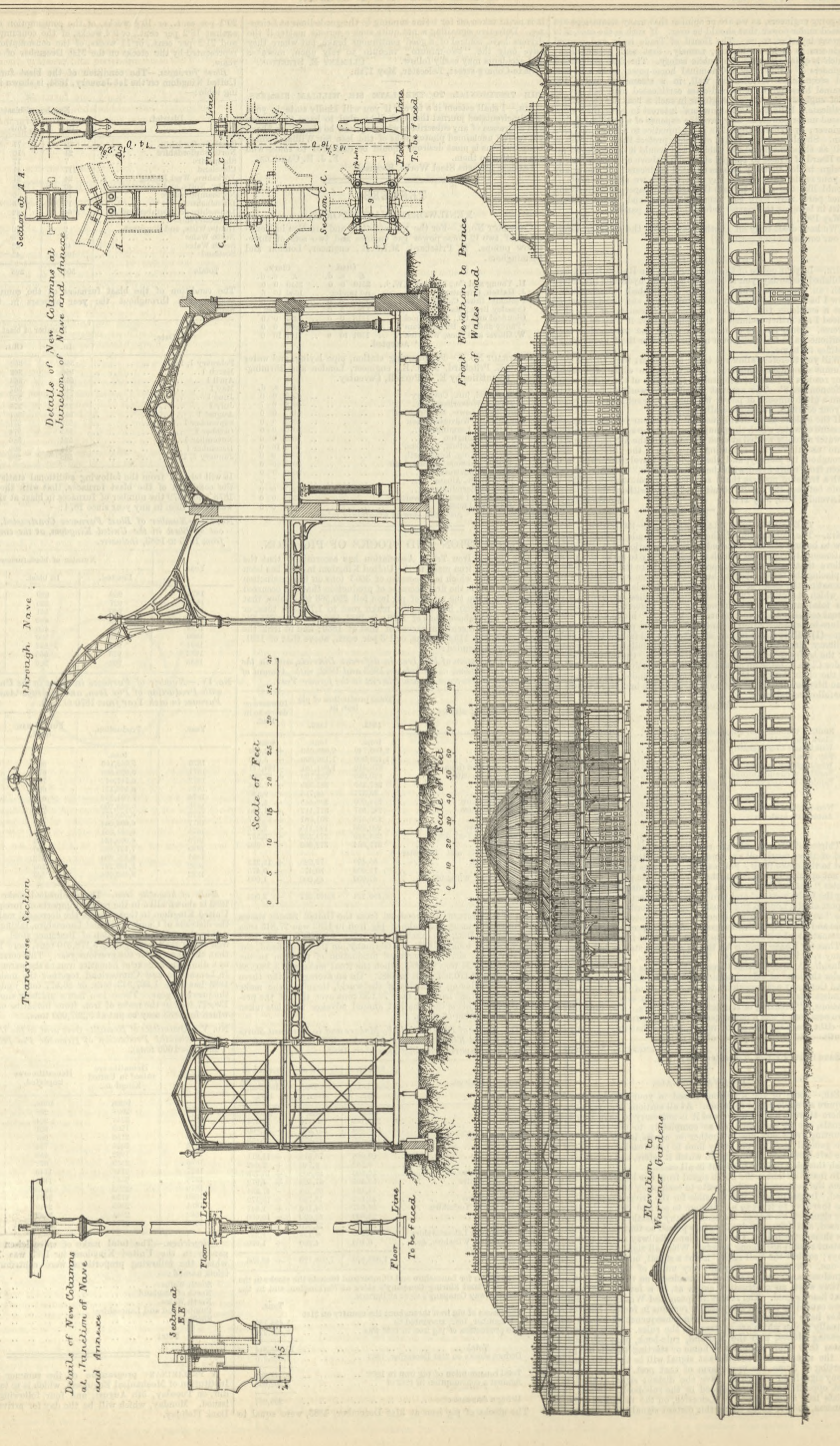
South Wales	71,200
North of England	50,400
North Wales	23,300
Cumberland and Lancashire	27,455
Sheffield	7,145
Total	179,500

A PRELIMINARY programme of the summer meeting of the Institution of Mechanical Engineers, which is to take place at Cardiff, on Tuesday, 5th August, and four following days, has been issued. Monday, which will be the day for arrival at Cardiff, is Bank Holiday.

THE ALBERT EXHIBITION PALACE, BATTERSEA.

MESSRS. BELL, MILLER AND BELL, WESTMINSTER, ENGINEERS.

(For description see page 389.)



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.*

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

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

W. R.—*There is no popular treatise on the gas engine.*

J. D.—*A letter for this correspondent awaits his application.*

A. E. E. (Muswell-hill).—*You appear to be unacquainted with Froude's researches. You might communicate with his son, Mr. E. Froude, Torquay.*

T. T. (Cardigan).—*As we understand your question, a fall of about 1 in 3000 will give a velocity of nearly 19in. per second. We shall be glad to see your calculations, for it is possible that we do not quite understand the conditions under which the discharge is to take place.*

JUSTICE.—*Seeing that there are many hundred sea-going engineers who would be glad at this moment to get employment on board ship at almost any salary offered, we fear that no good would be done by publishing your letter. So long as freedom of contract exists you cannot prevent a ship-owner from offering, and an engineer from accepting, any terms, however low. Nothing can effect a change but united action among the engineers; and this they never have taken yet, and probably never will.*

CARBONATE AND SULPHATE OF LIME IN BOILERS.

(*To the Editor of The Engineer.*)

SIR,—Will any of your readers inform me what material, chemical or otherwise, has the greatest affinity amongst water for carbonate and sulphate of lime? BOILER SCALE.

Spennymoor, May 21st.

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MEETING NEXT WEEK.

SOCIETY OF ARTS.—Monday, May 26th, at 8 p.m.: Cantor Lectures.—Lecture III., "Fermentation and Distillation," by Professor W. Noel Hartley, F.C.S. Wednesday, May 28th, at 8 p.m.: Twenty-third ordinary meeting.—"Primary Batteries for Electric Lighting," by Mr. I. Probert. Mr. W. H. Preece, F.R.S., will preside. Thursday, May 29th, at 8 p.m.: Applied Chemistry and Physics Section.—"Some Economical Processes Connected with the Woollen Industry," by Dr. William Ramsay. Friday, May 30th, at 8 p.m.: Indian Section.—"Street Architecture in India," by Mr. C. Purdon Clarke, C.I.E. This paper will be illustrated by means of the oxy-hydrogen light.

DEATH.

On the 15th inst., at Malmesbury, Cape Colony, JOHN FORTESCUE FOULKES, C.E.

THE ENGINEER.

MAY 23, 1884.

THE CONDITION OF TRADE.

FROM all parts of the country and from almost all departments of trade, reports reach us to the same desponding effect. Trade is as bad as it can be. It is by no means clear that Great Britain stands alone in this respect. The recent panic in the United States indicates that things are not going on there as well as they ought. It is notorious that in France grievous complaint is made of want of work; and in some of our colonies thousands of men seek in vain for any employment by which to earn a crust. We think that the cause of all this is not far to seek. With foreigners we need not concern ourselves, though much that we are about to say concerning home industries will apply to those of other nations. Strange as it may appear, England is badly off because she has too much capital. We use the word in its fullest sense, and do not restrict its application to money alone. We are rich not only in money but in raw materials, tools, machines, factories, plant, and labour. This last is very cheap, abundant, and, on the whole, good. The words bad trade and good trade are purely relative. The amount of business we now transact, the quantities of raw materials we work up, and the numbers of hands we employ, are all greater than the men of the last generation anticipated in their wildest dreams. But with all this it is difficult to earn a living either by labour or by the investment of capital. Hundreds of millions are comparatively unproductive; and those who possess them anxiously seek for any opening which gives a prospect that more that 2½ or 3 per cent. can be had for money. The result is bad trade, and those of our readers who care to follow us will, we think, fully recognise the truth of a statement which at first appears paradoxical.

In a town or a district a few old-established firms have for years carried on a trade from which they have derived fair profits. Careful personal management; a keen business aptitude; a desire to do everything well while overdoing nothing; and a consummate knowledge of the details of the trade carried on, have all contributed to the happy end attained. Some one possessed of money, and wishing for more, finds his way to the lucky region of which we speak. If one firm or two can make money, why should not another? In a very short time the old firms find rivals at their doors. In a district where, let us suppose, one iron-works stood, half-a-dozen spring into existence. The production of iron is multiplied six-fold. The direct result is that the price of iron falls. It cannot possibly be otherwise. With cheap iron it becomes possible to build cheap ships. We find, as a result of the operation of the law of which we speak, that half-a-dozen shipyards exist where one sufficed. Cheap ships mean low freights. At once more goods are imported and exported, and, to use a well-known phrase, the prosperity of the country increases by leaps and bounds. More money is made, and seeks investment, ironworks are added to ironworks, shipyard to shipyard. What is true of these trades applies to a host of others; and so production goes on augmenting almost without regard to the question of consumption. At last a critical point is reached, passed, and disaster begins. The new firms, working without the experience and care that distinguished the old firms, fall; the shareholders lose hundreds of thousands of pounds, and the old firms may count themselves lucky if they weather the storm. They have had to contend against a competition really unfair, because it has been carried on by the expenditure and total loss of capital instead of being conducted on sound business principles. Any one can undersell his rival if only his purse is long enough and he cares nothing for profit. Many of our readers will remember a case in point, which occurred in the North not many years ago. Of course we refrain from giving names. A limited company started the manufacture of wrought iron on a large scale, lost in a very short time about a quarter of a million, upset the whole course of trade by underselling old establishments, and finally collapsed, very nearly carrying down other firms with it. Such events, and many others like them, are due solely to a plethora of capital seeking investment. Men do not know what to do with their money. They produce more goods than are wanted, and ruin follows. The iron trade at the present moment supplies an admirable example of what we mean. The production during the last twelve months of pig iron and steel was enormous—greater, probably, than it ever was before. It was far in excess of the demand, and thousands and thousands of tons of pig iron now lie in stock for want of buyers. It appears under such circumstances to be sheer folly to go on making it; but it must be remembered that to reduce make is a very costly undertaking. The blowing out of a blast furnace represents a dead loss of some thousands of pounds. In many instances it is impossible to blow it in again until it has been relined, for when once cooled down contraction sets in and does its ruinous work. Then some £20,000 worth of capital is thrown idle, and blowing engines and boilers and stoves undergo very rapid deterioration when standing. Thus the ironmaster will blow out a furnace only as a last resource; there is, therefore, the more reason that caution should be used in building one. An example of the frantic desire to get a profit out of money was supplied some time since in a few terse sentences written by one of our own correspondents. The tin-plate trade was in a state of collapse; mills were thrown on the market by the dozen, and could find no purchasers. Bankruptcies and liquidations were the order of the day. Of course, the stoppage of so many mills meant a reduction of output. The few firms that survived the crash were able to put up prices a couple of shillings a box, and then barely made any profit; but the moment the rise took place, mills, just before unsaleable, readily found purchasers, and production began rapidly to augment. We do not profess to prophecy, but those who know most of the tin-plate trade regard its present position as anything but satisfactory.

Turning to another form of national capital, viz., labour, we find similar causes working to the same end. In almost every trade there are more hands than are wanted. The result is, of course, not only low wages, which would be endurable, but want of employment at any wage, which is unendurable; and it will be found that the moment there is the least prospect that wages are rising, young men will flock to that trade, and so very quickly overstock it. We are not proposing a remedy for this. It is, indeed, very difficult to see how a remedy may be supplied; but one thing is certain, namely, that the cure proposed by Mr. Swift, of the Steam Engine Makers' Society, in our columns some time since, must be inoperative. He holds that the hours of labour for steam engine makers should be shortened, when more men must be employed to do the same amount of work. Mr. Swift's remedy would be effectual to a certain extent, provided wages were to be reduced in exactly the same proportion as the hours of labour. But this is the last thing to enter his mind; consequently his scheme is tantamount to a rise in wages, the effect of which would be to render steam engine making attractive, and at once to augment the number of those adopting that trade as a means of livelihood. A fall in wages, or an increase in the hours of labour, would operate in the opposite direction, and men would be repelled instead of being attracted, as was the case with pattern makers some years ago.

It may, perhaps, be said that we are advocating restriction of output. We do nothing of the kind, and it must not be forgotten that the words may be used in two very different senses. To restrict output when profits are being realised in order to make them higher, is extremely unwise. It is courting direct and possibly disastrous competition; but to refuse to produce at a dead loss is quite another matter. Ironmasters are now in certain districts reducing output by blowing out furnaces. To denounce them for doing this would be about as wise as to blame them for not building more furnaces, and still further lowering the price of iron. There is no analogy whatever between refusing to work at a loss, and refusing to work at a fair profit. In this matter facts are too strong for doctrinaires; and if the ironmasters did not spontaneously restrict their operations, bankruptcy would step in and do it for them. After all, a limit is reached now and then, and production gets to its proper level, but much hardship is inflicted. It is too often forgotten that the demands of the consumer are limited, and a time may be reached at which a ship or ton of iron becomes as valueless to the world as the bag of gold which Robinson Crusoe found, was to him. As we have stated, we have no intention of suggesting remedies for a condition of trade which we can but deplore. The restriction of output for a time permits consumption to catch up with production. Thus, for example, all the steamers now lying idle, and practically unsaleable in our northern ports, will ere long be worth as much as ever, always provided that the building of new steamers ceases for a time. In like manner trade will revive; but how long it will take in the process depends on two factors—the rate of consumption and the rate of restricted production. There is only one way in which it appears to be possible to prevent a recurrence of seasons of bad trade, and that lies in the exercise of increased caution on the part of the capitalist, and especially of the small capitalist. If he refuses to take part in limited liability speculations, which even if successful for a time, are certain to overdo the market, all may be well. We write this, however, in the full knowledge that a promise of 10 per cent. will always induce men to sell out of the funds, and no amount of disastrous experience seems to be a sufficient warning to prevent this suicidal policy.

THE FOOLISHNESS OF UNDERWRITERS.

IN one of the longest speeches ever delivered in the House of Commons, Mr. Chamberlain stated on Monday night his case against the shipowners. It is quite beyond our purpose to consider his charges *seriatim*. Nothing that he has advanced has modified the views which we have already expressed, namely, that while we believe that legislation is necessary, we hold that this legislation should be based on the report of a Select Committee; and this is the more necessary because the charges brought by the President of the Board of Trade against shipowners are such that these gentlemen have every reason to ask for an inquiry, which they confidently affirm will clear their reputations as a body, and bring the real criminals to justice at the bar of public opinion. Our purpose now is to call attention to the curious statements made by Mr. Chamberlain concerning underwriters. If these charges are really true, then the foolishness of these gentlemen is almost incredible; and of all the puzzles presented by the science and practice of political economy, their continued existence as a class, and apparent prosperity is the most remarkable.

According to Mr. Chamberlain, it is a regular practice to insure ships for more than they are worth. Then they are lost—shall we say under suspicious circumstances, or as a result of gross carelessness? He made a detailed statement on this point, from which we quote a few passages:—"The Said was missing in 1883 and eighteen hands were believed to have gone to the bottom. She was insured for £16,000, and she was valued by a firm of valuers in the City at £11,000. Another vessel, as to which there was an inquiry held, was found by the Court to have been very fully laden; she was insured for £15,000, and valued only at £13,000. The case of the Consolation in 1883 was one in which no lives were lost; the vessel was insured for £17,000; her original cost was £17,000; she was ten years old, and valued at £11,500. In another case the vessel was insured for £14,500, and her estimated value was about £12,000. The gross freight was insured. In 1851 her cost with repairs was £13,261, and the owners admitted that 10 per cent. had been added to the cost for insurance, that being the usual mercantile transaction. Then we have another case—that of the Emily. The owner, when examined, would not state how often the ship had been strengthened. She was a vessel of 787 tons, and therefore at £10 a ton she was worth about £8000. She went to the bottom, although there were no lives lost. She was insured at £14,000. But these are not the worst cases; the worst are those of what are called single ship companies." Here we have over insurance clearly stated. It might be argued that so long as the insurance was not claimed, the underwriters would be none the worse. Further on, however, we come on the following: "In the case of one ship which was insured at £9000, and which was valued at £6000, when it went to the bottom the managing owner paid the shareholders 24 per cent. as profit on this vessel and returned the original capital, allowing nothing for depreciation. In another case a ship insured at £14,000 and valued at £11,500, paid 30 per cent. profit, and returned to her shareholders £232 on each £218 invested." The President of the Board of Trade holds that such cases are not uncommon, and he argues that the practice of full or over insurance causes a great national loss, because due care is not taken of costly ships, inasmuch as the owners have no interest in preserving them. Whether they sink or swim it is all one to them.

Now it can hardly fail to strike the impartial observer that if Mr. Chamberlain's allegations are true, the underwriters must be foolish. Not only this, the results of the operations of shipowners must be disastrous to them. If ship after ship be thrown away, the sums paid in the shape of insurance money must be enormous. We do not suppose that there would be any great difficulty encountered in obtaining and publishing a statement of the sums already paid in this year, or any one year, by underwriters; but

Mr. Chamberlain has put forward no statistics of the kind, although it is obvious that they would be extremely valuable. If, for example, he could show that a great many millions changed hands in this way every year the fact would be suggestive. The great difficulty is, however, to arrive at some explanation of the means by which underwriters could, under the circumstances, make a good profit. Thus, for example, if even a few ships are over insured and are lost through want of proper precautions, which are not taken because the owner has no interest in keeping his craft afloat, then the loss to the underwriters must be very heavy. It will be seen at a glance that all underwriting is based on laws of risk like those of fire and life insurance. If there is through dishonesty or something akin to it, a break in the law, the losses of the underwriters may be frightful. It would seem, however, that there must be some method in their madness, for, as we have said, they continue to extract a profit from underwriting, even from the worthless shipowners whom Mr. Chamberlain denounces as "broken-down tradesmen, waiters, Jew pedlars, and other people in the same walk of life." It requires some faith in Mr. Chamberlain to believe that underwriters really can and do compensate the shipowning community out of their own pockets for the loss of their ships; because this is in effect what his statements come to. If underwriters can be found to do this, they exceed in foolishness any other body of commercial men in Great Britain.

The truth is, of course, that underwriting is only profitable because the premiums paid exceed, on the whole, the sums paid as compensation. In point of fact, the shipowners suffer when a ship is lost, and not the underwriters. Insuring may be regarded as paying into a fund from which at one time A, at another time Z, recoups himself for a loss. It may be proved mathematically that the number of dishonest shipowners is fixed by the premiums which have to be paid as insurance, and that if these rates are low the dishonest men must be few in number. In fact, the key to the whole mystery of shipowning, and ship-insuring, and ship-losing, would be supplied by the publication of a statement of the total sums paid as premiums and as compensation for loss during, let us say, the last eight or ten years. It would then be found that the loss, be it what it may, ultimately falls, not on the underwriter, but on the whole shipowning fraternity; and wilfully or negligently to throw away or lose a ship is to take money out of their pockets. Beyond a doubt this truth is fully understood in all its bearings by shipowners and underwriters alike, and there is only one way in which the malpractices of which Mr. Chamberlain speaks can be made to work, namely, by the dishonest shipowner virtually cheating the honest one. One man runs his ship for years without loss, paying premiums all the time; another loses ship after ship, and is, of course, paid his compensation out of the premiums of his fellow shipowner. This is the broad way of putting the facts, but it will be seen that the premiums of a great many honest men would be required to keep a single dishonest man going; and for this reason, if for no other, we repeat that while we admit that there are black sheep in the shipping trade, as in all other trades, their number is comparatively small, and the shipowners as a class do not in any sense or way deserve the sweeping charges that have been brought against them. Mr. Chamberlain, indeed, seems to have taken little trouble to verify the accuracy of the few precise statements he has made. Contradictions have already appeared in several daily papers. Thus it appears that the Consolation referred to above cost £27,000, instead of £17,000; that £9000 were spent in repairing her; that £17,000 was her true value at the time of her loss; and that she was not in any way over insured. Again, Mr. Chamberlain said, "In the case of the Triumph, her homeward freight was insured for £10,000; she was wrecked before a single ounce of her homeward cargo was on board, and yet the owners recovered the whole of the £10,000." Messrs. Macintyre Bros., of Leadenhall-street, say, "It is quite true that this vessel was wrecked before loading her homeward cargo, but it is not true that we—the owners—received £10,000 from the underwriters for homeward freight, as we did not insure it." Inaccuracies such as these we have named would go far to spoil any case, however good; and Mr. Chamberlain has found himself obliged to throw the onus on the press. He has written to one daily contemporary to say that, as a written statement of figures had not been supplied by him to the press, "many errors have inevitably crept into the various printed reports, and I hope, therefore, that those who desire to examine into the facts will wait for a few days until a revised report can be prepared." We can only say that Mr. Chamberlain has been peculiarly unfortunate in this respect.

PROGRESS IN GAS TESTING.

JUSTIFICATION for the remarks which we offered towards the close of last year on the subject of gas testing in the metropolis is afforded by the recent action of the Gas Referees. These authorities have sanctioned the official testing of gas at the offices of the Metropolitan Board of Works, in Spring-gardens, where Mr. Dibdin, the chemist to the Board, reported the gas some time ago to be frequently under 16-candles lighting power, and on several occasions even below 14-candles. A fact like this cannot fail to command attention, and was very likely the cause of considerable surprise to the directors of the Chartered Gas Company, as well as to Mr. Vernon Harcourt and his colleagues, Professor Tyndall and Dr. Pole. At the same time that the deficient lighting power was noticed at Spring-gardens, mention was made that Paddington was without any sure protection as to the quality of its gas. This defect is to be remedied by a new testing station situated between Edgware-road and Regent's Park, about midway between the testing stations at Notting-hill and Camden Town. Other arrangements are in progress, so as to meet the altered circumstances consequent on the amalgamation of the London Company with the Chartered. But the gas in the district of the absorbed London company will not be tested until the end of the year, time being thus allowed for the requisite plant to be set up at the works, so as to effect the due purification of the gas. Another step has reference to the portable photometer which has lately been devised in the laboratory of the Metropolitan Board. This ingenious apparatus is of a perambulatory character, and although it only measures the lighting power of the gas, yet it possesses peculiar value, seeing that by its use it becomes possible to test the illuminating quality at any spot and at any time. Thus the gas may be tested for its illuminating power on the actual premises of the consumer. For the present the portable photometer has no recognition on the statute book, and its results cannot be taken as legal evidence. But the Metropolitan Board have asked the Board of Trade to promote a Bill which shall place the testings of the portable photometer on the same footing as those which are performed at the fixed stations. It is apparently contemplated to have more than one of these instruments, the communication to the Board of Trade being couched in the plural. Such a provision would be exceedingly serviceable, and would facilitate the testing of gas at unusual hours, as well as at unusual places. The efficient testing of gas threatens no harm to the companies, beyond the fact that they have to bear some part of the expense. To the public an assurance is given that they are having what they pay for, so far as quality is concerned. With respect to quantity, the Board of Trade are asked to amend the law concerning the registering apparatus, or indexes, attached to gas-meters, with a view to such indexes being officially examined and certified. The meters are already examined and certified, so that if the registering apparatus is correct all will be well. But there is no effectual testing of the wheel-work which measures off the quantities, and although in practice this omission may not have any injurious effect, it is well that it should be rectified. The practical defect is that the registering power of the meter at present is not tested to such an extent as to guarantee accuracy for large quantities. The accuracy may exist, but the test is insufficient as a proof.

Going yet a step further, the Metropolitan Board have addressed a letter to the Board of Trade asking that department to promote a Bill "legalising a more trustworthy standard of the illuminating power of the gas supplied to the metropolis." The authorities at Spring-gardens thus appear to have lost faith in the two sperm candles, "six to the pound," which are at present used as a photometrical appliance. It is probable that the Gas Referees are prepared to recommend something more scientific than a couple of candles. But vigilance must be exercised lest in changing the standard some damage befalls the consumer, as in the substitution of a new standard gas burner for the old burner used previous to 1868. By this change in the burner in which the gas to be tested was to be consumed, the so called 16-candle gas of the new *régime* was rendered very little superior in itself to 14-candle gas of the preceding period. Thus, the improved light was due more to the burner than to the gas; and unless private consumers purchased the new burner, they experienced small benefit from the new law as compared with the old. One advantage, indeed, was gained—that is to say, the new law was carried out, whereas the old one was a dead letter. Without doubt the gas consumed in the metropolis is a much better article now than it was prior to 1868, and the latest step has been to take care that the gas is duly tested in all parts of the immense district traversed by the complicated mains of the Chartered Company. The directors of the company have been recently reorganising their engineering staff, and the change they have thus effected has exposed them to some sharp criticisms in certain quarters. Hitherto each engineer has reigned supreme at his own station, but in future one engineer will have control over all the stations. The directors are evidently aiming at giving greater unity and consolidation to their system, and, so far as the public are concerned, we believe the result will be beneficial.

BUSINESS MANAGEMENT.

THE remarkable degree of success that attends the operations of some firms; the high position they attain, and the wealth amassed by their members, often present a contrast to the failure and decay, more or less rapid, of others. It may be useful if we endeavour to put before our readers some examples of mismanagement that have come at different times under our observation, and which may be regarded as typical of causes of failure in business. A most fruitful and very common mistake is penny-wisdom and pound-foolishness. A firm long established and doing a good steady business takes in a new partner; he holds, or conceives the idea, that above all things expenses should be cut down to the lowest limit; and that the things dealt in by the firm should be produced at the least possible outlay. Of course the principle is sound enough if applied in an intelligent and broad spirit of common sense. The spirit of the newcomer, however, is, it may be, not of this stamp. His idea is to employ the lowest wages men obtainable, irrespective of their skill, intelligence, or experience of the work in hand. He reduces the salaries of the heads of departments and the pay of the best men, who, in many cases, either at once resign, to carry their knowledge to some rival works, or else do so the moment a favourable time presents itself. The new men at lower pay, even if good and really cheap, are strange to the place, to its routine, and to the hands still remaining. The success of a firm with such a man at the head of affairs must be in daily peril. Change in any staff of men long accustomed to work together is always dangerous; the brain and labour machine is disjointed, and no longer moves smoothly. If it be true that it is well to produce cheap and sell dear, it is also true that the good thing is cheap, and still more so that the best is—*cæteris paribus*—the cheapest; and a really good man, intelligent and well skilled in his calling, is always worth his pay—worth good pay.

Another cause of failure in business is a division of control. By this we do not mean putting each department under distinct direction. What we mean is, putting any given department under divided control. A ship must be sailed by one captain; a coach must be driven by one man. The same thing holds good in business affairs. In some cases we have known the managing directors of private companies dealing in machinery, who would not leave control in the hands of the works managers or of the chief draughtsmen, nor even in the hands of the foremen. One director would go into the drawing-office and change all the jobs set to the staff there by the chief, in the latter's absence giving A's job to B, and his in turn to C, thus disturbing the chain of thought of all three, and of course delaying the work, as well as putting out of gear all the chief's business arrangements. The same thing was done in the shops. The works manager would have set out the work for the day, but while he was absent at his breakfast the managing director would go round the shops and disarrange everything; one man would be taken from a lathe, the character of which he understood better than any other man there; and here we must tell any of our readers who may think a lathe is a tool that any good turner in metal can use well, that such is by no means the case. Even lathes made in the best manner act more efficiently in the hands of some men than in those of others. All good practical managers know this, and therefore change men from tool to tool as little as possible. Heads of firms and managing directors as a class are not always practical men, and many of them are ignorant of certain details of workshop practice, and therefore should leave such things to the foreman or works manager, always taking care to secure and retain the services of thoroughly competent men by paying good wages.

The typical managing director of whom we write had another dangerous habit, namely, that of going to the pattern shop, or to the fitting shop, and causing alterations to be made, which alterations he did not always report to the drawing-office, and, as a consequence, it occasionally happened that parts of machines did not invariably go together quite satisfactorily.

Another faulty practice which we have known in business management—a fault which, like those we have already described, is not peculiar to any one firm or company—is that of not permitting men out on a job at a distance from the works to hire local assistance or tools, or to purchase small matters needed in the execution of the job. In one instance which we may select from many, they had to telegraph their wants to head-quarters, and wait, it might be, a day, or even longer, till men or tools were sent to them; thus entailing delay in the progress of the job, and causing dissatisfaction in the mind of the man for whom the work was being done. So tightly do some firms tie the hands of their outdoor foremen, that these cannot so much as hire a cart and horse to transport tools or materials till they have telegraphed to head-quarters for instructions. We have known cases where small tools needed on an iron bridge in course of erection were sent many miles by passenger train at an expense exceeding the value of the tools themselves, the foreman not being allowed to purchase them on the spot, though he had every facility for doing so. We have known a firm who sent the wages of forty to fifty men every week in Post-office orders to the foreman. This same firm, when erecting an iron bridge, finding it necessary to punch rivet holes in a number of ⅝in. plates, instead of marking them and sending them to a local shop about a mile distant to have the work done, made a punching machine themselves at great expense, and the firm not being regular tool makers, it was very imperfect, one of its defects being that it was geared so slowly that even when the engine moving it was run at its utmost speed, it only could make about six strokes, or punch six holes a minute, instead of twelve to fifteen, which is the regulation piece-work rate. Good punchers will not take piecework on a machine doing less than this. This firm would not at first hire a good portable engine to drive this same punching machine, but purchased for a few pounds an extraordinary fossil, resembling a portable engine of small size, so far as the actual engine went, and this they placed on top of a little egg-ended boiler. This beautiful machine was sent to the bridge sixty odd miles by rail, and carted from the station a distance of about two miles more. It lay on the site for some days, and at last it was set in brickwork at an expense of £15. The boiler was about 7ft. long by 2ft. 9in. in diameter. A grate was, of course, set in the brickwork at one end, and a square base being built at the other, a piece of iron pipe was erected on it for a chimney. There was no wheel flue whatever. We need hardly say the result was not altogether satisfactory. About three times as much coal was burnt as would have steamed an eight-horse portable engine, and even then it was only by bottling up the steam that five minutes' work was done in punching holes at the rate of about five holes per minute, when the bottling process had to be resumed for at least ten minutes. After two days lost at this sort of thing, a moderately good portable engine was hired and sent a distance also of sixty miles by rail, and the job got through somehow. It is causes such as those we have thus described that either bring firms to bankruptcy, or else prevent them from ever attaining to great positions.

DOCK AND LIGHT DUES AND STEAMSHIPS.

SOME attention has been of late given to the question of the pressure of dock dues and those on lights, on steamships. Probably the active cause of the consideration of this has been the extremity of the depression in the shipping trade, which has made a revision of every penny of the expenditure of steamships needful; and it is proved that there is an inequality in the method and assessment of dock dues at different ports that is unsatisfactory; and also that the more frequent voyages of the steamship in a regular trade make its payments of dock and light dues more oppressive. For instance, a steamer loads a cargo for the Mediterranean at one port, and the dock and river dues, lights, stowage, &c., amount to £101; whilst the same vessel at a port only twelve miles from the first, for a similar tonnage of cargo, pays only £61; so that it is clear that the service rendered to the vessel by the docks, &c., is either too lightly charged at one port, or too heavily at another. Another instance may be given; a vessel loading at Newport paid £45 for dock dues whilst a slightly smaller vessel, for a similar service at London, paid £50; and, further, paid only £26 at Barrow. The inequality of charge arises under the various Acts of Parliament; but just as these are overruled in the cases of passenger railways, and in the cases of some other trading companies—overruled for the general good of the customers, so it is contended by the shipowners—the dock and port charges should be; and they also urge that the charge for lights for a national purpose should be borne by the nation instead of the merchant navy only.

THE AUSTRIAN FACTORY LAW.

WHAT would the British workman think of a law under which his hours of labour were limited to eleven per day? Yet in Austria the passage of such a law is looked on with delight by one section of the community, and with fear by another. On Wednesday the Lower House passed almost unanimously the most important section of the Government Factory Bill, whose provisions will revolutionise Austrian industry. It provides that workmen in factories shall not be occupied for more than eleven hours out of the twenty-four, and shall have at least one hour's interval for meals. The Minister of Commerce, on the advice of the Chambers of Commerce, may permit in certain cases one additional working hour daily; the schedule of these exceptions to be revised triennially. The "normal workday," as it is technically called, has hitherto existed only in Switzerland, and its introduction into Austria must, it is said, seriously diminish her power of competition with other countries, and particularly with Hungary, where no such restriction of labour exists, and whose manufactures, as is guaranteed by the Commercial Treaty, may freely enter Austria. The result of this experiment will be anxiously waited for. It may be of infinite service, and it may lead to great disasters. Whether the working man will be better off, on the whole, is the question. If he is, then it may be taken for granted that the movement will be a permanent success. If, however, the industries by which he lives are ruined, it is not easy to see how the nation as a whole can be benefitted.

LARGE PLATE ROLLING PLANT.

ON Thursday, the 15th inst., a formal inauguration of a very fine set of plate rolling plant took place at the Codnor Park Works of the Butterley Iron Company. The machinery includes a 28in. plate mill of very fine proportions, and with rolls 7ft. 6in. and 10ft. in length, driven by a pair of compound tandem reversing engines, with cylinders 30in. and 50in. diameter reversed by hydraulic apparatus, and running two and a-half revolutions to one of the rolls. Steam is supplied by a battery of Lancashire boilers heated by gas from a very large battery of Wilson gas producers which supply gas to heating and other furnaces. The new plant also includes a very large plate shearing machine and a fine set of furnaces. The mill was started in presence of a large party of guests, and a number of long steel plates most successfully rolled and finished. The visitors were afterwards entertained at lunch by the proprietors, when some interesting particulars relating to this old firm, established in 1790, but as vigorous to-day as when Mr. Jessop, to whose memory a monument stands on the top of the hill at Codnor Park, was its active managing partner. To these works and the machinery referred to we shall recur in another impression.

LITERATURE.

The Practical Applications of Electricity. A Series of Lectures Delivered at the Institution of Civil Engineers, Session 1882-3. London: The Institution, 1884.

THE punctuality and dispatch with which the "Proceedings" of the Institution of Civil Engineers are published has not marked the appearance of this volume of lectures, a fact from which we infer that Mr. Forrest has not been able to drive lecturers, or some of them at all events, as he can those who read papers. At the recent dinner of the students of the Institution, Sir F. Bramwell jocularly spoke of Mr. Forrest as a nigger-driver, to which he retorted that he was nigger-driven. Both assertions may be true, but if Mr. Forrest had exercised this qualification of a secretary in getting these lectures published, and thus have deserved as well as earned the distinction bestowed upon him by Sir F. Bramwell, he would have earned the thanks of all interested in electrical subjects. A lecture on any of these over a year and a-quarter old contains much that is no longer pertinent to part at least of its subject, and hence their value when printed so long after date is very much less than if printed early. This is much more observable than it would be with lectures such as those which have been delivered during the now past session of 1883-4 on "Heat and its Applications."

This series, numbering six in all, was the outcome of a proposal made in 1879, though it was not resolved until 1882 to carry the project into effect. The first lecture was by Mr. W. H. Preece on "The Progress of Telegraphy," a subject which he dealt with in a very interesting manner, and showed to what great things the English system of telegraphy had arrived. An illustration of this is given in the description of the way in which press telegrams are distributed all over the United Kingdom, so that the last words of a long speech are often in the newspaper offices in Dublin, Belfast, Edinburgh, London, Leeds, Aberdeen, Liverpool, Manchester, Birmingham, Newport, Cardiff, Plymouth, Exeter, and other great centres, a few minutes after they are delivered. A political speech was recently delivered in Coleraine, in the North of Ireland, and arrangements were made so that this speech was being delivered all over the kingdom from the minute it began, and repeated to every town of any size. Press telegrams are sent at a loss. At the time that the telegraphs were in the hands of private companies, about 5000 words were sent to the press per day. In the spring of 1883 this had grown to 934,154 words. In 1882 over six and a-half millions of words were sent to the press every week.

Sir Frederick Bramwell's lecture dealt with the invention, development, and construction of telephones and telephone exchanges.

Sir William Siemens' lecture was on "The Electrical Storage and Transmission of Power." In this he described various forms of dynamo-electric machines, and to some extent dwelt upon the theory of their construction. The electric tramways then constructed are described. A good deal of information has become available on transmission of power since this lecture, and much has been said, for instance, on the size of conductors since the lecturer proposed a 3in. iron rod for conducting 4000-horse power over 25 miles with an electro-motive force of 200 volts, and a return of at least 40 per cent.; or since Sir W. Thomson said a half-inch copper wire might convey 21,000-horse power a distance of 300 miles with a current having an electro-motive force of 80,000 volts. The remarks made Sir W. Siemens upon secondary batteries remain true to that subject. He spoke hopefully of their use within certain limited applications, and nothing has yet been done to show that these can be extended.

The lecture by Dr. John Hopkinson on electric lighting dealt with some of the most pregnant problems of the time, and his description of the theory of the Gramme machine attracted some attention; but on this subject much more complete treatment is now accessible.

Sir F. A. Abel's lecture was on electricity applied to explosive purposes. It was to a great extent historic, and will remain as an interesting summary of its subject.

Sir W. Thomson's lecture was on electrical units of measurement. It was characterised by the charm of Sir W. Thomson's style of imparting information and of dealing with the abstract beauties of the physical problems involved or collateral, and by his reaching the threshold of the real subject in hand after about two-thirds of the lecture had been delivered.

These lectures will be highly prized, and we may hope soon to see those on heat published.

BOOKS RECEIVED.

Report of the Proceedings of the Seventeenth Annual Convention of the Master Carbuilders' Association, held in Chicago, Ill., June, 1883. New York: Aitken and Prout.

Portland Cement for Users. By H. Faija, C.E. Second edition. London: Lockwood and Co. Weale's Series. 1884.

Analytical Summaries of the Patents, Designs, and Trade Marks Act, 1883, *and of the Patent Laws of all Foreign Countries and British Colonies.* By A. M. and W. Clark. London: A. and W. Clark. 1884.

Proceedings of the Association of Municipal and Sanitary Engineers and Surveyors. Vol. IX. 1882-3. Edited by T. Cole. London: E. and F. N. Spon. 1883.

Report of the New York State Survey for the Year 1883. By James T. Gardiner, Director Albany van Benthuysens Printing-office. 1884.

British Mining: a Treatise on the History, Discovery, Practical Development, and Future Prospects of Metalliferous Mines in the United Kingdom. By Robert Hunt, F.R.S. London: Crosby Lockwood and Co. 1884.

Heat. By Professor G. Tait, M.A., Sec. R.S.E. London: Macmillan and Co. 1884.

Great Industries of Great Britain. New edition. Part I. London: Cassell and Company.

A Treatise on Higher Trigonometry. By Rev. J. Lock, M.A. London: Macmillan and Co. 1884.

HIGHGATE HILL CABLE TRAMWAY.

THE Highgate Hill cable tramway, a length of about 4000ft., has been completed, and was a few days ago inspected by Major-General Hutchinson for the Board of Trade. The tramway is of ordinary construction, but centrally between the rails is a concrete trench about 12in. in depth and 8in. wide, the upper part of which is closed with the exception of a slot ·75in. wide. This upper part is formed of steel bars of Z section, supported on cast iron chairs 3·5ft. apart. In the trench are also fixed at intervals chairs which carry guide pulleys for the cable. These pulleys have wide grooves formed by sides meeting at 90 deg. and about 4·5in. wide. They run on stud spindles fixed at an angle of about 45 deg. The rope is thus easily lifted out by the gripper by which the car is hauled. At intervals boxes with covers are made alongside the trench for oiling the pulleys and for cleaning out. The line is single except where there are turn-out places, and this adds much to the difficulties which belong to working by means of a hidden cable. The engine house is placed at about a thousand feet from one end of the line, and the large pulleys, which immediately receive and deliver the cable to and from the trench on its way to and from the winding drum, have their peripheries close under the groove in the trench. These pulleys are made 100 times the diameter of the rope. At this place it becomes necessary for the car-driver to release the gripper holding the rope; otherwise the rope is cut or the gripper stem broken if the car is moving quickly. This adds to the difficulties of working, which are more than would be commonly thought, but which can be imagined when it is remembered that in one place two ropes are running in one tube, and at another only one, and that passing round a curve of but 75ft. radius. At the points and crossings the arrangements for working involve the use of cantilevers for carrying the points, so as to leave room under the points for the gripper. The tramway has been completed some time, but difficulty has been experienced with the driving drum or pulley. In San Francisco the cable passes several times round a drum so as to get the necessary grip. At Highgate the endeavour was made to avoid the wear of the rope which this method involves, and a pulley like those used in mining, as devised by Mr. Holroyd Smith, was tried. This consists of a cast iron grooved wheel about 9ft. diameter, with slots cast on either side of the groove for the reception of wood wedges placed not opposite each other, but so that one is opposite the space between two on the other side of the groove. The cable path is thus of a wave line character, and grip is due to this bending. The wood, however, soon wore under the heavy pull, and the pulley has been taken out and a cast pulley with a groove having sides more nearly parallel put in its place. The rope in this will, of course, be gripped simply by wedging itself in according to the pull on it, and much power will be lost in pulling it out of the groove. A Fowler's clip pulley would, of course, be the thing for the work, but this would cost a great deal more than the cheap expedients being tried, About 9000ft. of Scott's steel rope is employed. It is 0·875in. in diameter, weighs about five tons, and consists of six strands of nineteen wires, made of crucible cast steel wire, with a 9in. lay. It cost about £40 per ton, with a two years' guarantee, or about one-fourth the price paid in San Francisco.

The engines are by Messrs. Jessop and Sons, Leicester. They are two horizontal engines coupled to one shaft, but used only one at a time, and have cylinders 14in. by 30in. They are fitted with the Colman valve gear, and are provided with steam by two Babcock and Willcox's water tube boilers built in one setting. They are each of about 50-horse power nominal. The reason for their preference is not easily gathered, for there is room in the place for locomotive or Lancashire boilers, either of which would have cost less than these water tube boilers, with their costly setting. The tram-cars are of several kinds, namely, an open car such as is used in the States as a dummy, but provided with seats, a long car on two four-wheel bogies, and an ordinary London car. These are all provided with gripper attachments worked from both ends of the cars, and have been made at the Falcon Car Works, Leicester. They are provided with brakes of the ordinary kind and also with powerful slipper brakes, so there ought to be no danger of the cars getting away down hill. Every car has been at some expense fitted with a speed indicator by order of an officer of the Board of Trade. This is an illustration of the absurd misuse of authority which happily does not very often characterise the Railway Department of the Board of Trade. The cars can only go at the speed the rope is driven, and even if this were not the case, the driver would always trust much better to his eyes than to a speed indicator driven by a strap.

THE MANCHESTER SHIP CANAL.

AT length, after forty days' patient toil, the Select House of Lords' Committee, over which the Duke of Richmond and Gordon has most ably presided, have reached the close of their inquiry. The responsibility of sanctioning or rejecting a scheme which for its mere execution, apart from thousands of pounds spent in preliminary proceedings, was to cost ten millions sterling, was one not lightly to be undertaken, and still less readily to be disposed of, and it must be admitted that the Duke of Richmond and his four noble colleagues have discharged their task with remarkable skill and most exemplary industry. So thoroughly did they settle down to a complete investigation of this gigantic project—gigantic not only in itself, but in the effects it was anticipated to produce upon the greater part of the trade of the country—that many times, when one or other of the counsel has apologised for going into minute detail, or professed his anxiety not to waste time, the chairman has encouraged him to go on in his own way, adding that the Committee were not there to save time. Thus encouraged, the several parties have neither spared themselves nor the Committee in making out the strongest possible case, and however much one side may lament the decision, there can be no complaint of hurry or impatience on the part of the Committee. To find a parallel, or anything approaching a parallel, to so lengthy and exhaustive an inquiry as this has been—for it must be remembered that two Committees spent very many days in examining the scheme last session—one would need to go far back into the annals of Private Bill legislation, and if these proceedings were conducted on such a principle, this Committee at all events must claim exemption from Select Committee work for the rest of their lives. Something like 30,000 questions and answers in one only of the three inquiries, and numerous speeches, one of which—Mr. Pember's closing address—occupied nine or ten hours, will form a unique volume in the Parliamentary archives, and the Ship Canal inquiry will doubtless constitute for a generation or two a monument of legislative industry and commercial enterprise.

With the evidence of Mr. Findlay, general manager of the London and North-Western Railway Company, who condemned in resolute and unshaken terms the whole project as based upon fallacies and exaggerated estimates, and fraught with the most serious consequences to many important interests, the opposition of the Liverpool Corporation and the London and North Western Company, ended so far as evidence went. Mr. Pope, Q.C., leading counsel for these opponents, completed their case with a speech, which he opened by a sarcastic reference to the "confident assertions" of the promoters, and closed by allusions to the "rosy statements" addressed to the enthusiasm of the working classes to tempt them to invest their hard earnings in this undertaking. Evidence was afterwards given against the Bill on behalf of Sir Humphrey de Trafford and other landowners along the line of the proposed canal, who anticipated grievous injury and gross injustice from the project. The river Irwell is widely known—as the Liffey is—for its blackness and other objectionable qualities, and in the course of the last evidence Mr. Foster, C.E., described the river as no better than a "common sewer," while Dr. Tidy, official analyst to the Home Office, said there was no question that it was "practically an open sewer," and was in about as horrible a condition as could well be imagined, and both these gentlemen agreed that the result of the canal would be to increase these evils.

Mr. Littler, Q.C., addressed the Committee on behalf of Sir Humphrey de Trafford; Mr. Aspinall, Q.C., followed suit in support of opposition from other quarters, and then at last, on the thirty-seventh day, Mr. Pember proceeded to sum up the entire case. He confessed—with that modesty and diffidence which gentlemen of the long robe know so well how to assume—that he shrank from the task before him, but in the next sentence he warned the Committee that he should have to address them for a considerable time—a prediction he very fully realised. Starting with the very commencement of the inquiry, he went minutely and laboriously through all the details of his own and every other case, and when he concluded, after occupying the greater part of three sittings, everyone admitted that he had displayed a remarkable mastery of this most complicated matter, and had delivered a most powerful speech. On the conclusion of Mr. Pember's argument yesterday, the Committee announced that they must take some time to consider their decision, and would meet again on the following day for that purpose.

ALBERT EXHIBITION PALACE.

WE give an illustration this week of two elevations and cross-sections, with some details, which we hope to follow up next week with more details and a full description of the history of this building, which was originally erected in Dublin in the year 1856 from designs by Mr. A. G. Jones, architect, associated with Messrs. Ordish and Le Feuvre, and which has been removed from Dublin and re-erected near Battersea Park on an altered plan, with strengthening buttress towers to suit the requirements of the new site, with the addition of a picture gallery, banqueting hall, dining and refreshment-rooms, with smoking and billiard-rooms, and offices, built with Bath and Portland stone, from the designs of the engineers to the company, Messrs. Bell, Miller, and Bell, of Westminster and Glasgow, who have also superintended the re-erection of the old portion and the construction of the new buildings, which are now completed, with the exception of the internal arrangements; and we believe it is the intention of the company to further extend the building by the addition of a winter garden and other accessories, to make it one of the finest metropolitan exhibitions for intellectual and social enjoyment. The exhibition building is in plan of the form of a ⊣, consisting of a nave and transept, the former 460ft. in length and 82ft. in breadth, and the latter, intended for a concert-hall, 150ft. long and 118ft. broad, including the side aisles, with galleries above, the height of both being 60ft.

ELECTRIC LIGHTING AT THE HEALTH EXHIBITION.

No. II.

THE Edison and Swan Company's installation at the Health Exhibition, both from its extent and position, will attract the especial notice of visitors. The company is, in fact, responsible for one thousand lights, a number supplied by only two other exhibiting companies, and a large number of these is erected in the principal entrances and vestibules in Exhibition-road, so as to welcome the coming and to speed the parting guest. The annexed plan shows the distribution of these lamps, and it will be seen that besides the spaces mentioned above, the kitchens, the cookery schools, and the dining rooms will all exhibit the adaptability to domestic purposes of the light supplied by this well-known company. It will be seen also that the

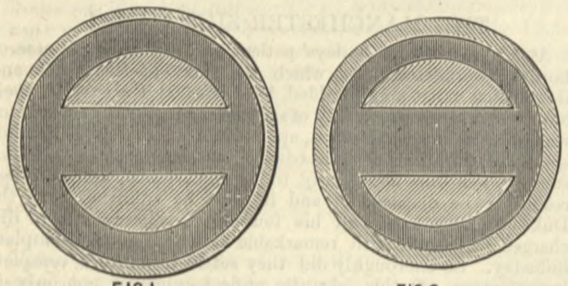
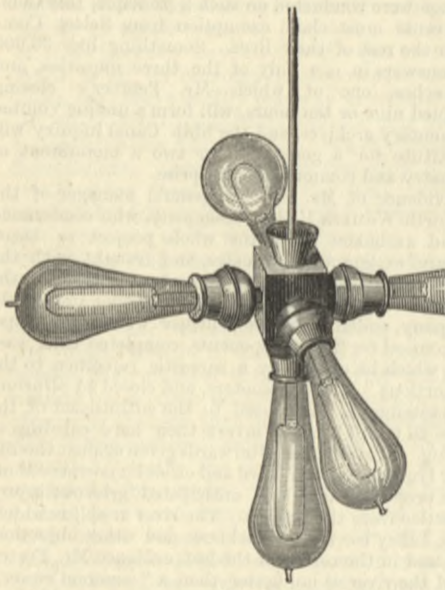


FIG.1. FIG.2.

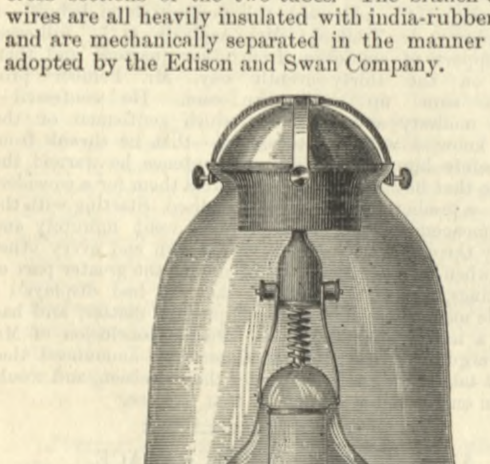
EDISON CONDUCTOR.

entire number of lamps is situated at a considerable distance from the machine room, and as, moreover, all the lamps lie in one direction in regard to the machines, and are all upon the same circuit, visitors will be able to see and appreciate what sort of thing an electric cable to supply current for one thousand lamps is. For the first 150ft., Edison tubing, with an area 1·05 square inches of copper conductor, surrounded by insulating compound and encased in iron pipes, has been employed, each cable being in a separate pipe, the two lines of copper being in this case employed as one conductor. For the remainder of the distance, *i.e.*, for about 650ft., a similar but somewhat



FIVE-LIGHT STAR.

smaller cable is employed, the conductor having an area of ·78 of a square inch. We give sketches showing the cross sections of the two tubes. The branch cables and wires are all heavily insulated with india-rubber, tape, &c., and are mechanically separated in the manner invariably adopted by the Edison and Swan Company.

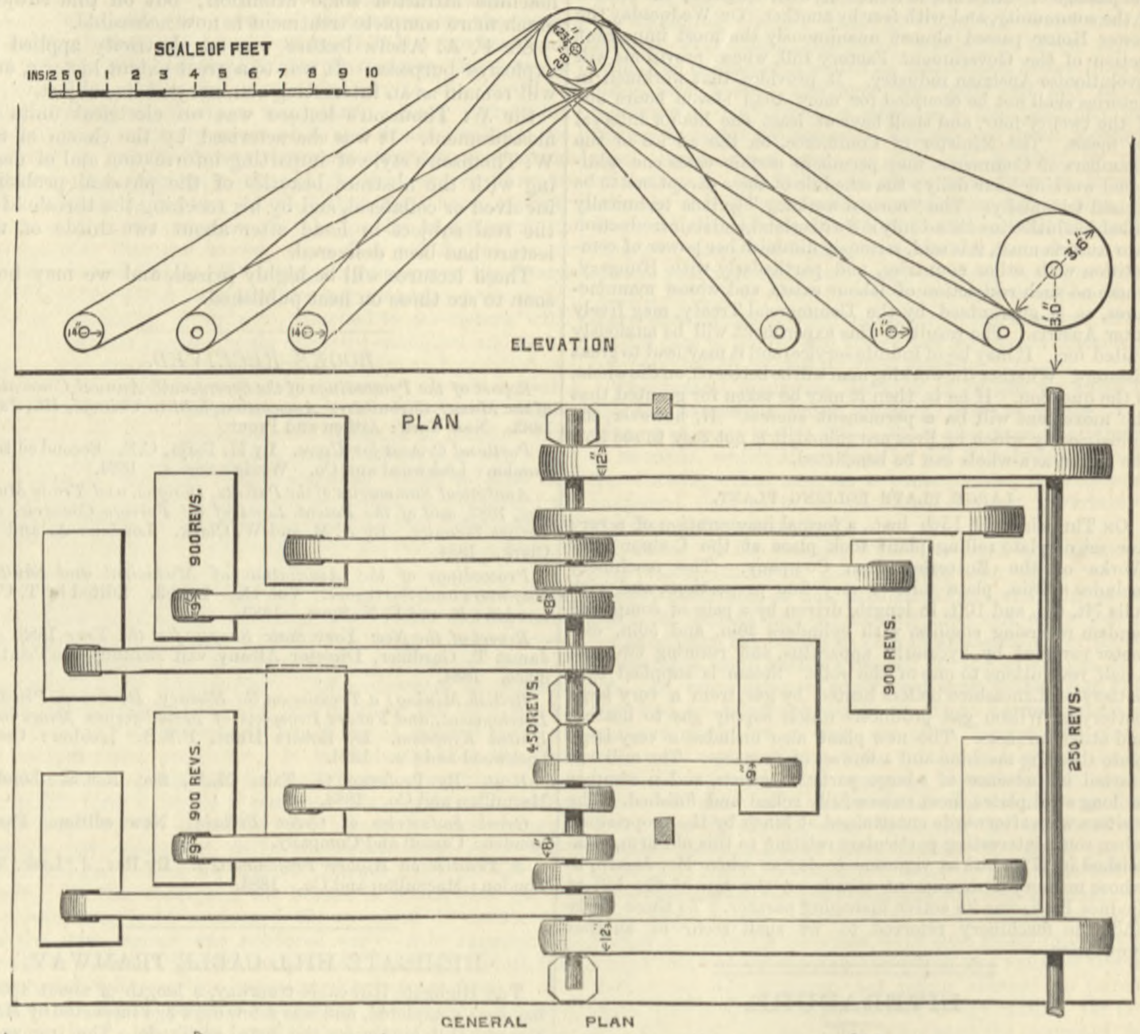


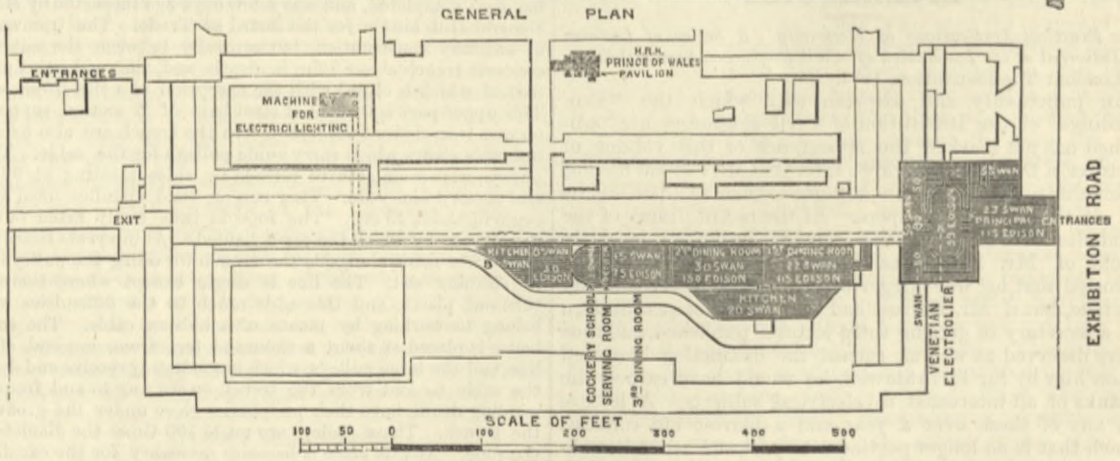
SINGLE-LIGHT PENDANT.

The relative resistance of the main and submain cables to that of the lamps, suppose all situated at the extremity, is calculated and adjusted to allow a fall of 12 per cent. of potential between the machines and the lamps. The actual resistance of the leads is ·02 of an ohm. At a distance of 530ft. from the dynamos a branch cable is taken off for supplying the dining rooms and kitchen, and those for supplying the vestibule and the entrance hall are taken off at a distance of 800ft., which may be considered the end of the main cable. It will thus be seen that the main cable forms a loop, of which the total length is nearly one-third of a mile, and its section is such that at no point will the current passing through it ever exceed the rate of 1000 ampères to a square inch of section in the conductor.

The lamps are all, with a few exceptions, what are commonly designated high resistance lamps, requiring an electro-motive force of 90 volts at the terminals, those of the Edison type consuming about ·75 and those of the Swan type ·7 of an ampère each, giving a light of from 16 to 20 candles each.

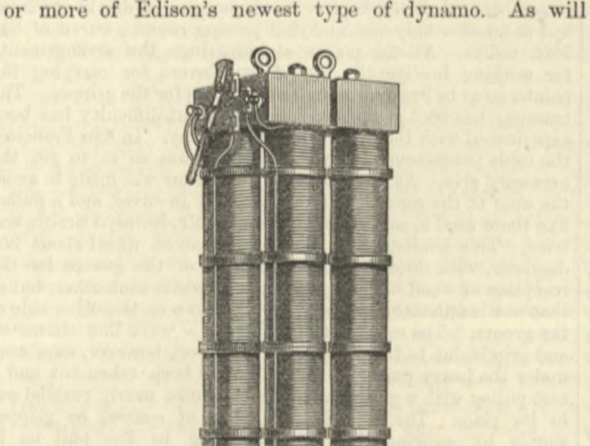
The machines which generate the electricity for these lamps are ten in number of the Edison L type, each capable of serving 150 lamps with an armature rotation of 950 revolutions per minute; thus there is an ample margin of power in case of accident. These machines have been





PLAN OF THE EDISON-SWAN INSTALLATION.

used as being most readily available, but it is intended as soon as possible to substitute in place of some of them one or more of Edison's newest type of dynamo. As will



EDISON L DYNAMO.

be seen from the attached plan, two separate countershafts driven off the main countershaft have been fixed, each driving five machines; each set of five is arranged to be stopped or started, one by means of an Addyman's friction clutch, and the other by striking the belt on to a loose pulley. All ten machines are connected in parallel to the main cables, and each of the ten can be controlled entirely at will both as regards the field and the main circuits. The field circuits of all the dynamos are in parallel between the mains in two groups of five each, each subdivision being controlled by a variable resistance thrown in at pleasure. The total field resistance is two ohms, and the total field exciting current is about 50 ampères. By this method of throwing in a variable resistance the electro-motive forces will be so governed as to maintain a constant potential of 90 volts at the furthest end of the main cables, the electro-motive force of the machines being probably rather over 100 volts. About 5000 Watts will therefore be expended in the fields. With the exception of Messrs. Verity Brothers' now well-known flower-basket chandelier, and a handsome cut-glass chandelier by Defries and Son, which are to be seen in the entrance hall and vestibule, the lamps have all been placed on simple wooden supports, the majority being in the form of a five-light star, the remainder as single light pendants, of each of which arrangements we give sketches.

THE SMALLEST LOCOMOTIVE IN AMERICA DOING WORK.—The Central Wharf Railway shops, Pensacola, Florida, has recently turned out the smallest locomotive ever made in the United States for regular service. The miniature locomotive, which is as perfect in its mechanism and equipment as the huge mastodon locomotive, was designed by Mr. John Douglas, the master mechanic of the work, and was built under his direction. The engine is for a 20in. gauge road. The cylinders are 5in. by 8in.; driving-wheels, 12in. diameter; wheel base, 7ft. 9in. The boiler is 2ft. 8in. diameter; 4ft. 3in. greatest height above rail, and has 97 flues 1½in. diameter. The tank is made to carry 180 gallons of water, and the coal bunkers have a capacity of 250 lb. The whole machine is 9ft. 6in. long, 4ft. 6in. wide, and weighs, in working order, three and a-half tons. A novel feature about the little engine is the mounting of the main frame upon two four-wheeled trucks, one being the driving truck, which is connected to an intermediate axle hung in the middle of the frame with a special bearing, so as to allow the driving truck to move around its centre to adjust itself to the irregularities of the road. This arrangement gives great freedom in passing the sharpest curves, and the long wheel base gives a steady motion to the engine on the track at a high rate of speed. The engine was set to work hauling construction material on the wharf, the track being very uneven, but she operates very satisfactorily. She pulls 15 loaded cars, weighing about 45 tons, and handles them easily. A pressure of 80 lb. is carried, and the valves are planned to cut off at three-quarter stroke.—*American Machinist.*

THE ROYAL INSTITUTION.

FLAME AND OXIDATION.

ON Thursday, last week, in the course of one of a series of lectures on "Flame and Oxidation" at the Royal Institution, Professor Dewar exhibited a machine for the manufacture of ozone on a large scale, constructed by Dr. Wise for use in a health resort under his charge in the Engadine. It had thirty-eight tinfoil plates, and the machine to drive the air through was a small turbine, there being plenty of water to drive turbines in Switzerland. By experiment he proved that platinum black would liberate iodine from iodide of starch, and that it did so by means of the air it carried down into the solution, because platinum black freed from air by being taken from beneath water in which it had been boiled, had not the same effect. He next showed that the mere presence of platinum black and air would oxidise alcohol into acetic acid, and became greatly heated in the process. In another experiment he showed that the shaking up of granulated zinc with water in a partly filled large bottle would cause the formation of a small amount of peroxide of hydrogen; he further stated that a solution of peroxide of hydrogen in water, although perfectly colourless and transparent, has the power of cutting off the ultra-violet rays of the spectrum. Carbonic acid, he said, is the highest oxide of carbon, and the substances adhere to each other with such tenacity, that even the intense heat of burning magnesium can do but little in the way of separating the oxygen from the carbon, for when burning magnesium is plunged in carbonic acid gas it burns fitfully for a short time, and then goes out. Notwithstanding this strong affinity, the leaves of trees separate the carbon from carbonic acid under the influence of sunshine, but how they do so is not known; the oxygen thus separated does not appear to be ozonised. The red rays of the spectrum are most active in effecting the decomposition in the leaf, and the action of sunlight is clearly one of deoxidation. The carbon is not deposited in its pure state, otherwise it could not move about in the plant; it seems to be produced first in the form of sugar, which is afterwards transformed into starch; or it may be that starch is formed first and sugar afterwards. As starch cannot move about in the plant, the inference is that sugar is formed first. In another experiment he showed that permanganate of potash--Condy's fluid—is deoxidised by the addition of peroxide of hydrogen, although both substances have strong oxidising powers.

THE OXYGEN IN WATER.

Last Friday night Dr. William Odling, F.R.S., lectured at the Royal Institution on "The Oxygen in Water." Sir Frederick Bramwell, F.R.S., presided.

Dr. Odling began by stating that in 1823 Faraday proved that a gas or vapour is nothing but a liquid at a temperature above its boiling point; and the lecturer exhibited a number of glass tubes containing liquefied gases, which had been prepared by Faraday, who liquefied nearly every known gas. It is only within the last six years that the five or six gases which had previously resisted liquefaction have been reduced to that state by perfected modern appliances for producing cold and pressure. At the present time a chemist in Paris is making liquid oxygen by the pound. The speaker said that when gases are dissolved in water they somehow assume the liquid state therein, and increase the bulk of the water. At 0 deg. C. 100 volumes of water dissolve 4·11 volumes of oxygen gas; at 15 deg. C. they dissolve 2·99 volumes. At 0 deg. C. 100 volumes of water dissolve 6886·10 volumes of sulphurous acid gas, and at 15 deg. C. 4356·50 volumes. A 100 volumes of water at 0 deg. C. dissolves 114,800·00 volumes of ammonia, and at 15 deg. C. 78,270·00 volumes. Water at a temperature of 45 deg. Fah. dissolves 2·199 cubic inches of oxygen per gallon, and at 70 deg Fah. 1·797 cubic inches per gallon. The barometric pressure has a feeble influence in causing variation in the amount of oxygen absorbed by water, the variation not exceeding a small fraction of a grain per gallon; yet in a large river that means a variation in the quantity of oxygen to be measured by tons. River water in summer contains about four grains of oxygen per cubic foot, and about five grains in winter. Every ten million cubic feet of water passing over Teddington Weir carry with them 17¼ tons of liquefied oxygen, or about 50 tons of liquefied air, when the water is at the temperature of 60 deg. Fah. In August, 1859, Dr. W. Allen Miller ascertained the proportion of oxygen in the Thames at low water, and found that as the Thames runs through London the quantity of oxygen in it diminishes as compared with the proportion it contains at Richmond; and discovered that about 12 or 13 tons of oxygen are lost between Richmond Bridge and Somerset House. Other chemists have since taken up the work, and their results agree tolerably closely. One method of testing the proportion of oxygen in water is by means of hyposulphite of soda—a salt in an inferior state of oxidation to the sulphite; the hyposulphite used is not that employed by photographers, which is, properly speaking, the thiosulphate of soda. The hyposulphite of soda used in the analysis of water bleaches the ammoniacal solution of oxide of copper; it also deoxidises indigo, magenta, and iodide of starch. White indigo is made blue by the air in water, but does not do so if hyposulphite of soda is put in the water first, to absorb the oxygen. When water is made blue by indigo, and hyposulphite of soda is added, the latter has the choice of two substances from which to absorb oxygen, and it deoxidises the air in water first; hence the quantity of hyposulphite used before the liquid is bleached, affords a method of measuring the proportion of oxygen in water. When the liquid is just bleached by adding no more hyposulphite of soda than is necessary for the purpose, it can be made blue by pushing down air into it, or by pouring it from one vessel to another. Tests of the Thames water show that at Erith, near the sewage outfall, it contains but about half a cubic inch of oxygen per gallon instead of 2 cubic inches per gallon; but lower down the proportion of oxygen rises again, until the water is within 10 per cent. of its richness in oxygen at Richmond. Thus the considerable power which flowing water possesses of keeping itself sweet and clean is no longer a matter of speculation, but one of positive proof. Still the power, great as it is, may be over-taxed, and often is over-taxed in some cases, when the organic matter is non-living. As to whether it has the power of destroying those minute living organisims, which are the germs of certain diseases, there are at present very great differences of opinion among chemists.

SANITARY INSTITUTE OF GREAT BRITAIN.—At the annual general meeting, held at the Parkes Museum of Hygiene, on Wednesday, May 7th, the Right Hon. Earl Fortescue in the chair, a report was presented by the Council on the progress of the Institute, and on the work achieved at the very successful Congress and Exhibition held at Glasgow in the autumn of 1883. The chairman of the Council, Dr. Carpenter, gave an address, and the officers for the ensuing year were elected, the president being his Grace the Duke of Northumberland, and the trustees Sir John Lubbock, Bart., D.C.L., F.R.S.; Thomas Salt, Esq., M.P.; and Dr. Richardson, F.R.S.

NON-CONDUCTING COVERINGS FOR STEAM PIPES.

IN a recent impression we published a report by Mr. D. K. Clark, C.E., on the value of various kinds of clothing for steam pipes. We now give an abstract of a paper by Professor John M. Ordway, Boston, read at the annual meeting of the American Society of Mechanical Engineers, by Mr. C. J. H. Woodbury, Boston, which further elucidates the subject.

Besides the usual number of fires caused by steam pipes, there have been some caused by steam pipe coverings, containing neither dye-stuffs nor oils, hence not ascribable to spontaneous combustion, and a test of the coverings was desirable. This was made under the auspices of the Boston Manufacturers' Mutual Fire Insurance Company, and the results herewith reproduced.

There have been two modes employed; one to enclose a small portion of pipe in a box, containing a thermometer ball, and noting the temperatures, the inverse ratio of which are not forced to show the relative excellence of the coverings; the other to let steam condense in a side branch for a given time, and weigh the water, which is reckoned as having parted with as much latent heat as is contained in that weight of dry steam.

It is difficult to fix a box so tightly to the pipe as to prevent air circulation, and the box has a larger cooling surface than the pipe, and there is no ready way of determining the amount of this continual radiation, which increases with the temperature of the contained air. There is no perfect non-conductor to jacket the air chamber. If all outward radiation could be prevented, the cavity would get as hot as the steam, and all coverings give the same result. To start with everything cold, and note the time to raise the air in the chamber to a given temperature, would be correct, but hardly practicable. This method will not give absolute or quantitative results, and the comparative figures need interminable questions; but the method was tried. Pieces of white pine plank were squared and rabbeted at the ends to receive wooden bases firmly screwed on. A 2in. hole is bored from the inner side, two-thirds through, making a cylindrical chamber. The inner side is planed out so that the concavity when properly lined may fit the convexity of the covering to be tried. A hole is bored from the top edge down into the chamber. The concavity and the chamber are lined with thick woollen blankets. The halves are clamped on the pipe covering, and thermometers let down into the chambers, their stems packed with cotton wool. The two chambers check each other.

The condensation method is indirect and uncertain, assuming that the pipe is always filled with dry steam. Besides, the cap and the other fittings lose heat in spite of any wrappings, so that the gross result must be corrected for that. This could be done by having 3ft. of pipe covered, then trying only 2ft., and then only 1ft., and from these results getting the amount of correction due to the fittings. In the trials by condensation there were used a branch pipe with its coverings, and a cock in the cap, with a rubber tube to carry the condensed steam to a glass flask. All the condensation in the connecting pipe runs back into the main pipe. The calorimetric method is direct and absolute, and closer to the truth. The calorimeters were made of sheet brass, and so shaped that they might completely include a portion of the pipe covering. The same tube serves for the introduction of water, and of the thermometer. There was a wooden paddle which may be swung back and forth and equalise the temperature. The whole apparatus was covered with cotton wool; and other coverings were tried, such as live geese feathers and soft woollen blanket. The calorimeters were filled with water of 10 deg. or 12 deg. C. colder than the air of the room, the thermometers inserted, and the water wheel agitated. The temperature of the water of the steam pipe, and of the air in the room, were noted. Observations were made every half-hour, until the water stood 10 deg. or 12 deg higher than the surrounding air. The water was then drawn off and weighed.

To neutralise the error from the radiation from the calorimeter, only that portion of the experiment should be used which lies between two observations, in one of which the water is about as many degrees colder than the air as it is hotter than the other. As the calorimeter takes up heat, we must add to the weight of the water as much as corresponds to the weight of brass, taking into account the specific heat. This must be determined from every calorimeter by mounting the apparatus on an unheated pipe, and letting cold water run in and allowing it to stand some time; then letting the water run out quickly, and replacing it with warm water of known temperature, which after some time is run off and

TABLE I.

	Diameter of covering.	Weight per foot in oz. Av.	Maximum heat in air chamber.	Condensed one foot, one hour in grams.	Kilo-cent'g heat units 1ft. one hour.	Pound-Fah. heat units 1ft. one hour.
	in.		deg. C.		deg.	deg.
No. 1. From Lowell Felting Mill.—I. Hair felt, with single cover of burlap	5½	21·4	53·98	40·67 gross	12·842	50·966
No. 2. From Lowell Felting Mill.—II. Hair felt, with single cover of burlap	4½	13·2	58·0	—	12·999	51·590
No. 3. Chalk and Lawton, Pawtucket, R.I.—II. Slag wool, wooden cage, burlap, cotton cloth, double	8	117·8	39·5	43·00 gross	14·465	57·408
No. 4. H. W. John's Non-Cond. Covering.—II. Asbestos fibre, asbestos paper, hair felt, asbestos paper, hair felt, asbestos paper, canvas	5½	29·3	47·88	—	14·498	57·539
No. 5. Greenwood's Co., New Hartford, Conn. Asbestos paper, hair felt, canvas	4½	17·3	61·8	—	15·074	59·705
No. 6. Chalmer Spence Co., New York.—II. Asbestos paper, hair, and pasteboard coiled together	4¾	30·1	55·65	—	15·713	62·361
No. 7. Asbestos Packing Co.—III. Asbestos paper, double, hair felt, paper, canvas	4½	19·9	51·61	—	15·761	62·551
No. 8. Asbestos Packing Co.—II. Asbestos paper, hair felt, paper, canvas	5	18·4	53·46	41·00 gross	16·078	63·809
No. 9. Chalmers Spence Co.—V. Air space, tin plate case, hair felt, canvas	4¾	20·8	57·0	—	17·122	67·952
No. 10. Chalmers Spence Co.—I. Asbestos, paper, hair, and pasteboard coiled together	4¾	21·7	62·0	51·00 gross	17·551	69·255
No. 11. H. W. Johns' Non-Cond'g Cov'ng.—VI. Asbestos paper, hair felt, paper, canvas	4	17·2	61·9	—	17·801	70·647
No. 12. Chalmers Spence Co.—IV. Air space, asbestos board, hair felt, asbestos paper, hair felt, pasteboard	6½	58·1	59·7	—	18·588	73·717
No. 13. H. W. Johns' Non-Cond'g Cov'ng.—I. Asbestos paper, asbestos paste, hair felt, asbestos board, hair felt, asbestos board, canvas	7¼	105·3	48·22	—	19·291	76·385
No. 14. J. H. Graham and Son, Boston.—III. Clay, paper, hair felt, laths, plaster	5	52·9	—	—	19·423	77·085
No. 15. J. H. Graham and Son.—V. Asbestos paper, hair felt, paper, canvas	4½	16·1	65·0	—	19·632	77·913
No. 16. Reed's Covering.—I. Paper cylinder, joint covered with paper	4¾	30·5	61·0	—	19·670	78·064
No. 17. Chalmer Spence Co.—III. Asbestos paper, hair, and asbestos paper coiled together	4¾	30·3	53·5	—	20·129	79·886
No. 18. J. M. O. Silicated rice chaff, cotton cloth cover	4¾	22·7	60·0	—	20·203	80·181
No. 19. Reed's Covering.—II. Air space, asbestos paper, paper cylinder	4¾	29·3	—	—	20·439	81·117
No. 20. J. M. O. Air space, straw board, hair felt, no cover	4¾	12·0	—	—	20·693	82·124
No. 21. S. C. Nightingale and Childs.—IV. Fossil meal and hair plastered on	4¾	60·7	—	58·00 gross	21·151	83·940
No. 22. J. M. O. Air space, straw board, peat moss, cotton cloth	4¾	10·6	—	—	21·631	85·848
No. 23. J. H. Graham and Son.—I. Air space, hair felt, laths, plaster	5¾	63·1	54·4	—	21·820	86·596
No. 24. J. M. O. Slag wool, straw board	4¼	24·1	—	—	22·807	90·510
No. 25. J. M. O. Slag wool, straw board	4¾	21·8	—	46·50 net	—	—
No. 26. S. C. Nightingale and Childs.—I. Fossil meal hair and plastered on	4¼	31·9	64·5	—	22·942	91·050
No. 27. S. C. Nightingale and Childs.—II. Fossil meal and hair plastered on	4½	26·9	—	—	23·462	93·113
No. 28. W. E. Parker, Pacific Mills.—I. Rye straw rope wound around, cotton cloth 4 ple	4½	20·2	64·8	55·00 gross	24·424	96·933
No. 29. J. M. O. Silicated hard wood, charcoal, cotton cloth cover	5	41·9	—	47·00 gross	24·650	97·830
No. 30. J. M. O. Carbon, plaster of Paris, flour, and hair plastered on	4½	33·0	—	—	26·909	106·800
No. 31. Asbestos Packing Co.—IV. Asbestos paste, clay and flax, paper pulp, mortar	5¼	100·1	63·0	—	27·411	108·78
No. 32. J. M. O. Dry rice chaff, straw board	3¾	8·4	—	—	27·607	109·56
No. 33. J. H. Graham and Son.—IV. Asbestos and clay, laths, paper, mortar	5	58·0	66·0	—	28·159	111·75
No. 34. Chalmers Spence Co., "Pat. Air Space." Half-inch air space, wire netting, asbestos paste	5	41·0	72·8	74·00 gross	28·579	113·43
No. 35. S. C. Nightingale and Childs.—III. Fossil meal and hair	3¼	17·1	—	—	28·882	114·62
No. 36. Chalmers Spence Co., "Solid Covering." Asbestos paste	4½	34·4	74·2	61·00 gross	29·599	117·47
No. 37. Chalk and Lawton.—II. Air space, tin-plate case, asbestos paper, tin-plate case	4	29·0	52·14	—	29·660	117·71
No. 38. Eureka Covering Co., Fitchburg, Mass. Meal, clay and hair, meal, clay, sawdust, flax, fibre	5¼	81·9	70·0	79·00 gross	30·171	119·74
No. 39. W. E. Parker, Pacific Mills.—II. Rye straw rope, cotton cloth, 6 ple. (after nine years' use)	4¼	9·8	70·8	—	30·286	120·20
No. 40. Asbestos Packing Co.—I. Asbestos paper, plaster, and flax fibre	5¾	111·5	73·8	—	31·267	124·09
No. 41. J. H. Graham and Son.—II. Plaster paste	5	67·5	79·8	—	33·477	132·86
No. 42. Sam'l Taylor's Non-Cond. Composition. Clay and short fibrous matter	5¼	94·1	77·3	—	36·782	145·98
No. 43. H. W. Johns' Non-Cond. Cov'ring.—IV. Asbestos paper, asbestos paste	6¼	201·8	69·2	—	37·951	150·61
No. 44. J. M. O. Anthracite ashes, plaster of Paris, flour, hair	4¾	79·2	—	—	39·159	155·41
No. 45. H. W. Johns' Non-Cond. Cov'ring.—V. Asbestos paper, asbestos paste	6½	171·2	70·0	—	41·079	163·03
No. 46. H. W. Johns' Non-Cond. Cov'ring.—III. Asbestos paper, asbestos paste	5¼	99·8	77·8	87·00 gross	43·097	171·04
No. 47. J. M. O. Mere air space	2 11/16	—	—	—	49·241	195·42
No. 48. J. M. O. Mere air space	4¾	—	—	—	50·405	200·04
No. 49. Fall River Steam Pipe Covering Co. Clay and refuse of vegetable fibre	4¼	65·2	91·8	—	51·727	205·29
No. 50. J. M. O. Asbestos paper wound round four times	2⅝	—	—	—	56·371	223·72
No. 51. J. M. O. Naked pipe	2 11/16	—	—	181·00 net	391·830	1555·10

weighed. Then have t = the temperature of the cold calorimeter, t' that of the warm water at first, and t that of the warm water after it is run in, and a the quantity of warm water drawn out and weighed; the heat units taken up by the calorimeter in grammes of water heated 1 deg. C., or in pounds of water heated 1 deg. F., will be

$$\frac{a\,(t'-\mathrm{T})}{\mathrm{T}-t}.$$

By this method we have an absolute measure of all the heat transmitted by the covering—at least, as far as comparative results between different coverings are concerned. Pipe coverings are of four general classes: (1) Those consisting of light fibrous matter—as hair, silk, wool, or paper, applied immediately to the pipe; (2) those consisting of paste or mortar, plastered upon the pipe in one or more coats; (3) those with an air space next the pipe; (4) complex combinations of different layers. Of all the coverings tried the most efficient was simply hair felt, with a cheap cover of burlap. Of the whole number, seventeen owe their efficiency to hair. Slag wool came third in rank, but it was 2in. thick and covered with wooden slabs 1in. thick, and these covered with three thicknesses of cloth. But this was not good wool, containing, as it did, 38 per cent. of shot. The more feasible covering was Nos. 24 and 25, made with the same fibre with the shot sifted out. Spongy paper, No. 16, is tolerably good; Reed's about the same as slag wool No. 25. Straw covered with cotton cloth, No. 28, was not good. The otherwise useless rice chaff, No. 18, moistened with water glass, was better than straw rope. Fibrous or porous matter acts mainly by virtue of the confined air; hence the looser the better. Asbestos is a non-conductor only when in the light, downy condition and full of air. Hard-pressed asbestos, No. 50, conducts heat very readily. Asbestos fails to prevent the burning of hair felt. None of the plastered class were worth much, except Nos. 21, 26, and 27—fossil meal. The more organic substance the better. Such fibres, when surrounded with incombustible materia , cannot char, except from superheated steam. Where there was no visible covering at all, as in Nos. 47, 48, and 51, there is a wonderful difference whether the calorimeter comes in direct contact with the pipes or a thin stratum of air intervenes. It seems that one-fourth inch is as good as an inch. The air space protected the organic substances from being scorched. The wrapping of asbestos paper does not insulate so well as the same thickness of mere air. The popular confidence in asbestos partakes of the nature of a superstition.

Coverings of the fourth class are no better than the simpler ones. The naked 2in. pipe, carrying 60 lb. more, may condense 181 grammes per hour per foot, and a cheap cover—No. 25—may reduce this to 46·5 grammes; saving 134·5 grammes per hour, or 2·96 lb. of steam in ten hours. So the covering of 100ft. of pipe would save in a year of 300 working days 88,800 lb. of steam, or five tons of coal per year, from 100ft. of the covering. Most of the coverings are too heavy. An increase of hair beyond 1in. in thickness, or 13 oz. of weight per foot, does very little good. As to ease of application, repair, or renewal, Nos. 16 and 19, 6, 10, 12, and 17 stand foremost, being moulded in form and bisected lengthwise. Straw rope can be wound around repeatedly, but in time it becomes so brittle that it is worthless when unwound again. It requires some practice to put on paste coverings with a trowel, and it is by no means easy to get them uniform and round. With the exception of the fossil meal, the plastered coverings are worthless when they are taken off. There was no chemical action by any coverings except such as contained plaster of Paris, which, when wet, rusts iron rapidly. The corrosion said to have occurred sometimes with slag wool that had become damp, must have been caused by the sulphate of lime formed by the oxidation of a trace of the sulphide of calcium in the slag.

Respecting durability, little could be learned by trials lasting only a few weeks; but it is known that animal and vegetable substances undergo a change by long continued heating. Wool, hair, cotton, and paper, in contact with the pipe at 150 deg. C., soon turn brown, and have their lustre much impaired. Straw suffers further out than poorer conductors. If hair gets wet while upon the pipe it will give out a very unpleasant odour for a long time. As to spontaneous combustion, it is difficult to pronounce with certainty.

There was a report that a certain paper covering had taken fire of itself, but two pieces of this were put upon the pipe near a boiler where the temperature was very high outside the pipe, and at least 150 deg. C. within the pipe; one of the pieces as it came from the maker, the other charged with cotton-seed oil—this oil readily induces the combustion of cotton-waste—and both the paper tubes remained so exposed to heat without showing the slightest inclination to take fire. Of course, organic substances get like tinder when they are exposed for a long time to the steam heat, and then very readily catch fire from a spark or flame. The impregnation of cloth wrappings with borax, tungstate of soda, or water glass lessens the danger from fire.

A covering of water glass and wood charcoal was tried, in which all the gas-forming material was of course taken out of the wood, and the carbon does not oxidise rapidly. Wood covered with a varnish like the soluble silica—see No. 29—and charcoal was rather too dense. The rice chaff in No. 18 was mixed with water glass, and made a light and efficient non-conductor. Chopped straw might act in the same way; but sawdust sucks up so much water glass as to make a paste that dries too dense.

Coverings containing flour or meal are liable to be troubled by mice, which ate even silicated rice chaff, and gnawed the interior of No. 12. The outside of the coverings may be made waterproof by covering with canvas and giving two coats of oil paint when the covering has become perfectly dry; but where there is trouble from within from leaky joints the waterproof outside occasions a spreading of concealed mischief inside. On the other hand, the very porous coating allows the vaporised water to escape, and if the leak is slight no harm is done. It is best to use a pretty loose material in making the joints, to separate those parts from the rest by impervious diaphragms of tin-plate or plaster, and to make them so they could be easily removed without disturbing the other operations.

In Table I. the specimens are arranged in the order of their transmitting power by the calorimetric method.

Table II.

No. 1. Hair felt, 856 grams; burlap and twine, 85g. Length, 18in.
No. 2. Hair felt, 493g.; burlap, 50g.; twine, 17g. Length, 18in.
No. 3. Slag wool, 2in. thick, 3860g.: wooden slats, ¾in. thick, and nails, 1815g.; wooden rings at ends, 1⅝in. thick, 540g.; tin-plate rings between wooden rings and pipe, 51g.; burlap, 127g.; cotton cloth two thicknesses, and paint, 270g.; tacks, 13g. Length, 24in.
No. 4. Asbestos paper faced with loose asbestos fibre, 16½in. × 25in., 205g.; ¾in. hair felt, 18in. × 10½in., 282g.; twine, 3g.; asbestos paper, 17½in. × 18in., 112g.; ¾in. hair felt, 17½in. × 14in., 407g.; twine, asbestos paper, 17½in. × 16in., 183g.; canvas, 19in. × 18in., 80g. Length, 17½in.
No. 5. Asbestos paper, 119g.; twine, 4g.; hair felt, 458g.; canvas, 94g. Length, 16½in.
No. 6. Hair and pasteboard, not easily separated. Whole weight, 1280g. Length, 18in.
No. 7. Asbestos paper doubled, 110g.; hair felt, 486g.; paper, 157g.; canvas and string, 93g. Length, 18in.
No. 8. Asbestos paper, two thicknesses, 98g.; hair felt, 1¼in. thick, 16½in. thick, 16½in. × 12in., 456g.; twine, 6g.: paper, 17¾in. × 31½in., 156g.; canvas, 87g. Length, 17½in.
No. 9. Tin-plate case and ribs, 580g.; 1in. hair felt, 495g.; canvas and twine, 94g.; Length, 23in.
No. 10. Hair and pasteboard cemented together. Whole weight, 910g. Length, 17¾in.
No. 11. Asbestos paper, three thicknesses, 172g.; twine, 6g.; 1in. hair felt, 552g.; twine, 23g.; paper, 123g.; canvas, 81g. Length, 23½in.
No. 12. End pieces of paper, 3in. long, lined with asbestos paper, 575g.; asbestos paper, hair felt, and pasteboard cemented together, 1860g. Length, 17¾in.
No. 13. Asbestos paper, two thicknesses, 167g.; asbestos paste, 1in. thick, 2910g.; ⅝in. hair felt, 385g.; twine, 5g.; asbestos board, 220g; ⅝in. hair felt, 505g.: twine, 6g.; asbestos board, 301g.; canvas, 107g. Length, 18½in.
No. 14. Clay, 760g.; paper, 115g.; hair felt, 280g.; laths, 430g.; iron wire and plaster, 2270g. Length, 29in.
No. 15. Asbestos paper, several thicknesses, 299g.; hair felt, 425g.; twine, 2g.; paper, 198g.; canvas, 137g. Length, 28in.
No. 16. Alike throughout, 1280g. Length, 17¾in.
No. 17. Hair and asbestos cemented together, 1290g. Length, 18in.
No. 18. Silicated rice chaff, 1060g.; wooden rings and cloth wrapper, 120g. Length, 22in.
No. 19. Asbestos paper rings, paper tube, whole weight, 1230g. Length, 17¾in.
No. 20. Wooden rings and straw board, 249g.; hair felt and twine, 443g. Length, 24½in.
No. 21. Fossil meal and hair, alike throughout, 2940g. Length, 20½in.
No. 22. Wooden rings, 87g.; straw board, 192g.; tacks, 5g.; outer rings of paper, 1½in. wide, 113g.; sphagnum, 174g.; cloth, 40g. Length, 24½in.
No. 23. Two iron rings, 1in. wide, and tacks, 440g.; ¾in. hair felt, 218g.; laths, 351g.; wire and plaster, 2350g. Length, 21½in.
No. 24. Gypsum rings, 256g.; straw board cover, 201g.; slag wool filling, 940g. Length, 24½in.
No. 25. Plaster ends, 253g.; straw board, 175g.; slag wool filling, 802g. Length, 21in.
No. 26. Hair and fossil meal, uniform throughout, 980g. Length, 13in.
No. 27. Fossil meal and hair, uniform throughout, 1270g. Length, 20in.
No. 28. Straw rope, 1in. thick, 400g.; cotton cloth, four thicknesses, 400g.; iron rings at the ends, not included in the weight given in Table I. Length, 16in.
No. 29. Silicated charcoal, 1760g.; wooden rings and cloth wrapper, 120g. Length, 19in.
No. 30. Paste of plaster, carbon, flour, and hair, 1560g. Length, 20in.
No. 31. Asbestos paste, 820g.; clay and fibre, 960g.; paper pulp, 1560g.; twine, 23g.; mortar, 3260g. Length, 42in.
No. 32. Wooden rings, 74g.; straw board, 166g.; tacks, 5g.; rice chaff filling, 240g. Length, 24½in.
No. 33. Asbestos and clay, 580g.; wood and wire, 325g.; paper, 332g.; plastering, 2052g. Length, 24in.
No. 34. Wire netting and sheet iron props, 210g.; asbestos paste, 1340g. Length, 16in.
No. 35. Fossil meal and hair, uniform throughout, 770g. Length, 19in.
No. 36. Asbestos paste, uniform throughout, 1300g. Length, 16in.
No. 37. Corrugated rings of tin-plate, 97g.; tin-plate cylinder, 345g.; asbestos paper, 204g.; tin-plate cylinder, 445g.; tin-plate ends, 30g. Length, 16¾in.
No. 38. Two kinds of paste not separated, 3290g. Length, 17in
No. 39. Straw rope, 160g.; six thicknesses cotton cloth, 212g.; iron rings at ends not reckoned. Length, 16in.
No. 40. Asbestos paper, 179g.; three coats plaster with fibre, 4430g. Length, 17½in.
No. 41. Paste, uniform throughout, 5740g. Length, 36in.
No. 42. Clay and fibre, uniform throughout, 3500g. Length, 15¾in.
No. 43. Asbestos paper and twine, 102g.; asbestos paste, 8760g. Length, 18½in.
No. 44. Ashes, plaster, flour, and hair, uniform throughout, 3740g. Length, 20in.
No. 45. Asbestos paper, 113g.; asbestos paste, 7370g. Length, 18½in.
No. 46. Asbestos paper, asbestos paste, together, 4320g. Length, 18½in.
No. 47. Clay and fibre, alike throughout, 2310g. Length, 15in.

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

(*From our own Correspondent.*)

This week the reduction of 2½ per cent. in ironworkers' wages, decreed by Mr. Avery, the president of the Wages' Board, came into operation. In some of the localities, particularly about Westbromwich, the men manifested on Monday a little disinclination to begin work upon the new terms, but happily the great majority have proved loyal to the Board.

The puddlers gave the most trouble at the Ridgacre Works in the Westbromwich district. Here they expressed their determination to strike if the reduction was enforced. To prevent a rupture, the masters consented to pay the old rate this week until a communication has been made with the men's leaders.

The reports brought to 'Change yesterday and to-day—Thursday—show that if the works are to be kept in anything like regular employ, much vigilance has to be exercised in looking up specifications. Lots of business might be had at very low rates, but many ironmasters still prefer to let such orders go elsewhere. The competition among the sheet makers in particular is excessive, and only a decided revival in trade is likely to stay it. Singles remain at £7, doubles at £7 10s. to £8, and lattens at £8 10s. to £9.

Galvanised sheet makers do not report much improvement, but official quotations keep up. Galvanised sheets rolled by Morewood and Co. were quoted, delivered at outports, £12 to £12 10s. per ton for 18 and 20 B.G., according to brand; £13 to £13 10s. for 24 b.g.; £15 to £15 10s. for 26 b.g.; and £17 to £17 10s. for 28 b.g. Cold rolled galvanised flat sheets of the "Woodford Crown" brand were £15 for 18 and 20 g.; £16 for 24 g.; £18 for 26 g.; and £19 for 28 g. The "Anchor" brand was £17, £18, £20, and £21, according to gauge; and the "Lion" brand was £20, £21, £23, and £24 respectively.

A few of the best bar firms are rather better employed, in much part upon colonial orders. The Earl of Dudley's quotations are still nominally 12s. 6d. above those of the other "list" houses, and stand at, for rounds, £8 2s. 6d. lowest quality; £9 10s. single best; £11 double best; and £13 treble best. His lordship's rivet and T-iron is £10 10s. for single best; £12 for double best; and £14 for treble best. Angles, and also strips and hoops, from 14 to 19 w.g., are £8 12s. 6d. lowest quality; £10 single best; £11 10s. double best; and £13 10s. treble best. Strips and hoops, of ⅞in. and 20 w.g., are £9 12s. 6d., £11, £12 10s., and £14 10s., according to quality; and of ¾in., £10 12s. 6d., £12, £13 10s., and £15 10s. respectively.

The report last week concerning the formation of a combination in the United States of importers of cotton tie hoops, to prevent excessive competition, was confirmed to-day in Birmingham. The title of the combination is "The American Cotton Tie Company," but that it does not include all the importers is fully evident from the circumstance that inquiries are being made by other buyers than the representatives of the company upon this side for lots of 2500 tons of cotton tie hoops.

The price at which the American company is getting the hoops delivered to Ellesmere Port or Liverpool, cut in 11ft. lengths and despatched sixty to the bundle, is understood to be £6 15s. per ton, though some of the makers are asking £7.

The financial collapse in America is making against business with that country in best iron and tin-plates. Certain of the tin-plate makers reported to-day that at the beginning of the month they might have booked orders from the States that would have found them work for three months; but they were unprepared to accept the prices offered, and now negotiations have been summarily suspended.

Plates are very slow of sale. Boiler sorts are quoted £8 10s. to £9, double best £10, and treble best £12. Special descriptions for flanging are £15 to £15 10s., and charcoals £17 10s. to £19 5s., according to maker. Tank plates are to be had at something below £7 10s.

Pigs remain in poor demand, and prices favour buyers. The stocks of some makers are very heavy. All-mines are 62s. 6d. to 57s. 6d., and common 42s. 6d. to 37s. 6d.

Advices received this week from Melbourne state that quotations for galvanised sheets ranged from £20 to £21 according to brand. Bar and rod iron were moving off at £9 to £9 10s. Sheets had been sold at £11 10s. for Nos. 8 to 18, and hoops at from £9 10s. to £10.

Further evidence is forthcoming of the progress of the steel trade. Experiments are now being made by the Butterley Iron Company: which owns extensive properties in Derbyshire, Nottinghamshire, and North Staffordshire, with a view to the production of steel by the Thomas-Gilchrist process from the company's practically inexhaustible ironstone supplies in the latter district. The company proposes to adopt to the working of the new material the existing plant at its Codnor Park Ironworks.

The Coal Trade Wages' Board held an important meeting in Birmingham on Tuesday, when it was announced that Mr. Joseph Rowland, solicitor, had consented to accept the position of president. The masters, through Mr. J. B. Cochrane, chairman of their section, presented their case for an immediate reduction of wages. For some time past, he said, they had been suffering owing to the very bad state of trade. They were now paying a standard of 3s. 8d. per day to the loaders in the thick-coal pits. The pikemen were paid according to the same standard, but if they did not work by the "stint" they were paid at the rate of 1¼ days for a day of eight hours. They asked the president to base his award upon the comparative wages and price of coal in 1879 and now. The operative section argued that 1871 should be the period of comparison with present prices and wages. The wages which were paid in 1879 were the lowest which had existed during the last half century. The masters further desired that the present actual selling prices, and not the list prices, should be considered, and a table of these running over the past ten years they put in. The president promised to make his award as early as possible.

The possibility of surface drainage works in South Staffordshire of greater magnitude than any that have hitherto been mooted and declared impracticable in that honeycombed mining district, is this week being canvassed by men who know whereof they speak. The General Drainage Committee of the South Staffordshire Mines Drainage Commissioners, compassionating the costly, but futile, efforts of the governing authorities of the thirteen towns in the Mines Drainage area to escape by individual sewerage schemes from the legal penalties incidental to the passage of sewage and detritus into the commissioners' surface works, have thought out a plan which appears, as far as can be judged from its present embryo condition, to possess the merit of feasibility. The formidable nature of the difficulties to be met with will be gathered from the fact that the existing Mines Drainage Works deal with what may be considered one underground sea, open directly or indirectly either by straight or tortuous courses from Wolverhampton to West Bromwich and Walsall, and even extending beyond the Rowley Hills close into Stourbridge, whilst the alleged injuries are contributed from the entire area east of Dudley, embracing all towns and other communities from West Brompton to Wolverhampton and Walsall inclusive. The extensive and splendid pumping plant of the commissioners may work on, like Sisyphus, for ever without result, unless some alteration be effected. It is known that the natural outfall of the area is on one of its confines in the locality of Wednesbury. The engineering obstacles in the way of conveying the waste water of all the authorities to this outfall may, the committee suggest, be got over by making use of certain of the main watercourses of the Commission. The sewage might be carried in pipes alongside of, and lying on the embankments of the streams. Mr. Walter Williams, as chairman of the Commission, gave a rough outline of the proposal at a conference in Wolverhampton on Wednesday. Recognising the importance of the possible saving of some £250,000, which a united scheme of this kind might, it is thought, effect, compared with individual schemes, the local authorities have invited further details, which will be given in a month's time. If the matter be then taken up, the best engineering opinions that can be procured will be called in, parliamentary sanction for the scheme sought, and a suitable terminus, known as Elwell's Pools, be obtained at Wednesbury to deal with the accumulated sewage and detritus.

The millmen's union, to which I last week referred, has now been formed. It will be known as "The Millmens' Association of South Staffordshire and East Worcestershire."

Ironfounders and machinery engineers are not busy. An order for 200 tons of girder work on account of the Great Western Railway has just been received by a Wolverhampton firm.

Manufacturers in this district are looking to benefit by the requirements which some of our home railway lines are just now expressing in connection with their supply of stores for the ensuing twelve months. The Great Eastern and the Cambrian companies are at date in the market. The East Indian Railway Company is also inquiring for galvanised sheets, wrought iron in the block, beater picks, &c.

The pipefounders note with satisfaction some new foreign inquiries on the market, but the competition continues such that the prices realised will, it is expected, yield but small profit. For improvements in the city of Buenos Ayres 4000 tons of pipes of 3½in., 2in., 5in., 4in., and 3in. diameter are needed, together with 800 sluice valves of 4in. and 2in. diameter.

The late struggle between the operatives and employers in the South Staffordshire nut and bolt trade has cost the men's association nearly £6500. It was therefore to be expected that at the conference of the operatives in Birmingham on Monday and Tuesday, at which besides the Staffordshire district, Liverpool, Sheffield, and South Wales were represented, everything should tend to the cutting down of expenses. One result—the overthrow of a proposal to establish an out-of-work pay fund—is satisfactory in a much broader sense than financially. It should help to prevent the recurrence of the strained relations between employers and employed that are so full of mischief to both sides.

Some 1500 of the operatives who have been on strike in the chain trade in the Cradley and surrounding districts have now again resumed work, at, according to the men, the advanced terms. But thirty of the employers still refuse to make any concession, and at these places the men remain out. The strike in the Wolverhampton plate lock trade has ended adversely for the men, work having been resumed on the old terms.

The Bill of the Birmingham Compressed Air Power Company, which has passed the House of Commons, on Tuesday passed the Standing Orders of the Upper House without opposition.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—There is no improvement in the condition of the iron trade of this district, business all through continuing very depressed, and that there is very little confidence with regard to the future may be judged from the fact that pig iron—chiefly Scotch brands—is being offered here for delivery over the whole of this year, and in some cases for a considerable period into next year on the basis of the present minimum rates, which, so far as Scotch iron is concerned, are quite 1s. under makers quoted rates. The finished iron trade also continues without animation, and the hipping season so far has brought with it no activity. The discouraging feature is that although prices are low, in fact so low that bear speculators are becoming more cautious in view of the fact that the bottom would seem almost to have been reached, they fail to bring forward any large weight of buying, and consumers appear to be quite indifferent about covering beyond their present requirements.

There was again an extremely dull iron market at Manchester on Tuesday. Quoted rates were nominally unchanged, but where there are orders of any weight in the market there is so much underselling that it is difficult to say within 1s. or 1s. 6d. per ton what prices needy sellers are prepared to take. During the past week Lancashire pig iron makers have closed with offers, which had been pending for some time, for a considerable weight of forge iron at about 6d. under their list rates, and this has pretty well filled up their books for the present. There has, however, been very little further inquiry coming forward, but local makers now hold firmly for 43s. 6d. to 44s., less $2\frac{1}{2}$ for forge and foundry qualities delivered equal to Manchester. A few orders are being got from consumers in the immediate neighbourhood of the furnaces, where there is an advantage in low rates of carriage, but on the basis of the figures quoted above there is practically little or nothing being done. For district brands quoted rates are unchanged, 43s. 4d. to 44s. 4d., less $2\frac{1}{2}$, remaining about the average for forge and foundry Lincolnshire delivered here; but beyond a few small parcels of foundry, there is no business of any weight doing. Outside brands continue to be offered here at very low figures. Good foundry Middlesbrough can be bought at about 44s. 4d. net cash delivered equal to Manchester, and good foundry Scotch iron at about 49s. per ton.

In the finished iron trade business still moves on very slowly. For shipment there is not very much doing, and the home trade continues extremely quiet. Some of the local forges have had to go on short time, and when they are kept fully employed it is on work taken at very low figures. The average prices for delivery into the Manchester district are £5 15s. for good local and North Staffordshire bars, £6 5s. for hoops, and £7 5s. per ton for sheets, but the market is weak, and there are low-class bars to be bought at £5 12s. 6d.

The steel trade is in quite as depressed a condition as the iron trade; hematites meet with a very slow sale and good foundry brands can be bought at about 55s. per ton less $2\frac{1}{2}$ delivered here, whilst manufactured steel is extremely low in price, and rolled steel girders of small sections for mill joists are being delivered into Oldham at £6 10s. per ton.

The condition of the engineering trades remains without material change; locomotive builders, tool makers, and machinists are kept fairly busy, but the weight of new work coming forward generally is falling off, and prices rule very low.

Brassfounders report that except for locomotive work the demand for all classes of engineers' fittings is on the decrease, and for marine fittings especially there is only a very small inquiry. Orders all through come forward only in driblets, and to secure even these prices have to be cut extremely fine.

The protracted strike in the Warrington wire trade is now at an end; the employers having made some slight concession, the men have returned to work. The orders accumulated during the strike and the replenishing of stocks which had been sold out are keeping the wire works fully going for the present, but the actual trade doing is still very small, and extremely low prices have to be taken for all descriptions of iron wire.

An excellent arrangement for the prevention of accidents to pit cages by the breakage of the winding rope has been designed and patented by Mr. Thos. Brown, of Walkden, and Mr. William Brown, of Little Hutton, near Manchester. For this purpose levers are placed on each side of the cage, and turn on pins, and form the centres on which the levers work. The ends of the levers are provided with huge joints, from which extend upwards suitable rods having rollers extending outwards, with flat circular surfaces to ensure an effectual grip on the guide rods, which are fixed to the sides of the cage. The opposite ends of the levers are secured by a hinge joint to connecting-rods, joined together above the cage by the rods, to which a link is attached to the winding rope. When the cage is suspended the rollers are drawn away from the guide rods, and the whole weight is supported on the connecting rods as well as the pins or centres of the levers. In the event of a breakage, the whole weight of the cage is thrown upon the centres, causing the suspended ends of the lever to fall and the opposite ends to rise with the rollers into the inclined plane and grip the guide rods, by which the cage is held, supported by its own weight acting upon the rollers in the inclined planes, thus preventing it falling down the shaft when unattached to the rope. Springs are also attached as an additional safeguard, in case of the accidental breakage of the rope. A model of this invention has been submitted to a number of mining engineers, and has been highly commended as an ingenious arrangement for effecting the purpose it has in view.

In the coal trade there is no material change, except that the demand for house fire coals has fallen off considerably with the recent warm weather, and pits are getting on to less time, with stocks accumulating where they are working four full days a week. Other classes of fuel for iron making and steam purposes continue only in moderate demand and plentiful in the market. Quoted rates are about the same as last week, but prices generally are weak, and for quantities very low figures are quoted. At the pit mouth best coal averages 9s.; seconds, 7s.; common house coal, 5s. 6d. to 5s. 9d.; steam and forge coal, 5s. 3d. to 5s. 6d.; burgy 4s. 6d. to 4s. 9d.; and good slack, 3s. 6d. to 4s. per ton.

For shipment there is a moderate demand at low prices, steam coal delivered at the Garston Docks or the high level, Liverpool, fetching about 7s. to 7s. 3d. per ton.

Barrow.—I have this week to report a continued quiet tone in the hematite pig iron market of this district. No improvement has occurred in the business doing, and the trade remains in a very unsatisfactory condition. None of the large ironworks in the district are now working full time, and at present there are few signs of a revival taking place. Transactions are very limited, as consumers are only operating for the purpose of supplying immediate requirements. Few orders are coming to hand on home account, and the business doing with foreign buyers is inconsiderable. The shipping season has now commenced, and with this it was expected that the orders received from foreign buyers would increase; but, so far, these expectations have not been realised. Prices are practically unchanged, and mixed samples of Bessemer iron are selling at 47s. 6d. per ton net at works prompt delivery. A considerable quantity of metal is now stocked at makers, but this is being gradually reduced. The steel trade shows a slight improvement, but prices remain so low that makers find it impossible to realise any profits on transactions. Rails are selling now at about £4 10s. and upwards per ton net at works. Wire is in better demand, as are also hoops. Shipbuilders are but indifferently employed, and few inquiries are coming to hand. Boiler makers, engineers, and other minor departments of the steel and iron trades are very quiet. The coal and coke trade presents few new features. Sales are of a somewhat languid character, and prices are rather easy. Shipping dull as freights are low.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

MESSRS. JOHN BROWN AND CO., according to their usual custom at this season of the year, are reducing the number of puddling furnaces. They have already given notice to several of their puddlers. Generally, the condition of the iron trade is extremely languid.

The new Dronfield Silkstone Colliery has been purchased by the proprietor of the Somersall Colliery, Dronfield—Mr. Sheard. It is stated that Mr. Sheard also contemplates purchasing the Gosforth Colliery, where there is an excellent bed of coal which has been abandoned for some years past. Mr. Sheard will no doubt resume working it, so that the Dronfield district will have some fresh signs of life in colliery affairs, if not in steel and iron.

It was rumoured last week that the site of the Dronfield Steel Works—from which Messrs. Wilson, Cammell, and Co., after absorption of Messrs. Charles Cammell and Co., migrated to Workington—have been acquired by Messrs. S. Osborn and Co., of Clyde Steel Works, Sheffield, for an extension of their business. On inquiry I find that this rumour is entirely incorrect. Messrs. S. Osborn and Co. contemplate an extension of their business facilities, but not in the Dronfield direction.

The miners are holding a good many meetings at present. At the annual demonstration of the South Yorkshire and North Derbyshire Miners' Association at Swinton on Monday, a variety of speeches were made in favour of unity, the adoption of a sliding scale for the regulation of wages, the Franchise Bill, and one condemnatory of certain magisterial decisions in regard to breaches of the Mines' Regulation Act of 1872 and Colliery Bye-laws. It was contended by Mr. W. Chappell, general secretary, that the magistrates were unnecessarily severe in their decisions, and that "the inconvenience caused to working men and their families by the fines levied by the magistrates of this country was becoming a burden too intolerable to be borne." Mr. Chappell added that "he had been told this startling fact by a solicitor, viz., that if a man was wanted to be sent to prison at Barnsley, he—the solicitor—had only to say so, and the man was sent; so that the solicitor was both solicitor and magistrate." Mr. Chappell will probably be asked to say something more about this "startling statement," which, if true, is very wrong, and if not true, is a shameful thing to say.

The strike of the miners employed at the collieries of the Stanton Coal and Ironworks Company gives evidence of dying out. On Monday 144 men turned in to work at Pleasley pit. At a meeting afterwards held, however, it was resolved to hold out against the masters. This resolution applies to the majority of the men employed at the other pits, notably, Butcher Wood and Silver Hill.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

BUT little business has been done in Cleveland pig iron during the last few days, and at the market held on Tuesday at Middlesbrough the tone was exceedingly quiet and even despondent. Merchants' quotations varied from 36s. 6d. to 36s. 9d. per ton for No. 3 g.m.b., but, as is well known, they have only small lots to offer at these prices. Makers as a rule continue firm at 37s. to 37s. 6d., and do no business unless they can obtain these rates. Consumers are at the same time quite content to purchase only what they require for immediate use, and hope by waiting to get their future wants supplied at lower rates. The price of forge iron is 35s. 6d. per ton if obtained from makers, but merchants are willing to supply at 3d. per ton less. Warrants are offered at 36s. 9d. per ton; but there are no purchasers.

The stock of pig iron in Messrs. Connal and Co.'s Middlesbrough store decreased 1550 tons during the week ending Monday, the 19th inst. The quantity now held is 51,877 tons. This is the first change in the stock for several weeks.

Shipments have improved somewhat during the last few days. The quantity of pig iron exported from the Tees from the 1st to the 19th inst., inclusive, is 51,648 tons, as compared with 48,499 tons in the corresponding period of last month.

The prices of manufactured iron remain unaltered. Orders are very scarce, and full time is not worked anywhere except at the bar mills. It is rumoured that one or two leading manufactures contemplate closing their mills until the demand improves. For average specifications prices are as follows:—Ship-plates, £5 to £5 2s. 6d. per ton; angles, £4 12s. 6d. to £4 15s.; and common bars, £5 2s. 6d. to £5 5s., all free on trucks at makers' works less $2\frac{1}{2}$ per cent. discount.

Owing to the closing of several collieries and the coke ovens attached throughout the county of Durham, distress among the colliers begins to be severely felt. At a special meeting of the Durham Miners' Association, held on Saturday last, it was decided to contribute £2000 from their accumulated fund towards the relief of necessitous members. This sum will be dispensed in the form of weekly allowances until trade improves. There is also great distress amongst the Cleveland miners, many of whom have been thrown out of work by the depressed condition of trade. Measures are being taken having for their object the formation of a relief fund.

The joiners and shipwrights at the repairing yards on the Tyne have received notice of a reduction of wages to the extent of $8\frac{1}{2}$ per cent. They new earn 36s. per week. It is not yet known whether they will acquiesce or not. At most of the Tyne boiler-yards notice of a 10 per cent. reduction in wages has also been given.

Messrs. Bolckow, Vaughan, and Co., Limited, have given 14 days' notice to the men employed at their No. 5 blast furnace at Witton Park to terminate their engagement, as the furnace is about to be blown out.

The last meeting for the session of the Cleveland Institution of Engineers was held at Middlesbrough on Monday evening last. Mr. Alfred Wilson, of Birmingham, read an interesting paper on "The Production and Application of Gas for Heating Purposes." A description of the "Wilson gas-producers" was lucidly given. Mr. Wilson then proceeded to demonstrate that heating by gas was preferable to the ordinary method of hand firing in three ways, viz.:—(1) Facility afforded for using the cheapest classes of fuel; (2) facility for obtaining comparatively perfect combustion; and (3) its adaptability to utilise the regenerative principle. The application of gas to the raising of steam, to the heating of iron, and to the melting of steel, were severally described and explained. An animated discussion ensued, the general tone being favourable to Mr. Wilson's methods, and commendatory of the efforts he has now for several years been putting forth in promoting the use of gas in place of solid fuel for heating of all kinds.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

BUSINESS has again been very slack in the Glasgow pig iron market. The financial panic in New York was not without its effect, and as business here is still in a very backward way, there has been a further decline in the values of warrants. Shipments of Scotch pigs are unsatisfactory, having amounted in the past week to 9739 tons, as compared with 11,925 in the preceding week, and 13,141 in the corresponding week of 1883. There is a decrease of 530 tons for the week in Messrs. Connal and Co.'s stock of warrant pig iron. Two furnaces have been extinguished—one at Calder and one at Lumphinnans—and the total number in blast is now ninety-five, against 116 at the same date last year.

Business was done in the warrant market on Friday at 41s. 7d. to 41s. $5\frac{1}{2}$d. cash. On Monday transactions occurred from 41s. $5\frac{1}{2}$d. to 41s. 2d. There was a rather better tone in Tuesday's market, with cash quotations up to 41s. $4\frac{1}{2}$d., closing at 41s. 3d. On Wednesday forenoon business was done at 41s. 3d. to 41s. 2d. cash, and in the afternoon at 41s. $2\frac{1}{2}$d. cash, and 41s. $4\frac{1}{2}$d. one month, closing, sellers, 41s. 3d. cash, and 41s. $4\frac{1}{2}$d. one month; buyers a halfpenny less. As to-day—Thursday—was observed as a holiday, in celebration of the anniversary of the Queen's birthday, the market was closed.

The quotations of makers' iron are:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 51s. 9d.; No. 3, 50s. 6d.; Coltness, 57s. and 50s.; Langloan, 53s. and 51s.; Summerlee, 51s. 6d. and 47s. 6d.; Calder, 52s. 6d. and 47s.; Carnbroe, 51s. 6d. and 47s. 6d.; Clyde, 47s. 6d. and 45s.; Monkland, 43s. 6d. and 40s. 6d.; Quarter, 42s. 6d. and 40s. 6d.; Govan, at Broomielaw, 43s. and 41s.; Shotts, at Leith, 52s. 6d. and 51s. 6d.; Carron, at Grangemouth, 48s. (specially selected, 54s.) and 47s. 6d.; Kinneil, at Bo'ness, 44s. 6d. and 44s.; Glengarnock, at Ardrossan, 51s. and 44s. 6d.; Eglinton, 45s. and 41s. 9d.; Dalmellington, 48s. and 43s. 6d.

The malleable iron trade is becoming very quiet, and the slackness in the shipbuilding orders is having a serious effect on the business of merchants. The past week's shipments of iron and steel manufactures from the Clyde embraced £27,000 worth of machinery, chiefly sugar-crushing plant and locomotives, £5000 sewing machines, £2400 steel goods, and £27,000 iron manufactures. In nearly every department of the manufactured iron trade the pinch of dull times is being felt, and there can be no doubt that business will be quiet throughout the summer months.

The action of the miners in holding idle days and restricting their hours on the days they are pleased to, is producing an awkward state of matters in the Lanarkshire coal trade. With less business doing by far than at this time last year, some of the coalmasters yet find themselves unable to load vessels that are seeking cargoes, and severals vessel are reported to have been sent elsewhere for supplies. The policy of the miners' leaders in this business is difficult to understand. All last year, when there was abundance of trade, they made no decided movement for an advance of wages, but now that the trade is falling off, and that the masters are unable owing to the reduced rates obtainable for their coals to pay any advance, the men are doing everything in their power to destroy the trade. At this date the shipments of coals are 64,000 tons less than they were last year. Those from Glasgow in the past week embraced 3200 tons to Canada, 1033 to Stockholm, 1000 to Cronstadt, 877 to Bordeaux, and smaller quantities to other places. From Troon 9335 tons were shipped; Ayr, 8604; Leith, 7000; and Grangemouth, 8649 tons. It appears that the advance of 6d. a ton obtained a week ago in Fife applies to only a few of the collieries, where pressing orders had to be met, the trade generally still being in a backward condition.

A conference of miners' delegates was held at Coatbridge on Monday, when reports were presented from the various districts in Lanarkshire and several places in Stirlingshire with reference to the restriction of the output. It appeared that restriction was very general; but there were notable exceptions where the men refused to be content with 3s. a day when they had the opportunity of making 6s. to 7s. These men were denounced by the speakers at the meeting; but it was resolved to defer any resolution as to the wages question until a subsequent conference.

The miners of Fife and Clackmannan have given their employers notice that after fourteen days they will restrict the output of coal by working not more than four days a week. It is feared that this action may provoke the masters to decide upon a general lock-out.

The annual meetings of the Scotch mineral oil companies are being held at present, and some of them are paying the large dividend of 20 per cent. and upwards. There is good ground for believing that too many mineral oil companies have been floated in Scotland within the past few months, and that when their products all come into the market—if they should ever do so—the business will become much less profitable than hitherto.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

THE principal event of the week in the district has been the starting of the three new blast furnaces at Cyfarthfa. This was effected on Monday, but without any demonstration. The blast was turned on by Mrs. Crawshay, and the first make of pig obtained on Tuesday. The force of blast registered was a little over 3lb. the square inch. The transformation of the works, from their old-fashioned character, has taken a little over two years to accomplish, under the personal direction of Mr. Edward Williams, of Middlesbrough. The machinery, as stated by me, is from the first makers in England, and though Bessemer iron will not be made for some little time, it will not be long before the whole of the steel works will be in full operation. In the face of the depressed condition of the steel trade, this starting at Cyfarthfa may be taken as showing some degree of hopefulness in the future; but the history of Cyfarthfa in the past shows that not unfrequently it did a moderate trade when the majority of iron works were silent. At present there is no denying the fact that all works are doing but a very middling trade. The improvement in tin-plate has imparted some amount of briskness in a few of the works which are employed in tin-bar. This reminds me that, by the omission of a word in my last report, I seem to imply that Rhymney had entered upon the tin-plate trade, instead of the tin-plate bar trade. Rhymney is making a special aim at a steel bar for tin-plate purposes, but in justice to Dowlais, I may add that at those works, also, the steel bar has been for some time in make. Referring to tin-plate, the Penclawdd works will soon be started, and the Llangennech tin-plate works have four mills working out of ten, and the distress in the neighbourhood is sensibly lessened. Good news also reaches me about Briton Ferry Works. In the matter of prices, 16s. and 16s. 3d. readily obtainable for ordinary coke plates. Steel plates are are also well booked. Best charcoals are not so well approved now as steel plates. Wasters of all sorts are in good demand, and enquiry from New York is increasing.

I was in the neighbourhood of Newport this week, and was much impressed with the signs of progress and prosperity there. The increased railway arrangements are beginning to tell very favourably, and as soon as the Rhondda coal is brought by the new railway, increased impetus will be certain. The activity higher up the Severn is not so marked. I am afraid as regards the Severn Bridge that it is more an engineering success than a commercial one. The house coal districts, of which Newport is the outlet, are doing a better trade, and prices for No. 2 are sustained at 8s. 9d. Steam coal trade of the week has been very brisk again, and 10s. 6d. to 11s. readily obtained. Small steam is not in very good request. Great activity prevails in all directions about Cardiff, but there has been no congestion at docks or on railway. The Barry case is certainly not favoured by the present condition of things; but then it is well understood here amongst those who are behind the scenes that the desire of the promoters is not to facilitate the trade of the district so much as to have a place of their own. If Barry should become an accomplished fact, the dockmasters' position would not be an enviable one. What is really wanted is the extension of docks in Cardiff to the West Mud, and the whole of the docks in the hands of a harbour trust with equal privileges to freighters. I am glad to note the progress of the Severn tunnel. The enterprise of the Great Western Railway, and the ability of Mr. Walker, have already accomplished great things. A great waste of country is now inhabited by a busy community, and by the time the Severn tunnel is finished there will be a populous township on the Welsh side.

I omitted to note, in referring to Newport, the great extension of wharves on the west side of the river. The Alexandra Dock Company is extending the new Blaina and Lovells wharves. The Ebbw Vale Company has also made great extensions, and others are in progress by Mordey and Co. The Patent Slipway Company is about to begin its dry dock at Newport.

A good breadth of the famous Mynyddislwyn seam has been rendered workable by some ingenious efforts at the old Bryn pit of late in tapping the water.

Mass meetings of colliers in the Rhondda Valley are to take place shortly, and Mr. Bradlaugh is announced to be present at one of them. Efforts have been made to make Swansea a harbour of refuge. I recollect a similar attempt made for Fishguard some years ago, but nothing has been done, though the place near Goodrick is well dotted with masts of foundered vessels—so many records of Government supineness in that direction. I am pleased to note the prosperous condition of things prevailing at Swansea. The import of pig iron and the export of coal are well maintained, and the patent fuel market is good.

The proposed Bill for interfering with the deep coal gates of the Forest of Dean is causing a good deal of agitation, and severa meetings in support of an opposition have taken place.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

*** *It has come to our notice that some applicants of 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.

13th May, 1884.

7615. Preparing, &c., Waste Substances, I. Levinstein, Manchester.
7616. Fire-lighters, H. Nixon and W. Dixon, Gateshead.
7617. Slides for Horizontal Saw Frames, T. N. Robinson, Rochdale.
7618. Embossing Pile, &c., Fabrics, &c., E. J. Homan, Bowdon.
7619. Crude Oxalate, J. and R. Crighton, Manchester, and J. Walsh, Middlesbrough-on-Tees.
7620. Flushing the Pans of Water-closets, T. Abbott and M. Hawthornthwaite, Lancaster.
7621. Small-arms, G. Wilkins, Birmingham.
7622. Railway Carriage and other Windows, A. W. Newton, Birkdale.
7623. Metallic Boxes, J. Appleby, Birmingham.
7624. Electro-magnetic Motors, E. Toynbee and I. R. Culley, Willesden.
7625. Quilted Felt Shirt, D. Barker, Manchester.
7626. Fastenings for Neckties, W. P. Thompson.—(*A. L. Gilbert, Milwaukee, U.S.*)
7627. Manumotive Velocipedes, W. P. Thompson.—(*S. Krnka, Austria.*)
7628. Cutting Scalops, Vandykes, &c., C. H. and F. J. Dale, Leicester.
7629. Working of Gas Producers, P. O. Whitehead, Manchester.
7630. Check-punching Machines, J. N. Williams, New York.
7631. Constructing Tricycles, F. W. Jones, Exeter.
7632. Gill Stoves, T. W. Roberts, Bramley, and Y. Haywood and Co., Rotherham.
7633. Window Shaking Preventers, T. Smith, Brockley, and J. Drewitt, Peckham.
7634. Self-adjusting Mill Stones, H. Coubrough.—(*G. Summerton, San Francisco, U.S.*)
7635. Bungs, C. Wingfield, Sheffield.
7636. Compound Buttons, G. L. Aston and A. Hames, Birmingham.
7637. Operating Sewing Machines, &c., A. M. Clark.—(*H. Field, New Bedford, U.S.*)
7638. "Concentrator" Gas Lamp, G. C. Wallich, Retired list of H.M. Indian Army.
7639. Condenser for the Microscope, G. C. Wallich, Retired List of H.M. Indian Army.
7640. Making Steel, W. Beardmore and J. McC. Cherrie, Glasgow.
7641. Marvellous Painter, S. Bellotti, London.
7642. Stereotype Plate Holders, R. W. Nelson, Chicago, U.S.
7643. Fittings for Nosebags, H. C. Goldfrap, London.
7644. Thief-proof Letter-boxes, R. Atkin and D. J. Callow, London.
7645. Violet Colouring Matters, H. J. Haddan.—(*H. Hassenkamp and the Farbenfabriken, vorm. F. Bayer and Co., Prussia.*)
7646. Producing Dyeing Compounds, &c., H. J. Haddan.—(*E. Frank and the Farbenfabriken vorm. F. Bayer and Co., Prussia.*)
7647. Automatic Boiler Feeder, A. Mayhew, London.
7648. Split Links, G. Hughes, Wolverhampton.
7649. Propellers for Steamships, D. McKellar, Dumbartonshire.
7650. Astragals or Sash Bars, W. Luther, Glasgow.
7651. Flat-flame, &c., Gas-burners, A. K. McKinnon and B. D. Weston, London.
7652. Argand Gas-burners, A. K. McKinnon and B. D. Weston, London.
7653. Illumination of Railway, &c., Carriages by Gas, W. H. Beck.—(*La Société Roux, Guichard, et Compagnie, Paris.*)
7654. Treating Cotton-seed, P. M. Justice.—(*The United States Cotton Seed Cleaning Company, New York.*)
7655. Treating Cotton-seed, P. M. Justice.—(*The United States Cotton Seed Cleaning Company, New York.*)
7656. Handle for Racquets, F. O. Heinrich, Wimbledon, and H. F. E. Nusser, London.
7657. Racquets, F. O. Heinrich, Wimbledon, and H. F. E. Nusser, London.
7658. Saws, J. H. Johnson.—(*L. E. Mosmier-Lambin, Paris.*)
7659. Egg and Cake Beaters, A. C. Rex, Philadelphia, U.S.
7660. Sash-line Holder, W. A. Wyatt, Gosport.
7661. Fumigating Green-houses, &c., T. Lowres and J. Lees, Birkenhead.
7662. Safes, S. Chatwood, Bolton.
7663. Fire-escapes, H. T. Bailey, Blackheath.
7664. Loading Coal into Ships, &c., C. L. Hunter, Cardiff.
7665. Purifying Water, W. Anderson, London.
7666. Water-closet Fittings, H. Doulton, London.
7667. Umbrellas and Parasols, C. D. Abel.—(*G. Gilardini, Italy.*)
7668. Electrical Meters, J. S. Raworth, Manchester.
7669. Galvanic Batteries, B. J. B. Mills.—(*B. H. Cadot, fils, and C. J. M. Barbier, France.*)
7670. Velocipedes, C. M. Linley, J. Biggs, and G. G. Tandy, London.
7671. Cigarette Cases, H. E. Newton.—(*F. S. Kinney, New Brighton, New York, U.S.*)
7672. Cooking-ranges, J. W. Brown, Leamington.
7673. Explosive Projectiles, M. Delmard, Plumstead Common.
7674. Sharpening Saws, W. R. Lake.—(*L. Martinier, France.*)
7675. Cisterns, R. Pringle, Blackheath.

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7676. Handles of Brushes, H. Besson and E. N. Kent, London.
7677. Valves, W. P. Thompson.—(*R. Wrigley, Rosa, British East Indies.*)
7678. Washing Unmounted Photographs, &c., A. McDonald, Penrith, and T. Kendall, Cockermouth.
7679. Belt Fasteners, F. Baumann, Prussia.
7680. Mixing or Disintegrating Fluid, &c., R. McNichol and I. Walsh, Manchester.
7681. Double-valve Mechanism for Ships' and similar Water-closets, J. G. Connell, Glasgow.
7682. Supports for Saddlery, T. F. Rippon, near Sleaford.
7683. Mining Machines, J. T. King.—(*S. C. Lechner, Columbus, U.S.*)
7684. Carving Forks, E. A. Cantrell, Sheffield, and E. Slack, Westgate.
7785. Index Calculator for Knitting Machines, E. Eggett, London.
7686. Driving Gear for Bicycles, R. Marshall, Nottingham.
7687. Embossing Trade-marks, &c., C. H. and F. J. Dale, Leicester.
7388. Metallic Fastenings for Buttons, G. Davis, Kentish New Town, near Birmingham.
7689. Perambulator, G. Smith, Cheetham.
7690. Conical and Pyramidal Roofs, G. Candler, Maidstone.
7691. Combined Shooting-stick and Mallet for Printers' use, R. A. Baxter.—(*L. Baxter, U.S.*)
7692. Cupboard Fasteners, J. and G. D. Brendon, Callington.
7693. Ether Freezing Microtome, J. Swift, London.
7694. Gas Carbonators, H. A. Costerton, Brighton.
7695. Vent-peg, J P. Allen, London.
7696. Curry-comb, F. G. Kleinstück, Dresden.
7697. Lace or Tulle, C. D. Abel.—(*L. S. la Serve and E. L. Davenière, France.*)
7698. Saddles for Bicycles, &c., T. Warwick, Aston.
7699. Automatic Electrical Current Regulator, J. Gilmore, Norwood, and W. R. Clark, Peckham.
7700. Stop-motion, J. Wilcock, and J. and E. Cockcroft, Mytholmroyd.
7701. Thrashing Grain, A. J. Boult.—(*A. Arrieta, Pampuluna, Spain.*)
7702. Smoke-consuming Grate, A. J. Boult.—(*P. Antoine, Haraucourt, France.*)
7703. Brake-blocks, E. Holden, jun., Ockley.
7704. Compass, &c., R. Meager, New Cross.
7705. Ranges, C. J. Burton, Deptford.
7706. Furnace Grates, H. J. Haddan.—(*M. Cocqueran, St. Pierre, Martinique.*)
7707. Castings, H. J. Haddan.—(*L. Perin, France.*)
7708. Organ Reeds, M. Gally, New York, U.S.
7709. Washing and Dyeing Machinery, J. Worrall, Ordsall.
7710. Pen-wiping Attachment for Coat-sleeves, W. Timms, Eastbourne.
7711. Enamelling Metallic Show-cards, C. Davidson and H. West, Glasgow.
7712. Monosulpho Acids of Beta-naphtylamine, E. Elsässer, Prussia.
7713. Red Azo Dye Stuffs, E. Elsässer, Prussia.
7714. Cranes, W. W. Hulse, Salford.
7715. Perambulators, A. Cornell, London.
7716. Valves, R. Wrigley, Rosa, East Indies.
7717. Telephone Transmitters, W. R. Lake.—(*J. A. Kingsbury, Chicago, U.S.*)
7718. Chaff-cutters, S. Long, Fulbourn.
7719. Invisible and Self-acting Match-box for Sticks, &c., H. Aumont, London.
7720. Telephone Receivers, W. R. Lake.—(*J. A. Kingsbury, Chicago, U.S.*)
7721. Weft-stop Mechanism of Power Looms, G. M. Wilson, Hawick.
7722. Cutting Double-pile Fabrics, H. H. Lake.—(*C. Coupland, Seymour, U.S.*)
7723. Warming Buildings, &c., P. Dalton, London.
7724. Calculating Machines, J. McCarthy, London.
7725. Mills, J. Davis, Bristol.
7726. Bolts, &c., J. W. Phillips, London.
7727. Artificial Fuel, E. Robbins, Battersea.

15th May, 1884.

7728. Winding and Reeling Frames, W. Pearson, Bury, and J. H. Pearson, T. Gough, and W. E. Schofield, Heywood.
7729. Steam Boilers, W. B. Thompson, Dundee.
7730. Sewer Ventilator and Manhole Cover, &c., A. B. Brady, Maldon.
7731. Preventing the Emission of Metallic Vapours, &c., from Chimneys, E. H. Cook, Bristol.
7732. Thermometers, J. Motherwell, Glasgow.
7733. Block-printing Machine, W. J. Shanks, Springfield.
7734. Revolving Fork or Arrow, C. Barker, Shadwell.
7735. Lifting, &c., Apparatus, J. Heap, Ashton-under-Lyne.
7736. Valves and Taps, E. Slack, Rotherham.
7737. Bicycles, &c., J. and J. Bradshaw, Southport.
7738. Anti-nicotine Pipe, W. Trubshaw, Willenhall.
7739. Earth-closet Apparatus and Separating Pail, A. Purkess, Andover.
7740. Coupling, &c., Vehicles, J. Darling, Glasgow.
7741. Steamships, &c., W. B. Thompson, Dundee
7742. Sound Signalling Apparatus, J. W. Black, Glasgow.
7743. Filing, &c., Machinery, J. Tickle, West Bromwich, and F. Leonardt, Handsworth.
7744. Labelling Packets, J. Tickle, West Bromwich, and F. Leonardt, Handsworth.
7745. Hand Ball Air Exhauster, J. W. Cousins, Southsea.
7746. Adjustable Instantaneous Shutter, T. Furnell, London.
7747. Lamps, T. C. J. Thomas, London.
7748. Sash Fasteners, E. B. M. Bond, London.
7749. Electric Bells, W. Blenheim, New Egham.
7750. Pneumatic Breech-loading Guns, T. N. Palmer.—(*D. M. Mefford, Ohio, U.S.*)
7751. Cleaning Tubes of Boilers, C. Allen, Woolton.
7752. Enabling Indicators to be Applied to Shafts, J. Young and J. Richardson, London.
5753. Fastening Doors of Carriages, C. Groombridge, Edmonton.
7754. Shirts, E. C. Goddin, London.
7755. Fire-lighters, W. Sylvester, Castleford.
7756. Barrel Organs, C. Pietschmann, Berlin.
7757. Doubling Frames, J. Higginson, Reddish.
7758. Rings for Ring-spinning, &c., E. Weild, Manchester.
7759. Buttons, A. B. Pickard, New Beckenham.
7760. Rugs, H. E. Preen, Kidderminster.
7761. Crayons, B. Wilcox, London.
7762. Breech-loading Ordnance, W. A. F. Blakeney, Glasgow.
7763. Drain Pipes, T. L. Watson, Glasgow.
7764. Automatically Closing Appliances for Tap Holes, T. Walker, Tewkesbury.
7765. Expanding Cog Wheels, W. G. F. Webster, Folkestone.
7766. Preserving the Arch of the Sole in Boots, W. S. Simpson, London.
7767. Exhaust Ventilators, T. Frost, Adelaide.
7768. Adjustable Shaft Fittings for Vehicles, G. Morris, Norwich.
7769. Thrashing Machine, P. Prégaldino, Brussels.
7770. Metallic Handles for Umbrellas, &c., G. Garbe, London.
7771. Anti-friction Ring Bearing, E. Edwards.—(*F. Mathieu, St. Julien.*)
7772. Precipitating Copper from Liquids, W. E. Brendon, Exeter.
7773. Electric Signal Apparatus, H. A. C. Saunders and A. C. Brown, London.
7774. Steamship Propellers, R. Wilcox, Victoria.
7775. Loom-shuttle, W. R. Lake.—(*Messrs. Zollinger and Wagner, Schaffhausen, Switzerland.*)
7776. Collecting Tickets, J. M. Black, London.
7777. Organs, H. Smith, Hammersmith, and W. M. Riddell, London.
7778. Lasts, H. Harding, London.
7779. Fast and Loose Pulleys, A. M. Clark.—(*F. Ermel, Paris.*)
7780. Lubricators, A. M. Clark.—(*J. J. Irvine, Tennessee, U.S.*)
7781. Speed Indicators, A. M. Clark.—(*W. H. Lord, New York, U.S.*)

16th May, 1884.

7782. Effecting Perfect Combustion in Furnaces, W. J. Chubb, London.
7783. Air Blast, &c., Kiln for Burning Bricks, C. Price, Leicester.
7784. Call Bells, W. F. Allcock, Birmingham.
7785. Combination Perambulator and Tricycle, F. Mirls and E. Pierce, Manchester.
7786. Jacquard Mechanism for Opening the Shed in Power Looms, J. Crabtree and J. Brearley, Heckmondwike.
7787. Winding Slivers for Combing Machines, J. Scott, Bradford.
7788. Rolling Billets from Iron, &c., J. Guest, Smethwick.
7789. Mounting the Ballooning Plates, &c., of Ring Spinning, &c., Frames, B. A. Dobson and E. Gillow, Bolton.
7790. Non-expanding Safety Paper Holder, F. E. Taylor, Birmingham.
7791. Measuring into Lengths all kinds of Laces, &c., A. H. Davies, Nottingham.
7792. Instantaneous Shutter for use in Photographic Pictures, W. Heath, Plymouth.
7793. Chimney Gear for Engines, F. A. Sharpe and W. Woollason, London.
7794. Knuckle Joint Swell for Looms, J. Slading and W. Hanson, Clitheroe.
7795. Sockets for Chisels, A. Reaney, Sheffield.
7796. Portable Apparatus for Withdrawing Fluids, J. Whitehead, Burnley.
7797. Couplings for Railway Vehicles, H. Stockman, Hampton.
7798. Apparatus for Spinning Cotton, &c., E. Hird, Bolton.
7799. Folding Steps, W. J. Gwynn, Malvern.
7800. Fastenings for Bags, &c., J. A. Jacobs, London.
7801. Expanding Bottle Stopper, G. S. Johnson and W. J. Pollard, Little Ilford.
7802. Heel Counters for Boots, &c., H. Snow and S. Bennett, Leicester.
7803. Rolls for Crushing Minerals, &c., J. Qualter, Barnsley.
7804. Removing Bessemer Converters, P. C. Gilchrist, Wolverhampton, and L. G. Fitzmaurice, Bilston.
7805. Generating Electrical Energy, G. G. M. Hardingham.—(*C. Mortimer-Sterling, Paris.*)
7806. Ventilating Water-closets, A. A. Collis, Cardiff.
7807. Studs for Chain Cables, E. I. H. E. and J. T. Whitehouse, Tipton.
7808. Fastenings for Corsets, &c., J. J. Clarke, Birmingham.
7809. Ventilation, J. Perriman, London.
7810. Cooling Brewers' Worts, W. H. Wills, Bootle.
7811. Distributing Liquids in the Form of Spray, S. and C. E. Owens, London.
7812. Pressing Trusses of Straw, &c., H. Harris, Boston, Lincolnshire.
7813. Gas Motors, E. de Pass.—(*S. François, Paris.*)
7814. Closing Openings of Various Section, G. Downing.—(*E. Leinert, Dresden.*)
7815. Carpets, A. F. Firth.—(*T. F. Firth, U.S.*)
7816. Gauging Sheet Lead, F. S. Smith, Yeadon.
7817. Tea and Coffee Pots, H. Stock, Chelsea.
7818. Facing Heads, J. W. Phillips, London.
7819. Drilling Machine, R. Robin, London.
7820. Rotary Flour Dressing Machines, W. B. Dell.—(*G. T. Smith, Jackson, U.S.*)
7821. Driving Chains, J. Fox, London.
7822. Sewing Machines, J. Fox, London.
7823. Dressing Cut-pile Fabrics, J. Worrall, Salford.
7824. File Cutting Machinery, A. Weed, Philadelphia, U.S.
7825. File Cutting Machinery, A. Weed, Philadelphia, U.S.
7526. Turning Leaves of Music, &c., C. Koester, London.
7827. Velocipedes, E. C. F. Otto, London.
7828. Velocipedes, E. C. F. Otto, London.
7829. Galvanic Element, A. M. Clark.—(*Wirth and Co., Frankfurt-on-Main.*)
7830. Imitation Seal Skins, S. C. Lister and J. Reixach, Manningham.
7831. Filters, W. Oldham, Balham.
7832. Safety Valves, J. H. Johnson.—(*Lethullier and Pinel, Rouen.*)
7833. Electrical Apparatus for Telephones, J. W. Brown, London.
7834. Securing Railway Rails in their Chairs, R. Punshon, London.
7835. Coupling and Uncoupling Railway Trucks, H. E. Brittin, Swindon.
7836. Automatic Sale and Delivery of Prepaid Articles, W. P. Keeson, London.

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7837. Skewers for Preparing Cotton, &c., A. Wood, Middleton.
7838. Cast Iron Skylight Frames, H. Steven and J. Walker, Glasgow.
7839. Separating Thrashed Corn from Straw Refuse, H. Courteen, Grantham.
7840. Holders for Rollers, J. S. Dronsfield, Oldham.
7841. Manufacture of Sulphydrates, A. M. Clark.—(*R. Blitz, Paris.*)
7842 Bicycles, &c., T. Hughes, Aston.
7843. Decorating Glass Ware, J. Northwood, Kingswinford.
7844. Steam Washing Machines, S. Smith, Keighley.
7845. Spinning and Doubling Cotton, &c., J. and H. Hirst, Huddersfield.
7846. Generating Steam, R. Dempster, Elland.
7847. Obtaining Sulphuretted Hydrogen from Alkali Waste, F. W. Zenaut.—(*H. von Miller, Austrian Silesia.*)
7848. Tricycles, &c., H. Moon and W. Morgan, Birmingham.
7849. Testing the Strength and Capacity of the Lungs, M. H. C Wrigley, London.
7850 Equalisation of the Specific Gravity of Worts, E. Page and R. Ranger, Maidstone.
7851. Pot Lids, J. Burrows Birkenhead.
7852. Raising Flax and Thistles, M. F. O'Rielly, Wicklow.
7853. Remodelling Photographic Negatives, &c., G. Brown, Deal.
7854. Music Stands, T. P. Palmer, Bristol.
7855. Planes, J. Thropp, Sheffield.
7856. Closing Device for Flexible Tubes, W. Elges, Berlin.
7857. Trucks for Moving Merchandise, H. Abbott.—(*W. C. Page, New York.*)
7858. Picking Motion of Weaving Looms, A. Sowden, Bradford.
7859. Shuttle Guards for Looms, T. R. Hill and T. Marshall, Bradford.
7860. Cleansing, &c., Steam Carbon Gas, J. Crutchett, London.
7861. Removing Snow from Railways, H. J. Haddan.—(*H. F. Schotola, Saxony.*)
7862. Closing Hansom Cab Doors, M. A. Israel, London.
7863. Manufacturing Paper, A. J. Boult.—(*D. J. A. Helmers and Ullman and Co., Germany.*)
7864. Hot-air, &c., Apparatus, C. Inwood, Staffordshire.
7865. Application of Pianoforte with Harmonium, I. Pritchard, Sherfield English.
7866. Door Knobs, &c., B. Swaine, Leeds.
7867. Mixing, &c., Dough, J. Hawley and J. Williams, Liverpool.
7868. Aerated Waters, A. Esilman, Bradford, and A. Hassal, London.
7869. Dyeing Mixed Cotton, &c., W. Clarke and H. J. Tansley, Nottingham.
7870. Curling Hats, W. E. Carrington, Stockport.
7871. Joint for the Hood Frames of Perambulators, &c., H. A. Reinhold, Woolwich.
7872. Looms for Weaving, P. Greenwood, Bradford.
7873. Coupling, &c., Railway Wagons, W. H. Moon, Wiltshire.
7874. Removing Sulphates, &c., from Potash Lyes, D. Urquhart, London.
7875. Gas Governor, C. D. Abel.—(*E. Schrabetz, Vienna, Austria.*)
7876. Weaving Beaded Fabrics, C. D. Abel.—(*L. Deshayes, France.*)
7877. Fret Saw Machinery, G. Jackson, Melbourne.
7878. Kilns for Burning Portland Cement, D. L. Collins, Grays, Essex.
7879. Case, &c., for Lime Cartridges, E. L. Sheldon, London.
7880. Purifying the Stems of Tobacco Pipes, &c., J. Nicholls, West Ham, Essex.
7881. Carpet-beating Machines, R. Handyside, Edinburgh.
7882. Combing Machines, J. H. Whitehead.—(*I. Best, Lawrence, U.S.*)
7883. Sugar-cane Mills, A. J. Struthers and J. Frame, Glasgow.
7884. Oxygenating Water, S. Delbarre.—(*A. Brin, Paris.*)

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7885. Regulating the Velocity of Bobbins, &c., C. Irvine and J. Patton, Belfast.
7886. Links for Chains, G. H. Court, Birmingham.
7887. Hat-making, J. Ashworth, Lancashire.
7888. Closing, &c., Doors of Railway Carriages, T. H. J. Smithson, London.
7889. Ring, &c., Spinning and Doubling Frames, R. Dawson, J. Cook, and H. Hopkinson, near Oldham.
7890. Paring the Heels of Boots and Shoes, F. Cutlan, Northamptonshire.
7891. Gasaliers, &c., W. C., A. T., and E. E. Jones, Chester.
7892. Effervescing, &c., Beverage, H. Cochrane, Belfast, Ireland.
7893. Nailing Machines, J. E. Cutlan, Northamptonshire.
7894. Syphon Tap, J. Wilcox, Birmingham.
7895. Valves for Stop-cocks, J. Crabtree, Yorkshire.
7896. Trimming, &c., Lace or Looped Fabrics, E. W. Whitehall, Nottingham.
7897. Scale Tang Cutlery, J. Winterbottom, Sheffield.
7898. Boxes, L. A. White, Lancashire.
7899. Bicycle Alarm Bell, &c., J. G. Stormont, Birmingham.
7900. Boiling, &c., Fibrous Materials, W. E. Gedge. (*F. C. Glaser, Berlin.*)
7901. Stoppering Bottles, E. Levette and S. Chambers, London.
7902. Gimlet-pointed Screws, H. J. Allison.—(*A. G. Beyer, New York.*)
7903. Automatic Time Indicators, &c., E. F. Bard, New York.
7904. Pickle Fork and Spoon Combined, R. Mogford, Birmingham.
7905. Case for Protecting Cut Flowers, Sir G. R. Sitwell, Derbyshire, and F. Plaister, Oxfordshire.
7906. Crank-power Chair, &c., T. McIlray, London.
7907. Tricycle, T. M. Bear, Colchester.
7908. Convertible Tandem Tricycle, J. Dring and H. J. Pausey, London.
7909. Bleaching, W. Mather, Manchester.
7910. Steam Washers, E. K. Heaps, Brotherton.
7911. Cutting, &c., Circular Lamp Wicks, L. A. Groth.—(*H. Rieger, Wurtemberg.*)
7912. Siphon, L. A. Groth.—(*J. P. y More, Barcelona.*)
7913. Obtaining Motive Power, E. S. Eyland, Bristol.
7914. Rendering Paper, &c., Damp-proof, H. R. Minns, Maidenhead.
7915. Dripping Pan, F. Brown, Luton.
7916. Obtaining Motive Power, J. C. Martin, Richmond.
7917. Drilling Submarine Rocks, H. H. Lake.—(*C. A. Sterling, New York.*)
7918. Thill Couplings, H. H. Lake.—(*C. Struck, U.S.*)
7919. Governing Apparatus, R. Rackham, Walton-on-the-Naze.
7920. Steam Pumps, R. Rackham, Walton-on-the-Naze.
7921. Slipways, J. Standfield, London.
7922. Purifying Musty Beer, G. J. Heathorn, Weymouth.
7923. Chain Pumps, S. B. Goslin, London, and R. Rackham, Walton-on-the-Naze.
7924. Wardless Key and Lock, F. Mann, London.
7925. Electric Conductors or Wires, A. F. St. George, Redhill.
7926. Recording Vibrations, &c., A. F. St. George, Redhill.
7927. Stripping Earth from Turnips, &c., W. Stark and W. Whyte, Dundee.
7928. Bicycles, &c., J. Laughlin, St. Louis, U.S.
7929. Fire-escapes, G. Dows, London.
7930. Saddles for Spinning Machines, H. L. Pierce, Rhode Island.
7931. Umbrella and Walking Sticks, W. H. Hawes, Wimbledon.
7932. Regulating Air Currents, A. W. L. Reddie.—(*L. Desailly and Dubois, Paris.*)
7933. Tanning Hides, A. M. Clark.—(*W. Maynard, New York, U.S.*)
7934. Knife for Channelling Boot Soles, C. W. P. Cowan, London.
7935. India-rubber Tires, F. Bird, London.
7936. Kneading Dough, J. H. Johnson.—(*Messrs. Deliry and Son, France.*)
7937. Kneading Dough, J. H. Johnson.—(*Messrs. Deliry and Son, France.*)
7938. Manufacturing Ribbon, &c., H. H. Lake.—(*H. Fouillet-Chevance, Paris.*)
7939. Cartridge Extractor, A. M. Clark.—(*N. O. Waymire, Garfield, U.S.*)
7940. Treating Iron, A. M. Clark.—(*R. B. Abbott, Freeborn, Minnesota, U.S.*)

ABSTRACTS OF SPECIFICATIONS.

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

3965. Construction of Boxes or Cases for Containing Articles to be Transmitted by Post or Other Means, *E. Herbert, Richmond.—15th August*, 1883. *6d.*

Relates to the construction of cardboard boxes, which can lie flat when not in use.

4108. Furnaces for the Combustion of Liquid Fuel, *J. H. Selwyn, London.—24th August*, 1883. *6d.*

Relates to the construction of a furnace for generating heat by combustion of liquid fuels with steam, built up of sections with air-tight joints, so formed as to admit of expansion and contraction without leakage.

4480. Ships, &c., *W. J. Clapp, Nantyglo.—19th September*, 1883. *6d.*

Relates to the employment in the construction of ships, turrets, and forts of iron, steel, or compound plates, rolled or otherwise formed with curved projections on the exterior thereof, and with cells or chambers on the interior thereof.

4535. Playing Cards, *E. Seedhouse, Netherton.—22nd September*, 1883. *4d.*

The cards are formed with a part or parts thicker than the remainder.

4542. Fastening Cravats, &c., *F. R. Baker, Birmingham.—22nd September*, 1883. *6d.*

Relates to the construction of a spring gripping fastener.

4549. Appliances for Stopping Holes Made by Collision, &c., in Ships, *J. Richardson, North Shields.—24th September*, 1883. *6d.*

Relates to the construction of a "pad" of flexible material, strengthened by cross bars and made water-tight at ends and sides by a border piece of india-rubber; and the mode of application of the same.

4576. Facilitating the Electrical Transmission of News, &c., *G. L. Anders, London.—25th September*, 1883.—(*Not proceeded with.*) *2d.*

The news is transmitted from a central station to branch stations by means of suitable instruments.

4617. Apparatus for Generating, Regulating, Measuring, Recording, and Integrating Electric Currents, *Sir W. Thomson, Glasgow.—28th September*, 1883. *3s.*

The armature core, in the form of a toroid, is constructed of square soft iron wire wound continuously and spirally, the circles being as nearly coaxal as possible. Each strand is insulated by thin paper, and the neighbouring circles are kept apart by distance pieces. For high potential currents the coils are made of square copper wire insulated with paper and wound in single layers radially on the toroidal cone. For large currents these are wound in a number of layers. The action of rotation is vertical, and the driving pulley is mounted on the shaft by a friction gear arrangement. The oiling is effected by centrifugal discs and collecting canals provided with suitable drain pipes and a filter attachment. The brushes are so mounted as to be lifted off the commutator should the direction of rotation be reversed, or two pairs of brushes are similarly mounted when the generator is to work in either direction. The field magnet coils are constructed from flat thin copper strips insulated with parchmentised paper, or the field magnets may consist of bundles of bars of very hard steel magnetised *in situ*. The invention further relates to a current regulator; an automatic "make-break" appliance;" a "long range" tangent galvanometer; a potential gauge, which in one form is applicable as a safety controller to prevent over incandescence of the lamps; an electrostatic volt gauge; a new form of Daniell's battery, used to "standardise" the gauges; and to a current recorder and integrator. This specification is fully illustrated by eighteen sheets of drawings.

4654. Apparatus for Enabling the Vehicles of Narrow-gauge Railways and Tramways to run upon Broad-gauge Railways and Tramways, and vice versa, *H. W. Hargrave, Adelaide, South Australia.—29th September*, 1883.—(*Not proceeded with.*) 4*d.*

Consists of an axle turned as a screw at both ends, one end as a right-hand screw and the other as a left-hand screw, and the wheels "tapped" respectively to revolve on the screws when required.

4657. Secondary Voltaic Batteries, *H. F. Joel, London.—1st October*, 1883.—(*Not proceeded with.*) 2*d.*

The electrodes are made of lead wires imbedded under pressure in oxide of lead. In constructing batteries on a large scale a number of perforated lead trays, carrying alternate layers of lead wires and oxide of lead, are superposed and bolted together. The charging and discharging is regulated by a galvanoscope apparatus.

4662. Apparatus for Ascending Towers, Spires, &c., *C. H. Fitzmaurice, Westminster.—1st October*, 1883.—(*Not proceeded with.*) 2*d.*

Horizontal shafts are arranged in adjustable bearings in a frame, and are geared together, such shafts carrying elastic or spiked wheels, which are caused to bear against the sides of the tower or other structure, so that when the shafts are revolved the frame will be caused to ascend or descend.

4666. Coal Shipping Appliances, *P. G. B. Westmacott, Newcastle-upon-Tyne.—1st October*, 1883.—(*Not proceeded with.*) 2*d.*

In order to lower coal from one level to another, a tubular shoot is employed, and is provided with a valve at bottom to control the passage of the coal, the shoot being always kept full, so that the coal will not be broken by falling. The shoot is telescopic.

4667. Couplings for Pipes, &c. *N. Thompson, London.—1st October*, 1883. 6*d.*

The object is to facilitate the connection and disconnection of two lengths of pipe or hose; and it consists in forming a flange on one pipe, having a socket on one face to receive a plain flange on the other pipe. The first flange on its other face has two or more inclines, and two or more slots in the edge thereof. A coupling piece is passed over the second pipe, and has a cylindrical cavity to receive the flange and inclines on the other pipe, two or more clips projecting inward, and being formed with teeth, with which engages a spring catch contained in a socket on the first pipe.

4676. Manufacture of Iron and Steel, &c., *G. Hatton, Hagley, Worcester.—2nd October*, 1883.—(*Not proceeded with.*) 2*d.*

This consists in treating molten pig iron first by blowing air through it until the silicon and the greater portion of the carbon are removed, and then completing the process after the manner of the open-hearth or Siemens-Martin or other process, in which the metal is subject to the action of flame arising from the introduction of inflammable gases above the surface of the earth.

4689. Locking the Hand Gates at Level Railway Crossings, *H. W. R. Smith, Kingston-upon-Hull.—2nd October*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to mechanism whereby the hand gates are locked by the action of turning the road gates, but which hand gates can also be locked by the signalman from his box.

4697. Water-closets, &c., *W. R. Lake, London.—2nd October*, 1883.—(*A communication from J. P. Putnam, Boston, U.S.*) 1*s.*

One feature consists in breaking up the lower flushing stream of a water-closet provided with an upper and lower flushing, into several minute streams below the normal level of the trap. Another feature consists in introducing the upper flushing stream into a large body of water; also in retarding the upper streams. Other improvements are described.

4715. Coloured Glass Windows, &c., *H. J. Allison, London.—4th October*, 1883. - (*A communication from J. Lafarge, New York.*)—(*Not proceeded with.*) 4*d.*

This consists in providing a light metallic framework as a substitute for the "leading" hitherto employed in coloured glass windows; and also in combining with the window a thin film or sheet of glass on either or both sides, to bind the segments together, and protect the glass work from the action of the atmosphere.

4717. Belts for Transmitting Motion to Machinery, *B. A. Barczinsky, London.—4th October*, 1883.—(*A communication from Messrs. Korngold and Jaffe, Poland.*)—(*Not proceeded with.*) 2*d.*

A woven fabric of flax is rendered waterproof, stretched, and folded to the required width, the folds being sewn together and pressed.

4718. Woven Fabrics of Irregular Widths, &c., *J. Lee, Rochdale.—4th October*, 1883. 6*d.*

The object is to weave the Eastern cloak called a "Bournous" in one piece by power; and it consists in employing a loose sleeve on the warp beam, to receive the warp to form the hood of the cloak. The healds are each divided into two lengths, one corresponding to the main warp, and the other to the hood warp. The main healds are actuated by the ordinary tappets and treadles, and the hood healds by an additional set of tappets and treadles.

4720. Producing and Burning Gas, &c., *E. Davies, London.—4th October*, 1883.—(*Not proceeded with.*) 2*d.*

Two or more vessels are provided, in one of which partitions covered with silk are arranged, and impregnated with chemicals, such as bisulphide of carbon, india-rubber, and alcohol, or sometimes ether. Air or steam is caused to pass through the silk, and the gas formed is purified and then burnt.

4722. Fishing Tackle, *W. J. McMullen, London.—4th October*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to a check action for winches to permit of fishing lines being freely drawn off the reel as required and payed out, while it prevents the spindle from overrunning and the coils of the line thereon from becoming thereby loosened and liable to entanglement.

4723. Manufacture of Axes and Adzes, *T. Myers and G. Neill, Rotherham.—4th October*, 1883.—(*Not proceeded with.*) 2*d.*

The eye and head of the adze is cast in combination with a portion of the blade, and to it the blade proper is welded.

4724. Making Castings, *J. Stanley and L. Bailey, Sheffield.—4th October*, 1883.—(*Not proceeded with.*) 2*d.*

This relates particularly to the moulding of such articles as grooved pulleys with flat or "ogee" shaped sides, and it consists in using a pattern representing half a pulley secured upon an axle, in combination with a bed-plate, which allows the axle to be turned so that the two half moulds can be made from the one half pattern.

4727. Umbrellas and Parasols, *H. J. Haddan, London.—4th October*, 1883.—(*A communication from W. Jaedicke, Berlin.*)—(*Not proceeded with.*) 2*d.*

The objects are to enable the umbrella to be readily opened and closed by one hand; to facilitate the exchange of the stick; and to prevent accidental opening or closing.

4728. Voltaic Batteries, *A. C. Henderson, London.—4th October*, 1883.—(*A communication from N. Bassett, Paris.*) 6*d.*

A primary battery is constructed with a zinc and carbon couple separated by a porous diaphragm, the liquid on the zinc side being a solution of an alkaline chloride, the carbon side having a solution whose formula is "Mn, Cl, Fe^2, Cl^3." In a secondary battery the oxide of lead is replaced by the oxide of manganese, iron, chromium, &c., or by their chlorides or sulphides. The porous cells are made from a mixture of plastic clay, broken crucibles, hard coke, and sesquioxide of iron.

4729. Lubricating Apparatus, *W. R. Lake, London.—4th October*, 1883.—(*A communication from E. L. Bucaille, jun., Paris.*)—(*Not proceeded with.*) 2*d.*

This relates to the use of a fixed vessel from which the lubricant runs to a channel leading to a number of branches provided with special cocks, which, when turned, allow a small quantity of the lubricant to pass. A special top plug to allow air to enter the vessel is described.

4731. Apparatus for Producing Spray, *H. Brooks and R. Mestern, London.—4th October*, 1883.—(*Not proceeded with.*) 2*d.*

A bulb is formed on the end of a supply pipe, and contains a cross bar with a centre hole for the passage of a valve spindle, and between this bar and a second cross bar, which is loose and capable of turning, a spiral spring is arranged. The lower part of the spindle carries a valve fitting a seat at the lower end of the bulb, so that water issues therefrom in a circular sheet, and is dashed against the blades of a screw carried by the valve spindle, whereby it is broken into a fine spray.

4732. Apparatus for Use in Transporting and Exposing Sensitised Photographic Plates or Films, *J. E. Atkinson, Greenwich.—4th October*, 1883. 8*d.*

This relates to the employment of envelopes in form of a rectangular frame constructed to carry one or two plates or films, and having a front opening provided with a sliding shutter. The camera has a back adapted to fit against the rear of the body, and hinged so as to be moved in and out of position. In the back is a receptacle for one envelope, and its front is provided with an opening, while at the side is a slot to enable the shutter of the envelope to be withdrawn.

4733. Safety Toy, *F. J. Thomas and R. H. C. Cotton, Birmingham.—4th October*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to a toy bomb into which a detonator can be inserted and be exploded when the bomb is thrown on to the ground. An elastic cord is passed round the hand, so that the bomb returns to the hand after the explosion.

4734. Harness, &c., *G. Bray, Deptford.—4th October*, 1884.—(*Not proceeded with.*) 2*d.*

This relates to means for securing horses to, and releasing them from, vehicles.

4735. Producing Printing Blocks by Means of Photography, *W. R. Woodbury, London.—5th October*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to the use of negatives of ruled lines, netting, gauze, or dots in the preparation of printing blocks by photography, so that such blocks will have the design produced thereon by a series of dots or lines.

4736. Carriages for Tramways, &c., *D. Phillips, London.—5th October*, 1883. 6*d.*

This relates to means for propelling carriages, consisting of a suitable motor driving an intermediate shaft, which imparts motion to a rock shaft, and this to a friction driving clutch operating by means of spoke-like arms, and which is situated on the carriage axle.

4737. Couplings for Continuous Brakes, *F. Wirth, London.—5th October*, 1883.—(*A communication from C. R. van Ruyren, Holland.*)—(*Not proceeded with.*) 2*d.*

The object is to render the couplings capable of automatically giving warning, and it consists in the application to each of a whistle which can be operated by air passing through them.

4738. Apparatus for Bleaching Cotton, &c., *G. B. Sharples, near Bury.—5th October*, 1883. 6*d.*

This relates to apparatus for carrying on the entire process of bleaching by the combined action of chlorine and carbonic acid gas in one vessel, and it consists of an open vat containing a perforated box to receive the material, a space being left all round such box. Above the vat are two gasholders, each open at bottom, and one sliding over the other, which has double sides and forms a seal.

4739. Type Writers, *H. J. Allison, London.—5th October*, 1883.—(*A communication from W. R. Perce, Providence, U.S.*)—(*Not proceeded with.*) 2*d.*

This relates to a type writer in which a key-board is depressed by a pointer, and a type wheel caused to revolve, suitable mechanism being combined therewith for advancing the paper and spacing the letters thereon.

4741. Trace Hooks, *O. Lampe, Germany.—5th October*, 1883. 6*d.*

The object is to enable the traces to be instantaneously released from the whiffle-tree without having to back the horse, and it consists in making part of the trace hook so that it can be turned on a pivot when released from a catch lever.

4743. Lids of Saucepans, &c., *L. B. Bertram, London.—5th October*, 1883. 6*d.*

The lid is provided with perforations which can be opened or closed by a screen or shield capable of being turned, the objects being to prevent liquids from boiling over and also to retain solids in the saucepan while straining off liquids.

4744. Apparatus for Pressing, Smoothing, and Finishing Garments, or Parts of Garments, also for Pressing Woollen, or Woven or Felted Fabrics, *W. and J. H. Beecroft, Leeds.—5th October*, 1883. 6*d.*

The iron is hung on the end of a horizontal tube mounted to slide between runners in bearings on a carriage attached to a vertical pillar capable of being raised and lowered, and also turned. On the table is a pillar to which one end of the sleeve board is hinged, so that it can be turned clear of the table to receive the garment. The iron contains a burner by which it is heated, the products of combustion passing off through the tube to which it is suspended.

4747. Burners for Burning Gas Mixed with Hydrocarbon Vapour, *J. W. Sutton, London.—5th October*, 1883. 6*d.*

The pipes by which mixed gas and hydrocarbon vapour passes to the burner are led down through the centre of the glass chimney of argand burners, the metallic vessel containing the hydrocarbon liquid being placed above the burners, so as to be heated thereby.

4748. Employing Organ Pedals in connection with Pianofortes, *J. Rushton, London.—5th October*, 1883.—(*Not proceeded with.*) 2*d.*

Hammers are used in connection with the pedals and caused to strike the wires of the pianoforte above the belly or sound-board when the pedals are actuated by the feet.

4749. Extracting Essential Oils from Hops, &c., *W. R. Lake, London.—5th October*, 1883.—(*A communication from T. A. Breithaupt, Alsace.*) 6*d.*

The invention consists particularly in extracting essential oil from hops by means of compressed air. The hops are heated by steam so as to burst the cuticles of the plant which contain the oil, and air is then forced into the closed vessel in which the operation is carried on. The volatilised oil mixes with the air, and is drawn off into a vessel in which a vacuum has been formed, and which is kept cool so as to condense the oil. Suitable apparatus is described.

4750. Propelling Ships, &c., *C. Crozier, Gateshead.—5th October*, 1883.—(*A communication from A. Keating, Valparaiso.*) 6*d.*

This consists in the use of hollow rams reciprocated by a suitable motor and working through pipes fitted to the stern of the vessel so as to propel the vessel by acting upon the surrounding water. An auxiliary screw propeller is arranged so as to enable the vessel to be propelled astern.

4751. Pyrometers, &c., *W. Lloyd Wise, London.—5th October*, 1883.—(*A communication from A. and E. Boulier, Paris.*) 6*d.*

This relates to improvements on patent No. 1698, of 1883, and consists in causing any variation in the volume of the liquid to be indicated by an electric bell, an electro-magnet simultaneously closing the supply pipe. To prevent injurious radiation on to the tubes conducting the liquid to the absorbing capsule, a flow of liquid is maintained in that part of their containing case which is adjacent to the capsule.

4752. Chains and Chain Cables, *C. H. Reed, Sunderland.—6th October*, 1883. 6*d.*

The object is to dispense with the process of welding the links of chains, and one method consists in forming the links in half parts and uniting them by means of dovetailing or similarly fitting the one part into the other. Two half parts, each forming one half of a separate link, may be cast in the usual connection to form a chain cable.

4758. Treatment of Ores, &c., containing Antimony, by the Wet Process, *J. Beveridge, Runcorn.—6th October*, 1883. 4*d.*

The inventor claims, First, the speedy separation of oxychloride of antimony in the crystalline form by the addition of an excess of water to the solution of trichloride of antimony, and heating the mixture to from 115 deg. to 155 deg. Fah.; Secondly, the recovery of the hydrochloric acid, and also the residual antimony remaining from the trichloride of antimony solution by the process described, which consists substantially in treating the trichloride solution with sulphuretted hydrogen in scrubbing towers, separating the sulphide of antimony that precipitates, aerating the residual acid, so as to expel the remaining sulphuretted hydrogen, removing the last traces of sulphuretted hydrogen by means of chlorine or a hypochlorite, and using the purified weak acid in condensers of alkali works instead of water; and Thirdly, in the process of treating antimonial ores in the wet way, dissolving out the antimony by means of hydrochloric acid with the aid of heat, and passing the sulphuretted hydrogen, given off up scrubbing towers, down which descends a stream of the residual weak acid, left after most of the antimony has been precipitated from it.

4759. Saw-sharpening Machinery, *H. Sands, Nottingham.—6th October*, 1883. 4*d.*

The object is to prevent fine dust or particles of emery being dispersed around machines in which a revolving disc of emery is used to sharpen saws, and it consists in arranging an exhaust fan so as to carry away the particles thrown off from the disc.

4764. Packing of Pistons for Steam Engines, &c., *W. R. Lake, London.—6th October*, 1883.—(*A communication from J. E. Bell, Baltimore, U.S.*) 6*d.*

This consists partly in a packing ring of annular shape, with the flanged part made much wider than the annular projecting face, so that it can wear off entirely before the flange can leave its recess in the piston-head; and further, in a packing piece with a tongue, which fits into a groove in the side of the packing ring, while a projecting pin enters a recess in the ring, so that the ring and packing piece must all move together, and thus prevent the main ring from slipping around on the piston, so as to expose the joint.

4766. Coke Ovens, *J. Jameson, Newcastle-on-Tyne.—8th October*, 1883. 6*d.*

The inventor claims the use of a separate wall or casing to a coke oven, enclosing a space wherein the pressure of air outside the actual oven wall is made approximately equal to the pressure within the oven, so as to stop or diminish leakage of air into the charge in the oven.

4768. Apparatus for Storing up Power for Assisting in the Starting and Propulsion of Tramcars and other Vehicles, also Applicable as a Continuous Brake for Railway Trains, *R. Heyworth, Manchester.—8th October*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to the construction of an air pump to be applied to the axle of a tram-car or other vehicle, whereby the power required to stop or retard such vehicle is utilised for compressing air into a receiver, and which compressed air is again used for assisting in the starting of the vehicle and for propelling the same up hill.

4769. Telegraph Cables, *T. C. Loe, London.—8th October*, 1883.—(*Not proceeded with.*) 4*d*

To prevent kinking in submarine cables, the core is covered with a series of flat galvanised iron bands laid so as to abut one on the other, edge to edge.

4770. Slide Valves, *C. de Lucia, Italy.—8th October*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to improvements on patent No. 3687, A.D. 1881, and have for their objects to simplify the construction and reduce wear and tear, and it consists in employing one rod instead of two to connect the slide valve with the piston which balances it; in constructing the piston in one piece; and in packing the piston with three small rings in place of one of complicated construction.

4771. Artificial Fuel, *E. Marriott, London.—8th October*, 1883. 6*d.*

This relates to apparatus for manufacturing perforated blocks of artificial fuel, and it consists of a mould with a false bottom or follower operated by a cam to raise the compressed block; a plunger for compressing the fuel, and a number of core pins to form the perforation in the blocks, and which pins pass through holes in the plunger, and are carried by a reciprocating head.

4773. Manufacture of Cements, &c., *E. Robbins, London.—8th October*, 1883. 10*d.*

This relates to the manufacture of concrete from various descriptions of lime, such as lime putty or "cobble rocks," or other cheap earths or rocks, in combination or not with ordinary cements.

4774. Apparatus for Regulating or Controlling from a Distance the Flow of Gases or other Fluids through Pipes or other Conduits, *W. P. Thompson, Liverpool.—8th October*, 1883.—(*A communication from F. L. Muratori and E. Cros, Paris.*)—(*Not proceeded with.*) 6*d.*

The rise or fall of mercury in the limbs of a U-shaped tube complete one of two electric circuits, which by suitable mechanism regulate the flow of the fluid.

4777. Combing Machines, *C. Hoyle, and I. and J. Ickringill, Keighley.—9th October*, 1883. 6*d.*

The object is to draw off from the circle of a "Lister's" combing machine two or more slivers of such length of fibre or staple as will better suit the requirements of the worsted trade, and it consists in mounting two or more sets of vertical drawing-off rollers at different distances from the comb circle.

4781. Conductors of Electricity, *J. G. Parker, Plymouth.—9th October*, 1883. 4*d.*

This invention is based on the principle that the current passes along the surface of the conductor, and that the insulating material, by its contact with the surface, impedes the current. The patentee therefore proposes to form his conductors with a series of parallel grooves.

4783. Apparatus for Cleaning, Separating, and Classifying Coal, &c., *A. Sottiaux, Belgium.—9th October*, 1883. 6*d.*

The mixed coal is caused to fall through a case, the bottom of which is divided into compartments, a series of bars being so arranged that the coal is divided and exposed to the action of blasts issuing from a series of nozzles, and which can be regulated in force, whereby the coal is classified in the compartments of the case, the dust being carried off to a chamber at one side.

4791. Railways, &c., *J. Kenyon, Blackburn.—9th October*, 1883 6*d.*

This relates, First, to the nuts, bolts, and fish-plates for securing rails in position; and Secondly, to an improvement in the rails. The holes in the fish-plates are conical to receive a correspondingly shaped split nut, the elasticity of which will secure the same firmly in position. The rail is formed with holes or slots in the web at points where it rests on the chairs, whereby the elasticity of the rail is increased.

4793. Railway Safety and Signal Systems, &c., *P. M. Justice, London.—9th October*, 1883.—(*A communication from C. Catala, Belgium.*) 6*d.*

This relates to mechanism under the control of the signalman, which when in the danger position will come in contact with a lever projecting from a passing train, and cause the same to apply the brakes to such train.

4794. Rotary Stands for Exhibiting Photographs, &c., *A. M. Clark, London.—9th October*, 1883.—(*A communication from C. A. Schmidt, New York.*) 6*d.*

Consists in a rotary sample stand, of the combination with a vertical spindle or stand, of a rotary frame provided with wings, and of a spring device for holding the said wings open so that the samples thereon can be seen.

4795. Fire-escapes, *A. M. Clark, London.—9th October*, 1883.—(*A communication from J. Zerr, Keokuk, U.S.*) 6*d.*

This relates to the combination with ladders of belts and ropes, by which persons can be lowered from burning buildings.

4796. Bottle-washing Machines, *A. M. Clark, London.—9th October*, 1883.—(*A communication from W. Cowles, New York.*) 6*d.*

A brush is formed of a metal tube, slit at the end, so as to form outwardly curved strips of various lengths. The tubular jar is fixed in a socket carried by a tubular spindle or water feed tube, which is situated within an outer tube capable of sliding thereon, and provided with hooked spring prongs, to engage the rim of the bottle mouth.

4798. Sewing Machines, &c., *L. A. Groth, London.—9th October*, 1883.—(*A communication from G. Fraenkal, Germany.*)—(*Not proceeded with.*) 2*d.*

This relates particularly to machines for sewing boots and shoes; one improvement relating to means whereby the channel made to receive the stitches is closed as the seam is being made. An adhesive material is delivered behind each stitch of the seam before the seam is covered. Various other improvements are described.

4799. Harvesting Machines, *B. Samuelson, Banbury.—9th October*, 1883.—(*A communication from the Marsh Harvester Company, Sycamore, U.S.*) 6*d.*

This relates to machines in which the crop after having been cut falls on to a platform to the rear of the cutting device, whence it is removed to a binding device, and it consists of the combination with a stationary, lateral, and preferably somewhat inclined, and recessed platform, of an apron or belts, or links mounted on top and bottom rollers which are at right angles to the cutter bar, and one or more of them being driven by gearing from the main driving wheel. These rollers give motion to the apron and cause the lower part to remove the crop from the inner side of the rearward platform to the lower platform.

4800. Electro-magnets, *J. H. Johnson, London.—9th October*, 1883.—(*A communication from E. F. Recordon, Geneva.*) 6*d.*

An electro-magnet is composed of an iron tube, or a number of such tubes, forming the core, and provided at each end with iron cheek plates, formed with flat surfaces. The coil of insulated wire is formed in the usual manner.

4807. Railways, *G. J. Harcourt, Clifton.—9th October*, 1883.—(*Not proceeded with.*) 2*d.*

A double chair is used to fasten the rail to the sleepers, and a connecting bolt runs through both parts of the chair and through the rail. Each chair is extended on one side so as to overlap the other part, and at the extremity a fastening is provided which, in conjunction with another fastening at the other other end of the base, fastens the chair to the sleeper.

4808. Venetian Blinds, *A. J. Boult, London.—9th October*, 1883.—(*A communication from J. B. Querre, France.*)—(*Not proceeded with.*) 2*d.*

This consists in the employment of chains passing over pulleys and provided with counterweights, the object being to facilitate the raising and lowering of Venetian blinds.

4809. Hydraulic Steering Apparatus for Vessels, *D. P. Dey, Brooklyn, U.S., and G. M. Hathaway, New York.—9th October*, 1883. 6*d.*

The object is to provide means for steering vessels in case the rudder has been carried away or is inoperative, and for turning boats under other conditions, and it consists essentially in the use of pipes open at their outer ends and capable of being revolved so as to direct their open ends in any desired direction, when by causing a current of water, air, or steam to issue therefrom, the vessel to which they are applied may be steered as required.

4814. Picking Motion for Looms, *J. Richardson and J. Robinson, near Bolton.—10th October*, 1883. 4*d.*

The picking shaft is fitted in brackets on the frame and has a tongue which is acted upon by a striker on the fly-wheel, so as to actuate the picking stick. The picking shaft has a second tongue parallel with the former, and a tappet on the weft motion shaft acts upon this tongue at every second revolution of the crank-shaft, whereby the picking shaft is partly turned and the first tongue moved out of the path of the striker on the fly-wheel, which is thus only allowed to act on the picking shaft at every other revolution.

4815. Electric Arc Lamps, *H. W. Pendred, Freshford, Kilkenny.—10th October*, 1883.—(*Not proceeded with.*) 2*d.*

The descent of the upper carbon is controlled by a train of wheels and a brake. The train is mounted in a cage actuated by a solenoid placed in the lamp circuit. On the completion of the circuit the cage is raised, and with it the upper carbon.

4820. Steam Boilers, *H. Turner, Upton, Chester.—10th October*, 1883.—(*Not proceeded with.*) 2*d.*

This consists in constructing vertical boilers with four or more distinct chambers, the lower one forming the furnace, and the two above it, which are placed one immediately above the other, are the fire or flame boxes, and the fourth forms the water and steam space.

4821. Railway Brakes, *F. C. Glaser, Germany.—10th October*, 1883.—(*A communication from A. Bolzano, Germany.*) 6*d.*

The object is to improve the construction of automatic lever brakes for railway carriages, whereby the ordinary brake levers and rods are dispensed with, and the brake apparatus is rendered independent of the oscillating framing of the carriage, the ordinary brake shafts and levers being replaced by an arrangement of toggle links and elbow levers, enabling the brakes to be worked by hand from any desired part of the train by means of a cord or rope.

4822. Manufacture of Strainer Plates for Straining Pulp, *G. Tidcombe, jun., Watford.—10th October*, 1883. 6*d.*

This consists in forming the plates in two parts, one being a plate cast with cells or grooves in its underside, and over which plate a second non-oxidisable plate, such as rolled sheet brass, is secured, and slits formed therein corresponding with the grooves in the underplates by means of circular saws. The wearing surface may be produced by electro-deposition.

4825. Attaching Door Knobs to their Spindles, *G. W. Davis, Birmingham.—10th October*, 1883.—(*Not proceeded with.*) 2*d.*

One knob is secured to a square spindle, the opposite end of which is made circular and screw-threaded. A slot is formed through the round end, and when the second knob is screwed on this end a screw pin is passed through its neck and the slot in the spindle, and engages a hole in the opposite side of the neck.

4827. RAILWAY BRAKES, *F. R. Ellis, Liverpool.—10th October*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to improvements on patent No. 622, A.D. 1879, in which the power is applied by the extension of volute springs, and by compression of these springs the brake is withdrawn. The power for acting upon a piston by which the springs are compressed is that of a vacuum or of compressed air. The present invention consists in substituting spiral springs for the volute springs referred to.

4828. MACHINES FOR CLEANING AND PREPARING COTTON AND OTHER FIBRE, *J. Elce, Manchester.—10th October*, 1883. 6*d.*

This invention is particularly applicable to machines for cleaning and preparing cotton, known as "exhaust openers," and it consists in connecting the exhaust fan directly to the mouth of the feed port by a short, straight pipe fitted to the fan casing and to the mouth of the port at the other end. Another part consists in dispensing with both the exhaust fan and beater, and making an expanding mouth the full width of the beater cages to the feed port, and if necessary increasing the power of the fan which exhausts the air from the cages. A third feature consists in making the beaters of the feeding machine also act as fans by attaching blades to the arms of the beaters which drive the cotton forward.

4833. HAMMOCK-CHAIRS, *C. Pieper, Germany.—11th October*, 1883.—(*A communication from E. Meyer, Germany.*) 6*d.*

This consists in the use of axles fitted with ratchet and pawl arrangement to stretch the hammock on the chair frame as desired, and also in a leg support attachment for hammock chairs.

4834. PACKING FOR THE GLANDS OF STEAM ENGINES, &c., *E. Turner, Bristol.—11th October*, 1883. 2*d.*

This consists in combining Linden fibre with hemp, flax, or jute, and using same to form the core of packing for glands, which is afterwards braided with yarns of flax or other fibre.

4837. SPECTACLES, &c., *W. Vale, Birmingham.—11th October*, 1883. 6*d.*

Consists in combining with the spectacles a hood or screen.

4338. PISTON RINGS, *J. Kerfoot, London.—11th October*, 1883. 6*d.*

Consists in the combination of certain alternative forms of segmental packing rings, with spiral springs inserted between the butt thereof, and in an automatic adjustment, through the piston junk or cover, being provided if required.

4340. BRIDLE BITS AND REINS, *J. C. Mewburn, London.—11th October*, 1883.—(*A communication from A. Haury, H. Rouvreau, and P. Guerineau, Paris.*) 6*d.*

Consists particularly in the employment in connection with the bit of frames or rings carrying pulleys, and of a special arrangement of reins for the purpose of enabling the driver or rider to more easily control and stop the horse.

4341. SCREW PRESS APPLICABLE FOR PRESSING GRAPES, &c., *H. J. Haddan, London.—11th October*, 1883.—(*A communication from D. Lille, Troucens, France.*)—(*Not proceeded with.*) 2*d.*

The press chiefly comprises a press-screw, on which is mounted a nut which, when screwed down along the screw, pushes the press block downward.

4342. MONEY TILLS, &c., *H. A. Costerton, Brighton.—11th October*, 1883. 8*d.*

Relates to the means for recording the amounts placed in the till.

4844. PURIFYING LIGHTING GAS, *W. E. Gedge, London. 11th October*, 1883.—(*A communication from J. E. A. Servel, St. Etienne.*) 6*d.*

Consists, First, in the circulation of the purifying liquid moved by the lighting gas itself, which exposes each of the molecules of this liquid to a chemical action favourable to the purification of this gas; Secondly, the regeneration of the gas water by quick caustic lime plunged into a vat, termed reservoir, communicating with the vat or vats, termed of purification, in such wise that the liquid is regenerated in a constant manner in its circulatory movement; Thirdly, the arrangement of the purifying vat with a bell or receiver, and that of the reservoir vat with shelves or stages carrying bags of lime.

4846. FITTINGS FOR ORDNANCE, TO SUIT THEM FOR DRILL AND PRACTICE WITH MINIATURE PROJECTILES, *R. Morris, London.—11th October*, 1883. 6*d.*

Relates to means of fitting small barrels into guns of larger calibre, and operating with them so that small projectiles can be fired over moderate ranges, and yet the drill and practice with the guns can be the same as when they are used for projectiles of full size.

4848. MANUFACTURE OF COLOURED GRAINED LEATHER, *F. Wirth, Frankfort.—11th October*, 1883.—(*A communication from Messrs. Hausmann Brothers, Homburg vor der Höhe.*)—(*Not proceeded with.*) 2*d.*

The hides, which are first properly tanned in the ordinary manner, are grounded with some bright colour, and are stretched and dried by any suitable means. The skin is now bleached before or after graining. Upon the leather thus prepared is laid, in a heated state, some dark colour, in such a manner as to cover the grain only, and leave the ground bright. When the covering colour has dried into the leather, the latter is moistened in the usual manner, and again beaten out, whipped up, or grained and finished off.

4849. CONTROLLING THE SUPPLY OF GAS TO RAILWAY CARRIAGE AND OTHER LAMPS OR BURNERS, *W. R. Lake, London.—11th October*, 1883.—(*A communication from M. L. Gaillard, Paris.*)—(*Not proceeded with.*) 2*d.*

Relates to a method of controlling the supply of gas to railway carriage and other lamps or burners by means of screens or shades employed with said lamps or burners.

4851. EXTRACTION OF THE PRECIOUS METALS FROM THEIR ORES AND FROM METALLURGICAL COMPOUNDS OR PRODUCTS CONTAINING THE SAME, *A. P. Price, London.—11th October*, 1883. 4*d.*

Relates to the general treatment of the ores.

4853. SOLIDIFYING LIQUID ACIDS, *C. Pieper, Berlin.—12th October*, 1883.—(*A communication from the firm of Vorster und Grüneberg, Cologne.*) 2*d.*

Consists in intimately mixing the acids with finely divided solid materials which are not affected by the same so as to form therewith a powdery mass or a thick paste.

4854. GRINDING AND POLISHING MACHINES, *H. Sackur, Berlin.—12th October*, 1883. 6*d.*

Relates to the combination with a rotating disc of a work table consisting of three superposed parts, movable in respect to each other, and mechanisms for imparting to the parts of the table such motion as that the upper part or slide will be moved horizontally in two different directions, and for adjusting the table in vertical direction.

4855. PENHOLDERS, *J. M. Spink, London.—12th October*, 1883.—(*Not proceeded with.*) 2*d.*

Relates to a cover to place over the nib when not in use.

4857. ENEMAS, CATHETERS, &c., *C. H. Butlin, Camborne.—12th October*, 1883. 6*d.*

The object is to so construct the nozzle parts of enemas, catheters, or like instruments for making surgical injections that a retention of the fluid of injection is obtained.

4861. GALVANISING WIRES BY GALVANO-PLASTIC PROCESS, *L. A. Groth, London.—12th October*, 1883.—(*A communication from E. Dentgen, Düren, Germany.*)—(*Not proceeded with.*) 2*d.*

The ordinary molten metal bath is replaced by an electro-deposition bath, through which the wire is continuously drawn.

4863. INTERNAL STOPPERS FOR BOTTLES CONTAINING AERATED OR GASEOUS LIQUIDS, *L. Vallet, Liverpool.—12th October*, 1883. 6*d.*

Consists partly in forming a knob, or button, or recess on, or in the base of the stopper, whereby the stopper can be grasped by a plier, or like-acting tool, and extracted from the bottle without removing the washer.

4864. VICES, &c., *J. Heap, Ashton-under-Lyne.—12th October*, 1883.—(*Not proceeded with.*) 2*d.*

Relates partly to constructing vices and chucks with jaws, which can be set out of the parallel, so as to grasp work of the taper or irregular formation.

4865. COUPLING SHAFTING, &c., *A. Muir, Manchester.—12th October*, 1883. 6*d.*

The objects are, First, to couple solid or tubular shafting without any projection, and without necessarily increasing the diameter of the shafts where coupled; to make the leading screws of lathes or other long screws or shafts of machine tools, cranes, and the like, in two or more pieces, connected by the improved coupling.

4871. PRODUCTION OF AMMONIA AND ITS COMPOUNDS DURING THE PROCESS OF MAKING COKE OR GAS, *H. Simon and W. Smith, Manchester.—13th October*, 1883. 4*d.*

Consists in the simultaneous introduction, at high temperatures, of aqueous vapour or steam and of hydrocarbons in the crude forms, or the vapours thereof among the fuel-contained gas retorts, coke ovens, or gas producers that are provided with apparatus for collecting and condensing the by-products, whereby an increased yield of the nitrogen of the fuel in the shape of ammonia and ammoniacal compounds is obtained.

4876. KILNS FOR BURNING LIMESTONE, *J. Briggs, Buxton.—13th October*, 1883. 6*d.*

Consists in the construction and arrangement of the kiln whereby the inventor is enabled to use the latent heat of the burning lime after passing the calcination point, to heat retorts charged with coal, Cannel, burgy, or slack, and to utilise the gas evolved from the latter as fuel to effect the calcination of the lime.

4877. COOKING APPARATUS FOR MILITARY PURPOSES, &c., *J. C. Baxter, Reigate.—13th October*, 1883. 6*d.*

Consists of a number of superimposed and interchangeable vessels, each of which is constructed with an internal space or passage which forms, when the apparatus is built up, and at the same time, a combustion chamber and a flue, the uppermost of said vessels being surmounted by a kettle or pot, which may act as a damper for regulating the draught through the apparatus.

4878. STEAM ENGINES WITH OSCILLATING CYLINDERS, *C. Jacobsen, Stockholm.—13th October*, 1883. 8*d.*

The object is the application of curved valve faces of the slide valves and the means for tightening the same.

4880. TELEPHONIC APPARATUS, *G. L. Anders, London.—13th October*, 1883. 6*d.*

To obviate the necessity of using a permanent magnet as part of the receiving instrument in cases where the transmitting microphone is not connected in the main-line circuit, two electro-magnetic receivers are so connected with two batteries and the line that all main-line currents shall pass through them.

4883. TRANSCRIBING MARKS, WRITINGS, CHARACTERS, CODE SIGNALS AND THE LIKE FROM STATION TO STATION DISTANT FROM EACH OTHER, *M. T. Neale, London.—13th October*, 1883.—(*Not proceeded with.*) 2*d.*

Relates to improvements on patent No. 985, dated 23rd February, 1883, and consists in alterations whereby the inventor is enabled to dispense with one of the vessels, and its connecting tube and also its plunger or piston, and the connection of its arm with the stylus or other marking appliance, and uses one vessel and its appendages only at each station, so that the code, mark, writing, or other indication can be transmitted and transcribed from one to the other or others from and to the several apparatus in connection by or through one main tube connecting the water or other fluid or liquid.

4885. DYNAMO-ELECTRIC MACHINES, *C. H. Benton, London.—13th October*, 1883. 6*d.*

The cores of the field magnets consist of a number of bars fixed to pole pieces, and having cast upon them end pieces. The armature coil is composed of copper plates tapered in section, and having a hole in the centre to fit over the soft iron core. A division extending from the hole to one end of the plate permits of their being connected together so as to form a zig-zag circuit. The soft iron core may be in the form of a drum made of rings of trough section, insulated from each other and fastened together, iron wire gauze ribbon being wound edgewise in the troughs and having the meshes filled up with iron filings.

4886. CONVERTING FURNACES, *W. R. Lake, London.—13th October*, 1883.—(*A communication from P. Manhès, Lyon.*) 6*d.*

Consists of a Bessemer converter or similar furnace provided with tuyeres or air passages arranged above the space to be occupied by the metal, and in combination with an air belt provided with orifices opposite the tuyeres.

4887. TORPEDOES, *T. Nordenfelt, London.—13th October*, 1883. 6*d.*

Consists in a locomotive torpedo or subaqueous vessel having a body lighter than water, and loaded with a fin, itself adapted to maintain an upright position.

4889. PUMPS, *W. Cowley, Liverpool.—13th October*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to construct a pump which combines accessibility of parts, and is adaptable to be used either as a lift pump or as a force pump.

4890. BOILING PANS AND FEED OF SIZING MACHINES, *W. Briggs and R. Taylor, Darwen.—13th October*, 1883. 6*d.*

The object is to place the valve through which size enters the boiling pan on the outside of the pan, and to connect this valve and the valve which admits size from the boiling pan to the sizing trough, to the float in the sizing trough, in such manner that the action of the valves is simultaneous, and a nearly constant level of size is maintained automatically in the boiling pan and sizing trough.

4892. DISINFECTING CLOTHES, &c., *O. Schimmell, Chemnitz.—13th October*, 1883.—(*Not proceeded with.*) 2*d.*

Relates to disinfecting by means of hot air and steam.

4893. FASTENINGS FOR SECURING INDIA-RUBBER FROGS TO THE LEATHER SOLES OF HORSESHOE PADS, APPLICABLE ALSO TO CLAMPING OR SECURING INDIA-RUBBER OR OTHER MOULDED ARTICLES TO OTHER MATERIALS, *R. Lewty, Manchester.—13th October*, 1883.—(*Not proceeded with.*) 2*d.*

Consists in the employment of screws.

4894. KILNS FOR BURNING LIME, &c., *S. De La G. Williams, Birmingham.—13th October*, 1883. 6*d.*

Consists in constructing a chamber or chambers or tunnels within the body of the kiln, in which chamber or chambers or tunnels a mixture of gaseous fuel and atmospheric air is ignited, the flame of the said ignited mixture passing through perforations in the said chamber or chambers or tunnels, and thereby intensely heating the descending column of limestone, or other material to be operated upon, as it passes by the said chamber, or between the said chambers or tunnels.

4897. PACKING CASES, *D. Rylands, Barnsley.—13th October*, 1883.—(*A communication from I. B. Groot, Albany, U.S.*) 6*d.*

Consists in packing cases or boxes strengthened by grooving and hooping or wiring.

4899. FASTENING FOR THE ENDS OF MACHINE BANDS, *J. R. Gould, Birmingham.—13th October*, 1883.—(*Not proceeded with.*) 2*d.*

Relates to the employment of a hook-and-eye.

4911. ELASTIC RODS, "BONES," OR STIFFENING FILLINGS FOR CORSETS, WHIPS, AND OTHER ARTICLES OF WEAR AND USE, *A. M. Clark, London.—16th October*, 1883.—(*A communication from E. K. Warren, Michigan, U.S.*) 6*d.*

The stiffening filling is made from the stalks, stems, or quill portions of feathers, which are bound together by a wire or thread or by a woven external covering.

4912. PIPE WRENCHES, *A. M. Clark, London.—13th October*, 1883.—(*A communication from J. L. Taylor, Ishpening, U.S.*) 6*d.*

Relates to a wrench made with a fast head or jaw, having opposite serrated sides in combination with a concave swinging jaw, forked and serrated.

4972. FOOD FOR ANIMALS, GAME, &c., *E. Wylam, London.—18th October*, 1883. 2*d.*

This consists essentially in combining cod liver oil with ingredients suitable for forming food for animals, game, or poultry.

5002. EXHAUSTING THE AIR, GASES, AND WATER FROM SUCTION BOXES FOR PAPER-MAKING MACHINES, *H. J. Allison, London.—20th October*, 1883.—(*A communication from G. Lord, New York.*) 6*d.*

The object is to produce a more perfect vacuum when operating upon pulpy fluids, and it consists of a reservoir connected to a box filled with water, so as to seal the ends of the two tubes, the shorter of which is connected to the reservoir near the top by a pipe extending downwards in the reservoir, and also by a second pipe at a point below the lower end of the former, the latter pipe being fitted with a stop cock. The longer tube is connected near the top to the top of the shorter tube, and also to its top is connected a pipe extending down into the reservoir. A third pipe extends from the top of the longer tube to a separating chamber, from the side of which a pipe leads to a box with a perforated cover, over which passes the wire cloth carrying the pump. A pipe leads from the bottom of the separating chamber, its lower end being sealed in water.

5054. TRACTION ROPE TRAMWAYS, &c., *J. Y. Johnson, London.—24th October*, 1883.—(*A communication from A. Bonzano, Pennsylvania, U.S.*) 6*d.*

The principal object is to impart the necessary lateral strength to the upper portion of the conduit of traction rope tramways, and it consists in forming the conduit with a bottom plate and side plates, the upper portions of which converge, transverse beams being provided, and braces secured at their lower ends to the beams, and at their upper ends to the side plates above the points where they begin to converge.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

296,483. HYDRAULIC APPARATUS FOR REMOVING SAND BARS, &c., *Roy Stone, New York, N.Y.—Filed September 24th*, 1883.

Brief.—A plough is formed of a curved water pipe having two upwardly-directed jet nozzles, and a branch

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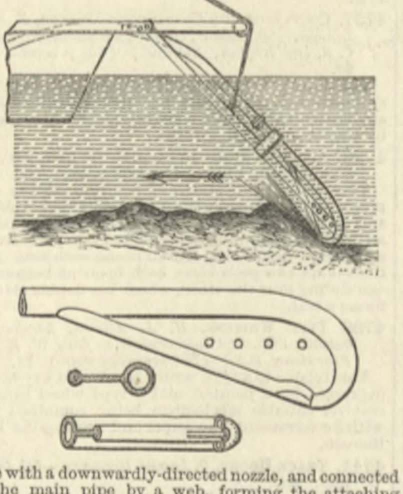

pipe with a downwardly-directed nozzle, and connected to the main pipe by a web, forming the attaching means to an inclined frame or drag.

296,658. COMBINED ANVIL, VICE, AND DRILL, *Jas. Weathers, Indianapolis, Ind.—Filed November 14th*, 1883.

Claim.—(1) In a combined anvil, vice, and drill, the anvil A, extended base B, perforated rib C, and standard D, which is provided with a female screw, all being cast in one piece, substantially as described. (2) The combination, with an anvil having the rib C and standard D, of the jaw K, the shaft E, and rod H, passing through the shaft, and connected to the jaw by the headed bolt J, passing through a hole in the same and fastened in the drill holder on the end of the

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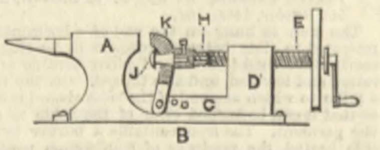

rod, all arranged to operate substantially as described. (3) The combination, with an anvil having the rib C and standard D, of the screw shaft E and rod H, which passes through it and carries the drill holder, all arranged as and for the purpose set forth. (4) The combination, with the anvil having the rib C and standard D, which carries the screw shaft E and drill rod H, of the removable bed I, adapted to fit against the back of the anvil, as and for the purpose set forth.

296,721. SELF-ADJUSTING FULCRUM LEVER WRENCH, *Benjamin F. Bennett, Lockport, N.Y.—Filed September 8th*, 1883.

Claim.—(1) In combination with the jaws of a wrench

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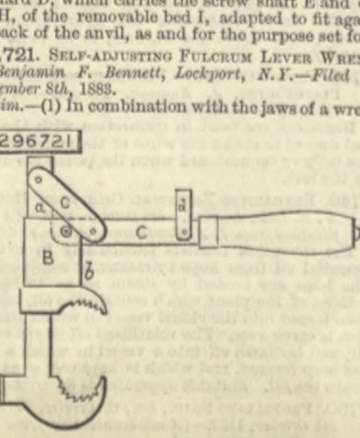

and a main bar *a*, the short or sliding bar *b*, having attached to its rear end the movable lever handle bar C, and with the fulcrum side braces *c*, all arranged and operating substantially as specified. (2) In a wrench, the combination of the jaws, long bar *a*, short movable bar *b*, with jointed handle bar C, plate B, metallic fulcrum side braces *c c*, and loop *d*, all arranged and operating substantially as specified.

296,681. ROCK DRILL, *George McC. Derby, Astoria, N.Y.—Filed June 20th*, 1883.

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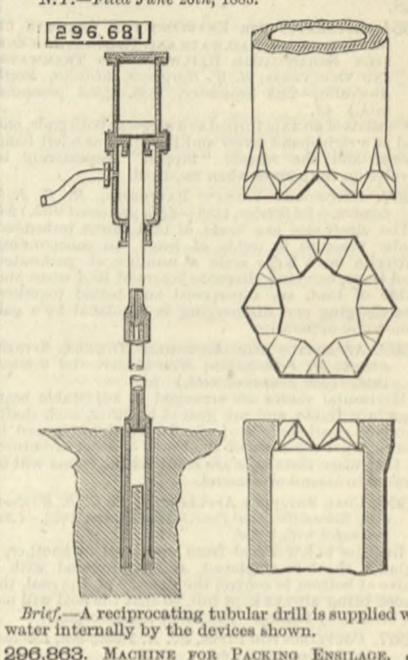

Brief.—A reciprocating tubular drill is supplied with water internally by the devices shown.

296,863. MACHINE FOR PACKING ENSILAGE, &c., *Louis McMurray, Baltimore, Md.—Filed February 28th*, 1884.

Claim.—(1) The combination, substantially as hereinbefore described, of the frame mounted upon a rotating supporting axle, the vertically reciprocating stamps, the tappet arm shaft, the hand crank, and gearing for connecting the hand crank to the tappet arm shaft and to the rotating supporting axle, whereby the machine is propelled and the stamps operated by power applied to the hand crank, as set forth. (2) The combination, substantially as hereinbefore described, of a frame mounted upon a rotating supporting axle, one or more vertically reciprocating stamps, a tappet arm shaft for lifting and dropping said stamps, and clutch gearing connecting said tappet arm shaft with the rotating supporting axle, and for disconnecting the same. (3) The combination

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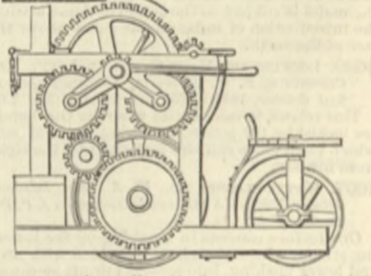

of the compressing roller, its frame, and the rotating supporting axle with gearing and a hand crank for propelling the roller, substantially as described. (4) The combination of the frame mounted upon a rotating axle, one or more vertically reciprocating stamps, a tappet arm shaft for operating said stamps, reversible clutch gearing for connecting and disconnecting said shaft and supporting axle, and a hand crank, substantially as described, whereby the machine can be propelled in either direction by the hand crank with or without simultaneously operating the stamps, or the stamps operated without propelling the machine, as set forth.

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