THE PRODUCTION OF IRON BY THE SIEMENS DIRECT PROCESS FROM MAGNETIC IRON SAND.

THE production of wrought iron and steel from ore direct, without the intervention of the blast furnace, is a subject constantly occupying the attention of many metallurgists. In the blast furnace two operations are accomplished. First, the removal of the solid impurities in the ore used, by fluxes, and in the form of slag. Secondly, the reduction of the oxide of iron it contains, by deoxidation, to the state of metallic iron. This combined operation with the common ores is very efficiently done in the blast furnace, but the resulting pig iron is somewhat impure, containing always a greater or less percentage both of carbon and silicon. For the production of wrought iron these substances have afterwards to be removed by the operation known as puddling, which consists of remelting the pig iron with fresh portions of oxide of iron, to oxidise and thus remove the carbon and silicon it contains. If, however, an ore of high percentage is taken, composed chiefly of oxide of iron, the production of metallic iron then consists almost entirely in the second process effected in the blast furnace; that is to say, the reduction of oxide of iron by deoxidation to metallic iron. This can be accomplished at a comparatively low temperature—about 800 Fah.—and a higher temperature is only necessary afterwards to melt and agglomerate the particles of metallic iron thus formed.

The method of reduction usually proposed in all direct processes is by the admixture of solid carbon, in the form of coal or charcoal, with the iron ore, both being brought into a fine state of division by grinding, in order to cause an intimate mixture of the particles, and thus facilitate the chemical action which takes place. Numerous processes and forms of apparatus have been proposed to effect this object, but the practical difficulties have been threefold. First, the difficulty of bringing the heat to bear on a powder, which, owing to the interstices between the particles, is always an exceedingly bad conductor of heat; secondly, the prevention of the particles of iron once formed being again reoxidised; and thirdly, the difficulty of getting rid of the solid impurities in the ore, which, when melted, form a highly acid slag, containing a very large percentage of iron.

One of the earliest attempts at the production of pure iron direct was by what is known as Blair's process, modifications of which have formed the basis of many subsequent attempts in the same direction. This process consisted of heating together a mixture of iron ore and charcoal, both finely powdered, in close retorts of peculiar construction. In this way the iron was reduced to a metallic state in the form of spongy iron, which was afterwards agglomerated in a melting furnace. The process, however, was abandoned, owing chiefly to the difficulty of the proper regulation of the heat, which was either not sufficient to penetrate to the interior of the retort, or so great as to cause a partial melting of the mixture near the sides, which was afterwards removed with difficulty. It was found also that unless the iron ore used was nearly pure, besides being free from phosphorus and sulphur, the loss of iron in the slag in melting was very great, and the quality of the iron itself was defective, being generally what is known as red short.

It occurred to Dr. Siemens that the chief difficulties in the direct process would be overcome by the use of a rotary furnace, which would accomplish the double object of thoroughly exposing the mixture of iron ore with coal or charcoal to the necessary heat by constantly turning it over, and also afterwards agglomerate the particles of metallic iron formed in the furnace, by rolling them together whilst in a pasty, half-melted state. In this way balls of metallic iron would be formed, in exactly the same way as the operation is done by hand in an ordinary puddling furnace. After many experiments this furnace, which has been previously noticed in our pages, has been brought to work practically on a large scale. The third difficulty, however, was still experienced; the necessity of having, if possible, a pure oxide of iron, which by reason of its containing no solid impurities would form no slag. Attention has lately been turned to the magnetic iron sand deposits which exist in some places on the sea coast in large quantities, especially in Canada on the banks of the St. Lawrence, though generally on the upper portions of the river, so mixed with ordinary sand as to be with difficulty separated from it. Lower down the river, however, the deposits are more extensive and purer. At Moisic, near the bay of Seven Islands, according to the Geological Report of Canada, there is a continuous broad belt of iron sand on the surface of the beach, some three miles long, and several feet deep, containing equal to 55 per cent. of metallic iron, with at the same time a total absence of phosphorus and sulphur.

The separation of these magnetic sands from all their impurities has been recently accomplished by a very ingenious invention of Mr. Edison. This machine is simply a hopper, fixed at an elevation, and so arranged as to allow the magnetic sand it contains, previously dried to prevent any cohesion of the particles, to fall from a long narrow opening at the bottom of it in a thin continuous stream. Electro magnets are placed at right angles to this stream, and so arranged as to simply deflect the grains of magnetic iron when falling, without allowing them to come in contact with the magnets. The magnetic iron thus falls into a receptacle at one side, whilst the impurities, consisting of sand, titaniferous iron, &c., fall in a direct line, and are thus separated. So complete is the arrangement that a single separator, requiring only a 3-horse power engine to elevate to the hopper and drive the dynamo necessary to supply the magnetic current, will pass through 70 tons a day of sand, giving a product, when fairly pure magnetic sand is operated upon, containing only about 2 per cent. of impurity. If passed through a second time, an almost pure magnetic oxide is the result—that is to say, an article containing 72 parts of metallic iron, combined with 28 parts of oxygen. Some of this separated magnetic iron ore, containing about 2 per cent. of impurity, has recently been worked in the Siemens rotary furnace, at the works of the Landore Siemens Steel Company, with the following results:—After a few trial charges, to ascertain the best mixture and most suitable temperature for working this material in the rotator, it appeared that a charge of 25 cwt. of magnetic iron sand, mixed with 6 cwt. of small coal, or charcoal, gave the best results. The whole time required for the operation, from first charging the furnace to withdrawal of the rough puddled balls, was on an average 3 hours 45 minutes. The yield, in the case of the small coal charges, was about 18 cwt. of rough balls; in the case of charcoal charges somewhat less, or about 16 cwt. The difference in weight may probably to some extent be accounted for by the impurities in the coal, and less perfect decomposition, as compared with the charges made with charcoal. The finished charges usually came out in the form of six or seven balls, some of them weighing over 3 cwt. They were mostly at once thrown, whilst red-hot, into the Siemens-Martin steel furnaces, and used for making mild steel, for which purpose they were found to be very suitable, and gave excellent results. One of the balls, however, from a charge made with coal, was roughly hammered into a billet, which on analysis gave:—Metallic iron, 96·95; slag, 3·04; phosphorus, ·002; sulphur, ·03; carbonaceous matter, ·17; manganese, trace. Probably the small quantity of phosphorus and sulphur contained in this sample was combined with the slag, and would be got rid of by reworking the billet in the usual manner. One of the billets from a charge made with charcoal was afterwards reheated, and simply rolled into a finished bar, without piling and reheating again as usually done. The bar thus obtained was of very fine quality of iron. Upon testing, the tensile strain was found to be 21·5 tons per square inch, with 23 per cent. of elongation.

From these statistics it would appear that when working upon pure magnetic iron sand, each of Dr. Siemen's rotary furnaces would produce six charges daily, with a produce of five tons per day of rough puddled bars, or say about thirty tons per week of shingled blooms. The fuel used in the gas generator for heating the furnace comes to as nearly as possible one ton of coal per ton of puddled balls made; and the wages, when working the rotators in pairs, with proper mechanical elevators for charging, would be about six shillings per ton of rough puddled balls produced. It seems probable, from these experiments, that the manufacture of fine qualities of iron and steel will before long be carried out on a large scale in the Siemens rotator, and that pure magnetic iron sand will considerably assist in its economical production. The reduction of magnetic oxide of iron to metallic iron is accomplished more easily, and at a lower temperature than sesquioxide of iron. Owing also to the fact of the magnetic oxide containing less oxygen than the sesquioxide, it requires less coal or charcoal in the process of reduction to metallic iron.

THE ENGINEERING AND METAL TRADES EXHIBITION.

No. I.

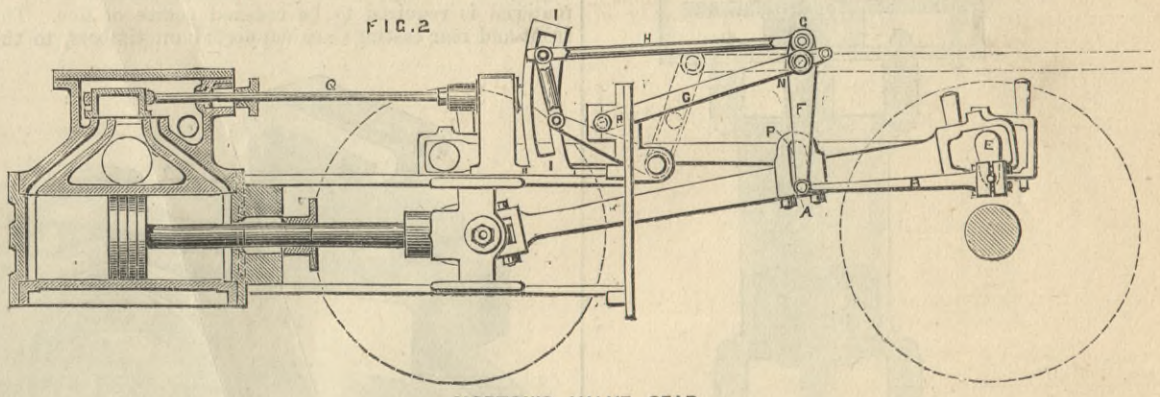
THIS Exhibition opened to the public on Thursday. We have referred to its general character elsewhere. Amongst the principal exhibitors are the firm of Sir Joseph Whitworth and Co., Limited, who show a great number of objects made of fluid-pressed steel, afterwards forged to the required shape by hydraulic pressure. Among them is a hollow propeller shaft, 55ft. long, weighing 15½ tons, which is stated to be 28 per cent. lighter and 30 per cent. stronger than it would be if made of solid wrought iron. This is a fine piece of work, but we question the advisability of making a screw shaft of such great length, not only on account of the difficulty in handling it, but on account of the great cost of renewal compared with what it would be if two or three separate lengths were used instead. It is well known that Sir Joseph Whitworth and Co. have given great attention to the production of hollow shafts, a form of which they are strong advocates, and for which they claim considerable advantage, inasmuch as it enables the forging to be more thoroughly done, gives more elasticity, and is more trustworthy when subjected to sudden stresses. The same principle is applied to crank shafts, a large example of which is shown, the crank pin portion being hollow, as well as the main body of the shaft. Fluid-pressed steel has also been recently introduced for the liners of large marine engine cylinders, a hoop being first made, and then enlarged to the required size by forging. A cylinder liner, 81in. diameter and 59in. long, made in this manner, is exhibited. There is also a steel air vessel 14in. diameter, as used by the Government for storing the compressed air for the Whitehead torpedoes, a number of various pieces of guns and projectiles, and a large assortment of surface plates and standard gauges and measures, for which the firm is so famous.

The Leeds Forge Company, who at all recent exhibitions have been conspicuous for their large and interesting displays, are again present, this time with a novelty in the shape of a large single-front marine boiler—one of eight being made for the Royal Mail steamship Moselle—which is fitted up inside as a miniature boudoir, and lighted with incandescent lamps supplied with electricity from batteries. This boiler has two mild steel Fox's patent corrugated furnace flues, 3ft. 7½in. diameter, the corrugations being rolled at one heat in Fox's corrugating mill. The end plates are each in three pieces ¾in. thick, and flanged round the outside to a depth of 8¼in., for the attachment to shell plates. The holes in the bottom front plates, into which the corrugated flues are fitted, are flanged to a depth of 3¾in. Reversed flanged plates, with short return tubes, are attached to the back end of the flues. A second plate flanged all round forms the back of the fire-box or combustion chamber, and this is curved to meet the top flange of tube plate, thus avoiding a seam of rivets in the crown of the combustion chamber, and by its form offering greater resistance to collapsing. The shell is made of mild steel plates $\frac{15}{16}$in. thick, in three rings, each of three plates. The whole of the material is Leeds Forge "Special" mild steel, and the workmanship is excellent throughout. Fox's patent corrugated flues are shown in great variety of form, but are so well known and so widely used as to need no further comment. As an instance of their comparative safety when overheated from shortness of water, a furnace cut from one of the boilers of the Assyrian Monarch is exhibited. In this case the furnace became red hot and gradually came down in two pockets, drawing out the corrugations until the plate was straight. It then quietly tore open and relieved the boiler without injury to anyone. A case of samples of Leeds Forge "Special" mild steel for boilers and "Special" steel for furnaces is interesting. These plates have been carefully tested, and show a resistance of about 24 tons per square inch for the last-named quality, with an elongation of from 3in. to 3¾in. in a length of 10in. There are six samples cut from the welded portion of six different furnaces, three having been welded by Fox's machine heated by ordinary coal gas, and three in the usual way in a coke fire; the former on being tested were found to have a resistance within 6 per cent. of that of the original plate, while in the latter the strength was only 35 per cent.

Messrs. John Fowler and Co., of Leeds, show samples of Greig's patent portable railway, which is extensively used both in this country and abroad for a great variety of purposes in which a permanent way would be inadmissible. In this railway the rails are rigidly secured to metallic sleepers, the jointing being effected by steel chairs rivetted to the sleepers and by clutch bolts of peculiar form, so avoiding the drilling and punching of the rails and the use of loose fish-plates and bolts. In this way accuracy of gauge is ensured at all points without adjustment, and this accuracy is maintained so long as the line remains in use, while great facilities are afforded for expeditiously laying the line without having to rely on skilled labour. The system may be advantageously applied for clearing hay in irrigated meadows, thus preventing the destructive action of the wheels of heavily-loaded carts, and it is extensively used by planters in cotton and sugar plantations, in diamond fields, and in mining districts and collieries, where its portability and easy adaptation to every description of traffic has been much appreciated. Special wagons have been designed for use with this railway, for conveying sugar-cane, Indian wheat, cotton, and other similar crops, to the mill; and various forms of these are exhibited. Some of the wagons are almost entirely composed of iron and steel, combining lightness and strength, and these may be used for carrying materials which are destructive to timber. There is also a portable turntable, 3ft. 6in. diameter, and a narrow-gauge second-class passenger car, to carry ten persons, on four wheels, with a driver's platform at each end, which is intended for the use of colonists, planters, and employers, for providing easy means of communication between villages and outlying stations in a colony, or for facilitating the carrying on of industrial operations.

Messrs. W. B. Dick and Co., of Leadenhall-street, exhibit a locomotive for the 2ft. 6in. gauge, intended for Burmah. This engine has 6in. cylinders, 12in. stroke, and a saddle tank. It has four coupled wheels and a pair of trailing wheels. It weighs empty 5½ tons. The most noteworthy feature about it is the valve gear, which we illustrate. It will be seen that it closely resembles Joy's, a swinging link taking the place of the curved incline. It would be very difficult to make the action of this gear intelligible by a description. The radiating crank P is fitted into a projection on the connecting rod at a point about two-thirds from the crosshead centre, and the movable point A is actuated by an overhung crank, E, on the main crank pin of the engine. The quadrant I forms part of the slide valve rod Q, the link or links C vibrating from a fixed centre, and as the die is raised or lowered in the quadrant the engine goes forward or backward. Messrs. Dick exhibit a large sectional working model, which illustrates the action of the gear very clearly.

FIG. 2

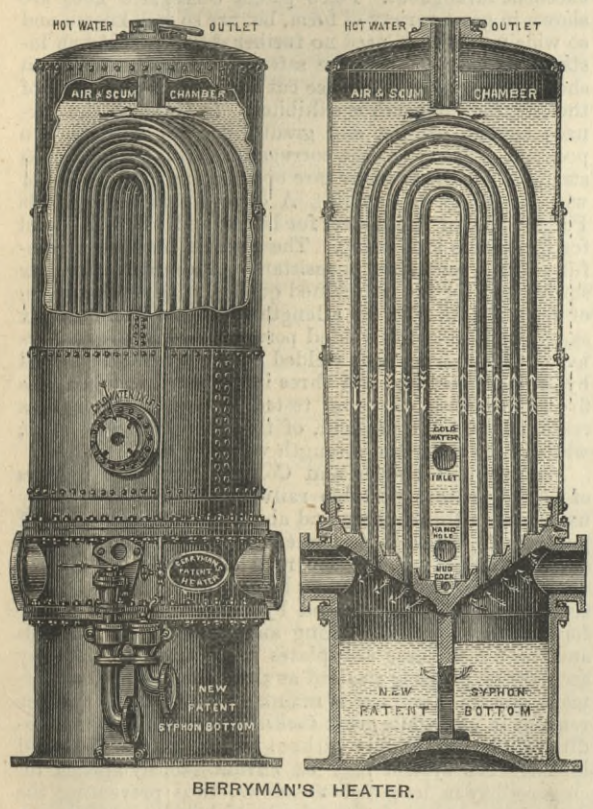


MORTON'S VALVE GEAR.

New designs of vertical and horizontal steam engines are

shown by Mr. A. W. Harrison, of Abergavenny. These engines have cylinders oscillating on trunnions, and the piston-rod being connected directly on to the crank, compactness is secured, and the connecting-rod with its cross-head and motion bars dispensed with. The slide valve works in the same manner as in an ordinary engine, but instead of being enclosed in a chest it slides between the cylinder and steam chest, and can be seen at work, the advantage claimed being the reduction of a considerable amount of friction by lessening the area upon which the steam pressure acts. Another feature is the arrangement by which the valve can be taken out for examination or repairs by merely slackening one nut about a turn, instead of having to break joint and take off a cover. The engines are made in all forms—vertical and horizontal, fixed on boilers, and separate—and are stated have given great satisfaction. We hope to illustrate a launch engine on this principle shortly.

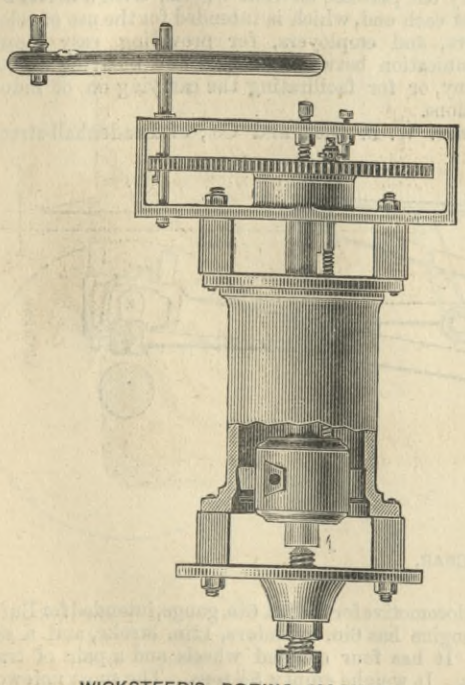
Messrs. Joseph Wright and Co., Tipton, show the Berryman feed-water heater and the Berryman condenser. Though no doubt familiar to most of our readers, we illustrate the feed-water heater below, the engraving showing one of a set supplied to the Monkbridge



BERRYMAN'S HEATER.

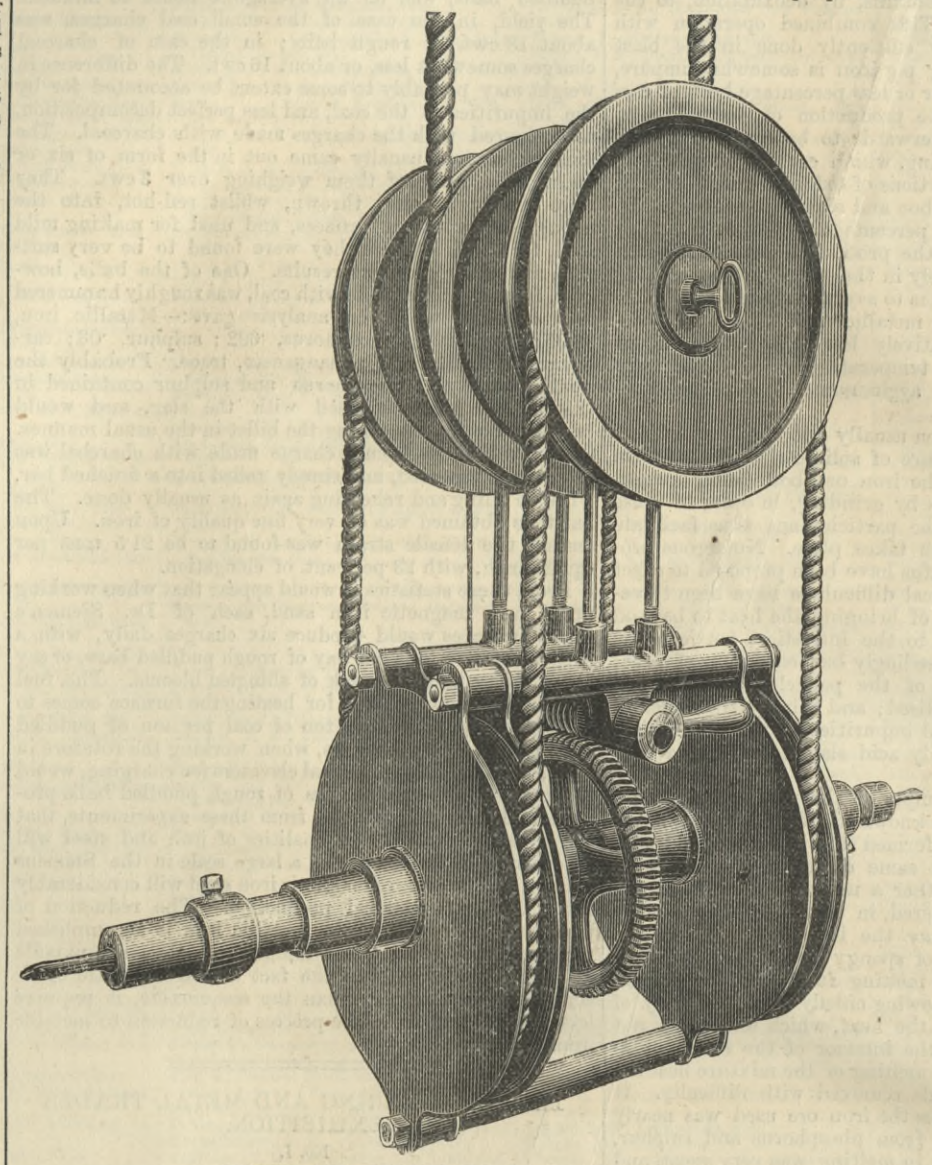
Iron Company. In this case Messrs. Wright guaranteed a saving of 5000 tons of coal per annum, a result which was found to be fully realised after nine months' working. The new patent syphon bottom, in conjunction with other improvements, is a great addition to former patents. Among other advantages it improves the appearance of the heater, and saves a costly foundation, and no pipes are required beneath the floor level for carrying off the condensed steam water.

Messrs. James Gibbs and Co., London, in addition to their specialities in gun-metal engine and boiler fittings, show two new and useful tools, viz., Wicksteed's cylinder boring machine and Wicksteed's tube stretcher. The



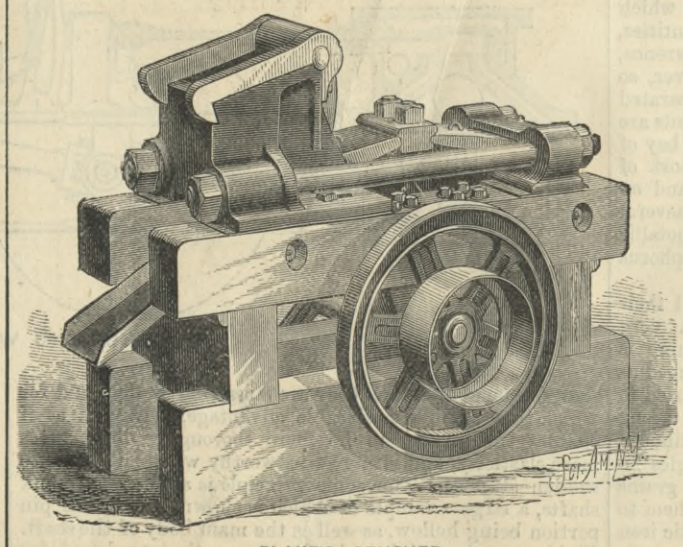
WICKSTEED'S BORING MACHINE.

former tool has been designed for re-boring out the cylinders of engines in their places, in order to avoid the trouble and expense of removal to an engineer's shop, and as will be seen from the illustration, the principal feature about it is the method of attachment, which is so arranged as to suit different sizes of cylinders without any special preparation. As this tool can be applied in less time than it would take to set the cylinder in a lathe, it should meet with a good reception at the hands of engineering firms who make a speciality of repairing work, and should also prove of service to other users of steam engines who, owing to the trouble of having the cylinders bored out in place, often prefer to incur the loss of fuel resulting from the waste of steam in a worn cylinder rather than the loss of time and expense attendant in taking it off and sending to the works to be re-bored. The tube stretching apparatus consists of a screw, which is put through the tube to be stretched and attached to each end by malleable iron clasps, which hold the tube absolutely tight without injury. It is then put into the fire and heated, the screw being turned until the required length is obtained. The tube is stretched without injury, and it is done in a quarter the time required by the old method, without any hammering.



HOLDEN AND BROOK'S BOILER DRILLING MACHINE.

Messrs. Lewis Olrick and Co., Leadenhall-street, E.C., exhibit several of Mather and Platt's specialities, such as small engines, pistons, and boring tools, all of which are well known and need no description. They also have one of the latest improved Blake's crushers, in which all tensile strains are taken on wrought iron and steel instead of cast iron. A perspective view of this machine is given below, and the construction will be readily understood. The movable jaw is suspended in a three-sided framework of cast iron with a broad base, forming the front part of the machine in which the material is crushed. The back piece or toggle block is also of cast iron, and is connected by two strong wrought iron or steel tie-bolts to the part in front, the tie-bolts also serving as regulators to adjust the jaw opening according as the material is required to be crushed coarse or fine. The front and rear castings are supported on timbers, to the

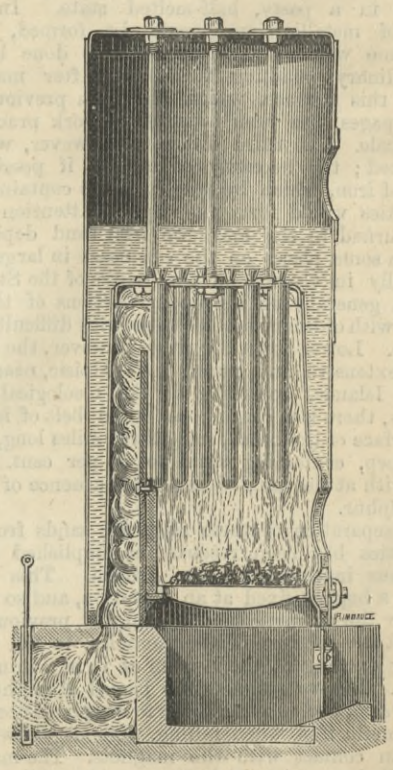


BLAKE'S CRUSHER.

underside of which are bolted the boxes carrying the main excentric shaft. This breaker can be run at a higher rate of speed than the old form of crusher with cast iron frames, and will consequently do a greater amount of work. Messrs. Olrick also show a Field boiler of 25-horse power—one of three built for the Edison Electric Light Company. We illustrate this in section in next column, and it will be seen that instead of the products of combustion escaping direct to the chimney through an uptake above the fire-box, they are turned down over the top of a plate placed in the fire-box and delivered into a flue at ground level. During a two days' trial with a boiler of this construction an average evaporation of 10·93 lb. of water from and at 212 deg. Fah. was, we are told, obtained per pound of coal, with ordinary stoking.

An ingeniously simple form of boiler shell drilling machine is exhibited by Messrs. Holden and Brooke, of Salford, Manchester, and is illustrated by the annexed engraving, as made under Mr. Borland's patent. Hitherto machines for the purpose have been rather costly, but that we illustrate has been designed to work inside a boiler shell and to drill the two holes at the opposite ends of a diameter at the same time, and thus requires no heavy framing, the boiler forming the abutment to drill against. The two drill spindles rotate in opposite directions, in order that drills ground the same way will do for either spindle. The machine is driven by means of a rope running overhead with slack or compensating weight and slide, so that the machine remains in any position in which it is placed. The machine is simply suspended by the driving rope, and one rope from the driver spindle passes round and drives the two drill pulleys. The tightness of this rope may be either that due to the weight of the lower part of the machine, or some pull may be put upon it and maintained by the vertical rods which carry the countershaft bearings. There is no gearing in the machine except the worm and worm wheel for giving the automatic feed. The worm is easily thrown out of gear so that feeding may be done by hand. The machine can be stopped without arresting the motion of the driving rope, and as the weight of the machine is balanced by the weight attached to the compensating slide pulley bearing overhead, no special appliance is required for raising or lowering the machine.

A number of Portland patent rotary steam engines, pumps, and blowers, are shown by Messrs. Goldschmidt, Hahlo, and Co., of Manchester, who claim that they have now overcome all the difficulties experienced by previous inventors in this direction. The principle and general design is precisely the same in both engines, pumps, and blowers, and will be readily understood by reference



FIELD'S BOILER.

to the illustration of the patent direct-acting steam steam pump which we give on page 3. The pistons consist of semicircular revolving vanes of a form which can be readily turned and shaped by machinery, so as to insure a good fit in the cylinder. There is no packing of any kind, except at the ends against the cylinder covers, where there are small metal strips kept up by steel springs, and the only leakage that can take place is between the cylindrical centre boss of one revolver

ROTARY STEAM PUMP AND ENGINE.

MESSRS. GOLDSCHMIDT, HAHLO, AND CO., ENGINEERS.

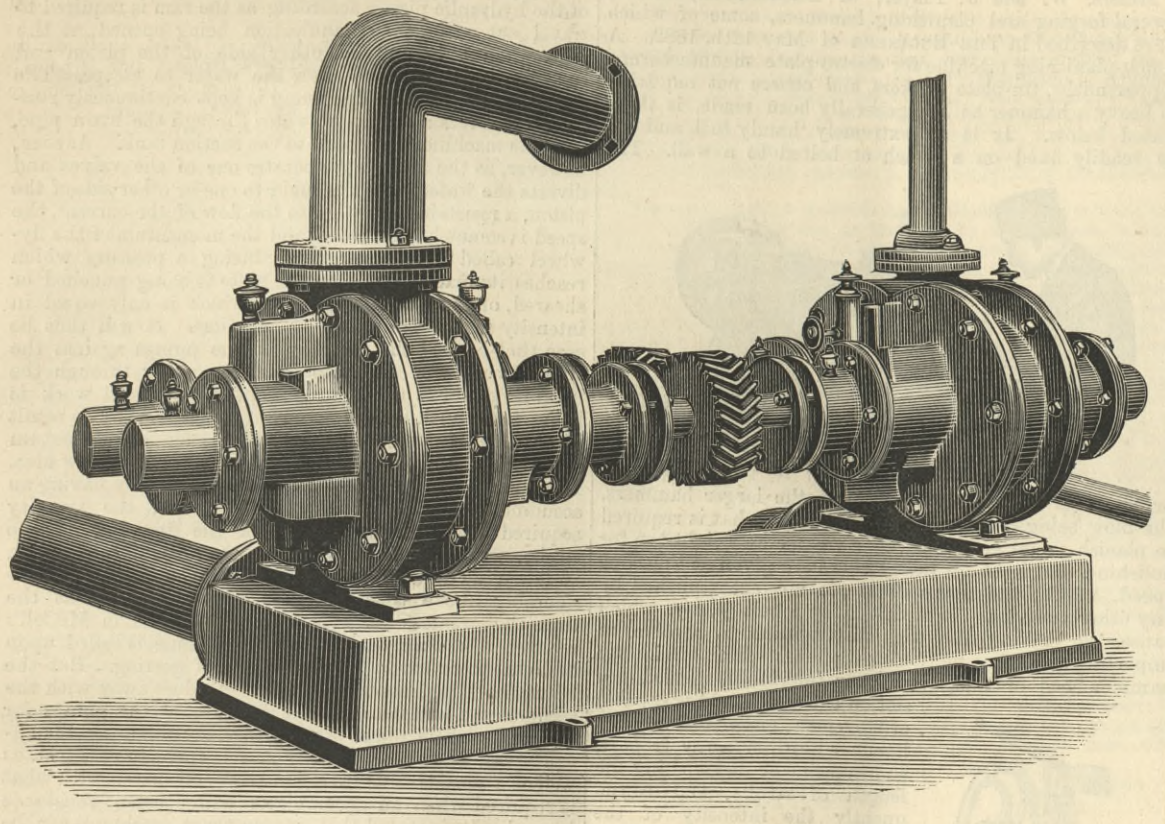


FIG. 1.

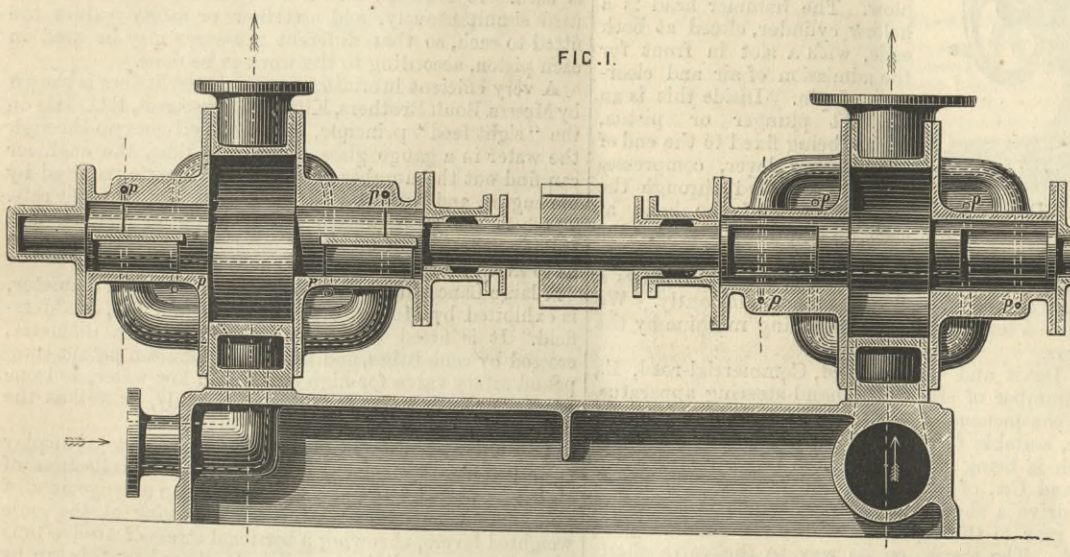


FIG. 2.

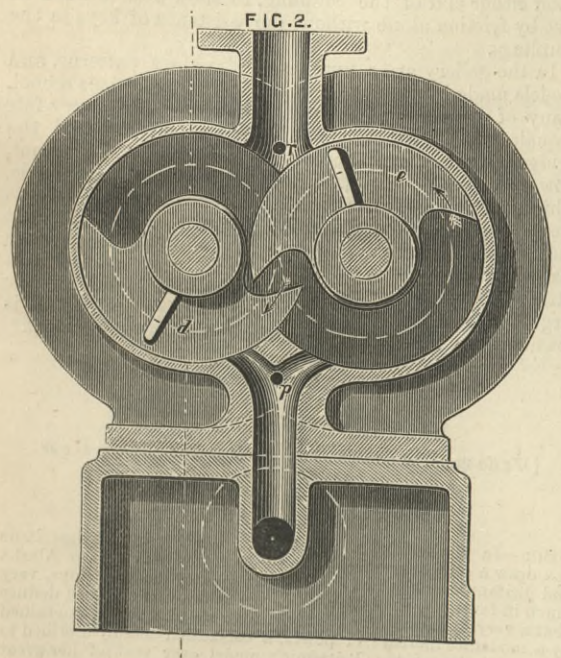
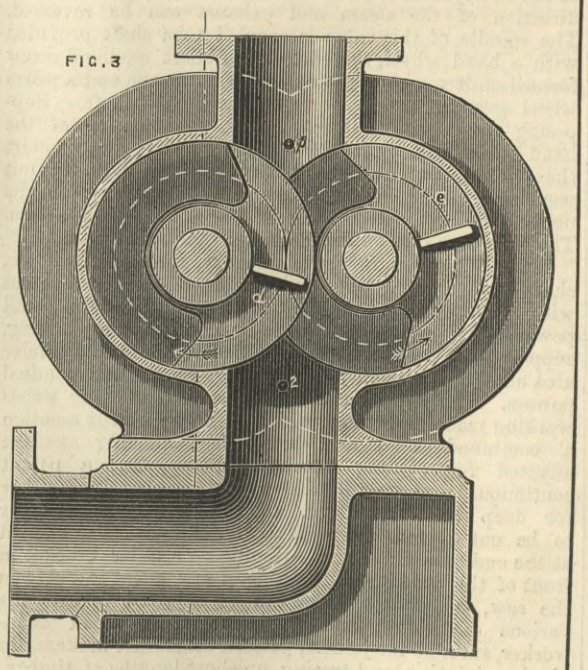


FIG. 3



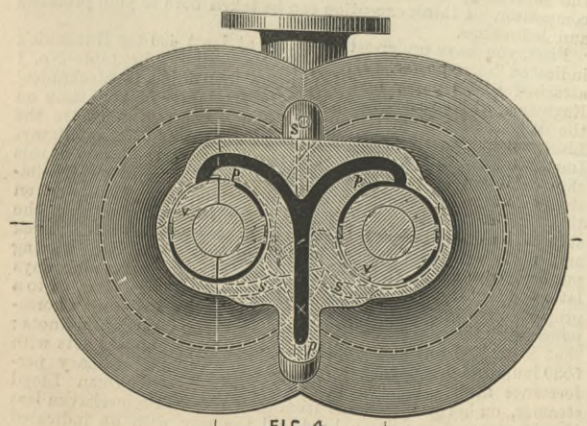


FIG. 4

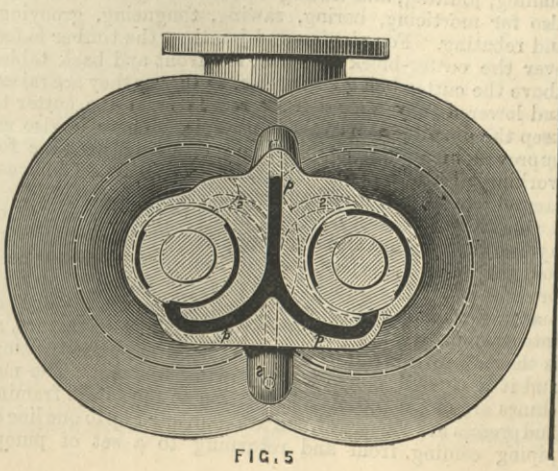
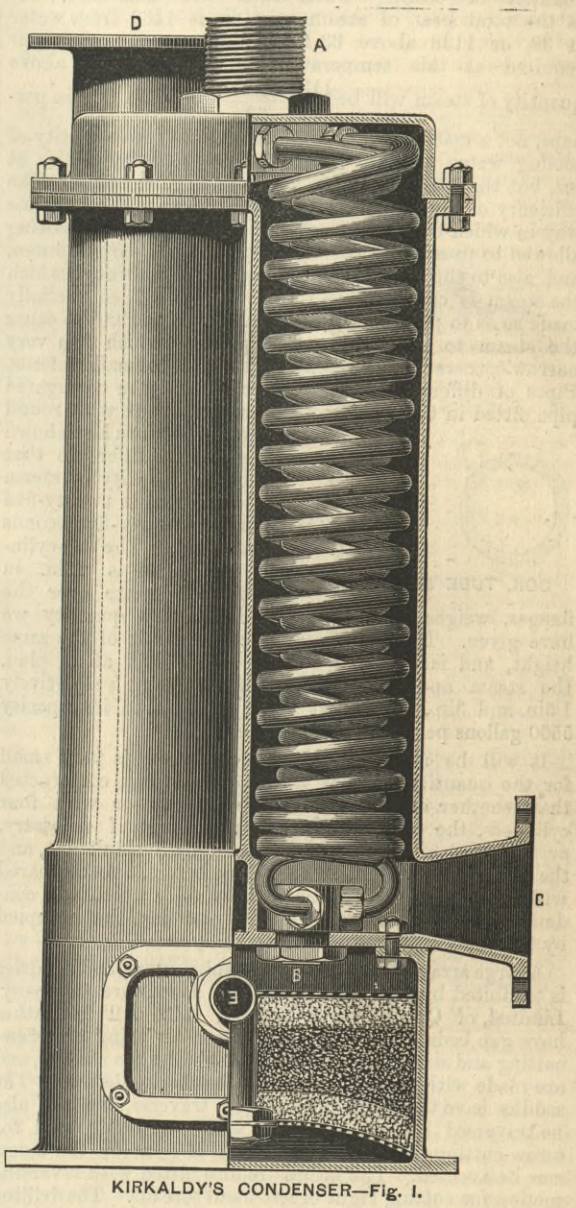


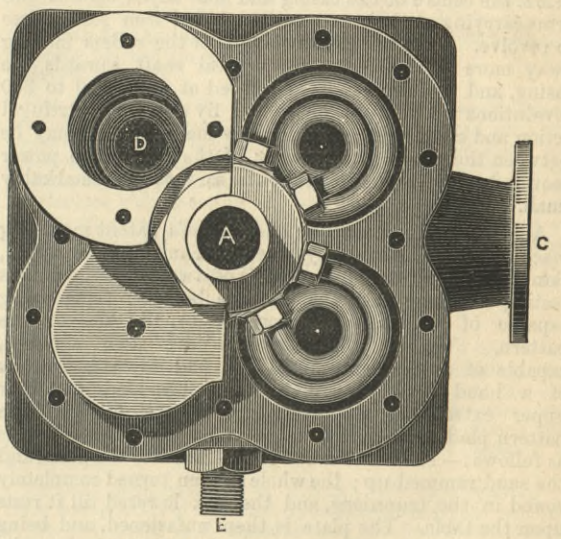
FIG. 5

and the periphery of the other; but as both are circular and very narrow, they are easily adjusted, so that the entire leakage, when running at full speed, is claimed to be no more than in ordinary steam engines. The steam may act during the whole revolution, or may be cut off and allowed to expand. One of the chief advantages claimed by the inventors is an arrangement for automatically counterbalancing what they call the axial pressure, which, it is stated, acts very prejudicially in ordinary rotary engines and pumps, by causing friction and great wear and tear. This is accomplished by



KIRKALDY'S CONDENSER—Fig. 1.

providing the cylinder covers with balancing cylinders to receive the ends of the pistons, which are elongated for this purpose and truly turned. Small channels are formed to connect the delivery end of the pumps, or the steam inlet of the engines, with the balancing cylinders, and similar channels are provided to connect the suction of the pumps or the exhaust of the engines. The pressure thus admitted to



KIRKALDY'S CONDENSER--Fig

the balancing cylinders acts on the pistons in the opposite direction to that in the working cylinder, and the respective areas are adjusted in such a manner as to balance the thrust on the shaft. All the bushes are of phosphor bronze, the shafts of steel, and the pinions of case-hardened wrought iron; and we are informed that highly satisfactory results are being obtained with both engines and pumps, the efficiency of each being considerably above that previously given in similar machinery.

The sectional engravings given herewith illustrate the construction of the "compactum" condenser or still for producing drinking-water from sea-water, made by Mr. J. Kirkaldy, West India Dock-road, London. Our engraving shows the four-cylinder condenser, but it is made with either one, two, or four cylinders. Fig. 1 is an elevation partly sectional, and Fig. 2 a plan also partly in section. Steam to be condensed enters the coils, at A becoming condensed passes to the bottom, and thence through the filter material B at the bottom, from whence it passes away at E. The cold water enters at C, and

passes away at D. At a recent trial of the still or condenser of the small size we found that with the cooling water at 63 deg. Fah., and the steam at a temperature corresponding to a pressure of 45 lb. per square inch in the boiler, or about 41 at the site of the still, namely, 288·2 deg. Fah., this little thing condensed 10 lb. of steam in thirty-eight seconds, or at the rate of about 10 gallons in a little over six minutes. The cooling water was admitted by a pipe 1·5in. diameter, and it escaped at a temperature of 92 deg. Fah. The quantity of cooling water was not measured, but as the total heat of steam at 41 lb. is 1169 from water at 32, or 1138 above 63 Fah., the quantity of water required at this temperature to condense the above quantity of steam will be $\frac{1138 \times 10}{92-63} = 392{\cdot}4$ lb. It is, perhaps, not a matter of any importance what the quantity of cooling water used, as there is always plenty of this at sea, but the above may be taken as a good result. The efficiency of the condenser is no doubt due to the complete way in which the cooling water is split up and not being allowed to pass away through any part in a large column, and also to the corrugated form of the pipe through which the steam is conveyed—a form which has been specially made so as to present a good deal of surface, and to cause the steam to pass through a passage which has very narrow corners which present large surface to small contents. Pipes of different kinds were tried, and the corrugated pipe fitted in the same condenser to compare with round pipe of the sections here shown made such a difference that the given quantity of steam was condensed in twenty-five seconds and thirty-five seconds respectively. The one-cylinder condenser is 29in. in height, 5·5 square over the flanges, weighs 80 lb., and condenses the quantity we have given. The four-cylinder condenser is of the same height, and is but 10·5 square inches over all in plan, the steam and cooling-water inlets being respectively 1·5in. and 3in., the weight being 300 lb., and its capacity 5500 gallons per day.

COIL TUBE SECTIONS.

It will be noticed that the condenser is very small for the quantity of work it will do. It is so constructed that whether of the small cylinder size or with four cylinders, the coils may be easily replaced if necessary, or the place of one may be stopped by a blank nut, and the rest of the condenser worked as before. As compared with the space usually occupied by stills which will condense the above-mentioned quantity per day, that occupied by the one we illustrate is remarkably small.

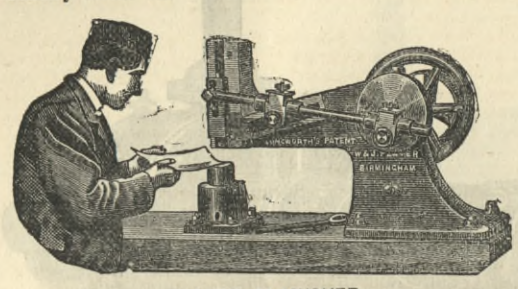
A large array of engineers' tools, lubricators, and sundries is exhibited by the Machinery and Hardware Company, Limited, of Queen Victoria-street, E.C. All the lathes have gap beds and are arranged for surfacing or screw-cutting and with back shaft. The spindles are of steel, and are made with conical or parallel necks as desired. The saddles have the usual quick hand traverse, and can also be traversed by the back shaft when not being used for screw-cutting; so that a great deal of wear on the screw can be avoided. The lathes are also fitted with reversing motion for cutting right or left-hand threads. The drilling machines are of various sorts and sizes, from a pillar machine with double gear to a small hand driller to admit 12½in. diameter. Lucop and Cook's patent centrifugal pulveriser is also shown by the same firm, and is claimed to be the most economical and effective machine for reducing all kinds of hard material to an impalpable powder. The mill consists of a slightly elliptical iron casing fixed on a foundation plate. A shaft runs a little below the centre of the casing and has keyed upon it two arms carrying at their extremities chilled iron rollers free to revolve. Slots in the arms admit of the rollers moving away more or less from the central shaft towards the casing, and when the shaft is rotated at from 250 to 300 revolutions per minute the rollers fly out by centrifugal action and crush and pulverise any material that may be between them and the interior of the case. The power required to drive the apparatus is said to be remarkably small.

An improved Woolnough and Dehne's patent moulding machine is exhibited by Messrs. Samuelson and Co., Banbury. This machine consists of two vertical columns resting on a bed-plate, the distance between them being capable of adjustment, according to the size of the pattern. Within the columns are two spindles, capable of vertical movement up and down by means of a hand lever, bearings being provided at their upper extremities for receiving the trunnions of the pattern plate. Below is a table on rollers. The action is as follows:—The bottom box is first fixed to the plate, and the sand rammed up; the whole is then turned completely round in the trunnions, and the box lowered till it rests upon the table. The plate is then unfastened, and being fixed in its bearings by set screws, is gently raised up by the hand lever, and the pattern withdrawn from the sand. The bottom box is now ready, and the top is prepared in precisely the same manner, the impression being taken from the other side of the plate. The advantages of this machine over other methods of moulding are that the most accurate castings can be taken from the pattern, and a perfectly smooth surface obtained, while the lift is so steady and true that little or no taper is required on the pattern.

The Saville-street Foundry and Engineering Company, Limited, Sheffield, show a number of Baker's patent blowers, exhausters, and pumps, of which they are the sole makers in this country, and which are too well known to require detailed description. The same firm has also a good assortment of crucible steel castings for marine and other purposes, such as they regularly turn out.

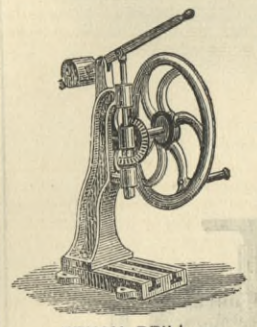
A large number of Manchester and other pumps are exhibited by Messrs. Frank Pearn and Co., Manchester, who also show Robinson's hot-air engine. The chief novelty is a vertical direct-acting ballast pump, which, together with the hot-air engine, we hope to illustrate at a future time, and we will content ourselves with merely saying at present that Messrs. Pearn's character for neat design and good workmanship is at least fully sustained.

Messrs. W. and J. Player, of Birmingham, exhibit several forging and planishing hammers, some of which were described in The Engineer of May 12th, 1882. A bench-planishing machine for electro-plate manufacturers, coppersmiths, tin-plate workers, and others not requiring so heavy a hammer as has generally been made, is illustrated below. It is an extremely handy tool, and can be readily fixed on a bench or bolted to a wall. The



PLAYER PLANISHER.

principle is the same as that of the larger hammers, the blow being capable of variation from what is required to planish metal ⅛in. thick, to an extremely light tap for polishing, and light or heavy blows are given at the same speed, which, the makers state, is not accomplished by any other machine. It is driven by a belt pulley, which causes the driving disc with its trunnion to revolve, so imparting a rocking motion to the lever which carries the hammer head or tup. The lever fulcrum is carried in a slot on the frame, and is capable of movement either towards the hammer head, or away from it, so increasing or diminishing the length of stroke, and consequently the intensity of the blow. The hammer head is a hollow cylinder, closed at both ends, with a slot in front for the admission of air and clearance of pin. Inside this is an air-tight plunger or piston, which, being fixed to the end of the rocking lever, compresses the air admitted through the slot in front of the head at each up and down stroke, thus forming a cushion, which takes away all liability to jar. The hammer is arranged to run at 300 blows a minute, and can be started and stopped instantly. We also illustrate a lever feed bench drilling machine by the same makers.



BENCH DRILL.

Messrs. Davis and Co., Limited, Commercial-road, E., exhibit a number of steam and hand-steering apparatus. The most conspicuous of these is a combined steam and hand gear, suitable for a vessel of 2800 tons, and of a type which is being supplied to Sir W. G. Armstrong, Mitchell, and Co., of Newcastle, and others. The steam cylinders drive a short crank shaft, which is connected by worm gear to the barrel on which the rudder chains are wound. The steam, on its way to the valve chests of the two cylinders, passes through a valve, by which the direction of the steam and exhaust can be reversed. The spindle of this valve is coupled to a shaft provided with a hand wheel, the end of the shaft having a screw formed on it working in a nut, carrying at one end a worm wheel gearing into a worm on the crank shaft. Supposing the engine to be stationary, the rotation of the hand wheel will shift the reversing valve, and so start the engine; but the moment the drum revolves, the nut working on the screw brings the valve back to the neutral position, and so cuts off the admission of steam. The gear thus follows the motion of the hand wheel.

Messrs. Thomas Robinson and Co., Limited, Rochdale, show one of their improved combined vertical engines with boiler, designed specially for saw mills where small power is required. The frame is in one strong casting, supported independently of the boiler, and the cylinder area and boiler capacity are very large for their nominal powers. The same firm exhibit several of their wood-working machines, among which we may specially mention a combined hand and power feed planing machine adapted for planing panels, scantling, &c.; a patent continuous feed saw bench which can be used either for deep or flat cutting, and in which the timber to be cut is fed by means of a fluted roller carried at the end of a radial arm swinging on a pillar bracket in front of the machine and capable of movement to and from the saw, so that the roller can be adjusted to suit the various diameters; and an improved universal wood-worker, suitable for joiners, pattern or cabinet-makers, for planing, jointing, and tracing up short lengths of timber; also for morticing, boring, sawing, tongueing, grooving, and rebating. For planing and jointing, the timber is fed over the cutter-block by hand, the front and back tables above the cutter being adjustable, so that as they are raised and lowered they approach or recede from the cutter to keep the opening as narrow as possible. There is also an improved moulding, shaping, and recessing machine for working all kinds of mouldings, such as are found in ornamental panels, and for shaping small patterns, &c.

One of the greatest novelties in the Exhibition is a set of hydraulic punching and rivetting plant, by Messrs. Higginson and Co., Liverpool, which has quite recently been brought out. The principle can be applied to any hydraulic machine tool, in which the pressure is only required at intervals for a short period of time, such, for instance, as is the case in punching, shearing, bending, and rivetting, and it is carried out in the following manner. The machines are of the usual construction so far as the framing and presses are concerned, and are connected up to one line of piping coming from and returning to a set of pumps driven by a belt in the ordinary way, and provided with a fly-wheel. At each machine is a valve by which the water from the pump can either be permitted to circulate through the line of main pipes, as it does when the tool is not in operation, or else it can be diverted to the top or bottom of the hydraulic piston according as the ram is required to travel out or in, a communication being opened at the same time between the other side of the piston and the return pipe, so as to allow the water to escape. The action is as follows:—The pump is kept continuously running and forces a stream of water through the main pipe, past the machines, and back to the suction tank. As soon, however, as the attendant operates one of the valves and diverts the water from the main to one or other side of the piston, a resistance is set up to the flow of the current, the speed is somewhat retarded, and the momentum of the fly-wheel called into play, so producing a pressure which reaches its maximum when the plate is being punched or sheared, or the rivet headed, and which is only equal in intensity to the resistance at the time. It will thus be seen that beyond the running of the pumps against the slight pressure necessary to force the water through the main no power is taken up except when useful work is being performed, and then only in proportion to the result obtained. Of course the mere utilisation of momentum for giving the blow in machine rivetting is not a new idea. It is carried out in Tweddell's plant, where by having an accumulator with a very long stroke, the velocity acquired in the descent through the first part of the stroke, when the resistance at the machine is small, is taken advantage of to increase the pressure considerably above that given by the weights just at the time the greatest work is being done; and in McColl's rivetter, where a fly-wheel at each machine is called upon to do the work through the medium of gearing. But the beauty of Higginson's plan is that he does away with the accumulator, and has only one fly-wheel at the pumps for working a whole plant of machines, so obtaining the advantage of extreme simplicity and lowness in first cost, as well as a considerable saving in power compared with what is required when an accumulator with constant resistance is used. It is stated that two or three machines can be used simultaneously, and overflow or safety valves are fitted to each, so that different pressures may be used in each piston, according to the work to be done.

A very efficient lubricator for engine cylinders is shown by Messrs. Boult Brothers, King William-street, E.C. It is on the "sight feed" principle, and as the oil goes up through the water in a gauge glass, a drop at a time, the engineer can find out the number of drops per minute required by his engine, and keep the oil flowing at the required rate. There is also an automatic arrangement for starting and stopping the feed of oil simultaneously with the engine, so as to avoid all loss when the machinery is at rest.

A large Lancashire boiler, 27ft. long, and 7ft. 6in. diameter, is exhibited by Messrs. J. Hopkinson and Co., Huddersfield. It is fitted with corrugated flues, 3ft. diameter, crossed by cone tubes, and has one Hopkinson patent compound safety valve for high steam and low water, and one patent auxiliary valve for high steam only, as well as the usual gauge and water fittings.

The Kirkstall Forge Company, in addition to a display of rolled shafting and spindles, exhibits a collection of Butler's patent frictional couplings, and an arrangement of 2in. shafts connected with them, and having at the ends weighted levers, throwing a torsional stress of twelve tons upon either end of the coupling, to show how this can be met by friction alone without the assistance of keys in the couplings.

In the gallery are a number of drawings, patterns, and models made by the students at the Crystal Palace school, many of which, especially the drawings, show a very fair acquaintance with the subjects; indeed, some of the bridge drawings are exceedingly well done. We cannot, however, speak in such flattering terms of the models, which, for the most part, are ill-designed and clumsy. It seems a pity to have permitted the students to turn out such a hideous steam engine as that exhibited, for there is scarcely a single part that would pass muster even in a little country engineering shop, much less in one of our large factories, where carefulness of design and detail is considered to be the first essential in making good work.

LETTERS TO THE EDITOR.

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

OLD AND NEW ATLANTIC STEAMERS.

Sir,—In the article under the above heading in your last issue you draw a comparison between the performances of the Alaska and Britannic on the last outward voyages of the two ships, very much in favour of the latter, and from the results obtained deduce that a very extraordinary increase in her speed would be obtained by a moderate increase of power, a conclusion mainly ascribed to the superiority of the Britannic's model over that of her great competitor. I think exception can be taken both to your premises and deductions.

First, you have under-estimated by at least 400 the Britannic's indicated horse-power. Mr. F. C. Marshall in the table No. 1 attached to his paper read before the Institution of Mechanical Engineers, at Newcastle, in 1881; Mr. Maginnis—at that time on the White Star Engineering Staff—in a paper read before the Liverpool Engineering Society a few years ago; and Messrs. Ismay, Imrie, and Co. in the information supplied with the model of this ship exhibited last year at the Shipwrights' Company's Exhibition, all unite in calling her 4900 indicated horse-power, and on this particular voyage there was every reason for driving the ship as hard as she would go, for not only was she sailing neck and neck with the fastest vessel in the trade, but, having put back with a flaw in her shaft, she was leaving again nine days late, and had the time to make up as best she could. Now, as to a proportionate increase of power, you say if the Britannic's horse-power were increased one-third she would steam seventeen knots; that is, a 5004 ton ship would be propelled seventeen knots with 6530 indicated horse-power—not such a very extraordinary performance after all. The Fulda, a new North German Lloyd steamer, on her passage went from the Clyde to Bremerhaven last March, steamed seventeen knots all the way with an indicated horse-power of 6200, and the Arizona herself has done the same speed on 6000; but neither of these ships has ever been able to

maintain their speed over the whole of an Atlantic run, and I fail to see why the Britannic should be so specially favoured that she alone of all the vessels in the trade is to be credited with the ability to maintain her measured mile speed under all conditions of ocean navigation. The Britannic has the same proportion of breadth to length and depth as the Alaska, and the proportion of gross tonnage is about the same also, so it is hard to see where the better model comes in; and, on the other hand, it is the opinion of all modern naval architects that any increase in the speed of the Atlantic passage must be accompanied by a large increase in the tonnage of the vessel. Again, you state that by increasing this ship's horse-power by two-thirds, 7500-indicated horse power by your calculation, 8160 by mine, she would, according to Mr. Froude, travel 3·4 knots per hour faster, and make the passage in six days five hours, steaming 18·6 knots. She might attain that speed on the measured mile, but it is doubtful. The Stirling Castle, with a displacement of 8000 tons, steamed 18·4 on the mile, with 8237 indicated horse-power, and the Britannic, according to your argument, with a displacement of 8500 could travel 18·6 at sea, with 8160 indicated horse-power. Not long ago you said that Mr. Biles knew as much about a ship as any man, and Mr. Biles says a ship of eight and a-half beams to length, and correspondingly fine ends—in fact, such a ship as the Stirling Castle—can be driven at a high speed with proportionately less power than a ship of ten beams to length, like the Britannic; and now you turn round and prove that according to Mr. Froude this latter ship could easily be made to leave all her competitors nowhere. If this theory of increasing a ship's speed 3·4 knots by an increase of two-thirds of her power, and 1·5 knots by an increase of one-third, is applicable to one ship it is evidently applicable to another. Let us apply it to the Arizona's speed, 17 knots on measured mile, indicated horse-power 6000, which increased by two-thirds becomes 10,000, and the speed 20·4 knots; again increase this last by one-third, and we have indicated horse-power 13,300, speed of ship 22 knots. I think that this is about your argument, and yet Mr. Pearce is building a ship—the Oregon—2200 tons bigger than the Arizona, and fitting her with engines of 13,500 indicated horse-power, in the hope of beating the Alaska by half a knot per hour, when, according to your theory and figures, he could easily beat her by six knots by simply putting these 13,500-horse power engines into a similar ship to the Arizona, which, I think, reaches the *reductio ad absurdum*. It is no easy matter to get a deck crew for the Alaska in the winter, but it would take a powerful imagination to picture the state of affairs on board the Britannic while making a passage of six days five hours during the equinoctials, or in the sort of weather we enjoyed in the North Atlantic during the major portion of last winter.

May I be permitted to intrude a little further on your space to offer a very few remarks anent your criticism of Mr. Seaton's new book. You quote his formula for finding the effective horse-power of a pair of compound engines, and after expressing a doubt as to its successful applicability, give an example to prove your argument. I have tried the formula myself on several engines with whose performances I am familiar, and find it very fairly accurate; and as to the example you give, no modern engine builder would entertain for one moment the notion of constructing a pair of engines with 40in. and 80in. cylinders, 48in. stroke, to work at 80 lb. pressure with 60 revolutions. We have plenty of 42in. and 80in. with 48in. stroke; for example, Mr. Wigham Richardson's Ville d'Oran, which, with 75 lb. steam and 69 revolutions, indicated 1881-horse power. Apply a correction for the increased speed and another for the reduced pressure, and then see how the formula acts. Mr. Pearce has made engines lately for the Chilae and Burgomeester den Fex, with cylinders 42in. and 80in., and 48in. stroke, working at 100 lb. pressure, and the Barrow Company for a cattle boat, the same cylinders and 80 lb. pressure; but in every case the revolutions are far in excess of 60, so your case is purely hypothetical, and in no way affects the value of the formula. Again, speaking of friction, you complain that Mr. Seaton totally ignores tail rods. It would be a good job if several other people would follow suit, as their utility is, to say the least of it, doubtful. Under Mr. Seaton's supervision there have been constructed two pairs of engines for Atlantic cargo boats, in which, perhaps, the length of stroke bears a larger proportion to the diameter of the cylinders than in any screw ships in our mercantile marine. These engines have no tail rods, and yet, in spite of the "heavy pistons being thrown about" by the rolling of the ship, the tail rods are never missed, and the expedition and ease with which the pistons and valves can be overhauled in port is a heavy set off against any imaginary good the tail rods do at sea. But the most inexplicable part of your criticism is your statement that Mr. Seaton's practical information is not equal to his theoretical knowledge. Here we have a man at the head of the engineering department of a great firm, turning out all sorts and classes of vessels, and yet of limited practical experience. Earle's is not a place like the great engine shops on the northern rivers, where the work is stereotyped, every engine exactly resembling its neighbours except in dimensions, and where machinery is sold at the old standard of nominal horse-power, but an establishment where ships are built for special services, necessitating a new design in almost every individual case, and therefore a place in which, if the manager did not know very much about what other engineers did when he first took charge, he would very soon have to learn, *nolens volens*, and as far as my judgment will enable me to express an opinion, I think that much of the work turned out by Mr. Seaton at Earle's would be very profitably studied by men holding responsible positions in works of much greater pretensions than the Hull shop. Lastly, anent your remarks on Mr. Seaton's chapters on propellers. Not being gifted with that editorial acumen that enables one man to say that another man means a certain thing when he says exactly the opposite, I feel that my best place is outside the controversy. I only beg leave to call to your recollection that at the time the Alaska, Servia, and City of Rome were on the stocks you published a lengthy article, demonstrating, beyond the shadow of a doubt, that these ships could not be driven at a high speed by a single screw, even of a minimum diameter of 24ft., and predicting failure in all these ships, and since that article was written, behold the Alaska, with a screw 23ft. 3in. in diameter and 34ft. 6in. pitch, has run to New York from Queenstown in six days twenty-two hours, indicating over 10,000-horse power, and stranger still, the Stirling Castle has run from Moosung to London in twenty-seven days four hours, steaming time, indicating nearly 8000-horse power, with a propeller 22ft. 4in. diameter and 31ft. pitch. I sadly fear your claim to be an authority on propellers must remain doubtful for some little time longer; but this is, no doubt, one of those subjects about which you say that "disputes rage," and as Mr. Froude is dead, and has no successor, every man may claim to know as much on the matter as his neighbours. WM. H. MOSS.

Sheil-road, Liverpool, July 3rd.

[We publish Mr. Moss's letter because we think it desirable that in all cases both sides should be heard. Our correspondent apparently lacks the power of drawing deductions with discrimination, and of reading with care. The absurd construction which he has put on what we have written concerning Atlantic steamers will not escape our readers, although Mr. Moss is, no doubt, unaware that he has written anything which can cause a smile. As regards what he has written concerning Mr. Seaton, we are willing to take his word for it that Mr. Seaton is an eminently practical man; but we repeat that his book does not supply ample evidence on this point. We are glad to hear that Mr. Seaton has successfully dispensed with tail rods. Such a departure from the best practice of the best firms possesses a good deal of interest. That Mr. Moss does not read with care is demonstrated by the paragraph, "no modern engine builder would entertain for one moment the notion of constructing a pair of engines with 40in. by 80in. cylinders, 48in. stroke, to work at 80 lb. pressure with 60 revolutions." Mr. Seaton is evidently of a different opinion, inasmuch as the figures in question are his, not ours, so that according to Mr. Moss, Mr. Seaton is not a modern engine builder. Perhaps Mr. Seaton when he has read Mr. Moss's letter will be disposed to say, "save me from my friends."—ED. E.]

MACHINERY EXHIBITS AT THE FISHERIES EXHIBITION.

SIR,—May I ask you to do me the favour of inserting the following in your next issue?

I see by your issue of the 15th inst. that my steam capstans at the Exhibition are somewhat erroneously mis-classed, or misnamed, as being in same class as other steam capstans there, viz., "Steam Trawling Smack Machinery." Although partially correct, only so in a secondary sense, as my first and most important object has been to design and adapt steam hauling to that much larger number of fishing vessels called "drifters," such as herring and mackerel boats, which comprise more than half of the fishing vessels of the kingdom, and earn in like proportion of the value of fish.

When their relative positions are considered, and it is borne in mind that the trawlers can get their gear by hand capstan in the average space of two hours, and the drifters, under best conditions, average five hours—and very frequently, on account of weather, the crews are nine hours at the capstan, hauling their two to three miles of gear on board—it will be seen that their requirements for steam capstans are greater than the trawlers. Further, the "drifters" are much smaller vessels, and have to carry ten times as much gear in bulk as the "trawlers," besides leaving space for the fish caught, and salt to preserve same with at sea; the average size of "drifters" being about 30 tons, ditto "trawlers" about 55 tons. In many cases the vessels are primarily built and used for drift fishing, and when such seasons are over adapted for trawling. Where, therefore, the space is of such paramount importance, the engines and boiler have always to be actually in the cabin; and although I have fitted up great numbers of these craft as well as trawlers, and the space taken up for engines and boiler with all necessary gear, occupying only 4ft. 2in. square on the cabin floor—but in such craft have always considered it a sacrifice of comfort on the part of the crew—it will now be seen—what is well known by all interested in the trade—how important it is to economise space, even at an assumed, not actual, loss of accessibility to the power applied.

Permit me here to express my regret that your inspection of my exhibits should have been made during the absence of both attendant and myself. I also regret that you did not distinguish my boiler, which you criticise as being like the "Sharpe-Palmer" patent exhibited by Messrs. Abbott; in fact, both were made to my order and requirement, excepting the manhole door—see enclosed tracing and other matter for your information.

The Fisheries Ironworks, Gorleston, H. I. C. KEYMER.
Great Yarmouth, June 26th.

THE RUNNING EXPENSES OF TRAMWAY LOCOMOTIVES.

SIR,—Having read a statement on page 492 of your last issue, viz., "The Running Expenses of Tramway Locomotives," and as the vertical boiler, "of which so much has been said," evidently alludes to those made by us, and supplied to the principal tramway companies in this country, will you kindly allow us, through the medium of your paper, to say that the tramway upon which the engines named are working is an exceptionally easy one to work for a steam line, it being comparatively level. If the same engines were transferred to such lines as are now being worked by our engines, viz., the Rochdale and Littleborough, the Nottingham District, and the Huddersfield Tramways, with gradients of 1 in 11½, the cost would work out very different indeed to 3·12d. per mile, as stated. Our largest class of engine, now on the Manchester and Bury Tramway, drawing two cars, each carrying forty to sixty passengers, and each weighing 3¼ tons empty, on gradients of 1 in 20, is working at a cost of under 5·5d. per mile run. On one occasion one of the above engines drew three cars, each 3¼ tons, and carrying 299 school children and 20 adult passengers, from Berry to Blackford Bridge, up a gradient of 1 in 20, stopping and starting on same, witnessed by the Mayor of Bury and other gentlemen. WM. WILKINSON AND CO., Limited.

Holme House Foundry, Wigan, July 3rd.

TELEGRAPH AND TELEPHONE WIRES.

SIR,—How to deal with telegraphic and telephonic wires is a question which is now puzzling town corporations and other authorities. If they are to be put underground, additions or repairs so frequently required could not be made without continual taking up of the streets, and to avoid this large special subways would have to be made at enormous expense.

A scheme has occurred to me which I think might be placed before the public for consideration. It is as follows: Each town or corporation to map out its district for main or trunk lines of telegraphic wires, all converging to a common centre, from which main trunk lines shall radiate say north, south, east, west, and at other intermediate points of the compass, or in such other directions as may be most convenient. Each single wire at its beginning and ending—it would only be a short length if the main lines were properly laid out—shall join the nearest main or trunk line. Say, for instance, a wire commencing in the south of the district, which, required to go west, would have to pass to the nearest trunk or main line in the south, then along the south trunk line to the central station, where it would be connected with one on the west trunk line, and so on. Of course this would take a greater length of wire than would be required to pass in a straight line between the two termini, but the advantages and convenience of the main line route, and the small cost of fixing, and repair, and inspection upon them, and the better state of order and insulation, would compensate for the extra length of wire.

The main lines would have to be carried on sufficiently high lattice-work erections made of iron—by preference—each formed by two supporting structures with cross lattice girders between them, to carry vertical bars, to which the insulators for the wires would be attached; the lattice girders would also form a proper permanent platform for the men who have to erect, inspect, and repair the wires.

The supporting structures would have to be fixed on good foundations, and so designed that additions could be made to the height to provide for additional wires when required. The wires to be arranged in a series of horizontal rows, one row above the others, carried on insulators attached to vertical bars having wheels or slides or other arrangements to move upon the lengthway of the cross carrying girders, so that all the vertical bars for the wires could be slid or moved for a foot or two apart to give a clear vertical space between any vertical row of wires for the men to get between them when required for repairs or renewal. The main lines of wires, if thought desirable, might pass directly over and in the direction of the streets, in which case the iron structures would require to have their foundations on the side walks—they need not be much more in the way than lamp-posts, and could be made to act as such—and when carried high enough they would be connected across the street by the lattice girders. There might be objections to street lines, in case of any of the wires breaking, but they would fall lengthway of the street, and this would be less dangerous than wires falling across the street. The chances of wires breaking on such a main line as that proposed would be small, as they could be so easily inspected and repaired or replaced. If carried high enough, the mass of wires, if very extensive, would not form any great obstruction to light or sunshine. If the main trunk lines were carried over the roofs of houses and buildings, which might be preferred, the walls of these would have to be altered, strengthened, or built specially for the purpose, and to form part of the building, and prepared to carry the supporting structures. The foundations and structures for the main lines would in the first instance be expensive, because they would have to be made strong and extensive enough to be capable of enlargement to meet the greatest probable demands, but after such structures as those proposed were made, the cost of fixing additional wires would only be a little more than the cost of the wire.

The main lines would have to be erected and maintained by a company or corporation, who would charge a rent for each wire. The lowest Post-office rate for wires is £5 per mile in the country. A main line for a mile of 5000 wires would bring in a rental of £25,000 per annum, at which rate the income would pay 5 per cent. upon £500,000. But a mile of structures and wires for such main or trunk lines would only cost a small fraction of such sum. Even 500 wires on a trunk line would bring in £2500, at £5 a mile, which is £2 less than the Post-office rate for over-house wires out of London; therefore I think main trunk lines of wires, as proposed, might be erected at very much less than the present cost, at the same time getting rid almost entirely of the present system of objectionable overhead wires fixed anyhow, and passing in all directions. P. J. L.

Manchester, June 30th.

ELEPHANT BOILERS.

SIR,—I have just read your article, and whilst agreeing with a great deal of what you say upon the merits of the elephant boilers, I cannot agree with your sweeping denunciation of the Lancashire. I speak from long experience of the latter, and could refer you to many instances of it working for ten, fifteen, or twenty years, and scarcely a penny spent upon repairs.

If it was so dangerous as you say from collapse of tubes, what about the merits of the invincible plug, the fusible plug I mean so much puffed up and recommended by inspectors and chief inspectors of insurance companies? Then as to the elephant boiler, I could refer you to a case where I myself put in a pair more than thirty years ago, and not many years since I happened to visit the town and found them at work doing well. But, Sir, the elephants, like all other externally-fired boilers, you should know, invariably give way just because they are externally fired, and are liable, of course, to dangers not known with internally-fired boilers, whether of the Lancashire or any other kind.

As to the insurance companies you remark upon, they are glad to get hold of any sort of boilers, good, bad, and indifferent, and the faster they blow up the better for the companies. I must say I am very much surprised that you cannot see this.

Iron Exchange, Birmingham, JOHN SWIFT.
July 2nd.

SIR,—It would doubtless be an advantage to steam users if there was some authority that they could refer to to ascertain the merits of steam boilers. Fifty years ago the variety was limited to about half-a-dozen, now they are endless, and difficult to say which is best, especially for those who have not had an opportunity of testing the various sorts. Although I have been engaged in making experimental tests for the past forty years, and have a long record to refer to, I would not like to pronounce in favour of any particular class hastily, as so much depends upon their situation, the fuel used, and the work they have to do. With respect to elephant boilers, they have got into disfavour in this country; their chief patrons—the millers—seem to have taken a dislike to them. There are several points against them. In the first place, they take up much room, and the next is the difficulty in keeping the brick setting in order; leakage occurs in the flues, and the rate of evaporation gets reduced. It is not uncommon to find the tubes patched that hang over the furnace; their duty per pound of coal is about 2 lb. less than the Cornish boiler. They certainly will stand a much higher pressure and bear more neglect, a consideration in a flour mills running night and day. Economy in coal consumption is so important that the elephant boiler will not be able to hold its own against the modern classes. W. A. MARTIN.

July 3rd.

SIR,—I agree with all that you have written in favour of elephant boilers, and I am glad to see that you have taken the subject of their merits up.

My experience is, however, that in England boiler-makers and boiler-setters do not understand the peculiarities of the elephant boiler. Thus, I have found them set so that the circulation of water in the lower tubes was interfered with, whereas it is a matter of the utmost importance that these tubes should be laid on a slight incline, so that the circulation in them may be excellent. Bad bricks too are used to line the furnaces; these soon tumble to pieces, and the furnace gets out of shape and the boiler is blamed. Then, the whole system, or want of system, used in setting them is as bad as can be.

On this side of the Channel we understand matters better. The elephant boiler gets fair play, and this is the reason why it enjoys so much favour with us. As examples of what elephant boilers properly made and set are, I may mention the new boilers put down at the new works of the railway company here. These have only been adopted because they are believed by the experienced engineers of the line to be better than any other type. Indeed, all over France it will be found that engineers have but one opinion, and this is that the elephant type is on the whole the best steam generator for land purposes. J. M.

Rouen, July 3rd.

SIR,—The remarks in your leading article of last week's issue on this matter I can fully endorse. If the users of steam were more aware of their great economic advantages in raising steam compared to a Cornish or Lancashire boiler, independent of the less wear and tear to them, they would be more used. The expansion of the elephant boiler being so universal that all parts of it are at work at the same time, consequently the strain is equalised and the wear minimised. I have two of these boilers constantly in use, one of them for a great many years, and should not wish to change them for any of the modern type. READER.

July 4th.

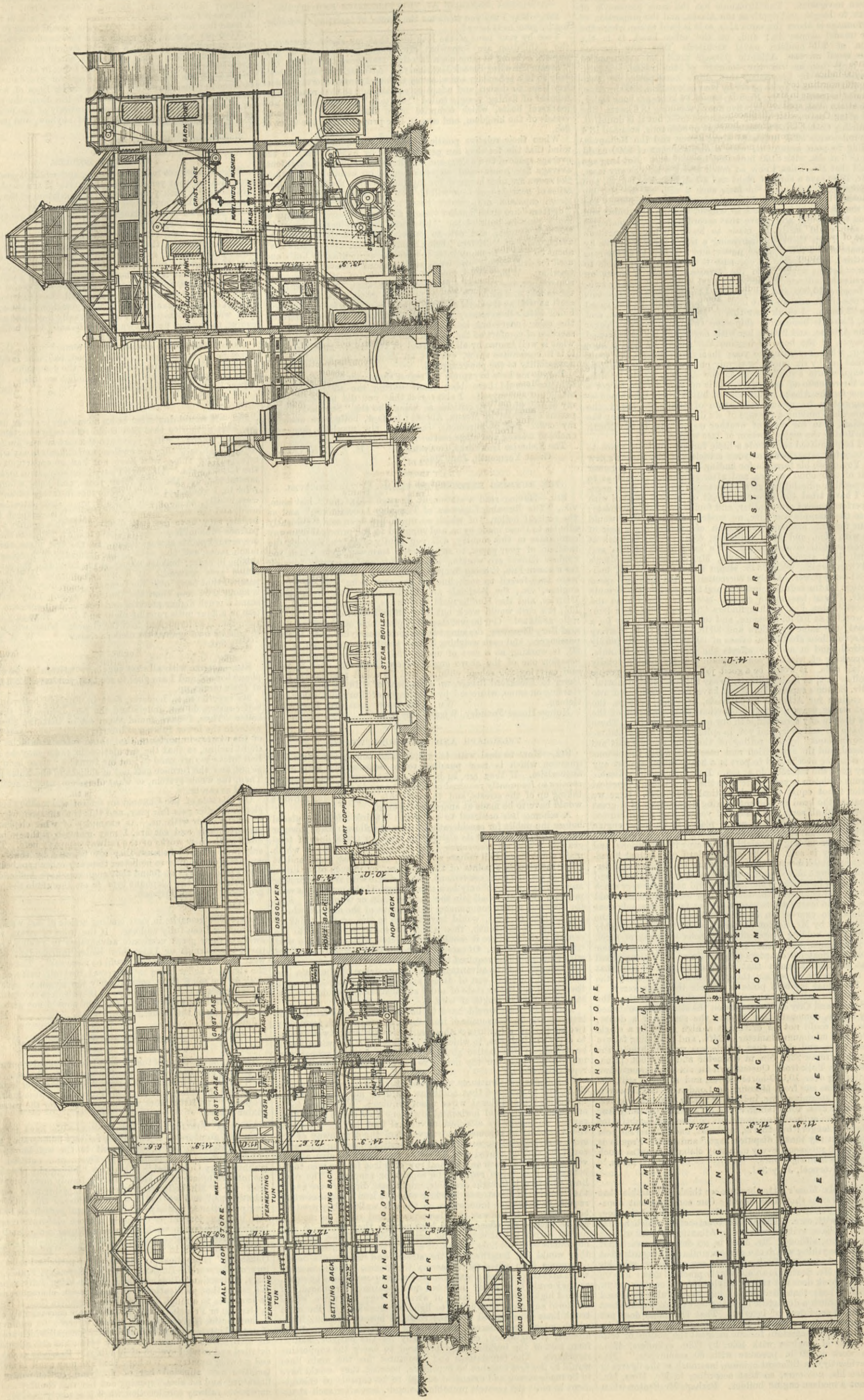
THE annual meeting of the River Witham Commissioners was held on Tuesday, the 3rd inst., at the Witham office, Boston. The engineer, Mr. I. E. Williams, C.E., reported that the river improvement works and the enlargement of the grand sluice were making rapid progress. The latter work will be completed for the passage of the winter floods.

RAILWAY BIBLIOGRAPHY IN RUSSIA.—We have received the three first numbers of a journal for railway bibliography published at St. Petersburg as a supplement to the well-known Russian railway journal, *Jeleynodorojnoye Dyelo*, and entitled "Bibliographitchesky Oukasatel." This new bibliography promises to be the most complete of its kind. It is certainly more comprehensive than the "Mittheilungen aus der Tagesliteratur des Eisenbahnwesens," and we had always considered this publication as near perfection as it was possible for mortal periodicals to be. But this Russian journal is certainly a more elaborate compilation; besides, it appears in weekly numbers of quarto size, and comprising from ten to twelve pages, while the "Mittheilungen" appear but monthly and in octavo form. The "Bibliographitchesky Oukasatel" is practically an index to the periodical railway literature of the world—England, America, Germany, France, Austria, Italy, Switzerland, Belgium, and Russia being fully represented. We regret that publication is in the Russian character, as it will be accessible to a much smaller circle of readers than if it had been in German or French. The journal is most conveniently arranged. A short notice is given of each article referred to, and everything of general interest contained in the fifty journals which are received are analysed and referred to. The editor has also adopted a very detailed and careful system of headings. Russia is as yet a young and growing country. We hope that she may avail herself of the facilities now afforded her of studying contemporary railway literature, and set about opening out her vast country and give an impetus to railway construction when it is sorely needed.

SWAN BREWERY, WALHAM GREEN.

MR. W. BRADFORD, LONDON, ENGINEER.

(For description see page 8.)



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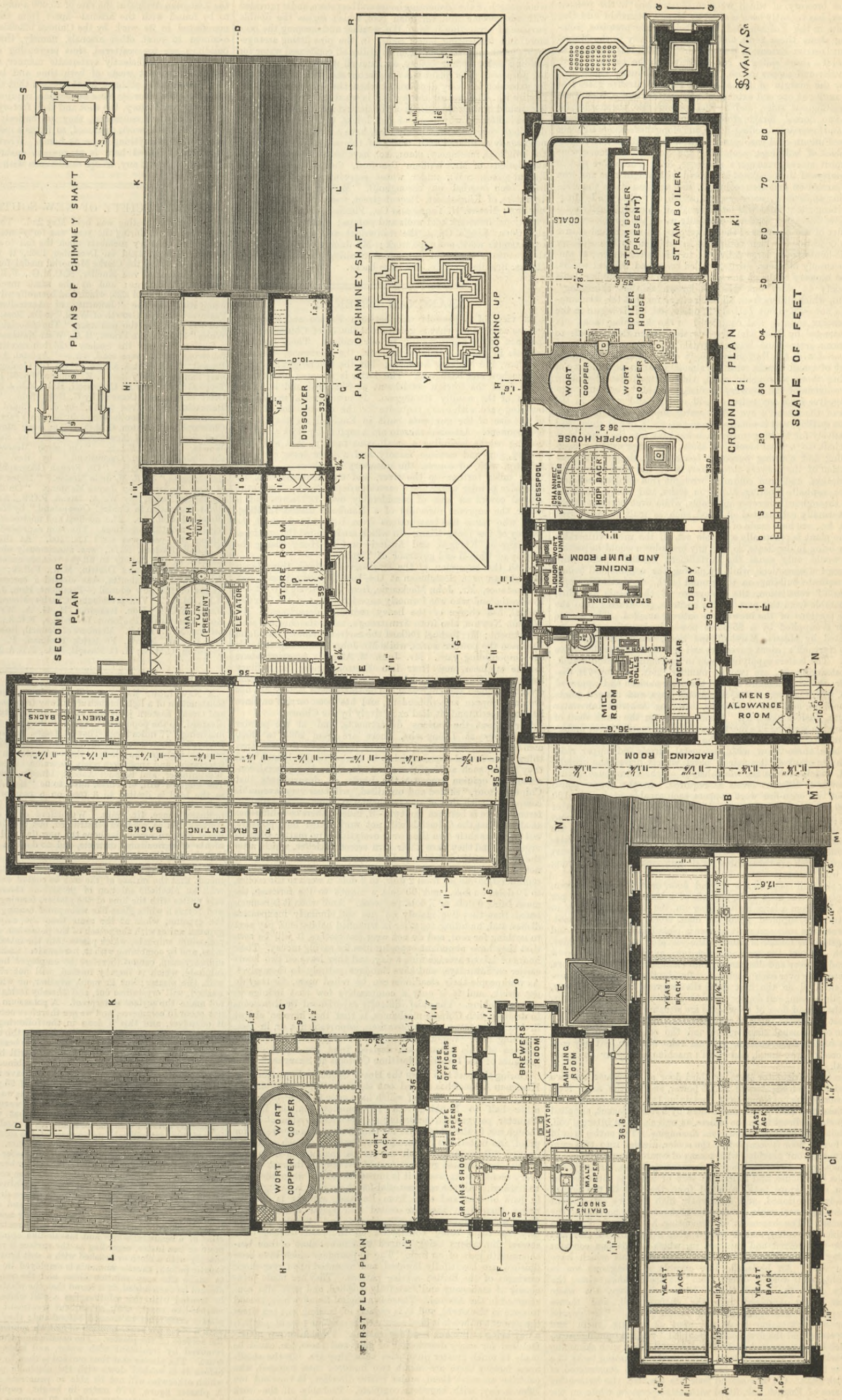


SWAN BREWERY, WALHAM GREEN, S.W.

THIS brewery, of which we give illustrations in the present number, has recently been erected by Messrs. Stansfeld and Co., on a site in the Fulham-road, near their former premises, comprising about three acres, and in close proximity to the Metropolitan District Extension Railway, from which it is intended to construct a short siding to run directly into the brewery yard. The boiler and copper house, brew house, chimney shaft, &c., occupy the margin of the site opposite the entrance gates; at right angles at one end extends the fermenting house, beer store, and loading-out stage, and at the opposite side, the stables for forty-two horses, forage stores, chaff-cutting room, carpenter's shop, and foreman's dwelling-house, and along the frontage adjacent to the Fulham-road has been erected a commodious and imposing block of buildings, containing the commercial offices, wine and spirit stores, manager's residence, &c. The centre part of the courtyard thus enclosed is covered with a light zinc and iron roof, carried on cast iron columns, and accommodates the cask-washing apparatus, cooperage, &c., which, as well as the loading-out arrangement is, as will be observed, of an exceptionally commodious character, rendered especially necessary for the efficient conduct of the business of the brewery, by the very mixed nature of its operations, which comprise, in addition to the ordinary public-house trade, large deliveries to private consumers, as well as the supply of wines, spirits, bottled beers, and mineral waters.

The brewery is one of the comparatively small number built expressly to carry out what is known as the "skimming" system, which differs from all others in so far that the fermentation is not carried out entirely in one vessel, but is begun in the fermenting squares and completed in the skimming backs. It is contended by those who advocate this system that it tends to produce a cleaner and brighter article than any other, while, as compared with the Burton system, it does not entail the multiplicity of small vessels, with the almost insuperable difficulty of keeping them thoroughly clean, which characterises the latter. In arrangement the brewery is distinguished by extreme simplicity, free from any twists or odd corners, and wholly in the reach of the master's eye. The water supply is ample, of the purest quality, and is obtained from two wells, one of them used exclusively for brewing purposes, being sunk into the water-bearing chalk to a total depth of 450ft., the other used for cask-washing and cleaning purposes, being 200ft. deep. The construction of the brewery throughout is of the most substantial description, cast iron columns, wrought iron girders, concrete arches, asphalte flooring, cast iron stairs, and iron roofs being used throughout wherever applicable, while even portions of the plant usually constructed of wood, such as malt hoppers, grist cases, &c., are here made of iron.

The plant is practically a double set, all the more vulnerable parts being in duplicate, so that any breakdown would be partial, and would only cause the curtailment instead of the entire stoppage of operations, while by placing the coppers and boilers in a separate building on the ground level, provided with ample means of ventilation, the annoyance of the steam and dirt, inseparable from this part of the business, penetrating into the other portions of the brewery is entirely avoided. The motive power is supplied by a 25-horse power horizontal engine, constructed by Messrs. Marshall and Sons, Gainsborough, fitted with Hartnell's patent governors and automatic expansion valve gear. The boilers supplying steam to the engine, hot liquor tank, cask steaming, &c., are two in number, 25ft. long by 7ft. diameter, of the Lancashire type of the most modern and approved style, with Galloway tubes, Adamson's rings, and flanged joints in the flues, and full mountings, including Ashcroft low-water alarum, fusible plugs, &c. A spur pinion on the crank shaft of the engine working in a mortice wheel gives motion to an underground shaft which actuates the deep well pumps. These are 6in. bore, three-throw, with gun-metal barrels and copper rods. From the crank shaft a pair of bevel wheels drives the upright shaft, which extends the whole height of the brewhouse, giving off power at different levels as required. In the copper-house are set two open-fire wort coppers, each capable of boiling 130 barrels of wort, and surrounded by a commodious side stage of cast iron gratings supported on wrought iron girders, and approached from the ground floor by iron stairs. Adjoining the coppers is the hop back, of English oak fitted with copper false bottom, and in the engine-room adjoining are situated the wort pumps, which are three-throw, with gun-metal barrels in strong cast iron frames.

In the mill room on the ground floor, next the engine-room, are placed the malt rolls, capable of crushing 25 quarters per hour, fed from a large malt hopper on the first floor, which in its turn is supplied from the malt store by an iron shoot. Between the rolls and malt hopper is placed the malt screen, and alongside the former is situated the elevator or Jacob's ladder, which delivers the ground grist into an archimedean screw extending over and discharging into either of two grist hoppers, situated one over each mash tun. Besides the malt hopper, there are situated on the first floor the brewers' room, laboratory, sampling room, and copper safes for spend taps from mash tuns. On the second floor of brewhouse are situated two mash tuns, one of cast iron, with internal rake machine and Steel's mashing machine of the usual construction, and the other of English oak, with copper false bottom, internal rake machine entirely constructed of gun-metal, and Steel's machine of copper and gun-metal.

On the refrigerator stage, or third floor of beerhouse, are two Baudelot's refrigerators of ample power, and on the same level is situated the hot liquor tank, containing 160 barrels, constructed of Bessemer steel plates, and heated by a steam jacket, supplied with steam direct from the boilers, as well as by an internal coil, utilising the exhaust steam from the engine. The entire area of the fourth floor is occupied by the cooler, divided into two compartments, but provided with means of communication from one to another. Above the roof of fermenting house, but adjacent to the brewhouse, and forming a sort of tower, is situated the main cold liquor tank, supplied from the well by the pumps already mentioned, and sufficiently high to give an efficient service at considerable pressure throughout every portion of the premises. The basement of fermenting house forms a portion of the beer cellar, and is floored with a mixture of clay and chalk well mixed and rammed in, which stands the constant rolling of the casks better than other materials which have been used. An hydraulic lift, capable of lifting one ton in weight, and worked direct from the main tank, raises the casks from the cellar to the loading-out stage, the waste water being delivered into the surface well, and thence pumped up and used for cask washing, &c. The ground floor of fermenting house is used as racking room and beer store, and the first floor is occupied by the skimming backs, which are constructed of Welsh slate, and fitted with skimming apparatus and attemperators. Between the skimming backs, at a lower level, are the yeast backs, which are also constructed of Welsh slate. On the second floor are situated the fermenting squares of English oak, fitted with attemperators, while on the third floor and in the roof over are located the malt and hop stores, furnished with a powerful frictional geared hoist. The loading-out stage, with cellar underneath, extends along the whole length of the fermenting house and beer store, and is provided with a handsome iron verandah roof, which serves the double purpose of protecting it from the weather and keeping the beer store and fermenting house cool. In the pipe fitting arrangements great care has been taken to utilise all condensed water for scalding casks, feeding boilers, &c., and all waste steam for heating purposes. The plant is a 50-quarter set, with ample space for extension in every department when the exigences of trade require it. The gearing throughout is wood and iron, the shafting turned, and all the fittings of the neatest and completest kind.

The buildings, which are of red bricks, with Corsehill stone dressings, covered with Brosely tiles, have a picturesque *ensemble* not usually associated with works of this class. The whole of the buildings, machinery, plant, &c., have been constructed from the designs of Mr. William Bradford, Carlton-chambers, 12, Regent-street, S.W., under whose superintendence the works have been carried on throughout. Messrs. G. H. and A. Bywaters, of King-street, Regent-street, were the building contractors; Messrs. H. Young and Co., Pimlico, executed the constructional ironwork and wells and pumps; Messrs. H. Pontifex and Sons, King's Cross, the millwright and engineer's work, coppersmith work, and pipe work; Mr. James Oxley, of Frome, the woodback work and gun-metal mashing machine, &c.; and Messrs. Brindley and Co., the slate backs.

KIANGNAN ARSENAL.

IN view of a possible war between France and China, a concise account of what is going on at the chief Chinese arsenal may not prove uninteresting to our readers. There are four arsenals in the Celestial Empire, viz., the Kiangnan, Tientsin, Foochow, and Nanking Arsenals; but the two largest are those of Foochow and Kiangnan. The latter is situated about three miles from the foreign settlement at Shanghai, and is on the banks of the muddy Hwangpoo. It comprises a small shipbuilding yard with every requisite for the construction of ships of the size of the gunboats built in England for the Chinese Government. Attached thereto are a capital dry dock and engineering works, including a small-arms factory, shot and shell factory, gun and carriage factory, and a large brass and iron-foundry, with, of course, the necessary storehouses. Two or three miles further up the river, and on the same side, are extensive powder works and a cartridge department. The entire arsenal covers an area of considerably over 200 acres, and is under the supreme direction of a Mandarin named Li Mingling, who takes his instructions from both Lin K'un-yi, the viceroy of the Liang-Kiang—in which are included the provinces of Kiang-su, Kiang-si, and An-hui—and Li Hung Chang, the viceroy of Chih-li and governor of Tientsin.

With the exception of the small-arms factory, there is an Englishman or a Scotchman at the head of every department. For instance, Mr. John Mackenzie, from Armstrong's Works at Newcastle, and who was formerly superintendent of the Turkish arsenal, has charge of the heavy ordnance department; Mr. William Newton, also from Armstrong's, takes the shot and shell department; Mr. Samuel Ballard the cartridge factory, Mr. John Atkinson the powder works, while Mr. John Rennie superintends the shipbuilding yard. Mr. John M. Allen is superintendent marine engineer, and Herr Leo Brettcheineider is military instructor. Otherwise the whole arsenal is worked by Chinamen, even to foremen and engineers. The small-arms factory has not even a European superintendent, and has been carried on since its late superintendent died exclusively by the Chinese.

Throughout the various departments, and at the powder manufactory at Loong-wha, there are from 2500 to 3000 men employed, and although none of them have to serve anything like a formal apprenticeship to the particular branch that they follow, such as English artisans do, there is a general consensus of opinion amongst the heads of departments that Chinese labour, "skilled and unskilled," will bear very favourable comparison with that of our mechanics at home. The only difference there is between the two—if, indeed, there be a difference at all—is that the Celestials will not work under high pressure, but will take their own time over everything, no matter what its urgency; and they have their own secret societies, which, after the pattern of English Trades Unions, see that their members do not do too much work or take too little pay. The scale of remuneration ranges from 2 dols. to 3 dols. a week to the coolies, to 70 dols., 80 dols., and 90 dols. a month to the foremen, the mean being 6 dols. or 7 dols. per week. And when it is remembered that they live mainly on rice and similarly inexpensive dishes, and, huddling together in wretched habitations, pay next to nothing for rent, and do not wear fine clothes, it will be seen that they have abundant opportunities for saving money. Their hours of labour average nine a day, and they leave off two hours earlier on Saturdays, and have Sundays entirely to themselves. As workpeople their steadiness can be relied upon, for they do not drink, and it is only a comparative few that indulge in opium smoking. The chief difficulty experienced by Europeans in dealing with Chinese mechanics, is that they have an almost invincible repugnance to innovations, improvements, or, in fact, anything new. We understand that the supplies for the maintenance of this arsenal are derived from two-tenths of the revenues of the Imperial Maritime Customs at Shanghai.

During the past two years the Heavy Ordnance Department at Kiangnan Arsenal has turned out eighteen 40-pounders on the Armstrong principle, half of which have gone to Tientsin and the other half to Nanking. A 120-pounder, 7in. in interior diameter, polygrooved according to the latest system at home, though not in the latest style for length of gun, is now ready for proof, and material is in store for twenty more of such guns and twenty 80-pounders, which are to be manufactured in due course; but as these guns are turned out only at the rate of one every month or six weeks, it is impossible to say when they will be finished. All the raw material for these guns is brought out in bars of iron and steel from England, and, as is done at home, these iron bars are coiled into spiral cylinders and then welded into solid coils, bored and turned preparatory to their being contracted on the steel barrels, their several dimensions being gauged to a minuteness of one ten-thousandth part of an inch. The 40-pounders which have been finished are beautifully bronzed, and mounted upon rear-chock carriages of the British service pattern. They are made principally of mahogany and tastefully polished, and were also constructed in the Arsenal. There is a capital foundry here, second to none in the world, and it is capable of turning out ten times the amount of work it does—only three or four tons of pig iron a day being at present used for casting. Projectiles are manufactured for every description of gun, and these, too, could be made in much greater quantities than they are. In the small-arms factory there are about two hundred men engaged, who contrive amongst them, under native direction, to turn out ten rifles a day, with bayonets complete. Probably all the work done at the other arsenals would not more than double the results obtained from the Kiangnan Arsenal, as Foochow Arsenal is chiefly devoted to shipbuilding. Cartridges are at present manufactured in the Kiangnan Arsenal at the rate of 25,000 a day. The great fault to be found with the arsenal—apart from the lack of energy manifested in its work by the Chinese officials—is one that is common to most other arsenals, namely, that its sheds and buildings are too scattered, thus preventing operations being carried on in a sufficiently systematic manner, and leading, consequently, to great waste of both time and labour. This has been unavoidable, perhaps, for the reason that the establishment has been built piece by piece as occasion required. However, so far as the gun factory, the shot and shell factory, and the small-arms factory are concerned, they are entirely upon European models, while the work produced, so far as a casual observer can see, is equal to anything done at home. What becomes of the arms manufactured here is at present enshrouded in some mystery, as few, if any, troops can be seen with them.

ROYAL SOCIETY OF NEW SOUTH WALES.

THE annual meeting was held May 2nd. The number of new members elected during the year was forty-one, making the total number of ordinary members upon the roll to date 486. At the council meeting, held on December 13th, it was unanimously resolved to award the Clarke Memorial medal for the year 1883 to Baron Ferdinand von Mueller, K.C.M.G., F.R.S., Government botanist, Melbourne; and at the same meeting the council awarded the prize of £25, which had been offered for the best communication on the "Influence of Australian Climates and Pastures upon the Growth of Wool," to Dr. Ross, M.L.A., Molong, and the prize for the one upon "The Aborigines of New South Wales" to Mr. John Fraser, B.A., West Maitland.

During the year the Society held ten meetings, at which the following papers were read, viz.:—"Annual Address," by H. C. Russell, B.A., F.R.A.S., &c. "On the Geology of the Hawkesbury Sandstone," by Rev. J. E. Tenison-Woods, F.G.S., &c. "On Tropical Rains," by H. C. Russell, B.A., F.R.A.S., &c. "On the Orbit of the late Comet," by G. Butterfield. "On a Method of Determining the True South," by J. S. Chard. "Notes on the Progress of New South Wales during the Years 1872 to 1881," by Christopher Rolleston, C.M.G. "On some Marine Fossils of the Coal Formation of New South Wales," by Rev. J. E. Tenison-Woods, F.G.S., F.L.S. "On some Mesozoic Fossils from the Palmer River, Queensland," by Rev. J. E. Tenison-Woods, F.G.S., F.L.S. "On French Geographical Societies and the Colonies," by E. M. de la Meslee. "Notes on the Aborigines of New Holland," by James Manning. "On the Ashes of some Epiphytic Ferns," by W. A. Dixon, F.C.S., &c. "On a Fossil Plant Formation in Central Queensland," by Rev. J. E. Tenison-Woods, F.G.S., &c. The medical and microscopical sections held regular monthly meetings. The sum expended upon the library during the year was £422 12s. 10d. At the annual meeting M. Louis Pasteur, M.D., was unanimously elected as honorary member of the Society to fill the vacancy caused by the death of the late Dr. Charles Darwin, M.A., F.R.S., and Dr. Ottokar Feistmantel, of Calcutta, was elected a corresponding member. Names of the new council:—President, Hon. J. Smith, C.M.G., M.D., M.L.C. Vice-presidents, Charles Moore, F.L.S.; W. A. Dixon, F.C.S. Hon. treasurer, H. G. A. Wright, M.R.C.S.E. Hon. secretaries, Professor Liversidge, F.R.S., F.G.S., &c.; Dr. Leibius, M.A., F.C.S. Members of Council, Robert Hunt, F.G.S., &c.; Dr. W. Morris, Frederick Poolman, P. R. Pedley, Chr. Rolleston, C.M.G.; H. C. Russell, B.A., F.R.A.S.

A NEW LIGHT RAILWAY.—Tenders have been received for the construction of a light branch of railway from the Great Northern and Great Eastern joint line at Blankney, between Lincoln and Sleaford, to the populous village of Billinghay, the length of the line being 7·77 miles long. That of Messrs. Benton and Woodiwiss, Derby, has been accepted, the amount being £42,352 5s. 4d. The contract includes the whole of the works, station buildings, signals, telegraphs, and appliances ready for traffic. Messrs. R. E. Cooper, Westminster, and Samuel Abbott, Lincoln, are joint engineers. The engines will, of course, have to be "light," like contractors' as the load is limited to 8 tons on a pair of wheels, but the ordinary carriages and wagons can pass over, the line being the ordinary gauge, 4ft. 8½in. We believe only one light line, in Norfolk has as yet been constructed, but the Great Northern and Great Eastern companies hope the new line will meet the requirements of agricultural districts, and no doubt a great deal is to be done in this direction.

WASHING THE SURFACES OF PLASTER CASTS.—Puscher recommends that the surface of the cast be coated over and over again with an alcoholic solution of potassium stearate. The stearic acid unites with the lime of the plaster, forming calcium stearate, and forms a white glaze-like waterproof coating on the surface of the gypsum, while at the same time the sulphuric acid of the gypsum unites with the potash of the potassium stearate and forms potassium sulphate, which passes into the interior of the gypsum mass, and by combining with it, hardens it. Sodium stearate, or our ordinary soap, cannot therefore be employed because the sodium sulphate, which is thereby formed, will not chemically combine with the plaster; but in moist weather, or when the gypsum is washed, will crystallise out, and thereby forms a crust, and does not make the surface waterproof. A potassium stearate soap does not occur in commerce, and we are therefore compelled to prepare it ourselves, and this is done in the following manner:—Three parts of caustic potash is to be dissolved in thirty-five parts of hot water and nine parts of stearic acid of the best quality are added to it. In a few minutes the stearic acid will have dissolved, and by constant stirring it will soon have combined with the potash to form a dense clear soap-like glue. We have now to add to this an equal weight of water and of alcohol of 95 per cent. strength, and the clear thinly fluid solution, as clear as water, is to be placed in a vessel containing lukewarm water to warm it. The plaster cast, which has been previously somewhat warmed, is to be repeatedly covered with the solution with a brush or a sponge until, in fact, the cast will take up no more of the solution, when it is to be placed on one side for two or three hours. By that time the alcohol will have evaporated and the plaster cast can now be washed with water and a sponge. If the water becomes very strongly coloured, it is a sign that the washing has been commenced too soon and the potassium soap has not yet been entirely decomposed, in which case the plaster cast, after having been dried, is again to be treated a couple of times with the soap, and after having been placed aside to dry for five or six hours, may again be washed with water. The plaster cast obtains by this treatment a waterproof crust of a beautiful white and marble-like appearance, which has more or less lustre, according as the surface is rubbed more or less sharply with a cloth or brushed with a soft brush. If in place of caustic potash, caustic ammonia is employed in quantity sufficient to make the soap solution clear, and the requisite quantity of alcohol be then added, it is found that the plaster cast, which may be treated with this solution, has a still white, more waterproof, marble-like crust, after subsequent treatment with water. Old plaster casts must be cleaned beforehand; they should be treated with a three per cent. solution of potash solution, which destroys the surface of the plaster. The caustic lime thus produced is then removed by treatment with water, and takes with it the dirty crust. The plaster cast thus purified is then to be dried in the air before it is washed down with the alcoholic potassium stearate, which otherwise will not be able to penetrate sufficiently deeply. A plaster figure, 0·75 metre in height, requires a solution of 1·3 grammes of potassium oxide in 40 grammes of water.

RAILWAY MATTERS.

THE large bridge over the Nerbudda, on the Bhopal State Railway, has been finished. Its total length is about half a mile.

A TREATY has been made for mutual working between the Northern, Southern, Eastern, and Paris, Lyons, Mediteranean railway companies of France.

AT a railway league meeting held at Port Douglas, Queensland, it was resolved to offer a reward of £500 for the discovery of a track up the coast range over which a railway to Herberton could be carried.

BOTH driver and stoker of a light goods engine on the line of the Irish mail of the London and North-Western Railway were found fast asleep last week on their engine. The men had been on duty fifteen hours.

THE Colombo, Ceylon, municipal authorities have sanctioned the construction of tramways through the main street of the native Pettah, or town, having its terminus near the Clock Tower within the fort, but will not consent for the present that lines shall be laid along the Galle Face and Kollupitya.

THE first sod of the Gravesend Railway was turned by Lady Waterlow on Saturday last. The new line will be about five miles long, and there will be stations at Southfleet and near Rosherville. The deep-water pier with which the line will be connected at Gravesend is an important part of the scheme.

ON Sunday evening while the Cornish mail train was running at the rate of about thirty miles an hour round a rather sharp curve near Menheniot, the last carriage, which was empty, suddenly left the rails, dragging with it a fish wagon. The train was quickly stopped, but not before the permanent way had been much damaged.

IN a report to the Board of Trade on a collision which occurred on the 16th April, between Dunleer and Drogheda, on the Great Northern Railway of Ireland, Major-General Hutchinson says :—"If the driver of the passenger train had had command of a quickly acting continuous brake, he would no doubt have been able to stop before reaching the goods train."

ON the railways of the United States the average of the accidents per day for April were 3·53 accidents, 0·87 killed, and 3·80 injured; for the year there were 4·27 accidents, 1·16 killed, and 4·92 injured. The average casualties per accident were, for the month, 0·245 killed and 1·075 injured; for the year, 0·272 killed and 1·151 injured. The averages per month for the year were 130 accidents, 35 killed, and 150 injured. April was below the average, not only in accidents, but also in killed and injured.

ON Tuesday the French Government voted 4,677,000f. (£187,080) for continuing work on the Senegal railway and forts. M. Ferry admitted that the expense had been considerably underestimated —133 kilometres of railway, and an expenditure of sixteen millions having been omitted—but said that this was due to want of experience of railway making in the desert. He deprecated the abandonment of five or six forts, the last raised on the banks of the Niger, and urged that a railway saved the expense of mules and asses in victualling, while the recent history of South Algeria had shown the great military advantage of railways.

ON Tuesday afternoon one of the most serious tramcar accidents occurred at Huddersfield that has yet happened. Five persons were killed, and about sixteen seriously injured. The road to Huddersfield town from Lindley is on a falling gradient nearly all the way, and the last half-mile is very steep, and ends with two very awkward curves. On Tuesday a car from Lindley, with a Wilkinson's engine in front, came down the hill at a high speed, and on one of the curves referred to, left the line and turned over. The persons on the top were thrown with great violence to the ground, and were cut and bruised terribly. Those inside were thrown into a confused heap, and also badly injured.

THE Government convention with the Orleans Railway Company was laid before the Chamber on the 28th ult. Two thousand three hundred kilometres of new lines are conceded to the company, which will bear the expense of construction up to 50,000f. per kilometre. It will also repay the 205 millions received from the State, under guarantee of interest, and will give 50 millions for lines already made; but it transfers certain short lines to the State. The company engages to construct 200 kilometres a year while it is guaranteed 56f. dividend, and will give up to the State two-thirds of any excess over 71f. M. Raynal urged the Committee to report on this and the other conventions before the prorogation, which, he said, could not be deferred beyond July 21st, on account of the Departmental Council elections.

A CORRESPONDENT of the *Nebraska State Journal* writes :—"I wish I could give you a description that would do justice to a railroad I rode on in Oregon. There used to be some coal mines up at Coquille City, and a wooden tramway was run up from the head of Coos Bay. The mines gave out, but the tramway was left. I heard there was a railroad, and when I got there the train had backed up to the end of the track. Well, you would have died to see that train of cars. The old man who had appropriated the tramway had got an old engine out of the mine and mounted it on a hand car and connected the driving shaft with the handle. This was the engine and tender. The baggage, mail and express cars, and the passenger coaches, were comprised in two rubble cars, such as are used in the section for carrying tools, rails, &c. The old man was a no less wonderful combination than the train. He was the company and the working force of the road. President, vice-president, stockholders, agent, conductor, engineer, fireman, and peanut boy, were all comprised in his lank form. He never had any trouble with the stockholders, and he carried the general office in his hat. My fellow passenger raised an umbrella when he got on board, and on my inquiry as to the need of an umbrella, said I had better raise mine—I would need it. When the train started I found out he was right. The puffing, wheezy old engine sent soot and water over us in a perfect shower. We got along, however, very well, and would have made the trip as quickly as we could have walked it, if the train had not stopped when we were about half way and waited half an hour for a man who wanted to go with us to finish his supper."

A REPORT has been published on the accident which occurred on the 20th April to a train of empty carringes belonging to the London and South-Western Railway Company, at the Snow-hill sidings of the London, Chatham, and Dover Railway Company, when the engine-driver, fireman, and one guard of the train were injured. The leading end of the engine fell into the fan turntable pit, and it and two front carriages were badly damaged, as well as the engine turntable in the pit. In the return to the Board of Trade from the London, Chatham, and Dover Railway Company, the accident is supposed to have "happened through the vacuum brake failing," but in the return from the London and South-Western Railway Company, it is stated "that the driver lost control of the empty train through not properly applying the vacuum and other brakes," and the engine fell into the turntable pit. Colonel Yolland says :—"A careful consideration of the statements of the men induces me to think that there is no evidence whatever to prove that there was any failure in the working of the automatic vacuum brake fitted to this train on this occasion, but there is most distinct evidence given by the driver himself to show that he did not understand the proper mode of working it, and used it most improperly while running through the Snow-hill station in pulling off the brake setter three or four times, and it was found at 'off' immediately after the accident happened. The brake should have been moderately applied in regulating the speed of the train down the steep incline of 1 in 40, whereas according to his own showing he did not apply it until he got to the Ludgate-hill end of the Snow-hill station. One thing is quite clear from this accident, that no untrained engine-driver should be permitted to drive a passenger train fitted with the automatic vacuum brake."

NOTES AND MEMORANDA.

A TON of wheat or seeds may now be sent from Delhi to Howrah, a distance of 954 miles, for £1 9s. 11¼d., equal to 0·3765d. per ton per mile.

THE annual death-rate in London last week was 17·16 per thousand of the population, and in the twenty-eight great towns of England and Wales it averaged 18·7 per thousand.

AT the salt borehole of the Newcastle Chemical Company, near Port Clarence, there has been considerable progress made. The red sandstone has been reached at a depth of 90ft., and more rapid work will now take place with the diamond bore, but it will be some months before the salt is reached.

THE number of miles of streets which contain water mains constantly charged, and upon which hydrants for fire purposes could at once be fixed, in each district of the metropolis, is now as follows: Kent, 85 miles; New River, 215; East London, 120; Southwark and Vauxhall, 119; West Middlesex, 89; Grand Junction, 48¾; Lambeth, 136¾; Chelsea, 68, making a total length of 881½ miles.

TAKING the average amount of organic impurity contained in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the metropolitan water companies and by the Tottenham Local Board of Health during May last was:—Kent, ·9; Colne Valley, 1·0; Tottenham, 2·0; Chelsea, 2·1; New River, 2·1; Grand Junction, 2·6; East London, 2·9; West Middlesex, 3·0; Southwark, 3·2; Lambeth, 3·6.

BY a recent analysis of tobacco smoke, MM. G. Le Bon and G. Noel have extracted bottles of—(1) Prussic acid; (2) an alkaloid of an agreeable odour, but dangerous to breathe, and as poisonous as nicotine, since one-twentieth of a drop destroys animal life; (3) aromatic principles, which are as yet undetermined, but which contribute, with the alkaloid, to give the smoke its perfume. The alkaloid appears to be identical with collidine, which has been observed in the distillation of many organic substances, but its physiological and poisonous properties have been hitherto unknown.

THE gross increase in tonnage passing through the Suez Canal during the past three years is 1,866,151 tons, towards which British tonnage contributed 1,390,931 tons; and, while the increase in the total numbers of vessels was 996, the increase in English ships was 755. Nearly ten tons of English shipping used the canal for one ton of French shipping in 1882, and over twelve English ships passed through for every French ship. The actual number of English ships was fifteen fewer in 1882 than in 1881, but their tonnage was 269,048 tons greater; and, while the French steamers increased in the same period from only 123 to 197, their tonnage was rather more than doubled, having increased from 191,139 to 382,855 tons, showing the rapid increase in the size of steamers.

SPEAKING of the liquefaction of oxygen and nitrogen, the freezing of alcohol and sulphide of carbon by the use of liquefied ethylene, used by M. Wroblewski and K. Olszewski, as already recorded in this column, the *Scientific American* says :—Air contains by weight, approximately, 23 parts of oxygen and 77 parts nitrogen. It is common to compress it to a far greater degree than above mentioned. For motive power, in driving compressed air locomotives, a compression of the air to 1000 lb. to the square inch is in some cases employed. The difficulty heretofore experienced in the liquefaction of oxygen and nitrogen has been to obtain a sufficiently low temperature in conjunction with compression. This obstacle now appears to be removed, and a variety of new and valuable observations concerning the nature of gaseous substances may be expected.

TO preserve steel gun-barrels by coating them thinly with copper, M. F. Weil uses a composition, in which the usual cyanides of the alkalies are replaced by organic acids and glycerine. According to M. Weil, these baths require no renewal of organic elements, and can be used continuously when they are saturated with peroxide of copper. They possess, also, the advantage, owing to the property inherent in organic alkaloids, of dissolving the peroxide of iron without attacking the metallic iron itself, of cleansing the steel before the commencement of the coppering process, and more perfectly than can be done mechanically. The coppering is effected by putting porous clay vessels filled with caustic soda lye, in which zinc plates have been immersed, in the basin containing the organic copper base—alkaloid—and the steel. The zinc plates are connected by a thick copper wire with the steel articles to be coated with copper.

M. P. GERMAIN proposes to use the various degrees of resistance which selenium opposes to the passage of electricity at different temperatures, and under different rays of the spectrum, to the regulation of the temperature, in muffles for enamelling painted glass or porcelain. He uses a thermo-electric battery of thirty elements, which receives the heat directly from the muffle. The opposite pole is connected with the wall of a porous vessel, full of water, which maintains a sensibly constant temperature. The thermo-electric current increases in potential proportionally to the elevation of the temperature in the muffle. The selenium is brought into the circuit, but it remains comparatively unaffected until the muffle has reached the proper luminous temperature, when it allows the current to pass and to give a signal by means of a bell. We should imagine that a much simpler could be made by taking advantage of the rise in the pressure of steam by rise in temperature.

A GERMAN chemist, Herr Maximilian Zingler, has just patented a new process for manufacturing a substitute for gutta-percha. About 50 kilos. of powdered copal and 7½ to 15 kilos. of sublimed sulphur are mixed with about double the quantity of oil of turpentine, or with 55 to 66 litres of petroleum, and heated in a boiler provided with a stirring apparatus to a temperature of 122 deg. to 150 deg. C., and stirred until completely dissolved. The mass is then allowed to cool to 38 deg. C., and is then mixed with about 3 kilos. of casein in weak ammonia water, to which a little alcohol and wood spirit has been added. The mass is then heated to the former temperature—122 deg. to 150 deg. C.—until it is a thin fluid. It is then boiled with a 15 to 25 per cent. solution of nutgall or catechu, to which about half a kilo. of ammonia has been added. After boiling for several hours the mass is cooled off, washed in cold water, kneaded in hot water, then rolled out and dried. It is claimed that the product is produced much cheaper and cannot be detected from the real article. It is said to wear equally as well.

A NEW bichromate battery has been devised by Signor Luigi Ponci, director of the Como Technical Institute. The exciting fluid consists of 2½ lb. of potash, half a gallon of hydrochloric acid, and a gallon of water. The bichromate is crushed and dissolved in boiling water, when all the acid is added at once. A liquid is thus obtained, consisting of a mixture of chloride of pottassium and bichromate of potash, which forms no crystals. The battery is a wooden box lined with lead and provided with a leaden syphon for charging. It contains six rectangular glass cells with holes in the bottoms, which rest upon glass plates permitting of the circulation of the liquid. The elements consist of one zinc and two carbon plates, separated by a small band of india-rubber and clamped together. A six-cell battery is capable of producing a current of the same intensity as six small Bunsen elements. Three such batteries will keep in incandescence an eight-candle Edison lamp of slight resistance, and eight of them will maintain a good arc lamp. This battery is said to require no attention, while the liquid is not liable to change, and gives out no smell; nor is there need to amalgamate the zinc.

MISCELLANEA.

THE Select Committee on the Manchester Ship Canal Bill has conditionally passed the preamble of the Bill.

THE Canal Ironworks and attached cottages, Gravesend, opposite the new Tilbury Docks, will be sold by Messrs. Wheatley Kirk, Price, and Goulty, on the 11th inst.

THE number of visitors to the Fisheries Exhibition on Saturday last was 19,684, making a total for last week of 82,489. The total number from the opening of the Exhibition has been 609,753.

THE Darlaston Local Board have instructed Mr. E. Pritchard, C.E., to prepare a scheme, with an estimate of the cost thereof, of dealing with the sewage of the town, with the view of meeting the requirements of the Birmingham Corporation.

THE Select Committee of the House of Commons appointed to inquire into the merits of the Bills promoted by the Commissioners of Sewers and the Metropolitan Board of Works to compel the demolition of the District Railway ventilators, gave their decision on Wednesday afternoon, when the chairman announced that the Committee were not prepared to pass either of the Bills without amendment.

AN iron screw steamer, the Badsworth, of the following dimensions, was launched on the 25th ult. by Messrs. Oswald Mordaunt and Co., Southampton:—Length, extreme, 276ft.; breadth, 36ft.; depth to floors, upper deck, 24ft. 6in. The vessel is spar decked with poop, two small bridges, and topgallant forecastle. The engines, by the same firm, are compound, having cylinders 30in. and 60in., with a stroke of 42in., steam being supplied by two boilers 13ft. diameter, with a working pressure of 90 lb.

WITHIN the past six months the use of steel nails, the *Boston Commercial Bulletin* says, has increased largely. "They came into the market about a year ago, and found an immediate sale. One by one the leading nail companies of this State took up this line of manufacture, until all now produce steel nails regularly. No change in machinery was required. The knives for cutting the steel plates dull much quicker than on ironwork, but otherwise the cost of manufacture is not increased beyond the first cost of the steel bloom as compared with pig or scrap iron, which is used in making iron nails. At first the extra cost of steel nails was 1½ cents per lb., or 1·50 dols. per keg, but it has now been reduced to one dollar extra." We have not seen them yet in this country.

THE Wakefield Corporation Waterworks Committee have determined to again call in Mr. Hawksley, C.E., of London, and Mr. Jackson, of Bolton, to make another examination of the proposed site for new waterworks along with Mr. Filliter, of Leeds, the engineer for the scheme. It is said that the discovery of the fact that the coal has been won from under the site of the reservoir will necessitate the formation of puddle trenches all round the basin of the reservoir, and that instead of the cost being only £40,000, it will be at least £100,000. In order to minimise the alarming additional cost it has been suggested that the size of the reservoir should be considerably reduced, and that instead of being formed to contain, 320,000,000 gallons of water, it should be made to hold only 135,000,000.

THE port of London over-sea trade for the week ended June 23rd was:—Number of vessels entered in, 245; number of steamers entered in, 145. Number of vessels entered out, 142; number of steamers entered out, 96. Number of cargo vessels cleared out, 137; number of cargo steamers cleared out, 99. Tonnage of vessels entered in, 146,657; tonnage of steamers entered in, 104,966. Tonnage of vessels entered out, 91,606; tonnage of steamers entered out, 65,452. Tonnage of vessels cleared out, 91,585; tonnage of steamers cleared out, 66,049. Total number of British vessels cleared out, 107; British tonnage cleared out, 70,873. Number of British steamers cleared out, 81; tonnage of British steamers cleared out, 52,585. Number of British sailers cleared out, 26; tonnage of British sailers cleared out, 18,288.

BREWERS have occasionally endeavoured to replace wood by some more suitable material. Stone is used sometimes in the North of England; slate, in spite of its first cost, which is considerable, is fast growing into favour; and glass has also been recommended. The *Brewers' Guardian* proposes the use of glass, but thinks that its expense, the difficulty of obtaining it in sufficiently large sheets of the requisite strength, and its excessive liability to fracture, are too great to make its use practicable. Speaking of toughened glass, it is suggested that, if large sheets of it cannot be obtained at a moderate expense, tablets of a moderate size might be glazed together in a suitable framework by means of some insoluble and odourless cement. Fermenting squares, racking vats, yeast stillions, and other utensils made of such a material, would seem to meet all the requirements of the brewer, and would certainly be preferable to any other material, with the exception, perhaps, of slate, in the matter of cleanliness.

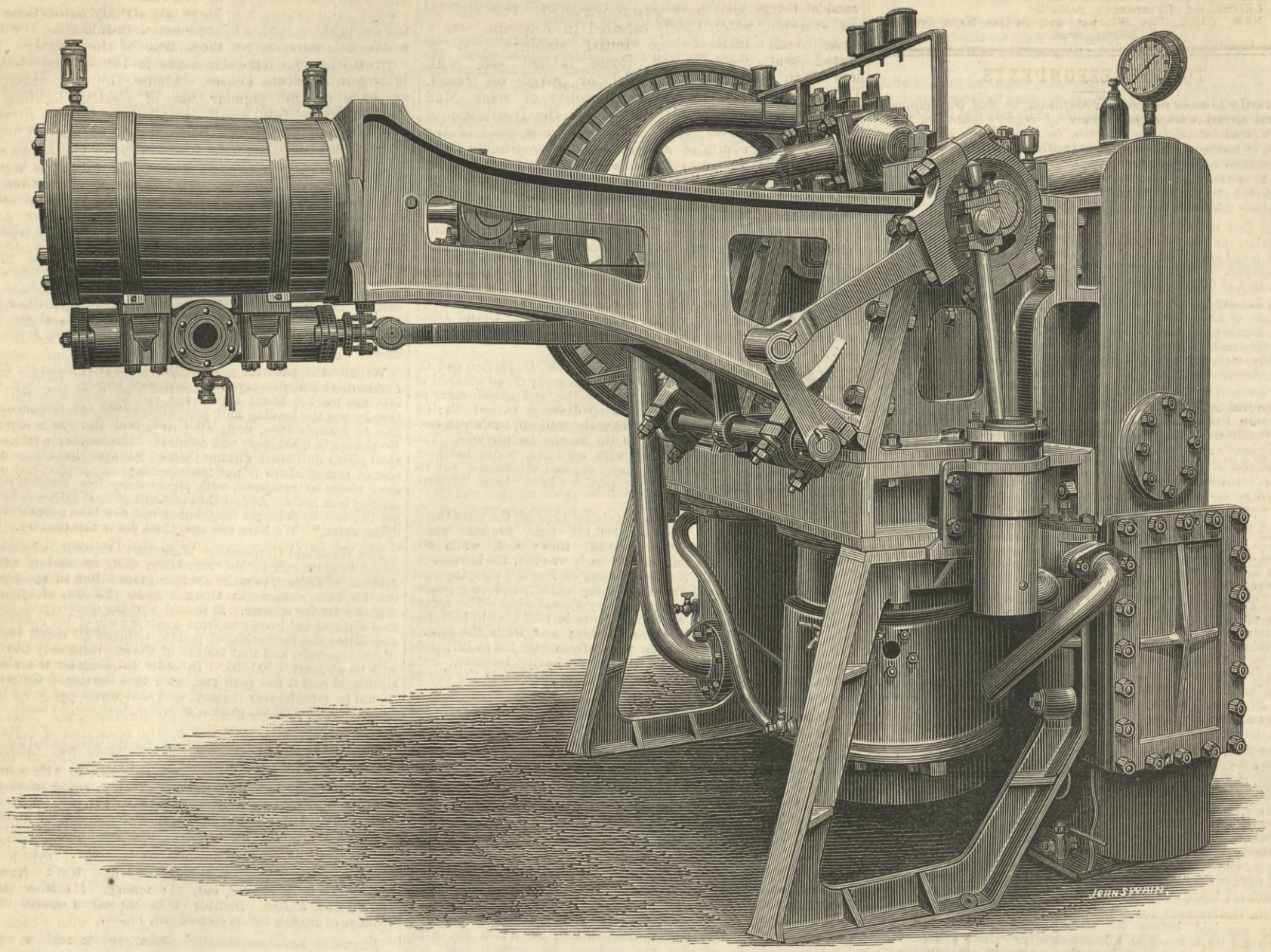
AT the closing meeting of the session of the Meteorological Society on the 20th inst. a paper was read, entitled, "Notes on a Second Series of Experiments on the Distribution of Pressure upon Flat Surfaces Perpendicularly Exposed to the Wind," by Richard H. Curtis, F.M.S. The results obtained in these experiments agree very closely with those of the former experiments. Another paper was read "On the Reduction of Wind Records," by the Hon. Ralph Abercromby, F.M.S. The author discusses the significance and best method of deducing from anemographic records the total quantity, the quantity from different points of the compass, the relative frequency, the mean and annual velocity, the mean velocity from different quarters, the resultant, and the mean and diurnal direction of the wind. A paper was also read "On River Temperatures as compared with Air Temperatures at Greenwich and Bremen," by Robert H. Scott, M.A., F.R.S. The author compares the results given in a recent paper by Sir G. B. Airy on a comparison between the records of the temperature of the Thames and those of air temperature taken at Greenwich with those published by Herr von Freeden for the temperature of the Weser as compared with that of the air at Elsfleda, close to Bremen, for the ten years 1858-67.

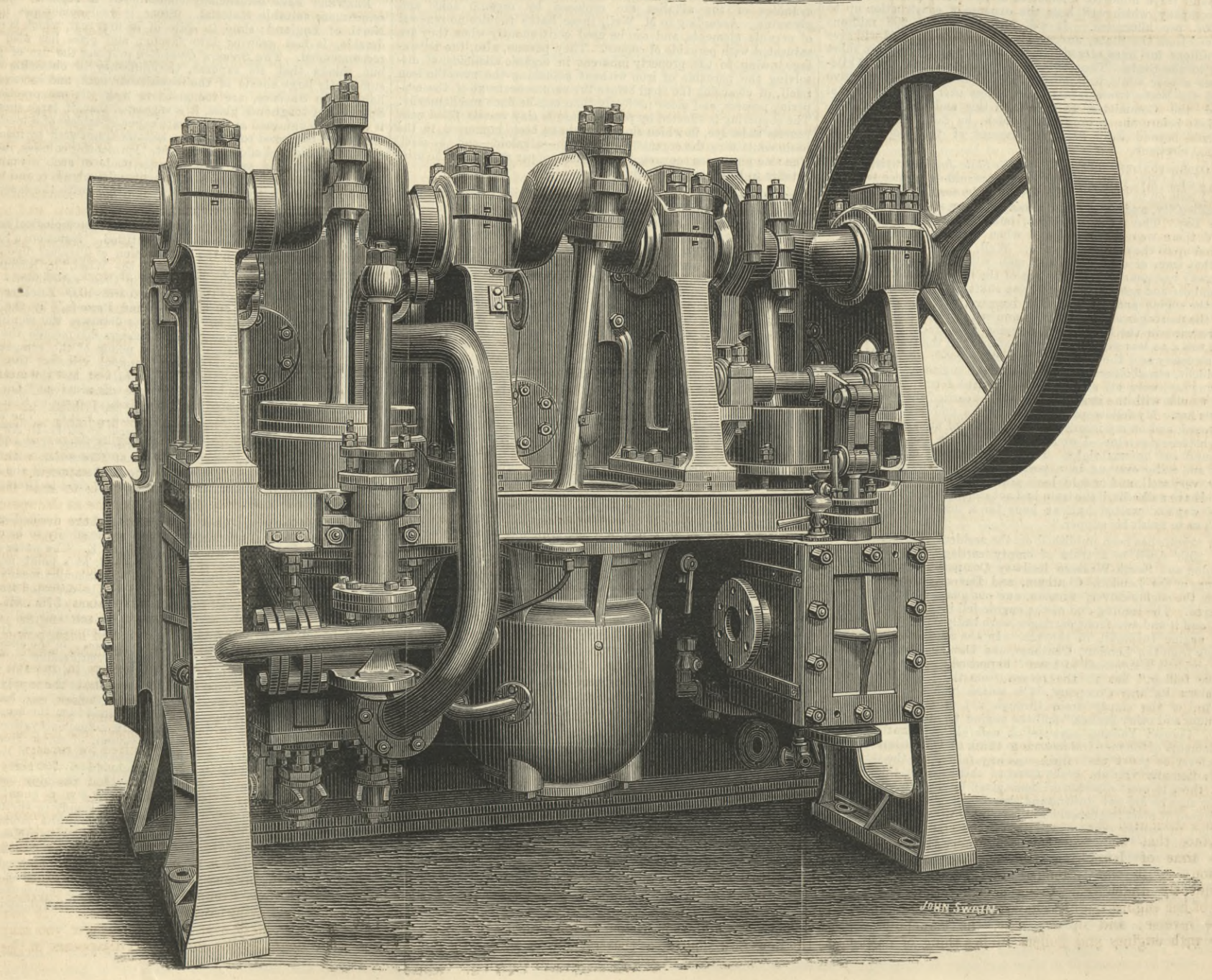
THE Stratford-upon-Avon Town Council have decided upon a new sewage disposal scheme and a new water supply to be carried out from the design of Mr. E. Pritchard, C.E. The water supply will be abstracted from Snitterfield Brook at a point near the Wolds. From this point the water will be taken by means of an underground conduit to a reservoir, and will be decanted from the reservoir to filter beds and from thence by means of 7in., 6in., 4in., and 3in. mains to the whole town. The reservoir will have a maximum depth of 22ft. and will have a water area of 4a. 1r. 20p., and will contain when filled 15,500,000 gallons. In the excavation for the conduit it is anticipated that a considerable volume of water available for the town supply will be met with; this is proposed to be conveyed direct to the filter beds, or the supply main, and is proposed to be quite independent of the reservoir, being, in fact, a supplementary supply, entirely distinct from the brook. Of course it is impossible to determine, until actual excavation takes place, what may be the probable volume of water from this source. The drainage area contributing to the Snitterfield Brook at the proposed point of abstraction is approximately 700 acres; this, with an average annual rainfall of 27in. and assuming one-third only finding its way to the brook, would give a quantity per annum equal to 142,518,600 gallons. The supply to the town is proposed at 15 gallons per 24 hours per head of the population; the mains having the capacity to admit of a supply sufficient for a population of 12,000. The water level of the reservoir when full is 290ft. above mean sea level, or nearly 159ft. above surface level of the ground in front of the Town Hall of Stratford-on-Avon; the water level of the filter being 271ft. above mean sea level. The total estimated cost of this work is £18,000, and of the sewerage works £5500.

IMPROVED GIFFARD COLD AIR MACHINES.

THE GENERAL ENGINE AND BOILER COMPANY, LONDON, ENGINEERS.

(*For description see page* 16.)





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THE ENGINEER.

JULY 6, 1883.

THE CATASTROPHE ON THE CLYDE.

THE capsizing of the Daphne within a few seconds after she left the launching ways is probably an unparalleled event; whether it was or was not also inexcusable remains to be seen. The Daphne is a screw steamer of about 500 tons, built for the Glasgow and Londonderry Steam Packet Company by Messrs. Alexander Stephens and Sons, Linthouse, Glasgow. She is 175ft. long, 25ft. beam, and 13½ft. deep. The ship left the ways at about half-past eleven a.m. quite successfully, but she had scarcely moved her own length from the shore when she turned over on her port side, and sank in less than three minutes. At the time of the launch she had about 150 workmen and about 50 others on board, and according to the latest advices it seems that 150 of these men have been drowned. It is stated that not a single plumber has been left on Messrs. Stephens' books. Into the descriptive details of the catastrophe it is not our province to enter; but it is our province to consider to what the event was due. The inquiry which will be carried out under Scotch law differs in many respects from our own coroner's inquest, and the proceedings may be greatly prolonged. Without anticipating what the ultimate verdict may be, we can deal with the facts as they stand. The most prominent fact is that the ship capsized, and the logical deduction—also a matter of fact—is that she had not sufficient stability. On these two points there is no room for any dispute. Why she had not sufficient stability is, however, a different matter, on which no opinion can be pronounced until evidence has been taken. An inquiry into this point will form a legitimate exercise for the jury called upon to pronounce a verdict, but it is not for us to say at present.

There is no reason to conclude that the builders were not competent in the fullest sense of the term. The shipyard of Messrs. Stephens and Sons is one of the most complete in the world. Ships are turned out of it by the score. As has not been inaptly said, "Messrs. Stephens and Sons weave ships." Their plant for making marine engines is all but perfect. The use of the chisel or the file is almost unknown in their yard. The slips are commanded by powerful traversing cranes competent to take up a whole marine engine complete—when not too large—in the erecting shop, carry it to the hull, and drop it in. Ships have not infrequently been launched at Linthouse with steam up. Some of our daily contemporaries have attributed the upsetting of the Daphne to the circumstance that she had her machinery on board. At the time of launching her engines only were in position, as it was intended to put her boilers in subsequently under one of the harbour cranes. The presence of her engines ought to have made her more stable than the reverse; and in any case, the launching of steamers with engines and boilers in is a thing of daily occurrence. We fear that the explanation of the catastrophe is simply that the Daphne was an exceptionally tender ship—that is to say, a craft with little or no initial stability. Recently, and we think unwisely, a number of vessels of this kind have been constructed. The Austral, for example, which nearly capsized in Australia, was a vessel with little or no initial stability. It is stated that the City of Rome is not safe with less than 1000 tons of coal or cargo on board. In a paper "On Curves of Stability of some Mail Steamers," read by Mr. Biles before the Institution of Naval Architects in April, 1882, mention is made of the Thames, the property of the Peninsular and Oriental Company. She is 392ft. long, 42ft. beam, and 34ft. deep. On a mean draught of 19ft. this ship had so little stability that she heeled 12 deg. to port or starboard, according to which way a moderate breeze was blowing. In the course of the discussion which followed, Mr. Henwood mentioned a ship 250ft. long, which, when empty, had a list of 11½ deg. to starboard, and he brought her upright by shifting 13 tons of dead weight on her upper deck. It must be clearly understood that these ships of small initial stability are not necessarily unstable or unsafe when they are loaded; but the tendency to build such vessels is not the less to be condemned. They are unstable because they are too high—to speak in popular language—for their width, and before they can be considered safe they must be brought far down in the water. If we put a board flatwise on the water, it will be extremely difficult to overset it, while it would be impossible to make the same board swim upright, with one edge up and the other immersed. Let us suppose that the board is a foot wide, and ten feet long. If now it be sawn in two, and the strips nailed together, we shall have a compound plank, 6in. deep and 2in. wide, and the addition of a small amount of lead on one edge would suffice to make this structure swim with one edge up; without the lead this would be impossible. The tender ship is in a similar condition, and without ballast or its equivalent she will not swim upright. It has been stated that the reason why the Daphne turned over was that she was suddenly checked by a cable fixed to an anchor, provided to prevent her from going too far. So far as we have learned the arrangements for launching were like those always adopted on the Clyde. From the hawse-pipes on either side depended cable chains held by heavy weights to the ground, with just sufficient slack, allowing for the distance the anchors were expected to drag, to pull up the vessel when she reached the middle of the channel, which at this point has a breadth of about 500ft. Assuming that she was a tender ship, it is quite possible that the check in question would heel her over. Mr. Henwood made a ship stand up with 13 tons of dead weight, and it is evident that the initial stability of this ship, up to 11½ deg., was measured by this weight. Bearing this in mind, it is easy to see that an anchor and cable might put on sufficient strain to turn over the Daphne until her side lights were submerged; her sinking would follow as a matter of course. But the obvious answer to this line of reasoning is that she ought not to have been so tender that an anchor and cable could turn her over. It has also been stated that there was a great deal of lumber on her deck, but no amount of lumber which could be carried under the conditions ought to have upset the ship.

It is quite evident that in this case the system of building tender ships has been pushed too far. If no lives had been lost, we might regard the upsetting of the Daphne with equanimity if not pleasure. Recently there have been many and heavy losses of steamers. Ships have disappeared with all hands, and left not a trace behind. There is some reason to think that these steamers capsized. It is at least certain that in some cases owners have pushed their desire for deep ships to a length which has been earnestly deprecated by shipbuilders of eminence—among others, Messrs. Denny and Co. The foundering of the Daphne will perhaps do something to convince shipowners that they are going too far. It is true that a ship which cannot be launched without risk may be loaded so as to be perfectly safe; but it is also true that a mistake in the loading may render her quite the reverse of safe. The case of the Daphne proves that it is unsafe to take liberties with small steamers, while that of the Austral teaches the same lesson for large craft. Taken together, they appear to cover the whole range of possible screw steamers.

ELECTRIC LIGHTING.

SUMMER nights do not direct attention to electric lighting; and corporations, as well as private individuals, may be excused if they do not feel much interest for the time being in the relative values of two systems of illumination. For this, among other reasons, little or nothing is being done just now in electric lighting. But we have passed the longest day, and autumn, and even winter, are now so near that we ought to make provision for them. The time is opportune enough, therefore, for considering the present position of electric lighting and its prospects of success. These last are not as encouraging as is desirable. In certain quarters attempts are made to put things in a pleasant aspect. We should not do our duty if we followed this vicious example. For nearly two years the electric light in many forms has been before the public; and enormous sums have been, nominally at least, subscribed to work various patents and different systems. It has been estimated that considerably over two millions sterling has been actually subscribed, and in some shape or way spent, in connection with electric lighting. It must be admitted, we think, that there is very little to show for this enormous outlay. A sixth-rate gasworks would give more light than all the electrical apparatus in Great Britain put together. A few railway stations, as for example, the Great Northern, Great Western, and Great Eastern termini, are more or less badly lighted by now old fashioned arc lamps. In the City we have a few hundred street and private lamps. A small district round Holborn Viaduct is lighted on the incandescent system by the Edison Company, and the new Law Courts, a theatre, and a restaurant or two have been lighted on the same system by the Swan Company, and this is really about all the commercial lighting that is to be seen. There is a fine display at the Fisheries Exhibition, and one much less remarkable at the Westminster Aquarium; but these are strictly exhibitions of electric lighting, and not commercial installations. What is true of London is yet more true of the country. No progress whatever has been made in introducing electric lighting into private houses. Almost the only examples we have of the popular use of electric lighting is supplied by a few small installations in the Strand, and at Brixton, arc lamps being almost exclusively used; incandescent lamps are to be found in one or two hotels and restaurants; and the Brighton Pavilion will, it is hoped, be lighted in the same way in a few weeks. But when we have summed all up, the work done by the electrical engineers is as a drop in the ocean compared with that done by the gas engineers. We know that what we write will be very unacceptable to a few individuals; but it is the truth, an unpalatable truth, perhaps, but one that may as well be told now as further on.

The question why the use of the electric light does not extend naturally suggests itself. Many answers may be given, uncertain Parliamentary action may be cited among others; but we think that two supply all the information needed at the moment. The first is that the public have no confidence in it, and the second that it is not only too dear, but too troublesome. Householders are accustomed to turn a tap and light their gas, and the gas is always ready when wanted. No private householder will use a steam engine and dynamo when he can have gas, and if he does not obtain the light in this way he cannot, it seems, have it at all, at least up to the present. As to the expense of the electric light, there are really next to no data to go upon. No one can tell, for example, whether the Edison Company is lighting the Holborn district at a loss or not; and the same thing may be said of every company actually doing work at a price; but there is very good reason to think that in all cases the cost of electric lighting is under-estimated, because electricians and electrical engineers, as a rule, quite lack the commercial knowledge which is essential to an accurate estimate. As an example, we may say that we saw not long since an estimate for the power required to run a certain number of arc lamps, which was based on the power spent in the lamps, with 10 per cent. added for contingencies. Nothing was allowed for engine friction, the resistance of belts or shafts, and the efficiency of the dynamo was taken at 90 per cent. The proper estimate in this case would have been to regard the power expended in the lamps as 40 per cent. of the indicated horse-power required.

The most recent utterances on the subject of electric lighting are those of Mr. Gordon, who read a paper on the subject before the Society of Arts. Mr. Gordon is manager of the electric light department of the Telegraph Construction and Maintenance Company. He is an able electrician, and the inventor of a capital dynamo; but this did not prevent him from saying much with which we cannot agree. We do not refer so much to the electrical portion of his paper, if we may so speak, as to the engineering part. Here we must quote Mr. Gordon:—"In putting up a plant for 10,000 lights, in the middle of a populous town—a town of wealthy houses, where the inhabitants do not at all like smoke and waste steam—there are a great many matters to be attended to." Mr. Gordon gives a diagram, showing three engines of the marine type, each driving a huge dynamo. The engines stand side by side, with the boilers behind them. "This," says Mr. Gordon, "is not the only way, perhaps not the best way in which it could be worked out, but it is one way which has recommended itself to us. There is the plant, an end elevation, and an elevation of the boiler house. Of course, we have to get our boilers in pretty close; there are seven boilers here. Then there is the dynamo house with three dynamos, each working 5000 lights, two to be always at work, and one in reserve, the whole plant being designed for 10,000. Then we have an arrangement so that the mains are laid double. That is to say, each house has half its lights from one dynamo, and half from another, so that, supposing an earthquake upset one of the dynamos, and put it wrong, then only half the lights would go out; the town would not be put in darkness. There is one class of accident which may occur to any machine, and it is, I think, about the only difficulty which large dynamos are liable to, that is getting a hot bearing. But an engine-driver is not worth his wages if he cannot keep an engine with a hot bearing going for a quarter of an hour; and supposing he finds he has a hot bearing, all he has to do is to start the spare dynamo, get the speed of that the same as the speed on the other, start the exciting engines, get the pressures constant, then pull over the switch, and all that will happen will be a slight jump in the light, and then the engineer may instantly stop the heated dynamo and attend to the bearing. The engines are condensing engines, each dynamo to have two, and they will require about 510 indicated horse-power when at full work. Each engine is calculated to have a power of 275 indicated horse-power, so as to give about 550-horse power available, which is sufficient reserve. Again, there are boilers in reserve; 4½ boilers would give sufficient power, so that there will be always two boilers standing quite idle, which can be cleaned. There is a large crane running along the roof, which we use to put the machinery into its place, and to lift any part of it as may be required for repairs."

Here at the very outset we have Mr. Gordon doubling all his leads, although it is well known that the cost of leads is one of the greatest foes of the electric light. He has provided only 50 per cent. more plant than is required, and it is enough to point out that if one dynamo broke down, and the engine driving another dynamo as well, he could only supply half light. It is no use to argue that such a thing cannot happen, because it has actually happened to the plant of the Edison Company in Holborn. Furthermore, he insists on having condensing engines. "If you only want 10 or 20, 50 or even 100-horse power, you may send the waste steam up the chimney, it disappears in the

air, and you hear no more about it: but if you have over 1000-horse power, even in this station, which is regarded as a small experimental one, and send the waste steam into the air, two or three unpleasant things will happen. First, you will choke the chimney, because the effect of the steam will be to cake the soot, and so spoil the draught, and some day you would find the furnace would not draw; secondly, that steam would attract all the London blacks, and form a fog to which our present fogs would be as nothing, and that would be a bad introduction of the electric light, one of the great arguments in favour of which has been that it is to keep our houses clean. With a condensing engine, the waste steam is all condensed, and goes away in the form of water. It is a hard saying to say there must be condensing engines, because condensing engines very greatly increase the first cost; but in spite of this, I say we must make up our minds that if we have the electric light at all, we must be prepared to pay for condensing engines. We must remember, too, that there is a special clause in the Electric Lighting Act, and in the draft Provisional Orders, pointing out that no parliamentary powers, conferred on a corporate or other body, are in any way to be regarded as a protection to them against being indicted for a nuisance, if they should cause one. Therefore, we must arrange the plant so as not to cause a nuisance. With electricity there is more loss in transmitting it to a long distance than with gas, so that we cannot place our electric lighting machines at a great distance from the town. About half a mile radius is a convenient distance, and therefore the stations must be tolerably central."

It may be highly desirable to have condensing engines, but not for the reasons stated by Mr. Gordon. We never before heard of the exhaust steam from an engine collecting "blacks;" but what, we may ask, is to be done where no condensing water is to be had? There are not a few districts in which the cost of water would be greater than that of coal. If it be, indeed, true that electric light engines must condense their steam, then another weight is added to an already over-burthened system.

If Mr. Gordon spoke as an engineer of experience, he would say that to work such a plant as he speaks of economically, he ought, as far as possible, to work it continuously. With two dynamos and engines—that is to say, with two-thirds of his plant and one half his costly leads—he would get a much better in the sense of a safer result by supplementing his dynamos with secondary batteries. But Mr. Gordon's machine gives an alternating current, and he does not believe in secondary batteries, and, in the course of the discussion which followed the reading of his paper, he said:—"Storage was not analogous to pumping gas into gas reservoirs. You could not store electricity; you stored energy, and the analogy to storing energy was winding up a spring or pumping up water to a high cistern. Suppose you had a steam engine which worked a quantity of machinery in a large factory, what would be thought if some one came to you and said if your engine broke down the shop must stop, so you must have storage; and told you to take off the belt, use the engine to pump water into a high reservoir, and let the water run down again, and turn a turbine, and drive a shaft, and then you would be sure not to break down? They would not think much of the practical nature of such advice; and if he added, you must pump it into a cistern which leaks very badly, they would think still worse of him."

This is scarcely a fair picture; but even as it is we are content to say that the advice given would be good. Under certain circumstances it would be advisable to pump water even into a leaky cistern. Let us ask Mr. Gordon what he would think of a gas company which had but two enormous retorts to supply 10,000 lamps and provided no gas-holder? He would say the manager of such works or his directors did not know how to prepare for contingencies. We see a strict analogy between Mr. Gordon's scheme and this. If he will use his engines to force energy into storage batteries during the day, he can depend on a moderate amount of plant to keep his light going at night. It is possible that until the storage battery is used freely there will be no electric lighting done worth talking about. But it may be argued with much force that there is yet no storage battery available. So much the worse for the electric light. We are quite willing to concede that a battery of uncertain durability which costs £300 and lights twenty-five incandescent lamps to 16-candle power for a few hours, will not help electricians much, but such a battery certainly does not represent finality in this direction. However, if it did, Mr. Gordon's solution of the whole difficulty is not the true one. We prefer Mr. Crompton's plan of using a comparatively large number of engines and dynamos, and so subdividing the results of a breakdown that they become infinitesimal.

THE ENGINEERING EXHIBITION.

YESTERDAY the Engineering Exhibition in the Agricultural Hall, Islington, set on foot by Mr. Barnett, was opened to the public. On Wednesday afternoon there was a private view for members of the press and a few specially invited visitors. It will, of course, be remembered that Mr. Barnett last year organised an exhibition largely devoted to marine engineering, which was eminently successful, especially from the exhibitors' point of sight, and we see no reason to doubt that the present exhibition will be equally satisfactory. Mr. Barnett has taken great care to have, if we may use the words, a considerable change of programme; and those who visit the Agricultural Hall during the next ten days will find much that they have not seen before. We regard with some regret, however, the absence of all the models of naval architecture which last year proved so attractive. It is true that room could not be found for them in the main body of the hall, but space was available for them in the galleries. It is possible, however, that considering the existence of the Fisheries Exhibition, Mr. Barnett has acted wisely in excluding to a considerable extent nautical exhibits.

The contents of the Agricultural Hall are, in a very strict sense of the word, engineering in their character. There is a good collection of machine tools, although nothing with the exception of a hydraulic rivetter, and one or two smaller exhibits, can be regarded as strictly novel. In another place we have dealt very fully with the contents of the building, and it must suffice to say that Mr. Barnett, aided by Mr. D. K. Clark, Mr. D'Alton, and the other members of a competent and ample staff, seem to have left nothing undone to satisfy both exhibitors and the public. Nothing is more appreciated by both than an honest determination on the part of the organisers of exhibitions of this kind to do full justice to them; and the experience obtained of Mr. Barnett's management during his last year's exhibition has evidently been satisfactory. If it was not, certainly exhibitors would not have done as they have done this year. The character of the exhibits is, upon the whole, of the most superior description. Thus, the exhibit of Sir Joseph Whitworth and Co. is, in itself, worth a journey to see; indeed, few more splendid displays of steel work have ever been got together than this. The exhibit of the Leeds Forge Company is another wonder in its way, and it may be taken as an evidence of the appreciation of the firm for Mr. Barnet's exhibition that the cost of this exhibit will, we have reason to believe, exceed £1000.

That exhibitions as a whole have done this country harm is an opinion entertained by many engineers and manufacturers who ought to be competent to speak with accuracy on this point. They hold that the International Exhibition of 1851 taught foreigners a great deal too much. It is, however, too late in the day to deal with this question now. Even if those who condemn exhibitions are right, the mischief has been done, and nothing we can show now will teach the intelligent foreigner much that he does not already know or cannot easily learn. It remains to us to make our exhibits invariably of such a class that the national reputation may be kept up. In many respects both English design and English workmanship are still greatly in advance of anything produced abroad; and this is especially true of locomotive and marine engines. It is unfortunately true that indifferent exhibits may do much to lower the tone of an exhibition and to convey a very false impression to visitors. We do not say that there is nothing bad in design, material, or workmanship to be found in the Agricultural Hall; that would be to assert too much. But we can safely say that there is very little to be seen mediocre in character. The truth is that the exhibition of last year, followed by its copy on the Tyne, gave a high character to these undertakings, and it is felt that it will not do to make a bad display. To compete with such firms as the greatest represented at the Agricultural Hall this year in excellence of design, material, and workmanship may appear a serious undertaking; but the very circumstance that such a competition is necessary acts as a stimulus, and promotes the production of good work. It will not do to be beaten; and it is fully understood that as much merit may be found in a little launch engine as in a huge steel forging by Whitworth or Krupp, only the merit is of a different kind. Let it be felt that an Exhibition is really to contain first-class exhibits sent by firms of world-wide reputation, and the tone of the undertaking becomes elevated. None but those who know that they will not disgrace themselves will show at all, and each exhibitor will do his best to make or maintain his reputation. For this reason Mr. Barnett is to be congratulated on the presence of much that is to be found in the Hall, and should he repeat his venture, we have no doubt that he will find year by year that the exhibits grow in importance and value.

One of the most attractive points about the present Exhibition, as far as the outside public is concerned, is the great variety of the exhibits. We do not find the same things produced and reproduced over and over again with small modifications. On the contrary, almost the whole range of mechanical engineering is fully represented—from a locomotive to a gland packing, from a steam pump to the latest novelty in lubricators, everything will be found; and those interested in engineering, even remotely, who cannot succeed in spending pleasant hours in the Agricultural Hall must, we think, be hard to please. The organisation of the place is as nearly as possible perfect in every respect, and this is a most important point. Those who can and do not visit the Exhibition will, we think, make a mistake.

BASIC STEEL AT AMSTERDAM.

ENGLAND, France, Germany, Austria, and Belgium have all alike contributed specimens of basic steel to the Amsterdam Exhibition. The specimens have been got together by Messrs. Thomas and Gilchrist, the inventors of the process, and they testify to a capability by this metal which, viewed in the light of earlier knowledge in this branch of metallurgy, is remarkable. The British specimens from the Patent Shaft and Axle-tree Company's Works, at Wednesbury, are designed to show the applicability of the steel to locomotive tubes, tin-plates, Galloway tubes, and rivets. France contributes striking illustrations of the ductility and the malleabity of the metal. The specimens of plates from the Creusot Works have borne the severest punishment, including the flanging 6in. by 6½in. deep of a central hole, and the edges of a plate ·59in. thick, and 165 lb. in weight; and beaten out, the unflanged portion into a stride or A-shape, while the flanged edge is almost elliptical in outline, and the hole circular. The capability of the angle iron appears in the sample bent hot into an S-shape, the upper possessing a smaller radius than the lower curve. The quality of the rails, made also by Messrs. Schneider, is told in the one complete twist on a length of 5ft. 9in., weighing 110 lb. The handling of the basic plant by the Hoerde Hutten Verein, Germany, is shown mainly in a large collection of rail sections, tram rails, and sleepers, together with some plates. Similar sections come from the Teplitzer Walzwerk, of Teplitz, Austria. The tenacity of the steel comes out in the manner in which the specimens have submitted to cold bending and twisting. Demonstrative of the different degrees of hardness which the metal can be made to acquire is the circumstance that the carbon in the rails is 0·35 per cent., and that in the rolled sleepers 0·08 per cent. Test pieces made from the sleeper material have a limit of elasticity from 13·4 to 14·6 tons per square inch, a tensile strength of from 25·4 to 27·6 tons per square inch, an elongation of between 29 and 33 per cent., and a contraction of area of between 53 and 63 per cent. Tubes flanged and bent close, cold, yet without sign of fracture, are the contribution from a second Austrian steel works, the Witkowitzer Bergbau. The Belgian contribution is an assortment of wire from the finest to the ordinary thick from the Les Acieries d'Anglear, of Renory, Ougrée. The content of carbon in this wire is from 0·12 to 0·15 per cent. The same firm likewise show steel wire upon their own account.

PRICE AND PROFIT ON GAS.

A STATEMENT of the price of gas over a period of twenty-six years, and of the profit on its production over the bulk of that time, has been compiled at Middlesbrough. In the year 1856 the net price of gas in the town named was 5s. 10d. per thousand cubic feet; in 1860 it was reduced to 5s.; and successive reductions brought it down to 3s. a little more than ten years ago. After being stationary for a year or two it was raised in the period of the coal famine to 3s. 5d., but successive reductions brought it down to 2s. 6d. last year, and this year there has been the further reduction to 2s. 3d., whilst that absurdity, meter rent, has been discontinued. A neighbouring borough has cheaper gas even than this, but it cannot be said that gas in the north Yorkshire town named has been dear for a considerable period; and it is interesting to notice that there has been a continuous growth in the consumption and a continuous enlargement of the profits. Very naturally there has been an increase of the capital invested in the manufacture, and the interest paid, and the redemption money are greater. But despite that the profit after paying these—the profit that has been used to reduce the rates, for the works belong to the Corporation of the town—that profit has been increased from £1500 in the year 1867 to £4536 for the last year. The statistics of the production are only given for a limited number of years; but for the year ending in, but not with 1880, the gas made was 147 millions of cubic feet. In the following year it rose 12 millions of feet, and in the last year reported on there was a still larger increase that brought up the total make for the year to 178 millions. A table is given of the cost of the manufacture, but as this is for a very limited period, it may be sufficient to state that the gross cost of the production was a fraction over 2s. 3d., and that bye-products sold realised over 1s. 4d., and thus the net cost of the gas was below 1s., and there was thus a substantial balance to pay interest from. It is evident that gas at a low rate is the most profitable to the maker, and that large as has been the consumption, there is a still larger area of supply that may be entered with cheaper gas.

BOOKS RECEIVED.

A Chronological History of the Origin and Development of Steam Navigation. By George H. Preble, Rear Admiral U.S.N. Philadelphia: Hamersly and Co. London: Trübner and Co.

The Student's Mechanics: An Introduction to the Study of Force and Motion. By Walter R. Browne, M.A. London: Charles Griffin and Co., 1883.

Die Kriegsschiffbauten, 1881-82. Zusammengestellt von J. F. von Kronenfels, K. K. Hauptmann, D.R. *Das Schwimmende Flottenmaterial der Seemächt.* Erster ergänzungsband. Wien. Pest-Leipzig: A. Hartleben, 1883.

Practical Treatise on the Strength of Materials. By Thomas Box. London: E. and F. N. Spon, 1883.

The Young Man's Assistant to Cotton Spinning, Revised and Enlarged. By A. Prestwich. London and Manchester: John Heywood, 1883.

Society of Engineers: Transactions for 1882. London: E. and F. N. Spon, 1883.

Duncan's Manual for British and Foreign Tramcar Companies, 1883. London: Effingham, Wilson, and Co., 1883.

Elementary Applied Mechanics. Part II. By Thos. Alexander, C.E., and A. W. Watson, C.E. London: Macmillan and Co., 1883.

The New Principles of Natural Philosophy. By W. L. Gordon, F.R.G.S. London: David Bogue, 1883.

Lathe Work: A Practical Treatise on the Tools, Appliances, and Processes employed in the Art of Turning. By Paul N. Hasluck. London: Crosby Lockwood and Co., 1883.

The North-East Ports and the Bristol Channel. By W. Clark Russell. Newcastle: Andrew Reid.

The Theories and Practice of Centrifugal Ventilating Machines. By Daniel Murgue. Translated by A. L. Stevenson. London: E. and F. N. Spon, 1883.

Life of Sir William E. Logan, Kt., LL.D., F.R.S. Compiled by Bernard J. Harrington, B.A., P.R.D.

WILLIAM SPOTTISWOODE.

YESTERDAY the remains of the President of the Royal Society were laid in Westminster Abbey, near the burial place of one of his ancestors, John Spottiswoode, Archbishop of St. Andrew's, who died in 1639.

His extraordinary private worth is known only to the few; the industry and self-denial of his early days, his fidelity to friends, his readiness to help, his unremitting devotion alike to knowledge and to duty.

Mr. Spottiswoode was born in 1825, and was the descendant of an old Scottish family. His father was the head of the Queen's printing-office, to the direction of which he succeeded, and it became under his direction one of the best-managed establishments of the kind in existence. After spending some time at a school kept by Mr. Buckland—brother of Dean Buckland—he went to Eton. Here, however, he stayed but a short time; he and his brother attempted some chemical experiments—in which detonation played a prominent part—at a time when science had no place in our public schools. No blame it appears, however, was attached to the brothers, who were transferred to Harrow. Thence he went to Balliol, and in 1845 he took a first-class in Mathematics, and in 1847 he took the Senior University Mathematical Scholarship. Although on quitting college he entered upon the active management of the business of the Queen's printers, resigned to him by his father, he still lectured at Balliol, and later on was appointed examiner in the Mathematical schools.

But Mr. Spottiswoode was almost as accomplished as a linguist as a mathematician, and so good an Oriental scholar that he was urged to undertake an edition of a great work on Indian astronomy, on which he contributed a paper to the "Journal" of the Asiatic Society. In 1856 he visited Eastern Russia, and the first book by which he became generally known was his "Tarantass Journey through Eastern Russia," a work so full of observation, and written in such a vivacious and graphic style, that its readers might well have hoped for a succession of such volumes from the same pen.

His earliest scientific work consisted of five quarto pamphlets, published in 1847, under the title of "Meditationes Analyticæ," and since this date scarcely a year has passed without a contribution from him to one or other of the branches of science in which he was interested. Many appeal only to specialists, and deal with abstruse mathematics; but in these, as in his more

purely physical work, fellow students, both in this country and abroad, admit that he showed an intellect, not only of the highest training, but of rare clearness, penetration, and even originality. Spottiswoode has been termed "the incarnation of symmetry," and this feature of his mind comes out, not only in his mathematical work, but in those beautiful researches in physics connected with polarised light, and certain forms of electrical discharge, with which his name is intimately associated. While the great bulk of Spottiswoode's researches was given to the scientific world through the medium of the Royal Society and such journals as the "Philosophical Magazine," his many-sidedness found outlets through other channels of publication. Thus, we find him reading a paper to the Geographical Society on "Typical Mountain Ranges, an application of the Calculus of Probabilities to Physical Geography," to the Musical Society a lecture on "Beats and Combination Tones," and to the Astronomical Society one on "A Method of Determining Longitude."

In 1871 he became treasurer of the Royal Society, of which he had been at the date of his death—from Roman fever—president for four years. To be president of the Royal Society is much, but, great as the honour of that presidency is, probably few to whom the honour has fallen have shown so full and wide a capability for the varied duties implied in it as was possessed by him. He knew and appreciated his fellow-men of every grade; he had seen the ways and cities of many people; his native courtesy had been polished by use; he was, above all things, a man to be trusted and relied upon. He was a believer in science and a believer in religion, and his name is not one which will be lightly weighed in the conflict which it is sometimes attempted to set up between the two. He was tolerant, but he was not tolerant to that point which reaches intolerance. As to his personal relations this is not the place to dwell upon them. But it would be equally out of place to make no mention of the fine and unfailing courtesy and kindness, the sincere and complete unselfishness which endeared him to people of all ages who came in any way under his influence.

SIR EDWARD SABINE.

THE death last week, at Richmond, of General Sir Edward Sabine, ex-President of the Royal Society, at an age which only lacks five years of a century, carries us back to a time which, from the standpoint of science at least, is a very remote period. He was, we find to our surprise, some sixty years ago working in the company of such men as Wollaston, John Dalton, Peter Barlow, Pond, the Astronomer Royal, Mr. Airy, and Mr. Owen, while the activity of his life was maintained to make him a contemporary of such men as Spottiswoode, Cayley, Huxley, Tyndall, and others. He was born in Dublin, October 14th, 1788; his family is stated to have come originally from Italy, but latterly to have been settled in Normandy. He was trained at the Royal Military Colleges of Marlow and Woolwich, and obtained his commission in 1803, and received his captaincy in 1813. Much active service he does not appear to have seen, the main event in his military career being in connection with the campaign against the United States—1813-16—when, in 1814, he commanded the batteries at the siege of Fort Erie. He was later on, about half a century ago—1830—on duty in Ireland during the disturbances of that time. He became Lieut.-Colonel in 1841, Lieut.-General in 1859, and he retired with the rank of General in 1874. Very early in his life he took the greatest interest in physical science, especially in the subject of terrestrial magnetism; and a reference to the "Philosophical Transactions" of the Royal Society will show how indefatigably he pursued this branch of experimental science throughout the rest of his life. During the American Campaign he distinguished himself by exceeding his orders; but the offence was forgiven through the brilliancy of the result which attended it. The war concluded, he was appointed astronomer in Ross's Arctic Expedition in 1818, and accompanied Parry's Expedition in 1819-20 in the same capacity. For the next few years he was employed by the Government to make pendulum experiments near the equator and in the north, and he published the results in 1824. In 1825 he was appointed with Sir John Herschel the British members of a joint commission between the French and English Governments, to determine the precise difference of longitude between the observatories of Paris and Greenwich, by means of rocket signals; and in 1827 he was engaged in determining by direct observation the difference in the lengths of the seconds pendulum at Paris and at Greenwich, and of the magnetic force of the earth at those two stations. For many years after this, to verify his theories and complete his knowledge, he carried on experiments in magnetism, and with the pendulum in different latitudes in all parts of the globe, from the equator to the Arctic Circle, and regular reports were sent to the Royal Society and the British Association. In 1836 and 1837 he presented to the British Association an account of a magnetic survey of the British Islands, and a report of the variations of the magnetic force in different parts of the globe. Again in 1840 he still deals with the great subject of terrestrial magnetism, and thirty-two years later he was working in the same direction, and in 1872 we find him bringing before the Royal Society his thirteenth contribution on the subject of terrestrial magnetism. It is not probable that Sabine had no distinct idea of simply benefitting navigation by his researches, immeasurably good and satisfactory as such an idea would have been, but of pursuing science for its own sake, for the mere desire of adding to a correct knowledge of the multifarious phenomena of our wonderful universe.

A result of his report for 1838 was the despatch of Captain James Ross, in command of the Erebus and Terror, to make an energetic survey of the Antarctic region; and three meteorological observatories were established at St. Helena, the Cape, and Van Diemen's Land. The reports were sent home and the results were reduced and published; and among other relations which Sabine did much to establish, were those between certain magnetic phenomena and sunspots, and the influence of the magnetic action of the sun and moon upon the earth. Nor must we forget to point out the good results which follow from the pendulum experiments, to which we owe our present conception of the exact figure of the earth.

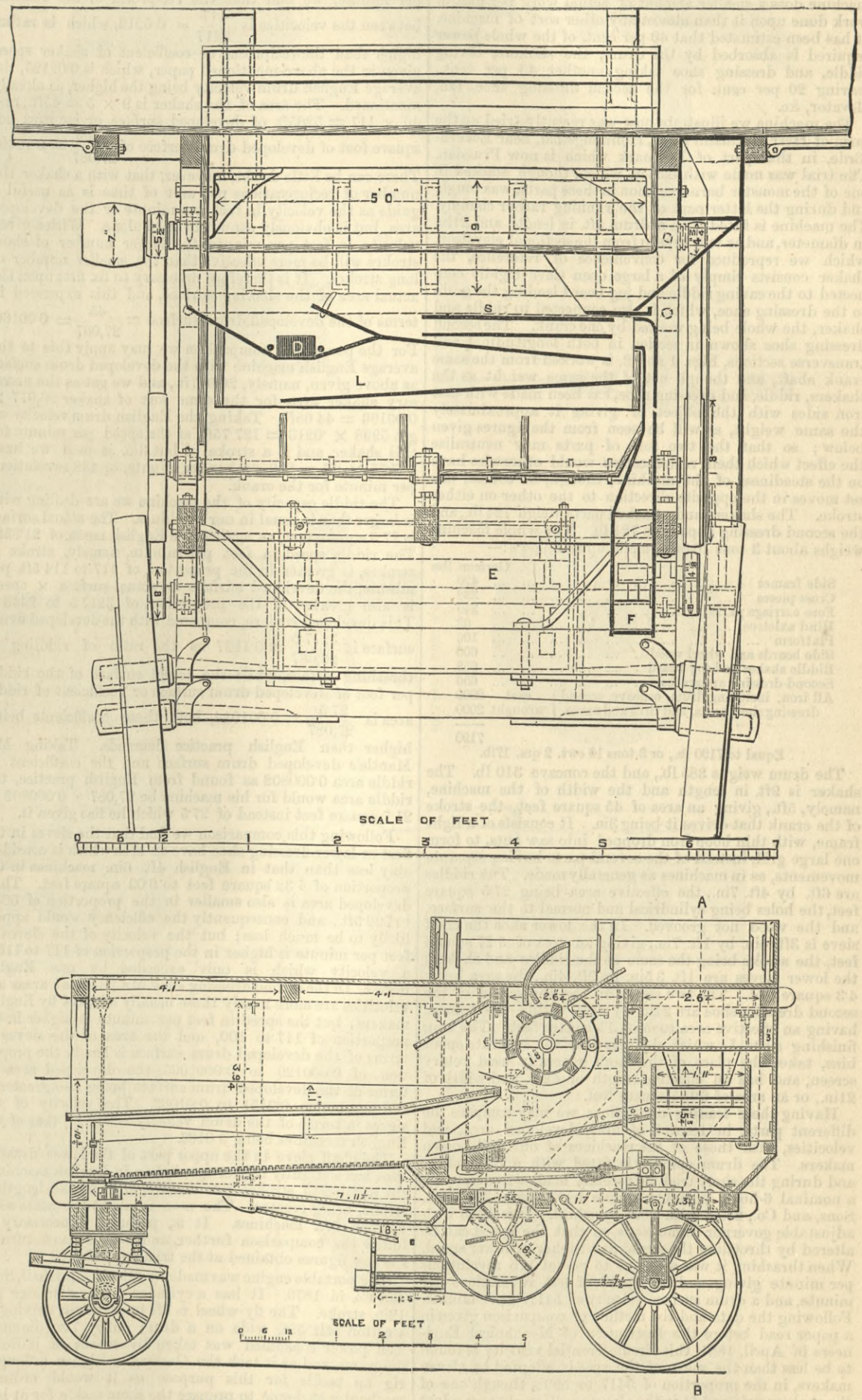
Sabine was elected to the Royal Society so long ago as 1818, was chosen a vice-president in 1850, and succeeded the late Sir Benjamin Brodie in the presidency in 1861. He held the post for several years, and so late as 1870 presided at one of the *conversazione*. In 1879 he lost the accomplished and congenial wife whom he had married upwards of half-a-century before. She it was who translated Humboldt's "Kosmos," which he edited in 1849-58.

He was made K.C.B. in 1869, had the Prussian order *pour le mérite*, the Italian of Sts. Mauria and Lazaro, and the Brazilian of the Rose. He had received the Copley and Royal medals, and had been elected corresponding member of many of the principal academies and societies of Europe and America. The name of Sabine will ever hold a high place in the annals of science and the history of navigation.

TRIAL OF A SINGLE CRANK THRASHING MACHINE.

A YEAR ago, at Reading, the judges found themselves constrained to depart a little, only a little, from the no trial policy of the council of the Royal Agricultural Society. A thrashing machine was exhibited by Messrs. Nalder, in which the riddles and shakers were driven by one crank, and the shaker boxes used as connecting rods thus saving bearings and presumably power. There was obviously sufficient novelty and promise in the arrangement to make it impossible to pass the machine over, and the judges awarded the makers a silver medal. But before or after this was done, a little farce in the way of a trial was played. Some straw was procured, and some corn and grass seeds. The machine was started, and the already thrashed straw fed in by one man, while two others fed in the corn—barley or wheat—and the grass seed; thus constructing a sort of synthetic puzzle on which the analytic powers of the machine were tested in a comfortable way. The three ingredients seem to have gone through the machine with sufficient celerity to show that they had done it before, and to have separated with enough distinctness to indicate proficiency in that also; at any rate, the judges were satisfied that these things would all go through the machine, and they were able to award the silver medal to Messrs. Nalder without any of the uncomfortable excitement of a competitive trial. The simplicity of the test was its leading feature. It is quite unnecessary to insist upon the very marked difference between it and the complicated tests carried out in 1875 at Cardiff, when such superfluous refinements as quantity, time, and power, were imported into the discussion of the trials as elements affording comparative indications of the value of the several machines. These things were unnecessary in 1882, because they were obtained with different machines in 1875.

As no real tests have been made for so many years, we readily agreed to be present at the trial of a machine which was recently made in a small place in Denmark, with the machine which we illustrated and described in our impression of the 20th October, 1882, as designed and constructed by Mr. A. W. Mantle, an English resident in Eckernförde. From the year 1875 to the year 1883, without taking stock by systematic trial of the development of a class of machine which takes a prominent place amongst all those used in agriculture, is a long time, and if no improvement has been made it is desirable to know even that. Thrashing machines do not pay to make. This must be true, because all or nearly all the makers say so. Yet they are afraid to attempt the production of a much simpler machine which, if successful, would pay to make. Thrashing machines are very delicate things to deal with, and so long as trade is fairly good, a manufacturer will not risk the outlay almost always incident upon the construction of a thrasher new in general arrangement, in whole or in part. It is hardly possible to predict what will be the result of any material modification; a satisfactory result can only be obtained by experiment; it cannot, as in steam engine work, be calculated upon. It is therefore excusable on the part of thrasher makers that so long as no special inducement exists, and trade remains good, they should prefer to move exactly upon the lines of the machines they have proved to work well. This, how-



MANTLE'S SINGLE CRANK THRASHING MACHINE.—Figs. 1 and 2.

ever, is of course not the view of the Royal Agricultural Society, the object of which is to encourage improvements which will effect economy in labour and power. We may, perhaps, therefore expect that a gold medal will soon be offered by the Society for the best new thrashing machine which will give a good sample and good quantity, without the present size and weight, and without the expenditure of the enormous amount of power at present required, compared with the power actually employed in the thrashing itself. At Cardiff—there are no official trials to refer to since 1875—the easiest running machine took 52 per cent. of the power required to drive it when thrashing to run it empty, while the several machines tried took from 52 to 77 per cent.; or, in other words, the thrashing machine does a smaller amount of actual work per unit of work done upon it than almost any other sort of machine. It has been estimated that 40 per cent. of the whole power required is absorbed by the drum, the shakers, caving riddle, and dressing shoe taking another 40 per cent., leaving 20 per cent. for the second dressing shoe, fan, elevator, &c.

The machine we illustrate now was recently tried on the farm of Herr Hermann Beek, Hoffnungsthal, near Eckernförde, in that part of Denmark which is now Prussian. The trial was made with barley, which, though stacked in one of the monster barns common in these parts, was tough, and during the latter part of the running rather clammy. The machine is fitted with a drum 5ft. in length and 21in. in diameter, and as will be seen from the sectional elevation, which we reproduce for convenience of reference, the shaker consists simply of a large open sieve rigidly connected to the caving riddle and jog board leading the grain to the dressing shoe, which is also connected to riddle and shaker, the whole being worked by one crank. The second dressing shoe shown in section in both longitudinal and transverse sections, Figs. 1 and 2, is worked from the same crank shaft, and though not of the same weight as the shakers, riddle, and dressing shoe, has been made with cast iron sides with the object of giving it approximately the same weight, as will be seen from the figures given below; so that the two sets of parts may neutralise the effect which their reciprocation would otherwise have on the steadiness of the machine, though, of course, one set moves in the opposite direction to the other on either stroke. The shakers and attached parts weigh 724 lb., and the second dressing apparatus 721 lb. The whole machine weighs about 3 tons 10 cwt., made up as follows:—

	German lbs.
Side frames	420
Cross pieces	338
Fore carriage parts	349
Hind axletree	63
Platform	106
Side boards and wheel wood	600
Riddle shaker and jog board	658
Second-dressing apparatus	656
All iron, including drum, concave, second dressing shoe, axles, and tires and naves { cast 2000, wrought 2000 }	4000
	7190

Equal to 7190 lb., or 3 tons 10 cwt. 2 qrs. 17lb.

The drum weighs 385 lb., and the concave 310 lb. The shaker is 9ft. in length and the width of the machine, namely, 5ft., giving an area of 45 square feet, the stroke of the crank that drives it being 3in. It consists of a light frame, with thin hoop iron dropped into saw cuts, to form one large grid, instead of the several parts having separate movements, as in machines as generally made. The riddles are 6ft. by 4ft. 7in., the effective area being 27·5 square feet, the holes being cylindrical and normal to the surface, and the wood not grooved. In the lower shoe the chaff sieve is 3ft. 4in. by 1ft. 7in., giving an area of 5·27 square feet, the stroke being the same as the riddles and shaker; the lower sieves are 1ft. 3·5in. by 3ft. 4in., the area being 4·3 square feet. The two sieves in the upper part of the second dressing shoe are 24in. by 21in. within the frames, having an effective area each of 3·5 square feet. The long finishing sieve L, which delivers into the separate spout bins, takes the place of the more generally used rotary screen, and has an effective length of 42in. and width of 21in., or an area of 6·125 square feet.

Having these leading dimensions we may compare the different parts, in respect of area, developed area, and velocities, with those of the machines of our well-known makers. The drum spindle is fitted with a 7in. pulley, and during the short trial we recently made was driven by a nominal 6-horse portable engine by Messrs. Marshall, Sons, and Co., fitted with a 5ft. fly-wheel. It is fitted with adjustable governor connections, so that the speed can be altered by throttling the steam at a higher or lower speed. When thrashing it was set so as to run at 115 revolutions per minute giving a drum speed of 985 revolutions per minute, and a drum surface velocity of 5417ft. per minute. Following the data and the method of comparison given in a paper read before the Institution of Mechanical Engineers in April, 1881, this circumferential velocity is found to be less than the mean of the speeds adopted by eleven makers, in the proportion of 5417 to 5998, though one of the makers referred to in the above-mentioned paper adopt 5471 as the speed. The developed drum surface—that is to say, the product of the circumference of the drum by its length and by its circumferential velocity, is 27,087ft., which is only a little in excess of the mean of the same value for 4ft. 6in. English machines above referred to, which is 26,917ft. This value is a more complete indication of the thrashing capacity of the machine than simply the drum velocity. The area, developed area, and velocities of the other parts of the machine, which have to deal with the products of the work of the drum, may be referred to it in order to obtain a systematic relation between the whole of the parts.

As already stated, the shaker is one large open grid, and is not composed of several distinct sections having relative motions. It is therefore not easy to compare this with machines fitted with box shakers. It would seem, however, that the velocity or feet moved through per minute by this shaker should at least equal that of the separate parts of a box shaker, unless the feet moved through per unit of time by the English shaker is greater than is necessary, which is not likely to be the case. The speed adopted by Mr. Mantle is, however, less than that in the English shakers in the proportion of 117ft. per minute to 127ft., which is the average of ten machines. The effectiveness of the shaking will, however, depend on the number of shakes given to the straw per unit of time, or in other words, upon the number of strokes per minute; and this, in Mr. Mantle's machine, is 468, as compared with 346 in the English machine, the stroke being only 3in., as compared with a mean stroke of 4·4in. With shakers, then, it is a question whether the speed in feet per minute should be taken as the basis of calculation and comparison, or the number of strokes per unit of time; but if we take the former, and refer it to the drum velocity, namely, 5417ft. per minute, we find that the reciprocal of the relation between the velocities is $\frac{117}{5417} = 0{\cdot}0213$, which is rather higher than the reciprocal or coefficient of shaker speed given in the above-mentioned paper, which is 0·02125, the average English drum velocity being the higher, as already mentioned. The area of the shaker is $9 \times 5 = 45$ft., and $45 \times 117 = 5265$ft. of developed surface, or an area per square foot of developed drum surface of $\frac{5265}{27{,}087} = 0{\cdot}194$ft. There can be little doubt, however, that with a shaker the number of reciprocations per unit of time is as useful a guide as the velocity in feet per minute or the developed area, but it obviously cannot be used alone. With a given velocity in feet per minute the larger number of short strokes will be more effective than the smaller number of long strokes. It is therefore necessary to fix first upon the actual area of the shaking surface, and this expressed in terms of the developed drum surface $= \frac{45}{27{,}087} = 0{\cdot}00166$. For the purpose of comparison we may apply this to the average English machine with the developed drum surface as above given, namely, 26,917ft., and we get as the necessary shaker area for the same sort of shaker $26{,}917 \times 0{\cdot}00166 = 44{\cdot}68$ft. Taking the English drum velocity we get $5998 \times {\cdot}0213 = 127{\cdot}75$ft. as the speed per minute for this shaker, and if a stroke of but 3in. is used we have $127{\cdot}75 \times {\cdot}25 = 219$ strokes per minute, or 438 revolutions per minute for the crank.

The riddle capacity of the machine we are dealing with is larger than is usual in our machines. The actual surface is 27·5 square feet, as against the English mean of 21·85ft. The riddle speed in feet per minute, namely, stroke × strokes, is greater in the proportion of 117 to 114·5ft. per minute, the developed surface or actual surface × speed is also greater in the proportion of 3217·5 to 2446·6. This developed surface, compared with the developed drum surface is $\frac{3217{\cdot}5}{27{,}087} = 0{\cdot}1187$ as the ratio of riddling to thrashing surface, while the actual surface of the riddle per foot of developed drum surface or coefficient of riddle area is $\frac{27{\cdot}5}{27{,}087} = 0{\cdot}001014$, both these coefficients being higher than English practice demands. Taking Mr. Mantle's developed drum surface and the coefficient of riddle area 0·000802 as found from English practice, the riddle area would for his machine be $27{,}087 \times 0{\cdot}000802 = 21{\cdot}7$ square feet instead of 27·5 which he has given it.

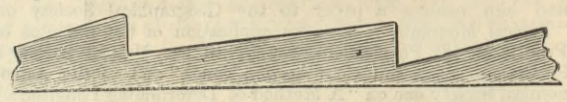
Following this comparison we find that the sieves in the first or lower dressing shoe have an area which is considerably less than that in English 4ft. 6in. machines in the proportion of 4·32 square feet to 6·09 square feet. Their developed area is also smaller in the proportion of 505·4 to 722·5ft., and consequently the efficiency would appear likely to be much less; but the velocity of the sieves in feet per minute is higher in the proportion of 117 to 115·7, a velocity which is only exceeded by one English maker. In the second dressing shoe Mr. Mantle's areas and velocities are more nearly those usually adopted by English makers; but the speed in feet per minute is higher in the proportion of 117 to 100, and the area of the sieves in terms of the developed drum surface is less in the proportion of 0·000129 to 0·0001065, the developed area in terms of the developed drum surface being also greater in the proportion 0·0151 to 0·01063. The velocity of the sieves in terms of the drum velocity is 0·0213, that of the English machines being 0·0166.

The chaff sieve in the upper part of the lower dressing shoe has a slightly higher speed than in English machines, the number of strokes per minute, and not the length of stroke, being greater. The area is about the same as in English 5ft. machines. It is, perhaps, unnecessary to follow the comparison further, and we may now turn to the few figures obtained at the trial run referred to.

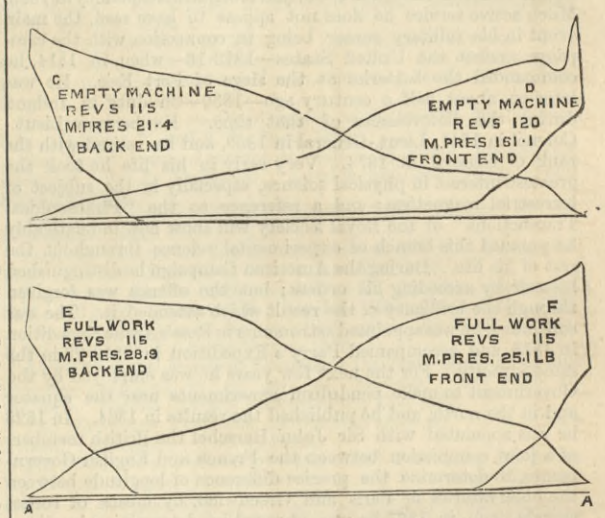
The portable engine was made by Messrs. Marshall, Sons, and Co. in 1879. It has a cylinder 8·5in. diameter and 12in. stroke. The fly-wheel is 5ft in diameter, driving by a cotton belt 5in. wide on a drum pulley 7in. diameter. The power consumed was taken by means of indicator diagrams, and as it took the German workmen as long to rig up tackle for this purpose as it would ordinary mechanics at home to prepare the same tackle for at least three engines, the indicator was attached by means of a pipe and socket screwed alternately into one and the other end of the cylinder. The difference between the diagrams from the two ends of the cylinder remained, however, tolerably constant, so that the diagrams will give fairly accurate indicated power.

Diagrams were first taken from the back end of the cylinder, with the drum only running, and of these diagrams A is a sample. This gives a mean pressure of 15·9 lb., and, assuming the same mean for the front end of the cylinder, 6·28 indicated horse-power. The diagram B was taken immediately afterwards, with the drum, shaker, and riddle, but not the elevator running, and indicates 7·23 indicate horse-power. Diagram C is taken from the same end of the cylinder, with the whole of the parts of the machine running empty, and indicates 8·46 horse-power. The diagrams from the front end of the cylinders, however, all show a lesser mean pressure in the average ratio of 110 to 100. We have thus as the indicated horse-power required to run drum only, 6·90; indicated power to run drum, shaker, and riddle, 7·95; indicated power to run whole machine, 9·30.

After taking these, a preliminary run with the barley referred to was made, and after a little more than two hours the machine was stopped to make some adjustments which were found to be necessary, as this was the first run with this machine, though one of the same kind had done a large quantity of work on the same and other farms. In the new machine a few alterations had been made which were not found advantageous. For instance, five strips of the form here shown had been fixed from end to

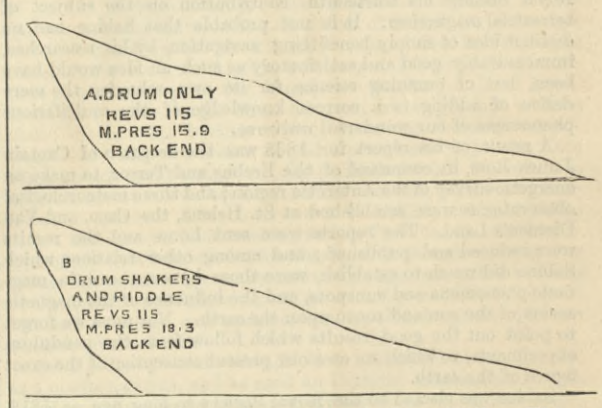


end of the shaker, but it was found that these rather retarded than helped the straw off. The delivery board into the lower sieve had also to be carried well over the first sieve, as shown, instead of only about 4in., as it was; and a strip had to be placed in front of the second sieve of the lower shoe to prevent the grain from flying off. The hanging screen over the shaker had also to be weighted to keep it down, so as to stop grain from being thrown over by the drum, and the shaker had to be nearly level instead of with an upward inclination from the drum. During this broken run, however, 1000 kilogrammes of barley were thrashed, yielding 350 kilogrammes of corn, giving the weight of straw and cavings to barley 1 to 1·857. On the next day the shaker delivered more freely, and very little grain was thrown over by it, and none by the drum. The corn thrown at the lower second sieve of the shoe was very little, but at the high speed at which the crank is driven, it appeared that a wider sieve would be desirable. The thrashing was clean as on the previous day, and the blast elevator did not break any noticeable quantity of grain; but the corn was not thoroughly dry, that is to say, the straw was not crisp, but, more especially as the pile was worked into, it was rather tough, indicating a certain amount of dampness. The separations by the sieve L below the second dressing shoe, Fig. 2, were not quite so good as could be desired, but the sieves were only made of perforated zinc instead of wire as is intended, which will no doubt improve the sample. During 1 hour 20 minutes, 20 centners or 2200 lb. of grain were delivered into the sacks, and taking the same relative weights of grain and of corn, or grain with straw, as given above, the quantity thrashed would be 2200 + (2200 × 1·875) = 6325 lb., or 2·82 tons



thrashed in 1 hour 20 minutes, or nearly 28 minutes per ton. The feeding, however, was very inefficient and difficult, for the corn was mostly rough stacked and tangled, very little being in sheaf, and the weather was very hot. Part of the time, about a quarter of an hour, the maker fed, and during this time the diagram E, amongst others, was taken from the back end of the cylinder, and this one, worked with one taken when the men were feeding, and one taken afterwards, gave a mean of 10·38 indicated horse-power.

During a run of ten minutes, when one of Mr. Mantle's workmen fed as fast as he could, or as the tangled state of much of the straw would admit, 356 lb. of barley were



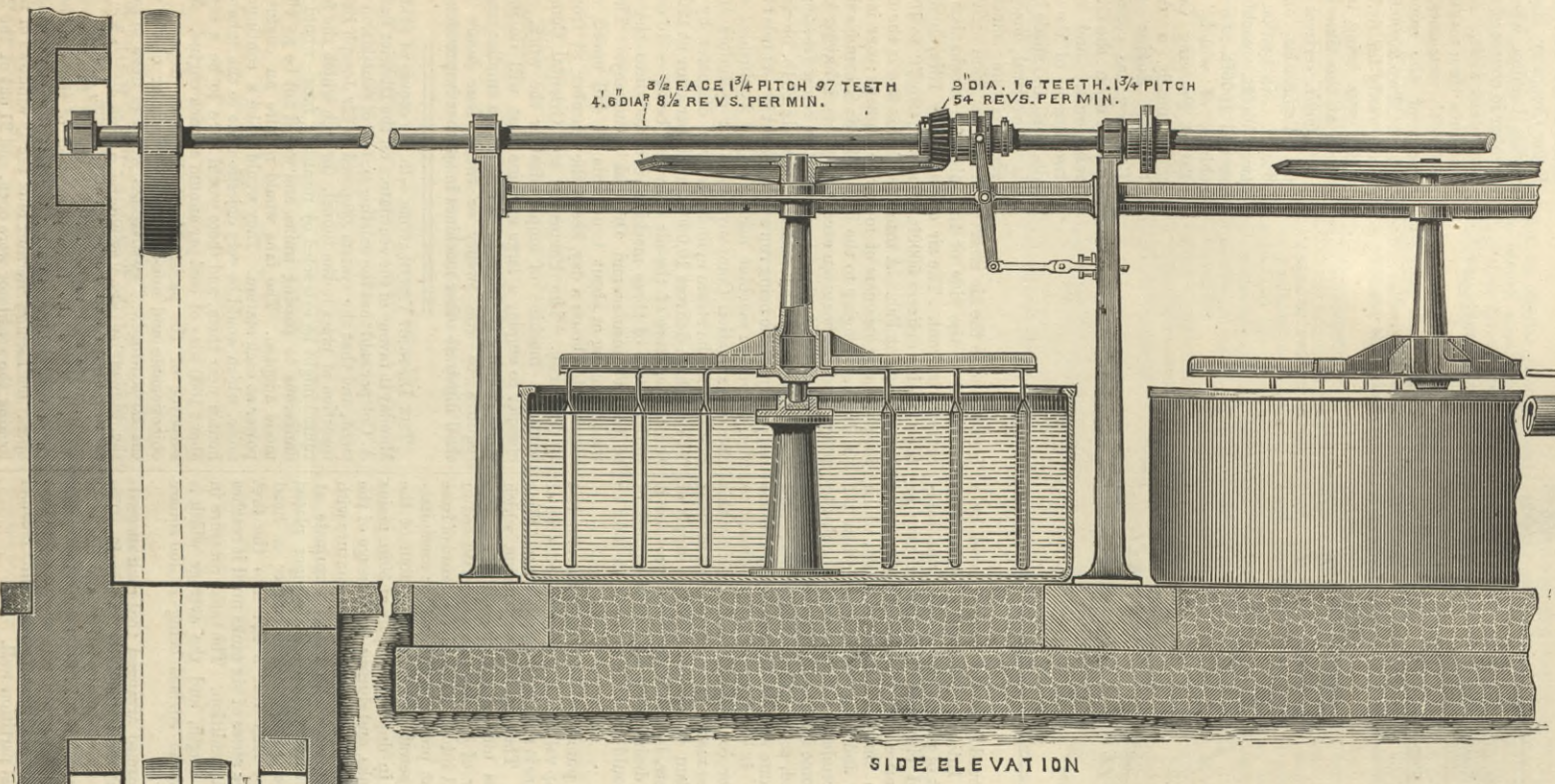
delivered into the sacks, or 3 cwt. 0 qr. 20 lb. This is equivalent to about 1017 lb. of corn in sheaf. During this time the indicated horse-power, as shown by diagrams E and F, was 10·67, and from another pair it was 10·40, or a mean of 10·52 indicated horse-power. Deducting one-seventh as the difference between dynamometer and indicated power, we get an average of 9-horse power. This result may be taken as comparing well with those obtained at Cardiff, when three-quarters of a ton of barley in sheaf was thrashed in from 11·46 to 14·81 minutes, with from 7·42 to 9·47 brake, not indicated, horse-power.

From the figures we have given it will be seen that the power required to drive the machine empty bears about the same relation to that required to work it full as did

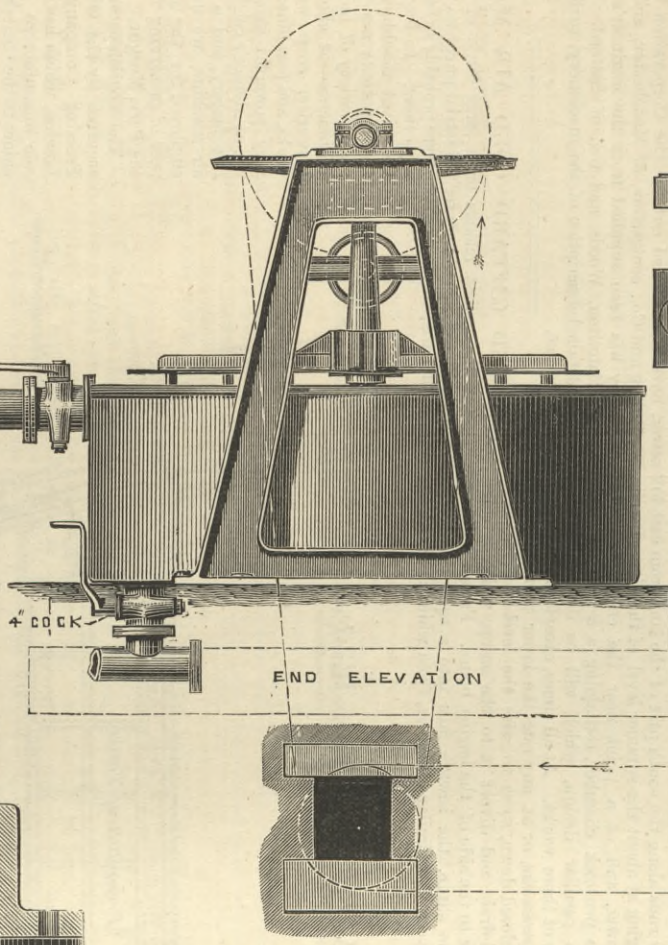
SALFORD SEWAGE WORKS—LIME-MIXING MACHINERY

MR. ARTHUR JACOB, M.I.C.E., SALFORD, ENGINEER.

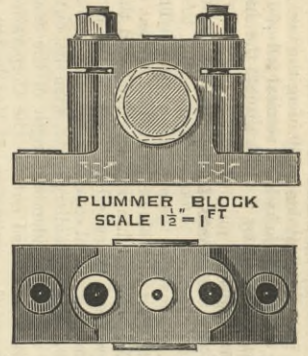
(*For description see page 8.*)

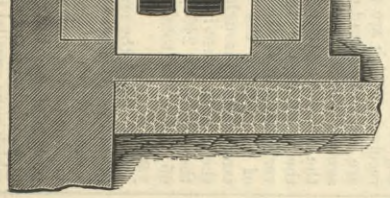


SIDE ELEVATION



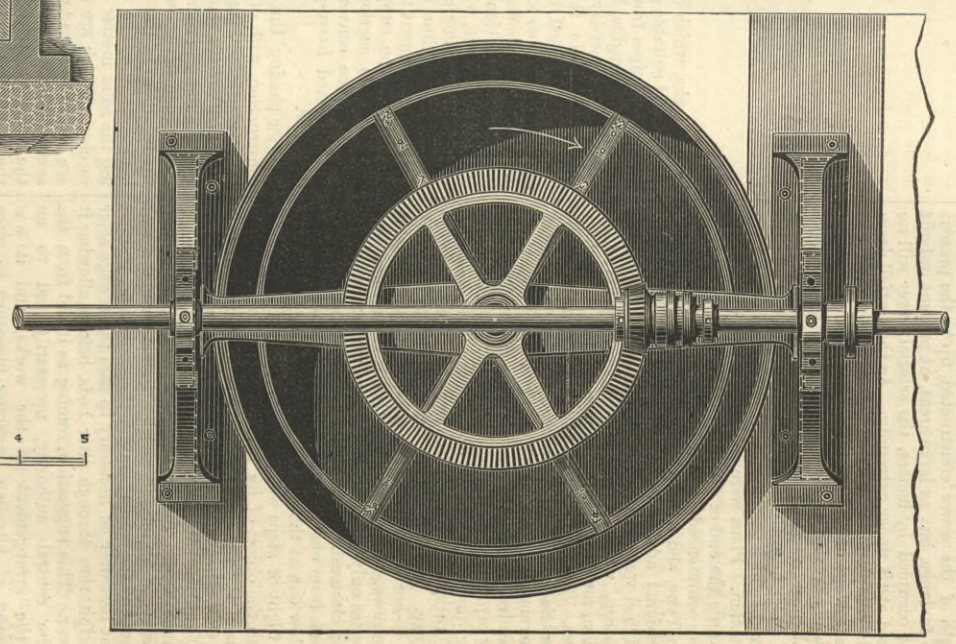
END ELEVATION





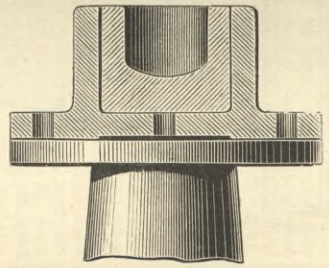
0 1 2 3 4 5

SCALE OF FEET

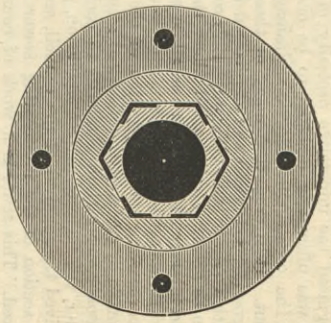


JOHN. SWAIN.

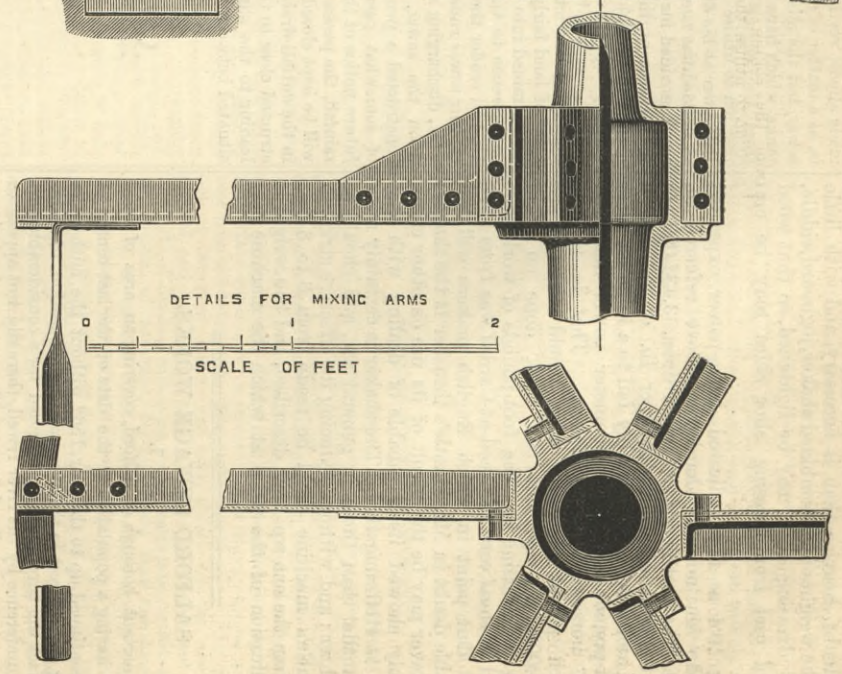
PLAN



DETAIL FOR FOOT STEP



SCALE 1½" = 1 FOOT



the mean of those at Cardiff, which ranged from 52 to 77 per cent. The main reciprocating parts are, however, without doubt, heavier than is necessary, and with little trouble the weight of the combined shaker, jogboard, riddle, and first dressing shoe may be lightened, so that wood instead of cast iron dressing shoe sides may be employed.

Taking 10·4 as the indicated horse-power expended during the ten minutes' hard run above referred to, we get as the foot-pounds of work done, 3,432,000, or 3430 foot-pounds of work done per lb. of sheaf corn thrashed, and this would probably fall to a little less than 3000 foot-pounds if the dynamometer power instead of indicated horse-power were taken. That is to say, that each pound of sheaf corn would have to be raised 3000ft. to represent the work done on it in thrashing and dressing it. The foot-pounds of work done per pound of sheaf corn thrashed at Cardiff was from 2073 to 2531. One point in which English makers will feel considerable doubt in Mr. Mantle's thrasher is the shaker; but whatever may be the result of its use on other crops, it certainly showed itself capable of dealing with that thrashed at Hoffnungsthal. The shaker is certainly more cheaply made than those in general use, and should be much lighter; and without reducing its effective strength Mr. Mantle's machine could be made from 6 to 8 cwt. lighter than the one we have described, and the weight is some indication of the price at which the machine may be made.

SALFORD SEWAGE WORKS.

No. I.

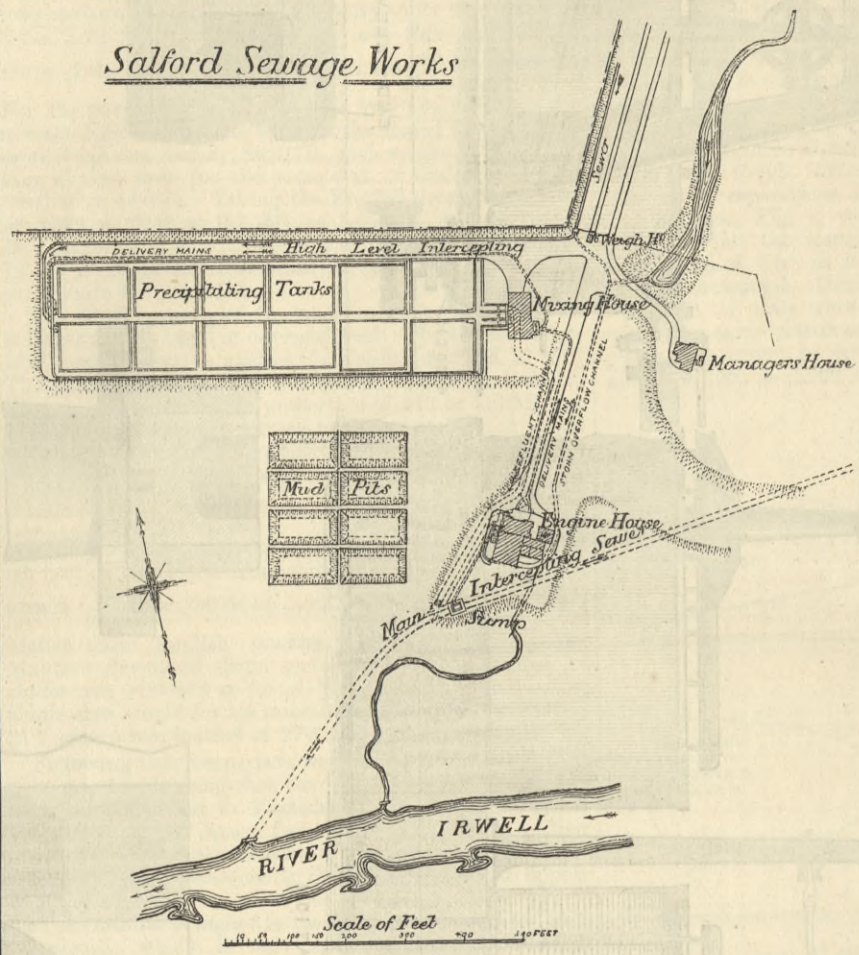
THE important borough of Salford, covering an area of 5208 acres, and having a population at the date of the last census of 176,233, continued up to the year 1862 without the authorities displaying any interest in the ever-important question of drainage. In fact the borough being bounded for a considerable part of its circumference by the river Irwell, there did not appear to be any pressing necessity for expenditure on main drainage works, whilst there was so convenient a receptacle as the river for the filth of the borough. Twenty years ago, however, Salford, unlike the other districts adjoining, which up to the present time have done absolutely nothing to divert their liquid refuse from the river, recognised the imperative necessity of undertaking a work which was ultimately destined to be one of importance, and began the construction of arterial drainage works of considerable extent. It is true that many of these newly constructed mains gravitated towards and discharged into the river, presumably with a view to their being ultimately connected to an outfall sewer to be hereafter constructed along the valley line, and which would intercept from the river all sewage and manufacturers' liquid refuse carried by the subordinate drains.

Several suggestions regarding the interception of the sewage from the river were made by competent professional men, all the schemes necessarily possessing certain similarity to each other, and finally Mr. Fowler, the engineer to the Corporation, prepared a scheme which received the approval of the council, and in the year 1873 the first section of the intercepting sewer for this scheme was commenced. This sewer is a work of considerable magnitude. It has an average diameter at its outlet of 8ft. 3in., and it diminishes in size to the upper end, where the sewer is of egg-shape, having an interior section of 4ft. by 3ft.

The total length of the sewer constructed, up to the present time is 4 miles 5 furlongs, but as large areas, at present unbuilt upon, come to be occupied by houses, the arterial sewer will no doubt be elongated at its upper extremity. As the outfall drain advanced towards completion it became necessary to consider in what manner the sewage of the borough could be most effectually and economically treated at the outfall, and the Corporation, after very careful consideration, determined, in 1876, to establish works at Mode Wheel, a suburb of Salford, for treating the sewage, the volume of which was estimated at twelve million gallons daily, by precipitation. Plans were accordingly prepared by Mr. Fowler, who towards the end of the year 1877, and before the outfall works were commenced, left the service of the Corporation for Newcastle-on-Tyne, and was succeeded by Mr. Arthur Jacob, at present professional adviser to the Corporation. The works as originally designed were in their main characteristics similar to those at Knostrop, which were designed by direction of the Leeds Corporation, for treating the sewage of that borough by the A B C process. The arrangement of the works as originally designed for the Salford Corporation consisted of a series of twelve tanks, arranged in duplicate in two rows. Into these tanks it was intended to lift the sewage direct from the intercepting sewer by a pair of centrifugal pumps, the total lift being 14ft. Adjoining the engine house was to have been erected a building for the reception of the machinery to be employed in treating the sewage. This machinery was designed to be driven by an engine of 40-horse power. After passing the precipitating material into the sewage it was arranged that it should flow into the tanks, one series only being used at a time, whilst the reserve series was being cleansed. Once delivered into the tanks, the sewage was to pass from one tank to another over a series of sills until it should flow out at the further end of the tanks, where a wide cascade or flight of steps was to be provided for the sewage to flow over, with the object of its being aërated, and from the foot of the cascade the sewage was to flow into the river Irwell. Before carrying this scheme into effect it was deemed advisable that the plans should be submitted to the chief engineer to the Local Government Board for his opinion. This gentleman, though not speaking in his official capacity, gave a general assent to the arrangement of the works; but, at the same time, pointed out that it might hereafter be necessary to pass the sewage after undergoing precipitation through filter beds, before allowing it to enter the river. This suggestion, coming as it did from the engineer to the central authority, necessarily led to an alteration in the arrangement of the works, and it was decided in prospect of filtration becoming necessary, to place the tanks at some distance from the river, and on higher ground, in order to secure full command of the land bordering on the river. The raising of the tanks to a height of 29ft. above the outfall necessarily led to the selection of a different type of engine and pumps, and it was finally decided to employ a pair of compound vertical engines, driving a pair of double-acting plunger pumps placed vertically under the steam cylinders. These engines, which have been erected by the firm of Messrs. James Watt and Co., of Soho, are fully described in our issue of August 12th, 1881. They are capable of lifting the whole of the sewage from the area which supplies the intercepting sewer and rather more than a quarter of an inch of rainfall in the day of twenty-four hours.

Certain other changes were made from the original designs. Instead of making the tanks of earthwork and puddle, with sloping sides lined with stone pitching on the inside, they have been constructed of concrete, by which the sides of the tanks are made almost vertical for facility of cleansing. The engine-house is, as a matter of course, erected in the vicinity of the outfall sewer, but the mixing-house is placed close to the end of the tanks, which have been constructed at a distance of 90 yards from the engine-house. The engineer, finding himself in a position to utilise the fall of the sewage, determined to employ the power at his disposal for driving the mixing machinery, and so avoided the necessity for a 40-horse engine originally intended to be provided for that purpose. No material change was made in the area of the tanks, but the arrangement of the supply channels was slightly altered. As a measure of economy a short intercepting sewer, which was not included in the original scheme, was laid, to collect the sewage and storm water from the high-lying district of Pendleton, which comprises about 1300 acres of land fairly covered with houses, which otherwise would have drained into the intercepting sewer.

Reference to the ground plan of the works, shown at page 15, will render their arrangement intelligible. The main intercepting sewer runs along the south part of the land from east to west, discharging at about the summer level of the river Irwell upon the sewer, and at a point near the engine-house is constructed a penstock chamber, containing a set of penstocks of somewhat peculiar design, which will be described in a future notice of these works. At all times, except during heavy rainfall, the penstocks, or at any rate the lower part of them, will be kept closed down, so as to raise the level of the sewage in the outfall drain and divert it to the sump, which is constructed close to the side of the engine house. From the sewer leading to the sump, the sewage falls into a square chamber situated between two similar chambers, from which it is cut off



by penstocks, which can be opened from the ground level by a capstan and suitable gearing. Into each of these side chambers the suction pipes from one set of pumps passes from the basement of the engine house, and either of the chambers may be cleansed if necessity should arise without the pumping being discontinued. In the suction chambers are fixed floats, which have been devised to control and stop the engines when the sewage descends so low as to render it possible for the pumps to draw air. The floats, which come into action shortly before the mouth of the suction is exposed, act upon a system of horizontal and vertical shafts, which gear one with another until the throttle valve in the engine house is reached, and the supply to the engines is thus kept under control by the floats. By this simple arrangement the engines may be left unattended without any risk, as the supply of steam is regulated by the supply of sewage in the suction chambers, but as a matter of practice it would not be convenient or desirable that a pair of engines of 450-indicated horse-power should be worked in a manner so irregular.

After passing through the pumps, which are of the simplest construction, with ordinary flap valves, the sewage is delivered at the mixing house, page 15, where it receives the proportion of lime necessary for its purification. The two delivery mains, which are each 30in. in diameter, pass underneath the tower and discharge themselves into a pair of cast iron receivers situated in the basement of the tower, and into these receivers cream of lime is discharged as the material at present employed for precipitating the solid matter from the sewage. From the bottom of the receivers, which are arranged in duplicate, a pair of 30in. mains are laid to the head of the tanks, and during the passage of the sewage through these mains there is ample time for mixture with the lime solution to take place. The mains terminate at the head of the tanks in ordinary bell-mouth pipes placed vertically, out of which the sewage issues under a head of 6ft. 9in. in the tower, and falls over a sill into the first tank, and so through the whole series of six tanks until it reaches the mixing house in a clarified condition. The tanks measure in the aggregate 246 yards in length, and the average width is 65 yards, the total area of water surface being 12,360 square yards.

The sills of the cross walls are so arranged that each succeeding sill is 6in. lower than the one immediately above it. The average depth of the sewage in the tanks is 7ft., and the total volume of the whole series when full is 778,600 cubic feet. The bottom of each tank slopes slightly in a direction contrary to that of the flow of the sewage, and the slope terminates in a channel which runs parallel to the cross partition wall.

For the emptying of the tanks differential pipes are provided, which are lowered by a small winch, and draw off the clarified sewage, leaving the deposit behind. The liquid escapes through subsoil drains into the river. After the clear water is drawn off men enter the tank and push the semi-fluid mud into the open channels above referred to, and in these channels are provided a number of outlets with water-tight covers. As soon as the covers are lifted up the mud runs out into mud pits, which are excavated in the vacant land adjoining the tanks. The sewage in flowing out of the tanks has a vertical fall of 15ft., and a pair of turbines are driven by it which actuate the mixing machinery in the lime-house.

The intercepting sewer for the Pendleton district passes down the road leading to the works, and runs along the north side of the tanks, as shown on the plan, in an open channel constructed of concrete lined with blue Staffordshire bricks. The cost of the works at Mode Wheel has been £101,000, and that of the intercepting sewer and the subsidiary sewer for the Pendleton district £97,000, making a total expenditure, with certain contingencies, of £200,000. The subsidiary sewer, with the outfall works and buildings and a considerable length of the main intercepting sewer, have been carried out for the Corporation by Messrs. S. W. Pilling and Co., contractors, of Manchester, and the mixing machinery has been supplied from the engineer's designs by Messrs. Hamilton, Woods, and Co., of Salford. We purpose giving a detailed description of the machinery, turbines, &c., in a future notice.

IMPROVED GIFFARD COLD AIR MACHINES.

ONE of the earliest makers on a large scale of refrigerating machines producing cold air for industrial purposes was M. Paul Giffard, of Paris, whose machines were probably in larger use than any others. In Paris and on the Continent machines under Giffard's patents are in use at a great variety of industrial establishments—at chocolate works, breweries, soap works, butter works, and paraffine works. Some very powerful machines are in use at Menier's celebrated chocolate factory, and a Giffard cold air machine, we understand, is employed for the peculiar purpose of preserving dead bodies at the Paris Morgue.

The English patents have been acquired by the Giffard Patent Freezing Company, Lothbury, London, which has conceded the sole manufacture of the machines to the General Engine and Boiler Company, Hatcham Ironworks, London, where we saw a number in course of construction at a recent visit. Amongst the machines then making were two 40,000ft. machines, and two others of the same size just begun. Two 20,000ft. machines nearly ready for delivery, one of which was being tested under steam at the time of our visit. A 10,000ft. vertical machine for the Peninsular and Oriental Steam Navigation Company, two 5000ft. machines, besides several 1000ft. and 2000ft. machines, of which the Giffard Patent Freezing Company has made nearly a dozen. The General Engine and Boiler Company has considerably improved upon the Giffard patent refrigerator, and we illustrate two forms of the machine as designed and made by it. Fig. 1 is a vertical machine, which reminds one somewhat of an iron piano, as the air reservoir of the machine stands against a bulkhead or the side of the ship, the mechanism being then entirely in front. The air cylinders are 13in. in diameter, and the machine delivers 5000ft. of air at from 70 to 100 deg. below freezing point Fah. A machine of this size is the most suitable for passenger steamers of moderate tonnage; one is fitted in the s.s. India, belonging to the British India Steam Navigation Company, where it has given excellent results, it having kept the meat chamber of the India as low as 20 deg. below freezing in the Red Sea, at the same time making five or six 28 lb. blocks of ice per day, the machine being run at only about two-thirds of its capacity. Fig. 2 shows a machine made for the Peninsular and Oriental Steam Navigation Company. The air cylinders are 16in. diameter, and the steam cylinder is 10in. diameter by 16in. stroke. The machine delivers 10,000ft. of air per hour at 120 revolutions, the temperature of the air delivered being – 40 deg. Fah. and under. One of these machines is fitted into the s.s. Thames, of the Peninsular and Oriental Company. This machine, when running at about two-thirds its full speed, and working eight to ten hours a day, keeps the chamber at from 10 deg. to 15 deg. Fah. The Peninsular and Oriental Company prefers having a machine of ample size for the work, and finds it cheaper to employ a large machine that will do its work easily when running twelve hours a day than a smaller machine which requires to run twenty or twenty-four hours a day. We shall illustrate other machines in another impression.

THE DISTRICT VENTILATORS.—In the course of evidence given on Monday in favour of the ventilators on the District Railway, Mr. E. A. Cowper said that the existing system of ventilation was most efficient, and that the system proposed by Sir Joseph Bazalgette—the insertion of pipes in the tunnel, through which the foul air in the tunnel might be extracted by means of fans—would be extremely dangerous to passing trains, and would not be as efficient as the mode adopted. The fans would require an engine of 80-horse power at each station. They would make a continuous humming noise, which would be very objectionable to the inhabitants of the houses near them, and there would have to be a consumption of about 1000 tons of coal per annum at each engine. Mr. W. Scott, surveyor of the parish of St. Pancras, deposed to the non-objectionable and non-obstructive character of the ventilators in the Euston-road. Two witnesses who had been engaged to watch the windows of the Westminster Palace Hotel, and of the Civil Service Stores and Foster's Parcels-office, Queen Victoria-street, which were said to be affected by the fumes of the gave evidence to show the large proportion of the windows at each of those establishments during the last few days which were kept open. On Monday morning 14 of the 19 windows of the hotel overlooking the ventilator were open, and 21 out of the 23 at the Civil Service Stores were also open.

ASSOCIATION OF MUNICIPAL AND SANITARY ENGINEERS AND SURVEYORS.

THE annual meeting of the members of this Association was held at Oxford on Thursday and Friday last in the Council Chamber of the Corporation. The retiring president, Mr. Charles Jones, Assoc. Inst. C.E., of Ealing, occupied the chair at the opening of the proceedings, and about fifty members attended. Several influential visitors were present, including the Provost of Queen's College, the Rev. Dr. Magrath, who is chairman of the Oxford Local Board, and Lieut.-Col. Jones, V.C., of Wrexham.

Mr. Thos. Cole, the secretary of the Association, read the report of the Council for the past year, which stated that during that period the Association has made increased and successful progress. Sixteen members had joined, and nine had died, retired, or been "written off." There were now five honorary and 210 ordinary members—total, 215. There was a balance in hand at the end of April of £126 18s. 4d. against £106 10s. 3d. last year, and the statement of assets and liabilities also showed the sound financial position of the Association. The council had considered the claims of several suitable places, and recommended that Newcastle-on-Tyne should be selected for the next annual meeting of the Association. The President moved, and Mr. Pritchard, Westminster and Birmingham, seconded the adoption of the report.

Mr. Jerram (Walthamstow) expressed regret that no district meeting had been held last year in the home counties. Had meetings been held they should have obtained more members, and the council should offer some explanation. He also criticised the mode of electing the council, and argued that the council should not merely select twenty-two names, but that every member of the Association should be eligible.

A discussion ensued, in the course of which it was explained that the convening of district meetings rested with the district secretary, and if he did not do his duty it was not the fault of the council. As to the mode of electing the council, the model of the parent society, the Institute of Civil Engineers, and the Association of British Architects, had been followed; but a proposition would be submitted to that meeting for altering the present mode of electing the council.

Eventually the report was unanimously adopted.

The council proposed Mr. Parry (Reading) and Mr. Walker (Croydon) as auditors for the ensuing year, but on the suggestion of Mr. Jerram, Mr. Dawson (Leyton) was substituted for Mr. Walker. Messrs. Walker (Croydon), Holton (Lewes), Goodchild (Teddington), and Mead (Hornsey), were unanimously appointed scrutineers to examine the voting papers next year for the election of president, vice-president, and council.

Mr. Vawser (Manchester) then submitted a proposition for altering the mode of electing the council. At present the council select twenty-two names for president, vice-president, and council, and for these a ballot is taken, but a member may strike out any names and substitute others. Mr. Vawser proposed that instead of this a list of all the members should be circulated, with liberty to members to vote for anyone they pleased. He contended this would be more satisfactory, and tend to popularise and extend the Association.

Mr. Jerram seconded the proposition on similar grounds, and affirmed that it was not right that the council should practically blackball anyone they pleased, and select their favourites.

Mr. Adams, Mr. Spencer (Tynemouth), and others supported the proposition.

M. Lobley (Hanley), one of the council, admitted that a case had been made out for enlarging the area from which the council is selected, but proposed as an amendment that forty names instead of only twenty-two shall be circulated amongst the members for ballot.

Mr. Carlton (Beckenham) seconded the amendment.

Mr. Lemon (Southampton) characterised the original proposition as impracticable and unworkable, and affirmed it would not result in so good or representative a council being selected as at present.

Several speakers followed on both sides, and the President, on the part of the council, said they had no special objection to the proposal, but they thought such a radical change should not have been sprung upon the Association without notice.

On being put from the chair, Mr. Lobley's amendment for increasing the number of names sent out at the ballot from twenty-two to forty was carried by a majority of five—eighteen for and thirteen against being recorded.

Mr. Angell (West Ham) then moved that no new rule, or alteration of any rule, should be entertained at an annual meeting, unless notice had been given before the 31st March in the current year, and the proposed addition or alteration had been circulated amongst the members of the Association. He objected strongly to any such important change being made in the constitution of the Association when only about a quarter of the members were present, and the rest had not had any notice of it whatever.

Mr. Jerram seconded the amendment, and heartily endorsed the principle it embodied.

This was unanimously adopted.

Mr. Jones, after speaking of the gratification it had afforded him to occupy the post of President of the Association, and acknowledging the courtesy and cordiality with which he had always been received, introduced the President-Elect for the current year, Mr. W. H. White, M. Inst. C.E., of Oxford, who was received with much applause. No member of the Association, he said, was more generally or deservedly respected; he was confident he would render valuable services to the Association during his year of office.

The President-Elect then briefly acknowledged the honour conferred upon him by placing him at the head of the Association, and hoped his year of office would be a successful and prosperous one.

Mr. Spencer then moved, in highly complimentary terms, a hearty vote of thanks to the retiring President—Mr. Jones, of Ealing—for his services during the past year. He had discharged his duties admirably, and had evinced the greatest kindness and courtesy to every member.

Mr. Vawser seconded the proposition, which was carried by acclamation; and the ex-president, in acknowledging the compliment, said he had done his best, and was gratified that his efforts had been appreciated.

The President then read a paper on the Sewage Works, Magdalen Bridge, and the tramways of Oxford, each of which were subsequently visited and inspected. There were two engines at the pumping station, one of which pumped the sewage in ten or eleven hours in dry weather; but in wet weather both had to be worked continuously. The indicated horse-power at fourteen strokes was fifty-five and a-half separately and sixty-three and a-half when worked together. The rising main, 24in. in diameter, is 2570 yards long. The sewage farm consists of 369 acres, of which sixty-four are permanent pasture, 226 arable, twenty-three are filter beds, and the rest are occupied by buildings and works. The land was so waterlogged that the whole had to be underdrained, at a cost of £9 per acre. The sewage pumped in a year was 522,265,575 gallons, or a daily average of 1,430,865 gallons, or about 1,657,986 gallons per acre. This was equivalent to a rainfall of 93·2in. per annum. The natural rainfall during the same period had averaged 30in. per annum. The total cost, including £2000 to provide drinking-water for Littlemore Asylum, previously obtained from the river, was £83,645. The annual cost of pumping was £1000. The financial results had been that up to Michaelmas last the receipts had exceeded the expenditure by £540. Neither the cost of pumping nor the interest on or repayment of loans was charged against the farm, but one-twentieth of the £4000 borrowed for stocking the farm had been paid off every year. An outbreak of cattle disease entailed a loss of £300 to £400, and the land when acquired by the board was so exceptionally dirty that a considerable area could not be cropped for a year. But for these untoward circumstances, and the depressed state of agriculture, Mr. White thought better results would have been attained. He then described the widening of Magdalen Bridge, across the two arms of the Cherwell, on to the main road to London. An addition of 20ft. in width is being made on the south-west side, which will provide a carriage-way of 32ft. 6in., and two 7ft. footways. The foundation proving to be running sand, elm piles had to be driven to the Oxford clay, 18ft. from the surface. There were 380 altogether, which had to carry about 12 tons per pile, or 400 lb. per square inch of section. The cost of 11in. piles, 14ft. long, driven by Lacour's steam pile-driver, was 43s. each, and of 9in. 38s. 6d. each. The foundations of the old part of the bridge were found to be two thicknesses of elm planking, without any heart piles, laid below the bed of the river. Skewbacks were accordingly cut under the old work, and inverted arches of 18in. brickwork in cement, with a versed sine of 3ft. 6in., were put in from pier to pier. The cost of the bridge, including repairs and land and compensation, had been £10,600, exclusive of the underpinning, which was paid for by the Thames Valley Drainage Commissioners. Mr. White added that, notwithstanding all the storm of opposition evoked, the antagonistic meetings, and articles in the London papers against "The destruction of an ancient monument," so far from any act of Vandalism having been perpetrated, he trusted the objectors would ultimately admit that a work of much public utility had been carried out without detracting from the picturesque character of the bridge and its surroundings. The tramways consisted of two separate lines, of 4ft. gauge, mostly single track, in the centre of the roadway. Mr. White said that the permanent way was of a simple and somewhat novel character, and was specially designed by the engineers. The rails are steel, of bridge section, weighing 67 lb. per yard, and have a continuous bearing upon a cement concrete foundation 4½in. thick. The rail ends are held by cast iron shoes 9in. in length, weighing about 23 lb. each, and are kept to gauge by a flat, wrought iron tie, 2in. by ⅝in., the ends of which are turned up so as to go into holes in the bottom of the shoes. On the upper side of the shoe there is a projecting rib 6in. long and ⅜in. deep, which fits accurately into the hollow of the rail, and along the outer edge of the shoe there is a lip, under which the outer flange of the rail fits. A wrought iron cover plate, 2½in. wide, is placed over the inner flange, and clamped down through the shoe by three ⅝in. bolts, the middle one also passing through the gauge tie. Thus the whole is fitted and fastened effectually without timber or iron sleepers or fish-plates. It is claimed that this mode of construction admits of alterations or repairs with a minimum of disturbance of the permanent way. The space between and 18in. outside the rails is paved with 5in. setts upon 4½in. of concrete, except that on each side the rail a course of wood paving, 2½in. wide, is bedded direct on the flanges. The points and crossings are of chilled cast iron, and the curved rails were bent cold at the works to proper templates. The lines had hitherto preserved their position and level accurately, and he believed the system to be a very good one. The average cost per mile of single line had been £3627.

The criticism which took place upon the President's paper was chiefly complimentary. M. Angel (West Ham) characterised the works as admirably designed, well executed, and working most efficiently. Mr. Gordon (Leicester) mentioned that he was indebted to Mr. White for the hint how to make a pipe sewer water-tight, in an inexpensive manner, in running land. He also spoke of the whole of the works they had seen as substantially constructed and well-designed, and said they would be a credit to any engineer in the kingdom. Mr. Lemon (Southampton) said the only unsatisfactory thing was the sewage farm, managed by the sewage farm committee. It was under manned and very inefficiently managed. Mr. Pritchard (Birmingham and London) said the idea that sewage was an unworked mine of wealth had been completely exploded by practical experience. He must say—and he had had some experience—that he had never seen a sewage farm satisfactorily worked by a local board or a corporation. If such farms were to be made to answer, they must be managed like Colonel Jones's at Wrexham or Lord Warwick's at Leamington. The Oxford engineers' works were as good as the sewage farm was bad. Several other speakers, having referred to the satisfactory state of the sanitary works executed under Mr. White at Oxford, Dr. Ackland, the leading local physician, asked to be permitted to say a few words. Dr. Ackland then referred to the eminently unsanitary state of Oxford in the early days of his professional career, when he could only refer to the state of things that existed there as a model of what ought not to be, and it was impossible to get either the municipal or University authorities to devote attention to the subject. He was, therefore, gratified to hear from a body so eminently qualified to express an opinion of the highly satisfactory and greatly improved state of things now. Mr. Gladstone and the Marquis of Salisbury had just taken their degrees before he (Dr. Ackland) joined the University as an undergraduate, and it was obvious that it would have been a great advantage to the country had they been surrounded by model sanitary arrangements instead of by what could only be pointed to as illustrating what should be avoided. Mr. White, in replying, stated the Local Board would have been delighted to have let the sewage farm, only they could not get anyone to take it. The sewage works, drainage works, and farm added 1s. 1d. to the rates. The thanks of the Association were accorded to the President for his paper.

THE SUPPLY OF ELECTRICITY BY LOCAL AUTHORITIES.

This was the subject of a paper read by Mr. W. Killingworth Hedges, Assoc. M. Inst. C.E. and Mem. Soc. Telegraphic Engineers. In the course of his remarks he said that, in order to prevent the establishment of a monopoly, local authorities were given the same rights as to laying down the necessary works and to supply their own electricity, as to any company. No less than seventy-seven applications were made at the end of last year by various corporations and local boards and other local sanitary authorities for provisional orders. From the many notices of opposition lodged against the applications of companies, either the local authorities did not consider electric lighting as yet sufficiently developed, or object to any portion of their district being placed in the hands of an electric company. Against the plan of local authorities acting as contractors might be advanced the supposition of future improvements in the means of generating electricity, and which might render costly machinery comparatively useless. On the other hand, the Act required the minimum charge to be now fixed, so that if the cost of production was cheapened the company's prices need not be reduced until the expiration of their licence. According to the Act the maximum charge must now be fixed, to do which the company will be guided by existing arrangements, so that if the cost of production be cheapened, the price charged by the company need not be so until the expiration of the licence. Considering the short period of a licence and terms on which it will be granted, it is only fair that the company should derive some profit and should have the benefit of cheapened production. But there are many objections to granting any company free control of the streets, some of which are very noticeable by the action of the existing gas and water companies. This would probably prevent the repetition of annoyances caused by contracting companies having access to the streets, as the mains would be led from the site deemed most suitable for the generating station and might be handed over to the contractors for the experimental or permanent lighting. Its gauge would be calculated to take sufficient current to supply the district at a determined electrical pressure, so as to give the required electro-motive force without risk from fire or danger to life. Mr. Hedges having entered at length into the details of generating power, electric mains, overhead and underground wires, dynamo machines, speed regulators, and storage batteries, went on to discuss the price of the supply and other details.

Mr. T. H. Blakesley, M.A., Assoc. M. Inst. C.E., opened the discussion, and complained that the Parliamentary Committee did not ask a question about alternating currents, their applicability, efficiency, and danger. Compared to direct currents they were dangerous to life, inefficient in action or limited in applicability, being useless for storage batteries, and comparatively so for the production of mechanical energy. The Act for public purposes practically restricted electricity to lighting, although directly there was a proper supply of electricity mechanical applications of it will swarm. Having pointed out how much cheaper electricity for all purposes could be supplied by one company, he spoke of the difficulty of securing complete insulation in damp situations by lead coating and other means, and said gutta-percha was alone effectual. He also considered the lower limit of 30 volts quite inadequate for the best and most economical lamps, corresponding in brightness to an ordinary gas jet; and he also referred to the unsatisfactory mode of calculating the energy to be charged for.

Mr. Jerram (Walthamstow) spoke against electric companies being allowed to acquire a monopoly like gas and water companies.

Mr. Jones (Ealing) spoke of the satisfactory lighting of Parliament-street with gas, and the Place de l'Opera in Paris; and though not prepared to advocate electricity, he said that it had certainly stirred up the gas companies.

Mr. Lemon (Southampton) doubted the accuracy of Mr. Hedges's estimates. Other speakers followed, and the objections raised were principally, that as yet no system of electric lighting is so satisfactorily developed for local authorities to adopt it, and there was also great uncertainty as to the cost.

SEPARATE SYSTEM OF SEWERAGE.

Mr. Albert W. Parry, Assoc. M. Inst. C.E., borough surveyor, read a paper on the separate system of sewerage as carried out at Reading. The system could not be regarded as complete, so far as surface water is concerned, as all the sewers are not new. A system of sewers for the disposal and utilisation of sewage was completed about seven years ago, and the old sewers, which formerly conveyed both sewage and surface water, are now used only for surface water, and in streets where there were no new sewers new ones are being laid. The urgent need of keeping rain water out of the main sewers had been shown by the sewage being dlluted and its volume increased, causing augmented cost and difficulty of dealing with it on the sewage farm. After describing the system of sewerage, he mentioned that the hard rule of excluding all surface water from the sewage sewers was relaxed in cases where there are small enclosed areas on the rear of houses, where a second grate or trap, if fixed for receiving rain water, would offer equal facilities for the emptying of slops. The number of houses was 8700, the average quantity of sewage pumped was 998,277 gallons per day, and the water supplied to the town was about 1,813,000 gallons daily.

A discussion ensued, which lasted nearly three hours. Mr. Gordon (Leicester) stated he had partially adopted the separate system, and was in favour of getting storm water to the natural outfall for the water of the district. Col. Jones (Wrexham) advocated the separate system, and said that in that way alone could the difficulty of disposing of sewage by irrigation be successfully accomplished. Surface water should go into the drains, and water supplied for domestic purposes only into the sewers. Mr. Jerram (Walthamstow) stated that for two or three years the system had been tried there, and had proved a failure. Sewage and dirty slops were being constantly connected with the surface drains, when repairs were needed, so that it was impossible to work the system satisfactorily. Mr. Lemon (West Ham) declared there was no perfectly separate system carried out in England, and if it were, it would not last a month. It was only applicable to some towns, and only where sewage was applied to the land, or had to be pumped, and then purified by precipitation and some chemical process. It was an extraordinary stretch of authority to compel houses to have drains for sewerage and for surface water. The only extent to which the system could safely and wisely be carried was, in suitable situations, to carry off into the natural outfall the water falling in open streets, that side of the roofs of houses and places under the sole control of the local authority. Mr. Pritchard (Birmingham and London) expressed similar views, and Mr. Angell (West Ham) agreed that the separate system should be limited to streets, open spaces, and the street sides of houses. It would be folly to attempt to carry it further. Mr. Parry replied at some length, but the general feeling was evidently strongly adverse to anything like an attempt to compel all houses to have two sets of drains, one connected with the sewers for sewage and house slops, and the other for surface drainage and inoffensive water.

ABINGDON WATER SUPPLY.

Mr. George Winship, Assoc. M. Inst. C.E., borough surveyor of Abingdon, read a paper describing the water supply of that town. About two and a-half miles from the town a trial shaft, 8ft. in diameter, was sunk through rock of the oolite series to a depth of 35ft. or 40ft., with a 5in. bore some 35ft. further in soapy clay. Nearly the whole of the water supply was obtained from a cavern in the rock about the bottom of the trial shaft, very little being obtained by boring below or from the strata above. The quantity having been proved, a reservoir was excavated and constructed around the trial borehole for storing 125,000 gallons of water. The level of the bottom of the reservoir is 240ft. above the Ordnance datum; and the quick service main entered the reservoir 10ft. from the bottom. This arrangement was adopted to save making a costly cutting 600 yards in length to place the pipes at the bottom of the reservoir. The shorter leg of this syphon was therefore about 9ft. in length, dipping to the bottom of the reservoir, while the long leg extended to a distance of 600 yards or thereabouts, and formed part of the main supply of Abingdon. When the water in the reservoir rises, as it generally does at night, up to or above the crown of the syphon, it discharges by gravitation simply, but when it sinks below that level syphon action is called into play to a greater or less degree. Mr. Winship then described the supply pipes, valves, meters, and fittings used.

The discussion was very brief, as the sitting had been protracted beyond the usual hour. Mr. Pritchard (Birmingham and Westminster) mentioned that nine years ago he put in a much larger syphon in the rising main which supplied Warwick with water, which had worked satisfactorily. It enabled a difficulty to be surmounted with comparative ease, as they unexpectedly came upon running sand in laying the main, and the syphon certainly saved between £2000 and £3000. The meeting then separated, but on Saturday several members of the Association visited the waterworks, and afterwards inspected the colleges and other places of interest in Oxford.

The Association's annual dinner took place at the Clarendon Hotel, on Tuesday night, under the presidency of Mr. White, when the mayor and other influential guests attended. The meeting was considered one of the best yet held.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY.—A large number of members of this Society visited the City Extension of the Metropolitan and District Railway on the 25th of June, and were conducted over the works by Mr. E. P. Seaton, the resident engineer. Among those present were the President, Mr. R. Twigg, M.I.C.E., and Messrs. Street, Walmisley, Munday, G. R. W. Wheeler, Willcocks and Cuxson, hon. secretary.

LAUNCH.—On the 25th ult. Messrs. Earle's Shipbuilding Company, Limited, launched from its yard at Hull a fine screw steamer, built for the Empreza Nacional—of Lisbon—line of steamers, for mail and passenger service between Lisbon and the west coast of Africa. Her dimensions are as follows:—Length, 310ft.; breadth, 37ft.; depth of hold to open deck, 26ft. The vessel is built to class 100 A1 at Lloyd's The vessel is being fitted by the company with inverted compound surface-condensing engines, of about 1450-I.H.P., the cylinders being 40in. by 74in. Steam will be supplied by two double-ended boilers, having a working pressure of 80 lb.

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

(*From our own Correspondent.*)

The iron market is this week disorganised since the forge hands are on strike, and they are doing their best to induce the millmen to join them. The strike originates in discontent at the declaration of the accountants to the Wages Board, which was made in Wolverhampton last Saturday, of the average selling price of bars during the three months ending May last. This average is declared to have been £6 15s. 3·35d. per ton, which is a reduction on the previous quarter of 4s. 2·65d. per ton. The drop carries a reduction in puddlers' wages of 3d. per ton, bringing them down to 7s. 6d., and millmens' wages in proportion. It came into force on Monday, and should prevail for three months. The puddlers, however, refused to accept it and threw down their tools.

The strike began in the West Bromwich and Smethwick districts, and gradually extended until now—Thursday—it has become pretty general at all but the chief Dudley and Wolverhampton works. The millmen mostly continue operations, being less unreasonable than the puddlers. But there is some fear that they, too, may be induced to leave off, since at a large meeting of the strike hands at Smethwick on Wednesday it was resolved to ask the millmen to come out at once.

The reduction in the average selling price is accounted for in that during two months of the quarter to which the accountants' return of three months ago related marked bars were selling at £8 per ton, whereas during the three months embraced in the present return bars have been £7 10s. But the men are open to no arguments, and because the scale has this time gone against them they have thrown it over, urging that because trade is just now somewhat better they ought not to be called upon to accept a drop. They further try to excuse themselves by urging that they wish that the net average selling price should be ascertained, not upon bars alone, but that sheets, which are becoming an increasingly important branch of the Staffordshire iron manufacture, should also be included.

The puddlers declare that they will not resume except at an advance of 6d. per ton. That they will get any advance is unlikely. Indeed, on 'Change to-day in Birmingham masters said that the only terms upon which they will allow a resumption are an acceptance of those against which the men have struck. The action of the men is the more important since the accountants' declaration regulates wages in all parts of England except Cleveland and Wales, though in some districts a month elapses before it takes effect.

The East Worcestershire and Shropshire ironworks continue running, as do also the leading works in the Dudley and Wolverhampton districts.

As 'Change closed in Birmingham to-day—Thursday—it became known that a monster procession, roughly estimated at twenty thousand, had marched this morning from West Bromwich to Dudley Port, then on to Tipton, then to Bilston, and then to Wolverhampton, and forcibly entering every ironworks on the line of route that was on, either in the mills or forges, had compelled the men to instantly cease work. The fire-bars were pulled out, the molten iron was left to spoil, tools were thrown into the canal, and other damage was done. Works' proprietors and managers, and the police—who mustered in strong force at some points—were powerless to stay the rioters. Numerous assaults were committed. Throughout South Staffordshire all the mills and forges, with few exceptions, are now idle. The North Staffordshire ironworkers have also come out on strike, and the works are standing. This afternoon the committee of the Wages Board met in Birmingham. The masters said it would be weakness to yield anything to the demands of the men. They loudly complained of the rioting. The men's secretary pronounced the strike most dishonourable. A full meeting of the Board is called for Saturday.

Buying this week is very limited. Finished iron makers will not consent to book orders except subject to eventualities. Indeed, it is not without difficulty that they are able to make deliveries under contracts previously booked. Consumers of sheets are most pressing in their requests for supplies. Prices are nominally stronger, but there is not sufficient business to test them. Sheets are quoted £7 15s. to £8 for singles; £8 7s. 6d. upwards for doubles; and about £9 10s. for lattens. Common plates are £8 10s., and boiler plates £9 10s.

Marked bars are £8 2s. 6d. to £7 10s., and common bars £6 10s. to £6. Hoops are £6 10s. to £6 15s., and gas strip £6 5s.

The quarterly meetings next week are expected to show a firm tone, and vendors of pigs made outside this district are strong, pending these gatherings. Derbyshire pigs are 47s. 6d. to 48s. 6d.; Northamptons, 46s. 3d. upwards, and west coast hematites 65s. to 62s. 6d. Native part-mine pigs are 50s. to 45s., and common 40s. to 38s. 9d.

Forge and furnace fuel goes off best, 9s. to 10s. per ton being asked for furnace coal; cobbles, 7s. 6d. to 8s.; and slack, 4s. to 5s. 6d. Forge coal in the Cannock district is 6s. to 6s. 6d. per ton, but in the Dudley district, 7s. to 9s. is paid.

The miners' strike in North Staffordshire does not exhibit any signs of a speedy termination. Some of the unionists are each receiving 10s. and 1s. per child, and non-unionists 3s. 6d. and 1s. per child, but notwithstanding this meagre allowance they yet appear contented, and at public meetings express their determination to keep out. The secretaries have been instructed to call the delegates together to consider the question of convening a national conference of trades' unions and other labour representatives, with a view to making the strike a national one. It is hoped that South Wales and Lancashire will absorb a further amount of labour.

The experiments made during the last quarter by the gas department of the Birmingham Corporation with regenerative furnaces have shown a considerable economy in fuel and labour, and the committee have authorised a further expenditure of £8213 10s. in an extension of the system, both at the Windsor-street and Saltley Works. The Ammonia Gas Purifying Company, Limited, has been allowed to experiment upon a small scale at the Windsor-street works with the process of purification in closed vessels. The result has warranted the department in giving facilities for its trial on a scale sufficient to test its applicability for the supply of the whole of their gas.

Engineering work of some importance will soon be in execution for the Birmingham Town Council. On Tuesday that body authorised its Water Committee to construct additional filter beds at Plant's Brook at a cost of about £5000. The area of the existing beds is 4865 yards, and that of the proposed additional ones some 4940 yards. The present station includes reservoirs with a storage capacity of thirty million gallons, and on an average one and a-half million gallons could be daily delivered. It sometimes happens, however, that owing to a less supply from other sources, filtration has to be unusually rapid; hence the necessity for further beds.

The wooden viaduct at Hoo Brook, near Kidderminster, on the line of the Great Western Railway Company, has been ordered extensive propping by Col. Rich, R.E., Board of Trade inspector, and the speed of the traffic across is reduced to ten miles an hour. These are precautions pending the erection of an entirely new bridge, preparations for which are in progress. The new bridge will be erected inside the curve of the present structure. It will be built of brindled bricks relieved with Derbyshire stone, the arches being of blue bricks. The length is to be 1093ft. The arches are twenty in number, with a 50ft. 6in. span each, and the piers on which they rest are 6ft. through where the arch springs. It is expected that the work will take some eighteen months to complete. The contractors are Messrs. Gabbutt and Co., Birkenhead, and the plans have been prepared by Mr. W. D. Rowbotham, engineer for the central division of the Great Western Railway Company.

NOTES FROM LANCASHIRE.

(*From our own Correspondents.*)

Manchester.—Although generally there is an absence of any great activity in the iron trade of this district, the market continues firm, and there is no anxiety on the part of makers either of pig or manufactured iron to press sales. In the pig iron trade the recent heavy buying at low prices has had a tendency to force up values slightly, but as this has had the effect of checking the giving out of further orders, it can scarcely be said that an advance has been actually established. In the finished iron trade makers are looking forward to shipments giving a stimulus to trade. Whether the new American tariff, which is now in operation, will tend to increase the exports to the United States remains to be seen, but at present it does not appear to have had any material effect. There is, however, an improvement in the shipping trade, and now that buyers find that the low offers made of late have not brought down prices, orders are being given out on pretty much the basis of the figures for which makers have been holding out.

Business was quiet at the Manchester market on Tuesday, but in some cases makers were asking a slight advance upon last week's prices. Pig iron makers being now pretty fully sold were very firm. For local brands delivered equal to Manchester makers were only open to book orders at their full rates of 45s. to 45s. 6d. less 2½ for forge and foundry qualities; in district brands the lowest prices now quoted for delivery here are 44s. 10d. to 45s. 10d. less 2½ for forge and foundry Lincolnshire. Consumers who are mostly well covered for the present are disposed to wait rather than buy further at the higher prices now asked, but a tolerably large business might be done if makers would book orders at a little under their full rates. So far as home requirements are concerned the demand for finished iron continues only dull, but shipping orders are coming forward pretty freely and prices are steady at late rates. For delivery equal to Manchester or Liverpool quotations are about as under:—Bars, £6 2s. 6d. to £6 5s.; hoops, £6 12s. 6d. to £6 15s.; and sheets from £7 17s. 6d. and £8 to £8 5s. per ton.

The Midland Railway Company has recently given out a considerable order in this district for various descriptions of machine tools, which has been divided amongst several of the leading makers. Messrs. Hetherington and Co. have one portion of the order, which includes the construction of twelve wheel lathes, and other portions including axle turning and other special lathes have, I understand, been placed in the hands of Messrs. Whitworth and Co., Messrs. Craven Bros., and one or two other Manchester firms. There is also a fair quantity of foreign work in the hands of local tool makers, and Messrs. Hetherington and Co. are executing considerable orders for the Bombay and Baroda Railway Company, the Great Indian Peninsula Railway, and the New Zealand Government Railway.

The evidence given by Mr. A. N. Rendell, C.E., before the Manchester Ship Canal Committee, to the effect that the locomotive building trade had gone very largely from Manchester to Glasgow, owing to the fact that the Glasgow people tendered 25 per cent. lower than the Manchester firms, and that, as a matter of fact, Manchester was being cut out by the greater economy and enterprise upon the Clyde, has caused no little indignation amongst the Manchester engineering firms. So far from the locomotive building trade leaving Manchester, the fact is quite the reverse. The Manchester locomotive builders have never been busier than they are at present, and the demand for locomotives made in this district is such that orders cannot be booked for delivery within any reasonably early period. More locomotives of Manchester manufacture are now being turned out than during any previous period in the history of the trade, and the evidence given before the Ship Canal Committee in favour of the Glasgow locomotive builders is regarded as a libel upon the Manchester engineers; indeed, a very strong feeling is expressed that evidence should be given in so reckless a manner as to practically tell the world that the system upon which work is done in the Manchester locomotive shops is so wanting in enterprise and economy that the local houses are beaten by the Glasgow builders by 25 per cent., and that, as a consequence, this branch of trade is leaving the district. I may add that it is asserted by engineers in this district, that those who know anything about locomotives are aware that the higher price obtained for Manchester-made locomotives is due solely to the superior character of the workmanship, just as some of the well-known tool makers in the district are able to command much higher prices than other firms engaged in the same branch of trade; and that it is because of the excellence of the workmanship that the Manchester locomotive builders are at present so full of orders, and that, in many cases, five, ten, and fifteen per cent. higher prices are being obtained for Manchester-made locomotives than are being obtained for those of Glasgow manufacture.

Experimental trials have been made upon a branch line of railway from Messrs. Evans and Co.'s Haydock Collieries to Earlstown Junction, with a new automatic locomotive signalling apparatus patented by Messrs. Croft and Lomax. The apparatus consists of a tappet fixed to a sliding bar, which communicates by means of a bell-crank with a disc signal upon the engine, in front of the engine-driver. In the four-foot way a metal box is sunk, in which an inclined plane is raised or lowered from the signal cabin. If at "danger," the tappet on the engine strikes upon the inclined plane and releases a weight communicating with the bell-crank, which moves a red light and an arm danger-signal on the engine, and at the same time blows a whistle. The results of the trials were considered satisfactory.

There is no material change to report in the condition of the coal trade. Business drags on slowly, with the quiet demand usual at this time of the year, and with a generally slack market there is a little easing down in prices to secure present business. There is, however, still a very firm tone as regards orders for anything like forward delivery. Sellers will not go beyond a couple of months at present prices, and generally colliery proprietors are very indifferent about entertaining forward contracts at all, even at advanced prices. In some cases the delivered rates for house coal have been reduced 10d. per ton. this month, but this does not affect the pit prices, and at a few collieries slack has been put up 5d. per ton. The average prices at the pit mouth are, however, without change, and may be quoted as under:—Best coal, 9s; seconds, 7s.; common round coal, 5s. 6d. to 6s.; burgy, 4s. 6d. to 5s.; common slack, 2s. 9d. to 3s. 3d.; and best sorts, 3s. 9d. to 4s. 3d. per ton.

The railway companies have recently been renewing their contracts for steam coal in this district, but to do this they have had to give on an average an advance of 6d. per ton upon the prices at which the contracts were taken last year, and the general basis of this year's contracts has been 5s. 6d. per ton at the pit for ordinary Lancashire steam coal suitable for locomotive purposes.

Shipping is fairly active, and is keeping some of the local collieries tolerably well employed. Delivered at the high level, Liverpool, or the Garston Docks steam coal averages 7s. 3d. to 7s. 9d., and seconds house coal 8s. 6d. per ton.

Barrow.—The business being done in hematite pig iron remains quiet, although there is a slight improvement on American account, prompt deliveries being required, for which fuller prices are offered. This is likely to have some effect in reducing stocks of metal in hand, both in the iron and steel trades. The new orders which have been booked for all sorts of iron have been mainly on account of steel makers, who have large orders in hand which require prompt attention. There is a very heavy output of all descriptions of steel, and makers have their mills running full time, not only in the rail, but in the merchant department. The work in the hands of makers is sufficient to maintain activity throughout the year, and it is more and more certain there will be a large shipment to America, the colonies, and the Continent before the end of the year. Prices of hematite pig iron are unchanged, but firm, at 50s. per ton mixed qualities of Bessemer, and 49s. for No. 3 forge, at works. Steel rails are in demand, not only as regards the double-headed and flange heavy sections, but in reference to small tram descriptions, and heavy rails for street tramcars. There is also an increase in the business doing with tin-plates, bars, &c., special mild and other steel for cutlery and fine purposes, and for general merchant qualities. The value of steel is quoted at from £4 10s. to £5 per ton net, and there is no chance of an improvement in prices either in an upward or downward direction. Iron ore is steady in tone, but quiet. Prices vary from 9s. to 11s. 6d. per ton net at mines, and stocks are very considerably held all round. Coal and coke steady; shipping fairly employed.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

It was my hope to have been able this week to have given the statistics of Sheffield exports to the United States for the six months ending June 30th, but on application to the United States Consul here it was found that he had received peremptory instructions from his Government not to supply any such information in future. This order is not peculiar to Sheffield, but is a general instruction to all Consuls, and has been issued in consequence of other Consuls having been indiscreet enough to disclose too much before the American official Blue-book is issued. The absence of the returns, which for years have been given every quarter, will be regretted by commercial people generally. The new order is another evidence of the care taken by the United States Government, even in the smallest item of detail, in regard to trade affairs.

In the Rotherham district the works engaged on heavy iron work are stated to be very busy, and the Parkgate Iron Company is about to make considerable improvements and extensions in its blast furnaces at the Holmes, where extra employment is much needed in consequence of the closing of the Holmes Colliery. There is an intention of re-opening the Brinsworth Ironworks, which would be another advantage for the redundant labour in the neighbourhood.

Railway material makers—in all departments except steel rails—are well employed, wagons, wheels, and axles being particularly brisk, though competition keeps prices very low. At the Phœnix Bessemer Works, the Ickles, the men who were re-engaged have abundant work. The merchant mill is kept continuously going the hammer department is also busy, and there is a brisk demand for the special steel, to the manufacture of which the proprietors are giving great attention.

The coal trade is in a fair condition, taking the season of the year into account. For the metropolitan and provincial markets the demand for house fuel is, of course, greatly lessened; but prices are generally about 10d. per ton higher than at the corresponding period of last year. Steam coal, for locomotive purposes, sells readily at 6s. to 6s. 6d. per ton, which is 6d. a ton higher than last year. Engine coal can be had at from 5s. 3d. to 6s. a ton, but the best houses quote 6s. 6d. to 7s. 1d.

Slackness in the building trade has told upon the stove grate makers, a fact which is clearly brought out by the year's operations at the Masbrough Stove Grate Works, Messrs. W. Corbitt and Co., Limited, leaving a net profit of only £63 12s. 6d. Several of the private establishments, however, are doing much better than that.

Messrs. Jehoiada A. Rhodes, and Barber, Britain Works, have just received a further order for the "Royal Devon" silver-mounted pottery from her Majesty the Queen. This makes the eighth order received within a year by this firm for the "Royal Devon" and other manufactures.

The recent strike of file-cutters has left one disagreeable incident behind it—a trade outrage of an atrocious character. Messrs. John Bedford and Sons, of the Lion Works, Mowbray-street, showed a good deal of "backbone," when the men turned out. Those who gave notice to leave were allowed to go at the expiration of their month's notice, but their places were quickly filled up, and the work was carried on with but little inconvenience. This becoming known to the trade, the workmen who had filled the vacant situations were seen by several of the unionists, who tried to induce them to leave their employment. Two men were persuaded to leave, but the others remained. One evening the premises were entered, and five wheel bands, used for file-grinding, were "removed." A sixth was rolled up ready for taking away. On clearing the cinders from the fires under the boiler, the engine tenter found a buckle which had belonged to a band. There is no doubt that five of the wheel bands had been burnt in the furnace, and the sixth was rolled up ready for a similar fate. The committee of the File Manufacturers' Association have resolved to recoup Messrs. Bedford for the loss they have sustained, believing that the firm had been punished for their prompt action in the file dispute. The committee have also under consideration the desirability of re-erecting the file-grinding machines at present in the town with as little delay as possible, so as to be used for the convenience of the general trade. Thus outrage always defeats its own end, and precipitates upon itself fresh disasters.

The Sheffield Electric Lighting Committee have received notices from the Electric Construction Company, Limited, and the Lancashire and Yorkshire Electric Lighting Company, Limited, both of whom intend to apply to the Board of Trade for a provisional order to provide electricity within the borough of Sheffield. The applications will be laid before the Town Council next Wednesday.

A triumph in fast railway travelling has to be noted this week. On Monday the Manchester, Sheffield, and Lincolnshire Railway Company commenced running its new express trains to and from London. The first train, leaving Manchester at 11 a.m., reached Sheffield at 11.53, or eight minutes before time, being due in at 12.1. At 12.5 it proceeded on its journey, and entered Grantham station—the only stopping place between Sheffield and London—five minutes before time, arriving at King's Cross a little earlier than the appointed time. The result of the first day's runs was to prove that the distance, which has formerly taken the fastest express 3 hours 40 min., can just as easily be done in 3 hours 25 min.—the time aimed at—but that the running could be made in 3 hours 15 min. The distance is 175 miles. This is an average of 54·72 miles an hour.

The Sheepbridge Coal and Iron Company, Limited, has won coal at the Glapwell sinking. The seam is the top hard, and the thickness was found to be 6ft. The depth of the shaft is 285 yards to the top of the coal. The company has just declared its half-yearly dividend at the rate of 5 per cent. per annum on the C guaranteed preference shares, payable on July 14th.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

There was a good attendance at the Cleveland iron market held at Middlesbrough on Tuesday last, and buyers of pig iron were more numerous than for several weeks past. The heavy exports of last month, and the better reports from Glasgow, have tended to strengthen the market, and it is thought not unlikely that the price of Cleveland iron will rise shortly. The sales made on Tuesday were mostly at 39s. 3d. per ton for No. 3 G.M.B., with prompt delivery. Most of the merchants, and some of the makers, were willing to accept that figure. Some asked more, the quotations of such ranging from 39s. 6d. to 40s. per ton. The quarterly meeting of the Cleveland Iron Market will be held on Tuesday next.

Warrants are seldom inquired for, though sellers are willing, as a rule, to take 3d. to 6d. per ton less than makers' prices.

The stock of Cleveland iron in Messrs. Connal's stores at Middlesbrough continues to fall. The quantity held on Monday last was 74,957 tons, being 550 tons less than a week previous.

The shipments of pig iron from the Tees last month were very satisfactory. The total quantity shipped was 94,043 tons, of which 37,402 tons went to home ports, and 56,641 tons to foreign ports. Scotland took 28,472 tons; Germany, 16,188 tons; France, 9750 tons; Russia, 8412 tons; Holland, 8309 tons; Norway and Sweden, 3565 tons; and Belgium, 3386 tons. The exports of manufactured iron and steel amounted to 19,815 tons. In June last year the quantities were: Pig iron, 68,373 tons; and manufactured iron and steel, 25,653 tons. In May this year 87,091 tons of pig iron and 29,725 tons of manufactured iron and steel were shipped.

Consumers of finished iron are still withholding their orders in the expectation of being able to buy at lower rates. Manufacturers are, however, fully employed on existing contracts, and there is great pressure upon them for quick delivery. They, therefore, hold firmly to the prices they have been quoting during the past three or four weeks. Ship plates are £6 to £6 5s. per ton; angles, £5 12s. 6d. to £5 15s.; and common bars, £5 17s. 6d. to £6; all free on trucks at works less 2½ per cent. discount. Puddled bars are £3 12s. 6d. per ton net at works.

The directors of the Walker Iron and Steel Company, Limited, have decided to close their works for an indefinite time in consequence of the unremunerative prices now obtainable for plates. Over 300 men have thus been thrown idle.

The accountant's certificate in connection with the sliding scale in the Northumberland coal trade was issued on Friday last. The net average selling price of coal for the quarter ending May 31st was 5s. 0·80d. per ton. This being an increase of 4·80d. upon the standard average selling price, the underground workmen and banksmen will receive an advance of 2½ per cent.

The Cleveland blast furnace-men have given notice to the Ironmasters' Association that they wish to terminate their sliding scale arrangement at the end of the present year. They have intimated that they are willing to consider the amendment of the present scale, or the construction of a new one. The Cleveland miners have also given notice to terminate their sliding scale on the 31st of December next.

Mr. C. J. Coleman, the stipendiary magistrate for Middlesbrough, was, it will be remembered, chosen to act as arbitrator in the wages dispute between Messrs. Bolckow, Vaughan, and Co., Limited, and their workmen at Eston. The employers claimed a reduction of ten per cent., which the workmen contended they were not entitled to. Mr. Coleman has now given his decision, awarding that the wages should be reduced by 2½ per cent. This arrangement will be binding on both sides till the end of the present year.

The local committee for the reception of the members of the Iron and Steel Institute at Middlesbrough in September next had a meeting on Tuesday last, and a preliminary programme was drawn up. It is proposed that the meeting shall last from Tuesday, the 18th, to Friday, the 21st, inclusive. One afternoon will be devoted to the Eston Steelworks, another to the saltworks at Port Clarence, and a third to the ironworks at Stockton. Most of the other works in the district will be thrown open to members. On the last day there will be an excursion to Whitby and Scarborough-by-Sea. Unfortunately the meeting will clash with that of the British Association, which commences at Southport on the 19th.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

THE Glasgow warrant market has shown considerably more vitality this week, and prices have slightly advanced. There is undoubtedly a more cheerful feeling in the market, partly due to the fact that there is some chance of the production being curtailed by the putting out of furnaces and partly on account of a better demand having sprung up for pig iron on the part of the United States. There is, however, a disposition to overestimate the importance of this fact in some quarters; and in proof of this statement it need only be mentioned that, although the freights for pig iron from the Clyde to America have been advanced 2s. 6d. per ton, only very few shippers have as yet paid the increased rate. Canada has also been taking a larger quantity of pig iron, and the inquiry from Germany is good, while large amounts are still being sent to Italy. The stock in Messrs. Connal and Co.'s warrant stores is increasing, but in a much smaller ratio than of late, less than 200 tons having been added in the course of the past week.

Business was done in the warrant market on Friday forenoon at 47s. 0½d. to 47s. 1½d. each, and in the afternoon at 47s. 1½d. to 47s. 2d. cash and 47s. 3½d. to 47s. 4d. one month. The market was firm on Monday at 47s. 2½d. up to 47s. 6d. cash and 47s. 5d. to 47s. 8d. one month. On Tuesday business took place from 47s. 5d. to 47s. 3½d. cash and 47s. 7d. one month to 47s. 5d. fourteen days. Transactions took place on Wednesday at 47s. 4d. to 47s. 7½d. cash, and to-day—Thursday—the market was strong, with business up to 47s. 8½d. cash.

The values of makers' special brands of pigs are firm as follows:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 57s.; No. 3, 53s.; Coltness, 60s. 3d. and 53s. 6d.; Langloan, 59s. 6d. and 53s. 6d.; Summerlee, 57s. 6d. and 51s.; Chapelhall, 57s. and 54s.; Calder, 58s. and 50s. 6d.; Carnbroe, 55s. and 49s.; Clyde, 51s. and 48s. 6d.; Monkland, 48s. 9d. and 46s. 9d.; Quarter, 47s. 6d. and 45s. 6d.; Govan, at Broomielaw, 48s. 9d. and 46s. 9d.; Shotts, at Leith, 59s. 6d. and 55s.; Carron, at Grangemouth, 48s. 6d. (specially selected, 54s. 6d.) and 47s.; Kinneil, at Bo'ness, 49s. 6d. and 47s. 6d.; Glengarnock, at Ardrossan, 55s. and 48s.; Eglinton, 48s. 6d. and 45s. 6d.; and Dalmellington, 49s. and 48s.

The different branches of the manufactured iron trade are for the most part very busy, and in some cases no little pressure is being used for the delivery of goods contracted for. There is also great activity in the engineering works of Glasgow and the West of Scotland; and the shops and factories generally are working very busily, so as to prepare for the annual summer holidays, which are now close at hand. The past week's shipments of iron manufactures from Glasgow embraced £37,650 worth of machinery, £6838 sewing machines, £4100 steel goods, and £41,000 general iron manufactures, exclusive of pig iron, the export of which was valued at £10,000.

The coal shipments at some of the ports were being somewhat retarded a week ago from a scarcity of vessels, but this inconvenience has now been partly overcome by the arrival of vessels, and it is expected that the Quebec fleet will be requiring cargoes presently. The shipments of coal from Glasgow during the past week included 4690 tons for Canada, 1830 for Savana, 1620 for Algiers, 1610 for Rio de Janeiro, 850 for Monte Video, 700 for Bordeaux, and 610 for New Brunswick. In Fifeshire the coal trade is very brisk, and prices there have somewhat advanced, the rates for good coal, f.o.b. at Burntisland, now being 7s. 3d. to 7s. 9d. per ton. The colliery owners appear to be very shy of entering into contract arrangements at current rates, there being an impression that business will be even better and prices higher in autumn. During the half-year just closed the coal shipments at Burntisland have aggregated 341,790 tons, showing an increase of 50,000 over those for the corresponding period of 1882. There is only a moderate trade in coals at Leith. At Bo'ness the week's shipments have been fully 5000 tons, while 5643 tons were exported at Grangemouth.

On Saturday notices were posted at the Fife and Clackmannan collieries intimating that a fortnight from that date the wages of the miners would be advanced "to the extent of 10 per cent. on the rates current in May last year."

The half year's launches on the Clyde give a tonnage of 196,402, or 29,109 more than in the corresponding period of last year.

WALES & ADJOINING COUNTIES.

(From our own Correspondent.)

A SLIGHT improvement in tone has begun to mark the iron trade. There is more steadiness in price, and inquiries are coming to hand in greater quantity.

In the Newport district the complaint is that steel rails are very quiet. In the Glamorgan division things are better, and in the Swansea district the improvement in tin-plate has given much more animation. Rumours are current that several tin-plate works are changing hands, and will be restarted, but I defer naming them until actual operations are begun. In Carmarthenshire things look better. Tin-plate prices are steady; wasters command 14s. 6d., and primes, ordinary coke, 16s. 3d. to 16s. 9d.

The coal trade continues active, and most of our coalowners have their hands full. Outputs and exports are large in all quarters, and as regards Newport and Cardiff, averages are well kept up. There is, however, a little more readiness shown by coalowners in booking orders, and a slight weakness in price was observable last week, secondary qualities touching only 10s. 9d., that is 3d. less than in the previous week. Best steam coal commands 12s. in many parts; Rhondda large, 9s. 6d., and 8s. 3d. small; small steam, 4s. 6d.; and good graig at pit's mouth "through" will fetch 6s. 6d.

The North Dock stoppage has told upon the shipments of coal from Swansea. The export of patent fuel has been well maintained.

The Rhondda colliers at their last monthly meeting proposed certain alterations in their special rules. Arrangements are also approaching completion for the demonstration of the 16th July, when it is decided to stop work, and have a procession and open-air meeting. Mr. Burt, M.P., and others are expected. I hear that the voice of the meeting will be called upon to express an earnest wish for alterations in the franchise—by the extension of the borough franchise to counties—and support Trades' Unions throughout the country.

Co-operation between the Taff Vale and Rhymney will effect a material saving in viaduct construction at Quakers' Yard. The Taff improved viaduct will do away with the need of the projected construction by Rhymney.

Mr. Nixon's colliers are about to give another month's notice *in re* the doctor question.

The Bedlinog dispute—an important colliery at Dowlais—has been arbitrated upon by Mr. W. T. Lewis and Mr. D. Morgan, and amicably adjusted. Work is resumed.

PRACTICAL EDUCATION.—Those students in the Crystal Palace Company's School of Practical Engineering who are working for the marine branch of the profession, have just returned from their sea trip, which has also been made the occasion of an inspection of some important engineering works. These periodical excursions are intended to afford them real practice in the driving of marine engines at sea, and are a marked feature in the system of the school. Usually the run has been made from the Thames to Liverpool and back, but this year, with the intention of going over the works of the new Tay Bridge, the voyage has been made to and from Dundee—a distance of 1000 miles. On Wednesday, June 27th, at 9 a.m., the students, under the direction of Mr. J. W. Wilson, C.E., the principal, and one superintendent, embarked at the New Dundee Wharf, Wapping, in the steamship Cambria—950 tons—and the Dundee, Perth, and London Steamboat Company offered every facility for the work of the voyage. Before starting the speed of the Cambria was tested at the measured mile, and proved to be 14·25 knots. The dead reckoning was then taken, and was to time at all points, both out and home. For purposes of work, the students were divided into four watches of four hours each, during which time those on duty had to be in the engine-room taking their part in the driving, under the ship's engineer, Mr. Scott, in their usual working clothes. The water was smooth, and Dundee was reached at 5.40 p.m. on Thursday evening. On Friday morning the students rose at six, and an hour later proceeded up the river Tay, in the Perth steamboat. By the kind invitation of Messrs. Shield, they then inspected the Wallace Linen Weaving Works, where 1000 hands are employed, and saw much that interested them. Saturday was employed in looking over the old Tay Bridge and the works of the new structure which is being raised by Mr. W. H. Barlow, C.E., who was anxious that the party should see all they could. Mr. Byng, an old pupil of the Crystal Palace School, is one of the superintendents of the new bridge. After inspecting the Dundee, a very fast boat now being finished for the Dundee, Perth, and London Company, the students embarked again on the Cambria, at 9 on Saturday evening, for the return cruise, and arrived at the wharf in the Thames at 7.30 a.m. on Monday. The cruise was most enjoyable, and certainly the most successful ever made by the students of the school, who have gained from it much knowledge of practical work.

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.

26th June, 1883.

3149. LUBRICATING COMPOUNDS, T. Colgan, U.S.
3150. PREPARING TANNIC EXTRACTS, J. H. Johnson.—(*E. L P. and G. C. Cöez, France*)
3151. FIRE-PROOF BUILDINGS, W. Corliss, U.S.
3152. VACUUM BRAKES for RAILWAY TRAINS, &c., A. G. Evans, Manchester.
3153. MIXED TEXTILE FABRIC, D. C. Miller, Larkhall.
3154. COOKING RANGES, J. McI. Shaw, Glasgow.
3155. VELOCIPEDES, H. J. Lawson, Coventry.
3156. LAWN TENNIS NETS, R. S. Moss, Manchester.
3157. TILES, &c., T. H. Rees, Battersea.
3158. REGULATING FLUID PRESSURE, C. D. Abel.—(*G. Westinghouse, Pittsburgh, U.S.*)
3159. PLANING METAL PLATES, J. Imray.—(*E. Bouhey, Paris.*)
3160. COMPOUNDS for LINING FURNACES, J. Imray.—(*G. Duryee, New York, U.S.*)
3164. ANTI-SPEEDY CUTTER for HORSES, J. B. E. T. Lacombe, France.
3162. ATTACHING HANDLES to TEAPOTS, &c., W. H. Winter, Sheffield.
3163. COMPASSES, A. M. Clark.—(*W. H. Mitchell, U.S.*)
3164. MAKING PAPER, A. O. A. Feret, C. L. V. Ladame, and A. H. Feret, Paris.
3165. ATTACHING RAILS to METALLIC SLEEPERS, R. H. Brandon.—(*E. Tölcke and C. Eichhorn, Germany.*)
3166. THREAD-WINDING ATTACHMENT, H. J. Haddan.—(*A. Tabour-Moisson, Paris*)
3167. INCANDESCENT ELECTRIC LAMPS, H. J. Haddan.—(*R. H. S. Thompson, U.S.*)
3168. INDICATING POSITION of SHIP'S HELM, J. Liardet, Brockley.
3169. MATTING of FLOORS, W. R. Lake.—(*J. Bray, U.S.*)
3170. STARTING TRAMWAY CARS, J. Gemmel and T. Archibald, Paisley.
3171. COUPLINGS, J. T. Roe, Wandsworth.
3172. MAKING YARNS, &c., W. R. Lake.—(*J. T. Waring, New York, U.S.*)
3173. DRILLING HOLES in ROCK, W. L. Wise.—(*C. W. Burton, Paris.*)
3174. SAWS, J. H. Johnson.—(*F. Troemé-Becker, Paris.*)
3175. STEAM ENGINES, W. P. Thompson.—(*E. A. Corbin and G. W. Hunter, Philadelphia, U.S.*)
3176. FORGING HORSESHOE NAILS, A. J. Boult.—(*W. Werts, Philadelphia, U.S.*)
3177. PRINTING CLOTH, L. H. Philippi, Hamburg.
3178. FACILITATING ACTION of MAGAZINE RIFLES, H. S. Maxim, London.
3179. TRICYCLES, &c., C. Harvey, Yardley, and W. Paddock, Birmingham.
3180. LACE, W. Birks, Nottingham.
3181. HOLDING ROLLER BLIND CORDS, C. W. H. Brock, Bishop Waltham.

27th June, 1883.

3182. GALVANIC BATTERIES, J. William and J. Rogers, London.
3183. ORNAMENTATION of POTTERY, &c., T. Bevington, Hanley.
3184. MEDIUM of ADVERTISING, C. F. Pollak, London.
3185. TELEPHONIC TRANSMITTERS, C. F. Pollak, London.
3186. PICKS for MINING, G. W. Elliott, Aintree.
3187. MAKING CANDLES, W. H. Beck.—(*La Société Anonyme de Machines à Bougies et Chandelles Système Royau, Paris.*)
3188. PILED FABRICS, D. Marcon, Paris.
3189. METALLIC TUBES, R. Heeley, Shirley.
3190. HAMPERS for TRANSPORTING BOTTLES of ACIDS, H. Brunner.—(*C. Garneri, Paris.*)
3191. BRICK-MAKING MACHINE, P. Effertz, London.
3192. VALVES, A. F. and R. F. Craig, and R. Motion, Paisley.
3193. TREATING LINSEED, A. Ford, London.
3194. LOOMS for WEAVING, W. Smith, Heywood, and J. Wrigley, Bury.
3195. ROLLERS for WRINGING MACHINES, W. Lockwood, Sheffield.
3196. LUCIFERS, F. Engel.—(*W. Holmström, Sweden.*)
3197. FIRE-ARMS, W. R Lake.—(*J. H. Brown, U.S.*)
3198. FEEDING BOTTLES, E. Brasier, New Cross.
3199. PREPARING COMPOUNDS for SANITARY PURPOSES, H. E. Overbeck, Liverpool.
3200. INDUCING AIR from CHIMNEYS, &c., H. Burgin, Walthamstow.
3201. HEATING WATER, J. H. Johnson.—(*Messieurs Guillot, Pelletier, and Co., Orleans.*)
3202. CARRIAGE BRAKES, W. Corteen, Sheffield.
3203. LOADING OCEAN-GOING STEAMERS, G. Taylor, Penarth.
3204. VENTILATING WATER-CLOSETS, J. Farrimond and J. Whittaker, Southport.

28th June, 1883.

3205. BILLIARD MARKING, R. Bateman, Birmingham.
3206. SHIPS' BERTHS, E. Hoskins, Birmingham.
3207. TABLE FOUNTAINS, W. Aubert, jun., Balham.
3208. BOBBIN NET MACHINE, A. C. Henderson.—(*L. A. Lateux, Paris.*)
3209. SELF-FEEDING PENS, F. Byron, Chesterfield.
3210. PROPELLING STEAMSHIPS, J. Stewart, Blackwall.
3211. TREATING POROUS POTS, T. Coad, London.
3212. DOOR RETENTION STOP, W. E. Diehl, U.S.
3213. TABLE TRUCKS, T. McEntegart, Liverpool.
3214. FIRE-ARMS. M. C. de Arguibel, London.
3215. WARPING MACHINES, W. Marshall and J. Holt, Ravensthorpe.
3216. RAG GRINDING MACHINERY, C. Wilson and E. Scargill, Batley Carr.
3217. HAULING ROPES, &c., J. Harper, Scotland.
3218. MOUNTING ELECTRIC LAMPS, W. R. Lake.—(*J. Languereau, Paris.*)
3219. ELECTRIC CURRENTS, H. E. Newton.—(*A. I. Gravier, Poland.*)

29th June, 1883.

3220. PERMANENT WAY, B. Swaine, Armlee, and M. H. E. Albrecht, Leeds.
3221. CORKSCREW, R. W. Bradnock, Moseley.
3222. HOOKS for HANGING GARMENTS, &c., W. Allison, Glasgow.
3223. DYNAMO-ELECTRIC, &c., MACHINES, L. F. Lamkin, London.
3224. PIANOFORTE ACTIONS, J. J. Robinson, London.
3225. WATER WASTE PREVENTERS, E. Raitt, Brixton.
3226. DRIVING GEAR, A. Selim.—(*P. C. J. Lemaire and A. E. Poly, Paris.*)
3227. DRESS, &c., FASTENINGS, G. P. Lemprière, Balsall Heath.
3228. CLUTCH COUPLINGS, A. Boult.—(*M. Haas, Baden.*)
3229. CHROMATES of SODA, E. P. Potter and W. H. Higgin, Bolton.
3230 PURIFYING COMMERCIAL SULPHURIC ACID, W. J. Menzies, St. Helens.
3231. INDICATORS, S. Goodacre, Liverpool.
3232. PAPER, &c., Boxes, H. J. Haddan.—(*A. Brehmer, Saxony.*)
3233. ELECTRIC ARC LAMPS, C. Wüest, Switzerland.
3234. GAS BURNERS, H. H. Lake.—(*A. Lipsey, U.S.*)
3235. COMPOUND for DESTROYING MAGGOTS on SHEEP, &c., E. Hutchins. Snitterfield.
3236. PULLEYS, T. Smith, Brockley.
3237. LOCK-UP LIQUOR STANDS, R. Murray, Brixton.
3238. CARTRIDGES, H. E. Newton.—(*La Société Anonyme Dynamite Nobel, Switzerland.*)
3239. ROTARY ENGINES, W. Frost, Manchester, and T. T. Bond, Luton.
3240. MAKING FIBROUS CELLULOSE, A. M. Clark.—(*R. Blitz, Paris.*)
3241. GAS BURNERS, H H. Lake.—(*A. B. Lipsey, U.S.*)

30th June, 1883.

3242. TULLE MACHINES, C. Abel.—(*E. Davenière, Paris.*)
3243. BLEACHING KIERS, R. H. Ainsworth, Halliwell.
3244. AUTOMATIC ELECTRIC SIGNALLING, H. J. Haddan.—(*H. C. Reher, Hamburg.*
3245. MILLSTONES, J. Wetter.—(*C. Vincelle and E. Cayla, Algiers.*)
3246. OBTAINING SALTS of AMMONIA, J. Addie.—(*J. Addie, Spain.*)
3247. COOKING RANGES, J. Carrick, Glasgow.
3248. COMBING WOOL, &c., J. H. Whitehead, Leeds.
3249. PADS for SADDLES, J. A. Morgan, London.
3250. SAFETY SADDLE BARS, H. Phillips, Birmingham.
3251. DRILLING ROCKS, T. R. Jordan, London.
3252. PURIFYING SEWAGE WATERS, J. Bock, Germany.
3253. WRINGING MACHINES, J. Kenyon, J. Barnes, and R. W. Kenyon, Accrington.
3254. HORSE NAILS, J. A. Huggett and J. Swalwell, Battersea.
3255. EXHAUSTING GAS, &c., W. B. Wright, Bromley-by-Bow.
3256. TRICYCLES, &c., C. Mather, Manchester.
3257. BOILERS for MAKING PAPER, I. S. McDougall, Manchester.
3258. DESIGNS on ROLLERS for PRINTING, J. J. Sachs, London.

2nd July, 1883.

3259. ESCAPE WATER VALVES, W. Carrington, Openshaw.
3260. TRICYCLES, &c., W. T. Eades, Birmingham.
3261. COUPLING for SHAFTS, J. Jamieson, Winchester.
3262. OPENING VALVES, J. W. Thornton and F. Milan, Huddersfield.
3263. COMPOSITION for STIFFENING FUSTIANS, J. Sellars, Manchester.
3264. COMBING WOOL, &c., W. Terry and J. Scott, Dudley Hill.
3268. WINDING SLIVERS for COMBING MACHINES, W. Terry and J. Scott, Dudley Hill.
3266. CLIPPING SEALSKINS, L. A. Groth.—(*G. and F. F. Cimiotti, New York, U.S.*)
3267. SELF-INKING ENDORSING STAMPS, G. K. Cooke, London.
3268. RESERVOIR PENHOLDER, L. B. Bertram, London.
3269. FOLDING BROADCLOTH, &c., H. J. Haddan.—(*E. Tatham, New York, U.S.*)
3270. BASSINETTES, M. R. and R. F. Cook, London.
3271. TELEPHONIC APPARATUS, A. J. Boult.—(*C. S Steele, Washington, U.S.*)
3272. GAS MOTOR ENGINES, G. J. Kirchenpauer and L. H. Philippi, Hamburg.
3273. CORSETS. J. H. Johnson.—(*G. F. Levieux, Paris.*)
3274. CLASPS for CORSETS, H. M. Dyson, Honor Oak.
3275. ELECTRICAL RAILWAYS, W. A. Traill, Portrush.
3276. CLOCKS, A. M. Clark.—(*V. E. Versepuy, Paris.*)
3277. ELECTRICAL RAILWAYS, W. A. Traill, Portrush.

Inventions Protected for Six Months on Deposit of Complete Specifications.

3131. CONTRIVANCE for TELEPHONING from DELIVERY OFFICE without calling on the INTERVENING STATIONS, O. Schäffler, Austria.—*23rd June*, 1883.
3141. ELEVATOR STOPS, F. P. Canfield, Boston, U.S.—*25th June*, 1883.
3160. COMPOUNDS for LINING FURNACES, making FILTERS, &c., J. Imray, Southampton-buildings, London.—A communication from G. Duryee, New York, U.S.—*26th June*, 1883.
3177. PRINTING CLOTH, L. H. Philippi, Hamburg.—*26th June*, 1883.
3191. BRICK-MAKING MACHINES, P. Effertz, London.—*27th June*, 1883.
3232. PAPER BOXES, &c., R. J. Haddan, London.—A communication from A. Brehmer, Leipzig, Saxony.—*29th June*, 1883.

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

2634. TOBACCO PIPES, A. A. Percy, Glasgow.—*28th June*, 1880.
2693 SAFETY VALVES, J. D. Churchill, London.—*1st July*, 1880.
2623. MAKING PILE FABRICS, D. Marcon, Manchester.—*28th June*. 1880.
2626. STANDS for BOTTLES, W. Staniforth, Upperthorpe.—*28th June*, 1880.
2643. REGISTER for TELEPHONE SYSTEMS, J. H. Johnson, London.—*29th June*, 1880.
2674. LOOMS for WEAVING SMALL WARES, W. Glover, Prestwich.—*30th June*, 1880.
2736. MAKING ALCOHOL, J. H. Johnson, London.—*3rd July*, 1880.
3196. FURNACES for BURNING PYRITES, J. Mason, near Whitney.—*4th August*, 1880.
2635. COPYING PRESSES, G. Lowry, Salford.—*28th June*, 1880.
2668. INCREASING DRAUGHT in CHIMNEYS, A. M. Clark, London.—*29th June*, 1880.
2780. BENDING RAILS, E. W. Richards and S. Godfrey, Middlesbrough-on-Tees.—*7th July*, 1880.
2631. DECOMPOSING ORGANIC SUBSTANCES, W. H. and A. Hodge, and J. Eastick, London.—*28th June*, 1880.
2645. STEAM BOILERS, G. H. Babcock, S. Wilcox, and N. W. Pratt, U.S.—*29th June*, 1880.
2682. TREATING MEAT, E. A. Kirby, Kelsey Park.—*30th June*, 1880.
2691. OIL CANS, J. Heselwood and H. Webster, Leeds.—*1st July*, 1880.
2746. SHEEP SHEARS, W. E. Gedge, London.—*5th July*, 1880.
2749. CENTRE CRANES, T. Wrightson, near Stockton-on Tees.—*5th July*, 1880.
2839. TANNING HIDES, S. F. Cox, Yatton.—*9th July*, 1880.
2706. MAKING SNOW, F. N. Mackay, Liverpool.—*2nd July*, 1880.
2709. TOOLS for CUTTING TUBES, S. Buckley, Guide Bridge.—*2nd July*, 1880.
2726. HAY-MAKING MACHINES, J. Howard and E. T. Bousfield, Bedford.—*3rd July*, 1880.
2731. MINING ENGINES, J. Richardson, Lincoln.—*3rd July*, 1880.

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

2651. TREATING WOOD, E. T. Hughes, London.—*27th June*, 1876.
2663. HYDRAULIC PRESSES, R. Wilson, Patricroft.—*28th June*, 1876.
2690. SULPHATE of ALUMINIUM, J. Duncan and J. A. R. Newlands, London, and B. E. R. Newlands, Victoria Docks.—*30th June*, 1876.
2670. THROATS of SEWING MACHINES, W. R. Lake, London.—*28th June*, 1876.
2742. MAKING EXPLOSIVES, S. J. Mackie, C. A. Faure, and G. Trench, Faversham.

Notices of Intention to Proceed with Applications.

(Last day for filing opposition, 20th July, 1883.)

985. FORMING LETTERS from a DISTANCE, M. T. Neale, London.—*23rd February*, 1883.
992. FURNACES, P. W. Willans, Thames Ditton.—*23rd February*, 1883.
1016. ELECTRIC BATTERIES, R. H. Courtenay, London.—*24th February*, 1883.
1020. APPLYING RESISTANCE to ELECTRIC CURRENTS, L. Gaulard & J. Gibbs, London.—*24th February*, 1883.
1021. BOTTLE-STOPPERS, &c., W. R. Lake, London.—A communication from S. A. Bull.—*24th February*, 1883.

1026. ACTUATING CROSS-CUT SAWS, J. Richmond and W. Whiting, London.—24*th February*, 1883.
1030. SELF-ACTING GRABS, &c., W. D. and S. Priestman, Kingston-upon-Hull.—26*th February*, 1883.
1032. SCRAPING SHIPS' BOTTOMS whilst at SEA, G. W. Mallet, West Greenwich.—26*th February*, 1883.
1033. ROLLING METALLIC TUBES, P. M. Parsons, Blackheath.—26*th February*, 1883.
1035. SIGNAL LAMPS, J. Rogers, London.—26*th February*, 1883.
1073. TRANSFERRING LIQUID, F. J. Brougham, London. —A communication from Messieurs. Hazart et Cie. —27*th February*, 1883.
1076. COUPLING VEHICLES, J. Richardson and C. Greenwood, Harrogate.—27*th February*, 1883.
1082. BOILERS, T. Robottom, Nuneaton.—28*th February*, 1883.
1106. COMBINED BED, TABLE, CHAIR, and CLOTH RAIL, G. Bürklein, Munich.—1*st March*, 1883.
1107. PIANOFORTES, H. J. Haddan, London.—A com. from A. Biese and G. Zierold.—1*st March*, 1883.
1136. STEAM ENGINES, L. Perkins, London.—2*nd March*, 1883.
1177. LIFE-BOATS, W. M. F. Schneider, London.—5*th March*, 1883.
1191. FLUES, W. G. Hudson, Manchester.—6*th March*, 1883.
1212. RINGS for SPINNING FRAMES, A. M. Clark, London.—A com. from G. Jacquith.—6*th March*, 1883.
1252. BALE-TIES, &c., E. Hale, Liverpool.—8*th March*, 1883.
1319. PURIFYING WATER, J. H. Johnson, London.—A com. from G. S. Strong.—13*th March*, 1883.
1333. BURNING HYDROCARBON OILS, A. J. Boult, London.—A com. from C. Holland.—13*th March*, 1883.
1416. ADVERTISEMENT CLOCKS, F. W. Little, London.—17*th March*, 1883.
1838. PIANOS, E. G. Brewer, London.—A com. from L. N. Letailleur and P. Scholtus.—11*th April*, 1883.
2096. TEMPLES EMPLOYED in LOOMS, R. Bond, Bury.—25*th April*, 1883.
2476. WHEELS, &c., R. C. Mansell, Highgate.—17*th May*, 1883.
2539. ARC REGULATOR LAMPS, R. E. B. Crompton, London, and T. Crabb, Chelmsford.—22*nd May*, 1883.
2554. MACHINERY for SPINNING, &c., FIBROUS SUBSTANCES, G. A. Helliwell and J. H. Waller, Todmorden.—22*nd May*, 1883.
2576. WOOD STRUCTURES, J. Garlick, Birmingham.—23*rd May*, 1883.
2581. STOPPERING BOTTLES, &c., J. G. van-der-Kaa, London.—23*rd May*, 1883.
2588. STEAM ENGINES, A. Hoyois, Clabecq, Belgium.—24*th May*, 1883.
2596. GENERATING STEAM, H. Tipping, Greenwich.—24*th May*, 1883.
2604. DOUBLING YARNS, &c., W. H. Jones, Middleton. —25*th May*, 1883.
2663. ROTARY SCREENS, H. Shield and W. N. Crockett, Nottingham.—29*th May*, 1883.
2671. TRAMWAYS, W. P. Hope, Edinburgh.—29*th May*, 1883.
2679. CREEL PEGS, P. Coonan, Blackburn.—30*th May*, 1883.
2698. VENTILATORS, &c., J. Waple, Brixton.—30*th May*, 1883.
2722. ELECTRIC DEVICES for INDICATING SPEED, &c., R. P. Sellon, Surbiton.—31*st May*, 1883.
2724. CONVERTING RECIPROCATING into ROTARY MOTION, W. R. Lake, London.—A communication from F. Zassenhaus.—31*st May*, 1883.
2883. STOPPERING BOTTLES, R. J. Sankey, Ashford.—9*th June*, 1883.
3111. SEPARATING ORTHO-TOLUIDINE from PARA-TOLUIDINE, &c., J. Wieler, Cologne.—22*nd June*, 1883.

(*Last day for filing opposition*, 24*th July*, 1883.)

1044. TIN, &c., PLATES, W. A. Johns, London.—27*th February*, 1883.
1052. TILLING MACHINES, W. P. Thompson, Liverpool.—A com. from C. E. Sackett.—27*th February*, 1883.
1065. MINING SIGNALS, A. C. Bagot, Rugeley.—27*th February*, 1883.
1070. EMERY, &c., R. J. and A. Edwards, London.—27*th February*, 1883.
1079. MECHANICAL TELEPHONES, H. J. Allison, London.—A com. from G. Shaver.—28*th February*, 1883.
1083. SEPARATING SEEDS from EACH OTHER, P. van Gelder, York.—28*th February*, 1883.
1086. ENVELOPES, &c., E. Sturge, London.—28*th February*, 1883.
1096. HYDRATES of ALKALIES, C. F. Claus, London.—28*th February*, 1883.
1109. CIGARS, J. McGovern, Liverpool.—1*st March*, 1883.
1126. BRACKETS, J. Beech, Wolverhampton. — 2*nd March*, 1883.
1128. SHARPENING PENCILS, B. S. Cohen, London.—2*nd March*, 1883.
1130. METAL ROLLERS, C. J. Appleton, Salford.—2*nd March*, 1883.
1140. SHAPING, &c., METALS, P. R. Allen, London.—2*nd March*, 1883.
1160. DISINTEGRATING APPARATUS, C. Pieper, Berlin.—A communication from A. C. Nagel, R. H. Kaemp, and A. Linnenbrugge.—5*th March*, 1883.
1211. TARGETS, F. Clarke, Canterbury.—6*th March*, 1883.
1235. LATHES, W. Allan, Sunderland.—7*th March*, 1883.
1253. DRYING ROLLERS, J. Horrocks, Worsley.—8*th March*, 1883.
1266. APPARATUS for SUPPORTING the BODY in case of INJURY to the SPINE, J. W. Guilmette, Manchester. —9*th March*, 1883.
1293. TRACTION ENGINES, A. Greig and G. Achilles, Leeds.—10*th March*, 1883.
1344. PRICKING CARDS for LOOMS, P. Ambjorn, Paris. —13*th March*, 1883.
1473. REPAIRING LAST, H. Morris, Blackburn.—21*st March*, 1883.
1617. ELECTRIC LAMPS, &c., W. R. Lake, London.—A communication from C. Dion.—30*th March*, 1883.
1643. LATCHES, &c., F. J. Biggs, London.—2*nd April*, 1883.
1728. TOOL for POINTING MASONRY, F. Service, London. —5*th April*, 1883.
1756. ELECTRIC METERS, S. Pitt, Sutton.—A communication from J. Cauderay.—7*th April*, 1883.
1767. WEATHER-PROOF CARTRIDGES, &c., P. Jensen, London.—A communication from J. Schulhof.—7*th April*, 1883.
1977. SELF-ADJUSTING SAW-HANDLES, B. Goulton, Auckland.—19*th April*, 1883.
2223. OIL LAMPS, J. Fyfe, Glasgow, and T. B. Smith, Birmingham.—2*nd May*, 1883.
2438. INCANDESCENT ELECTRIC LAMPS, J. H. Guest, Brooklyn. U.S.—15*th May*, 1883.
2439. RUBBING, &c., TYPES, G. S. Eaton, Brooklyn.—15*th May*, 1883.
2580. CARTRIDGE HOLDERS, S. Pitt, Sutton.—A communication from H. Thronsen.—23*rd May*, 1883.
2629. POWER LOOMS, S. C. Lister and J. Reixach, Bradford.—26*th May*, 1883.
2630. "SILOS," J. W. Butler, Blackheath.—26*th May*, 1883.
2675. ELECTRICAL METERS, T. J. Handford, London.—A com. from T. A. Edison.—30*th May*, 1883.
2684. HARVESTING MACHINES, J. Wild, Tetney.—30*th May*. 1883.
2688. STEAM BOILERS, H. Johnson, London.—30*th May*, 1883.
2720. WATER METERS, H. Frost, Manchester.—31*st May*, 1883.
2734. PURIFYING ALKALINE SOLUTIONS, T. Glover, Runcorn.—1*st June*, 1883.
2773. WEIGHING MACHINERY, A. H. Emery, New York. —5*th June*, 1883.
2774. TESTING STRENGTH of MATERIALS, A. H. Emery, New York.—5*th June*, 1883.
2775. WEIGHING MACHINERY, A. H. Emery, New York. —5*th June*, 1883.
2776. GAUGES, A. H. Emery, New York.—5*th June*, 1883.
2777. TESTING STRENGTH of MATERIALS, A. H. Emery, New York.—5*th June*, 1883.
2778. TESTING STRENGTH of MATERIALS, A. H. Emery, New York.—5*th June*, 1883.
2801. CALORIC ENGINES, C. Ingrey, Fulham.—6*th June*, 1883.
2857. GENERATION, &c., of ELECTRICITY, T. J. Handford, London.—A communication from T. A. Edison. —7*th June*, 1883.
2881. FIRE-GRATES, H. H. Leigh, London.—A communication from Société des Foyers économiques Goujet et Cie.—9*th June*, 1883.
2887. ATTACHING LAMPS to CARRIAGES, N. Stretton, Birmingham.—9*th June*, 1883.
2909. DRYING OVENS, G. F. Edwards, Notting Hill.—12*th June*, 1883.
2912. BARBED FENCING, W. H. Johnson, Manchester.—12*th June*, 1883.
3039. FAN WHEELS, W. Schmolz, San Francisco.—19*th June*, 1883.
3141. ELEVATOR STOPS, F. P. Canfield, Boston, U.S.—25*th June*, 1883.
3160. COMPOUNDS for LINING FURNACES, J. Imray, London.—A communication from G. Duryee.—26*th June*, 1883.
3191. BRICK-MAKING MACHINES, P. Effertz, London.—27*th June*, 1883.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the* 29*th June*, 1883.)

6214. GAS ENGINES, W. Watson, Leeds.—29*th December*, 1882.
6231. STEAM TRAPS, &c., J. J. Royle, Manchester.—30*th December*, 1882.
7. FEEDING PAPER to MACHINES, F. Hoyer, Liverpool. —1*st January*, 1883.
24. GENERATION, &c., of ELECTRICITY, J. S. Williams, London.—1*st January*, 1883.
31. THILL COUPLINGS, &c., D. Green, Cincinnati, U.S. —2*nd January*, 1883.
33. IMITATED IVORY, S. Hahn, Berlin.—2*nd January*, 1883.
37. CHRONOGRAPH, A. G. Golay, Brassus, Switzerland. —2*nd January*, 1883.
38. VESSELS for LIQUIDS, G. A. J. Schott, Bradford.—2*nd January*, 1883.
39. CARBONS for INCANDESCENT ELECTRIC LAMPS, J. Weavish, Forest Gate, and J. Warner, Whitechapel. —2*nd January*, 1883.
40. SEWING MACHINES, H. Clarke, Leicester.—3*rd January*, 1883.
43. FRICTION DEVICE for SECURING CARPET LOOMS, &c., AGAINST BREAKAGE, T. Hardcastle, Kidderminster.—3*rd January*, 1883.
45. CUTTING WOOD, T. Andrew, London.—3*rd January*, 1883.
49. DYNAMO-ELECTRIC MACHINES, T. Rowan, London, and S. Williams, Newport.—3*rd January*, 1883.
63. ADJUSTABLE SPANNERS, J. Malin, Sheffield.—4*th January*, 1883.
64. STARTING, &c., TRAMCARS, B. F. Cocker, Sheffield. —4*th January*, 1883.
68. MOWING, &c., MACHINERY, J. E. Phillips, London. —4*th January*, 1883.
75. OILING CRANK-PINS, W. P. Thompson, Liverpool.—5*th January*, 1883.
84. FLAT WIRE ROPES, J. Lang, Wakefield, and J. Lang, Hyde.—6*th January*, 1883.
88. METAL ROLLERS, D. Appleton, Manchester.—6*th January*, 1883.
94. DRILLING MACHINES, W. Cooke, Dundee.—8*th January*, 1883.
131. OBTAINING STEP-BY-STEP ROTARY MOTION, C. D. Abel, London.—9*th January*, 1883.
149. SCREW BOLTS, &c., W. Barwell and T. Johnstone, Birmingham.—10*th January*, 1883.
159. SILICA BRICKS, A. H. Dunnachie, Glasgow.—11*th January*, 1883.
201. COMPOUND STEAM ENGINES, J. R. Wells, New York, U.S.—13*th January*, 1883.
223. DOUBLE-LOCK UNIVERSAL JOINT, R. Watkinson, Salford.—15*th January*, 1883.
382. VEHICLES PROPELLED by the RIDERS, J. Watson and G. Whalley, Keighley, and T. Weatherill, Leeds. —24*th January*, 1883.
405. INSULATORS, P. R. de F. d'Humy, London.—25*th January*, 1883.
635. SATCHEL, C. A. Morris, Herne Hill.—6*th February*, 1883.
1749. FILTERING in CENTRIFUGAL MACHINES, C. H. Haubold, Chemnitz.—6*th April*. 1883.
1821. VENTILATORS, T. J. Baker, Newark.—10*th April*, 1883.
1867. AUTOMATICALLY GUIDING, &c., FABRICS, J. Kerr, Church.—12*th April*, 1883.

(*List of Letters Patent which passed the Great Seal on the* 3*rd July*, 1883.)

6182. HORSESHOE MACHINES, F. Wolff, Copenhagen.—27*th December*, 1882.
28. DENOTING INCREASE of TEMPERATURE of COAL, &c., T. Rowan, London.—2*nd January*, 1883.
55. CUTTING STONE, M. Kellow, Penrhyndendraeth.—4*th January*, 1883.
74. FIRE-SCREENS, J. Betjemann, London.—5*th January*, 1883.
76. ENVELOPES, W. H. Hook, London.—5*th January*, 1883.
80. CURLING TONGS, C. Carter, London.—5*th January*, 1883.
82. SOLVENT for use with PAINTS, W. Johnstone, King's Lynn.—6*th January*, 1883.
87. INDICATING the PRESENCE of GASES, J. Catz, London.—6*th January*, 1883.
91. COOLING AIR, A. B. Wilson, Holywood, and J. Sturgeon, London—6*th January*, 1883.
114. SADDLES of BICYCLES, &c., J. B. Brooks, Birmingham.—9*th January*, 1883.
146. WHEELS, &c., R. R. Gubbins, London.—10*th January*, 1883.
151. HARVESTING MACHINES, W. P. Thompson, Liverpool.—10*th January*, 1883.
152. CEMENTS, W. P. Thompson, Liverpool.—10*th January*, 1883.
153. SEPARATING VOLATILE from NON-VOLATILE SUBSTANCES, W. P. Thompson, Liverpool.—10*th January*, 1883.
174. CANDLES, &c., H. A. Biertumpfel, London.—11*th January*, 1883.
184. MAGNETO-ELECTRIC MACHINES, H. H. Lake, London.—11*th January*, 1883.
189. SHEAVES, W. Alexander, Govan.—12*th January*, 1883.
197. KNIT STOCKINGS, W. P. Thompson, Liverpool.—12*th January*, 1883.
212. LETTING DOWN WINDOWS, G. T. Cheetham, Bradford.—13*th January*, 1883.
213. SASH FASTENINGS, E. A. Showell and C. Turner, Birmingham.—13*th January*, 1883.
226. PRODUCING HOMOGENEOUS METAL CASTINGS, G. W. von Nawrocki, Berlin.—15*th January*, 1883.
229. REPEATING MECHANISM, &c., for FIRE-ARMS, G. E. Vaughan, London.—15*th January*, 1883.
238. WATER-CLOSETS, H. H. Lake, London.—15*th January*, 1883.
251. CRANES, &c., H. J. Haddan, London.—16*th January*, 1883.
264. STEAM GENERATORS, A. M. Clark, London.—16*th January*, 1883.
266. TREATING CEREALS, W. H. Williamson, Wakefield. —16*th January*, 1883.
272. TREATING FECAL MATTERS, G. W. von Nawrocki, Berlin.—17*th January*, 1883.
294. HYDRAULIC MACHINERY, W. Donaldson, Ambleside.—18*th January*, 1883.
333. SMALL-ARMS, W. Hebler, Bern.—20*th January*, 1883.
340. COKE OVENS, R. H. Brandon, Paris.—20*th January*, 1883.
404. DISCHARGING MATERIAL RAISED by DREDGING, A. M. Clark London.—25*th January*, 1883.
461. PRODUCING CARBURETTED AIR, H. H. Lake, London.—27*th January*, 1883.
592. GALVANIC BATTERIES, P. R. de F. d'Humy, London.—3*rd February*, 1883.
690. ORDNANCE, W. L. Wise, London.—7*th February*, 1883.
782. CANS for MEAT, &c., T. G. F. Dolby, Dulwich.—13*th February*, 1883.
893. FURNACES, J. C. Mewburn, London.—17*th February*, 1883.
965. TRANSMITTING SIGNALS, A. F. St. George, London. —21*st February*, 1883.
1580. FASTENINGS for GLOVES, &c., E. D. J. Neupert, Prussia.—28*th March*, 1883.
1831. PLUSH FABRICS, J. H. Cunliffe, Rochdale.—11*th April*, 1883.
1875. PREVENTING LOSS of HEAT, E. Maw, Liverpool. —13*th April*, 1883.
1908. SEATS outside CARS, W. Walker, London.—14*th April*, 1883.
1910. SCREW-CUTTING MACHINES, A. M. Clark, London. —14*th April*, 1883.
1954. TYPE CASES, J. H. Johnson, London.—17*th April*, 1883.
2012. FLUXES, H. F. Taylor, Neath, and G. Leyshon, Tividale.—20*th April*, 1883.
2024. SIDE-SADDLES, T. G. Smith and B. Brooke, Wilts. —20*th April*, 1883.
2050. LAMP CHIMNEY, P. A. Bayle, Paris.—23*rd April*, 1883.
2070. ROLLER MILLS, A. J. Boult, London.—24*th April*, 1883.
2074. BOILER CLEANERS, J. F. Hotchkiss, New Jersey, U.S.—24*th April*, 1883.
2084. WIRE ROPE, H. H. Lake, London.—24*th April*, 1883.
2110. ENDLESS-BAND KNIFE MACHINES, R. B. Sanson, London.—26*th April*, 1883.
2204. ELECTRIC RAILWAYS, S. Pitt, Sutton.—1*st May*, 1883.
2242. CATCHING SOOT from SMOKE, F. C. Glaser, Berlin. —2*nd May*, 1883.
2255. RAILS for TRAMWAYS, H. H. Lake, London.—3*rd May*, 1883.
2290. PRODUCING INTENSE WHITE HEAT, C. D. Abel, London.—5*th May*, 1883.
2322. TRANSMITTING TELEPHONES, C. W. Hayes and S. R. Beckwith, Washington, U.S.—8*th May*, 1883.
2351. REMOVAL of SCALE in BOILERS, G. Downie, U.S. —9*th May*, 1883.

List of Specifications published during the week ending June 30th, 1883.

4188,* 4d.; 2338, 6d.; 2339, 6d.; 4610, 2d.; 5251, 2d.; 5274, 2d.; 5277, 4d.; 5281, 2d.; 5284, 2d.; 5287, 2d.; 5302, 2d.; 5305, 2d.; 5312, 6d.; 5323, 2d.; 5325, 2d.; 5329, 2d.; 5331, 2d.; 5336, 2d.; 5338, 2d.; 5339, 6d.; 5341, 2d.; 5343, 2d.; 5345, 2d.; 5346, 4d.; 5347, 2d.; 5348, 2d.; 5349, 6d.; 5350, 2d.; 5351, 4d.; 5352, 2d.; 5354, 8d.; 5355, 6d.; 5356, 2d.; 5357, 6d.; 5358, 6d.; 5359, 2d.; 5360, 6d.; 5361, 8d.; 5362, 6d.; 5363, 1s.; 5364, 2d.; 5369, 2d.; 5370, 4d.; 5371, 4d.; 5372, 2d.; 5373, 6d.; 5374, 2d.; 5375, 6d.; 5377, 4d.; 5378, 2d.; 5379, 2d.; 5380, 8d.; 5383, 6d.; 5384, 4d.; 5385, 4d.; 5386, 2d.; 5387, 6d.; 5388, 4d.; 5390, 8d.; 5391, 6d.; 5392, 6d.; 5395, 4d.; 5396, 6d.; 5399, 2d.; 5401, 2d.; 5402, 6d.; 5404, 6d.; 5405, 6d.; 5406, 2d.; 5408, 2d.; 5409, 6d.; 5410, 4d.; 5412, 6d.; 5413. 8d.; 5414, 10d.; 5415, 2d.; 5417, 6d.; 5419, 6d.; 5421, 2d.; 5422, 2d.; 5423, 6d.; 5424, 2d.; 5425, 2d.; 5426, 6d.; 5427, 2d.; 5431, 2d.; 5433, 2d.; 5435, 6d.; 5436, 2d.; 5437, 6d.; 5438, 4d.; 5440, 6d.; 5441, 6d.; 5443, 4d.; 5444, 6d.; 5445, 4d.; 5446, 6d.; 5447, 2d.; 5448, 6d.; 5449, 6d.; 5452, 6d.; 5454, 6d.; 5456, 4d.; 5457, 6d.; 5458, 6d.; 5459, 8d.; 5462, 6d.; 5463, 6d.; 5464, 6d.; 5465, 4d.; 5466, 6d.; 5468, 6d.; 5469, 4d.; 5470, 6d.; 5471, 2d.; 5472, 4d.; 5473, 2d.; 5475, 2d.; 5478, 6d.; 5479, 2d.; 5480, 6d.; 5482, 6d.; 5483, 6d.; 5484, 4d.; 5487, 8d.; 5491, 4d.; 5493, 6d.; 5585, 6d.; 5601, 4d.; 5642, 6d.; 5690, 4d; 1313, 8d.; 1332, 6d.; 1340, 6d.; 1345, 1s.; 1355, 2d.; 1458, 6d.; 1462, 6d.; 1468, 1s. 2d.; 1494, 6d.; 1562, 4d.

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

ABSTRACTS OF SPECIFICATIONS.

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

2338. MANUFACTURE OF ANIMAL CHARCOAL, *H. E. Jones, Stepney.*—18*th May*, 1882. 6*d.*

This consists in constructing retorts for effecting the distillation of bones, of fire clay or partly of fire clay and partly of iron, so as to enable a higher temperature to be used. The retorts are prepared by first distilling coal therein so as to fill up the pores or cracks. Exhausting apparatus is employed for diminishing the pressure in retorts and withdrawing the volatile products, which are caused to pass through sulphuric acid and give up their ammonia, the gases then being used for illuminating purposes.

2339. MANUFACTURE OF ANIMAL CHARCOAL, &c., *J. W. Ingham, Bow.*—18*th May*, 1882. 6*d.*

This consists in passing the volatile products of distillation of bones from the retorts into and through vessels containing soda lime, and in which high temperature is maintained, and to which steam is admitted, whereby ammonia and permanent gas can be obtained. Ivory black mixed with water is used as a luting for the doors of the retorts.

4162. ELECTRIC LIGHTING, *T. T. Smith, Finsbury.*—31*st August*, 1882. 10*d.*

Relates to means and apparatus for facilitating the lighting of private houses, &c., by electric lights. According to this invention a certain total number of lamps and given current of electricity only will be at the disposal of the householder, but the lamp fittings and electrical connections are such that the lamps and brackets can be removed from room to room as required. The fittings are described in detail and illustrated in the specification.

4235. MOUNTING OR HOLDER FOR FILAMENTS IN ELECTRIC INCANDESCENT LAMPS, *L. R. Bishop, New Kent-road.*—6*th September*, 1882.—(*Provisional protection not allowed.*) 4*d.*

Relates to an improved filament holder of platinum or other wire, bent and fashioned in a peculiar way.

4610. MASHING MALT, &c., *D. W. Hamper and E. Harper, Sowerby Bridge.*—28*th September*, 1882.—(*Not proceeded with.*) 2*d.*

The object is to provide for the continuous regular supply of malt from the bin, and a thorough moistening of the malt without the use of stirrers, or steam or hand power during the mashing operation.

4845. GALVANO-ELECTRIC BATTERIES, *J. Oliphant, Kingsland-road, and E. B. Burr, Walthamstow.*—12*th October*, 1882. 4*d.*

The object is to construct a battery, the current from which shall be produced by the decomposition of water, without destroying the positive element. The zinc element is gilded and placed in an external jar in a solution of dilute sulphuric acid or water, a small portion of chloride of mercury being also added. A carbon plate placed in a porous jar forms the other element, and is surrounded by a solution of nitric or sulphuric acid water and bichromate of potash or chromic acid.

5055. GENERATING AND STORING ELECTRICITY, *F. H. Varley, Mildmay Park Works.*—24*th October*, 1882. 8*d.*

This relates to dynamo machines of two kinds, an automatic switch for regulating the charging of accumulators, and self-acting meters. The first kind of dynamo is an ordinary continuously-driven one, whilst the other has a reciprocating motion, the field magnets having a central core of one polarity surrounded by a circular pole of the opposite kind, the annular space between the two affording the magnetic field from which a current is obtained by the reciprocating motion of a helix or helices.

5060. IMPROVEMENTS IN MACHINES AND APPARATUS EMPLOYED IN THE PRODUCTION, &c., OF ELECTRIC AND MAGNETIC CURRENTS, *J. S. Fairfax, Camden Town.*—24*th October*, 1882. 10*d.*

In forming permanent or electro-magnets the inventor makes use of the dust or other small particles of magnetisable material, excited or polarised by suitably disposed electric or magnetic currents, or else deposits or influences the arrangement of magnetic molecules while in a free condition physically, so that their magnetic axes are absolutely or approximately disposed symmetrically along the lines of force. To this end he fills with iron or steel dust, cases of such shape as will conform to the magnetic lines of force, as they are found to flow under the working conditions of the apparatus for which they are designed. The inventor describes dynamo machines made on his principle, and makes 32 claims.

5078. SECONDARY BATTERIES, *A. F. Hills, Penshurst.*—24*th October*, 1882.—(*Not proceeded with.*) 2*d.*

The inventor uses powdered oxide of lead in conjunction with perforated lead plates.

5109. BRUSHES FOR CURATIVE PURPOSES, *E. Parr, London, and J. R. Gibson, Camden Town.*—27*th October*, 1882. 6*d.*

Relates to a brush in which are wires that are magnetised, and produce a magnetic field in proximity to the skin the brush being used for curative purposes.

5142. ELECTRIC LAMPS, *W. R. Lake, Southampton-buildings.*—28*th October*, 1882.—(*A communication from B. Egger, Vienna.*)—(*Not proceeded with.*) 4*d.*

The invention consists of an automatically regulating arc lamp of the differential class, in which all springs, &c., are done away with, the weight of the parts in each case performing the work or having to be overcome.

5148. DYNAMO, MAGNETO, OR ELECTRO-MOTIVE MACHINES, &c., *B. J. B. Mills, Southampton-buildings.*—30*th October*, 1882.—(*A communication from T. Chutaux, Paris.*)—(*Not proceeded with.*) 4*d.*

The inventor causes the co-acting parts of armatures and field magnets to overlap or interpenetrate, whereby a large increase of polar surface is obtained.

5149. PROCESS FOR INCREASING THE CONDUCTIBILITY OF AND FOR INSULATING ROUND OR FLAT CABLES OR WIRES, &c., *B. J. B. Mills, Southampton-buildings.*—30*th October*, 1882.—(*A communication from T. Chutaux, Paris.*)—(*Not proceeded with.*) 2*d.*

This relates chiefly to wires used in winding the magnets, &c., of dynamo machines, and consists in coating them with a very thin covering of silver.

5164. TELEPHONIC APPARATUS, *J. G. Lorrain, Victoria Mansions.*—30*th October*, 1882.—(*Not proceeded with.*) 4*d.*

The inventor dispenses with a vibrating plate of magnetic material as usually employed. He causes two movable and adjacent parts of a continuous conductor, in which a current is flowing, to approach or recede from each other, and the undulation of the current thereby produced is utilised to vibrate a diaphragm.

5166. CIRCUITS FOR TELEPHONIC COMMUNICATION, *H. Alabaster, South Croydon, and T. E. Gatehouse, Camberwell.*—30*th October*, 1882. 6*d.*

Where an induction coil and induced currents are used, the inventors find it preferable to place the telephonic receiver in a local circuit, which usually includes the transmitter and a suitable battery, and which forms the primary wire of the induction coil. The secondary wire thus forms part of the line wire, without direct communication with either transmitter or receiver, and is put to earth at each end.

5167. TELEPHONIC RECEIVERS, *H. Alabaster, South Croydon, and T. E. Gatehouse, Camberwell.*—30*th October*, 1882. 6*d.*

This relates to improvements in patent No. 2675, 7th June, 1882, granted to the present inventors and H. R. Kempe, the object of which is to secure louder and better articulation.

5170. ELECTRIC BATTERIES, *F. Wirth, Frankfort-on-the-Maine.*—30*th October*, 1882.—(*A communication from G. Leuchs, Nürnberg, Germany.*)—(*Not proceeded with.*) 2*d.*

Relates to improvements on the present form of carbon manganese cells.

5174. ARC ELECTRIC LAMPS, *F. L. Willard, London.*—31*st October*, 1882.—(*Not proceeded with.*) 2*d.*

Relates to improvements in the feed action and mechanism of arc lamps.

5181. APPARATUS, &c., FOR ACCOMMODATING ELECTRICAL CONDUCTORS IN THE STREETS, *H. F. Joel, Dalston.*—31*st October*, 1882.—(*Void.*) 2*d.*

Relates to a cast iron curb for containing cables and wires.

5183. SECONDARY VOLTAIC BATTERIES, &c., *R. H. Woodley, Limehouse, and H. F. Joel, Dalston.*—31*st October*, 1882. 6*d.*

This relates to the construction of secondary batteries and to apparatus for regulating their discharge. The plates are constructed of lead wool—formed by shearing thin slices from a number of thin lead plates piled on one another—which is electrolytically or otherwise coated with lead oxide. Oxide is then mechanically mixed with the wool, and the latter applied to both sides of a lead plate which has been previously cut so that portions of it can be turned up as fingers projecting on each side, between and among which the wool is laid. The fingers are then bent down over the wool and the whole subjected to pressure.

5200. CONTROLLING VALVES OR COCKS BY ELECTRICITY OR HEAT, &c., *J. Formby, of Formby, near Liverpool.*—31*st October*, 1882. 6*d.*

This relates to means for controlling the supply of gas to heating stoves, &c., by means of a valve, regulated by a magnet acting against a spring, the said magnet being in circuit with a battery and an electric contact-making thermometer.

5230. PURIFICATION OF COAL GAS, *C. Estcourt, Manchester.*—2*nd November*, 1882. 2*d.*

This consists in the purification of coal gas from sulphur compounds by passing it either with $S O_2$—as a gas produced by any of the ordinary methods—through a solution of any of the following compounds or mixtures thereof, viz.:—Na Cl; K Cl; H Cl; Ba Cl_2; Ca Cl_2; Mg Cl_2; N H_4 Cl; (N H_4; H C O_3); (N H_4)$_2$ C O_3; (N H_4)$_2$ S O_4; Ca S O_4; Na_2 S O_4; K_2 S O_4; Mg S O_4; Na_2 C O_3; K_2 C O_3; and salts which contain S O_2, or through the S O_2 in watery solution or solution of any of the above-named salts or mixtures thereof, or the mixed gases passed into or through solutions of the needful compounds.

5241. ELECTRIC TIME BALL APPARATUS, *W. R. Lake, Southampton-buildings.*—2*nd November*, 1882.—(*A communication from the Standard Time Company, New Haven, Conn., U.S.*) 6*d.*

Relates to means for ensuring a rapid descent of the ball, combined with a counterbalance, whereby the shock occasioned by its fall is lessened when it reaches the bottom of its standard.

5251. APPARATUS FOR AERIAL NAVIGATION, *P. Jensen, London.*—3*rd November*, 1882.—(*A communication from G. Koch, Bavaria.*)—(*Not proceeded with.*) 2*d.*

The air ship or balloon is propelled and steered by means of two horizontal paddle wheels placed on each side in the lower part of the balloon, and revolved either together or separately by motors in accordance with the desired motion and the influence of outer air currents.

5265. UTILISING ELECTRICITY FOR MEDICAL PURPOSES, &c., *T. Welton, Southampton-buildings.—4th November*, 1882.—(*Not proceeded with.*) 2*d*.

This invention consists in passing a current, before its application to a patient, through a medicinal substance, such as a drug, salt, &c., by intercalating the latter in the circuit.

5272. COUPLING FOR LEATHER AND FLEXIBLE HOSE, *E. Nunan, San Francisco.—4th November*, 1882. 6*d*.

Two or other number of notches are formed in the outer face and edge of one half of a coupling, and behind the notches in the barrel portion recesses are formed slightly undercut for the reception of catch hooks on the underside of "dogs," so that they act as pivots in the recesses to enable the outer ends of the dogs to be lifted clear of the flange on the front end of the opposite half of the coupling when the coupling-up or the uncoupling have to be effected.

5268. BEARINGS OR THRUST BLOCKS FOR SCREW SHAFTS, &c., *J. Rebecca, Liverpool.—4th November*, 1882.—(*Not proceeded with.*) 2*d*.

This consists in placing rollers or balls in the bottom of the thrust block against which the shaft will work, and also in forming grooves in the collars on the shaft, and in the recesses into which these collars are placed. In these grooves, and between the collars on the shaft and the thrust portion of the block or bearing, other balls are inserted, so that in whichever direction the pressure on the shaft may come the collars will revolve against the balls and the friction be greatly reduced thereby.

5274. MEANS FOR ATTACHING HAT PEGS, COAT HOOKS, CURTAIN HOLDERS, WALL BRACKETS, GAS BRACKETS, CHANDELIERS, AND OTHER OBJECTS TO WALLS AND CEILINGS, *A. M. Clark, London.—4th November*, 1882.—(*A communication from Messrs. Gollot Frères, Paris.*)—(*Not proceeded with.*) 2*d*.

A cylindrical hole is bored in the wall and an expanding segmental plug is inserted and secured by turning a screwed rod, to which the bracket or other object can be applied.

5276. UTILISING THE MOTIVE FORCE OF WAVES, &c., *W. R. Lake, Southampton-buildings.—4th November*, 1882.—(*A communication from A. de Souza, Paris.*) 8*d*.

The invention is carried out, First, by the reception of the force produced by the backward and forward motion of the waves by suitable apparatus; Secondly, by the action of these latter, in a similar manner to pistons, upon a system of machines connected to them; and Thirdly, by the application of this motive force to the actuation of electric machines.

5277. WATER-WHEELS, &c., *J. Knight, London.—4th November*, 1882.—(*Not proceeded with.*) 4*d*.

The wheel is supported on a float, and its buckets are ventilated so as to prevent retention of water by suction. A suitable tank is arranged above and water elevated thereto by pumps.

5278. TELEGRAPH CABLES, *G. E. Vaughan, Chancery-lane.—4th November*, 1882.—(*A communication from S. Trott and F. A. Hamilton, Halifax, Nova Scotia.*) 4*d*.

To prevent the wringing and twisting asunder of cables when being recovered or laid at sea, the inventors make them as follows:—The strength-giving material of the cable is divided into equal parts, one of which is laid round the insulated conductor in one direction, and the other part in the other direction.

5281. BUFFING STRAPS FOR LOOMS, &c., *T. H. Brown, Manchester.—6th November*, 1882.—(*Not proceeded with.*) 2*d*.

The straps are slotted at one end, and the shank of the buffer passes through the slot, and in order to strengthen the strap a plate with a slot to suit the shank is secured thereto.

5284. TILLAGE AND PLOUGHS, *S. Walter, Berlin.—6th November*, 1882.—(*Not proceeded with.*) 2*d*.

This relates especially to the use of a plough by means of which the upper surface of the land is chemically and technically operated upon after sowing.

5285. MANUFACTURE OF ARTIFICIAL DUNG AND PURIFICATION OF SEWAGE WATER, &c., *S. Walter, Berlin.—6th November*, 1882. 4*d*.

The inventor claims, First, the employment of the process of precipitating fœcal matter from sewage or other foul and impure waters by adding herring brine or sea salt to the said waters, in order to be able to use the solid parts of the said fœcal matter—gained in the further process of filtration—as dung or guano; Secondly, the employment of the process of thoroughly purifying the fluid containing fœcal matter, passing it through a grating into a receptacle with a perforated and movable bottom, then through bramble or brush in a filtering basin, and from here again over brush into a third receptacle, whence at last, passing through heaped-up charcoal, it can be led into any river, stream, lake, or other watercourse without producing any deleterious effects.

5286. MACHINERY FOR THE MANUFACTURE OF BOBBINS, *J. Clayton, Bradford.—6th November*, 1882. 6*d*.

This relates to the combination of parts forming the apparatus for finishing bobbins with sand or glass paper or cloth, instead of finishing them by manual labour as hitherto.

5287. UMBRELLA AND PARASOL FRAMES, APPLICABLE ALSO FOR TENTS, *S. Scherer, London.—6th November*, 1882.—(*Void*) 2*d*.

The stick is telescopic, and to the upper part the ribs are connected, such ribs being in sections so as to fold up.

5288. REFINING CAST IRON, *J. Wetter, New Wandsworth.—6th November*, 1882.—(*A communication from C. Lévêque, France.*) 6*d*.

The object is the economical refining of cast iron after it has been obtained from the blast furnace, that is to say, to transform grey cast iron into white cast iron, by forcing through it an air current at a low pressure, such as is produced by the ordinary blowing engines of blast furnaces.

5289. TIGHTENING AND LOCKING BOLT AND NUT, *H. Scott, Liverpool.—6th November*, 1882. 8*d*.

This relates to a tightening and locking bolt and nut, and is applicable also as a device for securing wheels to their axles, and for various other useful purposes.

5290. APPARATUS FOR CONSUMING SMOKE IN THE FURNACES OF STEAM BOILERS, *F. J. Cheesbrough, Liverpool.—6th November*, 1882.—(*A communication from C. and H. Zacharias, Vienna.*) 6*d*.

This relates to the arrangement of two air canals running along the sides of the fire-box, and communicating at one end by means of an air admission regulator with the ashpit, at the other end with an air chamber that forms the fire bridge, and with a tube or canal that crosses the flue above the fire bridge, said air canals, air chamber, and tube being provided with slits through which the air coming from the ashpit, and having been heated during its passage through said canals, flows out into the fire at a convenient height above the fire grate, thus supplying a sufficient quantity of oxygen to cause a quick and complete combustion of the particles of coal hurried along by the flames and of the carbonic oxide.

5291. MACHINERY FOR SPINNING WOOL, &c., *W. Turner, Bradford.—6th November*, 1882. 6*d*.

This consists, First, in conducting the oil or lubricant by separate pipes to each spindle or tube; Secondly, in the employment of a fixed spindle and a revolving tube, the spindle being ground slightly hollow, so as to leave a bearing for the tube at top and bottom only. Other improvements are described.

5293. LOCKS FOR RIVERS AND CANALS, &c., *J. N. Moerath, Rome.—6th November*, 1882.—(*Not proceeded with.*) 2*d*.

This relates to the construction of locks for rivers and canals, whereby the ordinary thickness of the walls is rendered available for the passage of the whole or part of the water flowing through the river or canal, and to an arrangement for floating water wheels or their equivalent within for the passages between or at the sides of the said locks for obtaining motive-power.

5294. MANUFACTURE OF FININGS FOR SPIRITS, &c., *J. Blum, jun., Hackney.—6th November*, 1882.—(*Not proceeded with.*) 2*d*.

This consists in the use of alumina, preferably in the form of the sulphate, for the preparation of such finings.

5295. BOILER AND OTHER FURNACES, *W. Mowatt, Slateford.—6th November*, 1882. 6*d*.

The object is to prevent the formation in, and emission from, boiler and other furnaces of smoke or unconsumed particles of carbon, and generally to improve combustion of the fuel, and this object is effected by fitting in connection with the doors of the furnaces a novel arrangement of appliances or devices, through which steam and air are injected over or into the burning fuel, and by which the admission of the steam and air is regulated and controlled.

5296. APPARATUS FOR TAPPING CASKS, &c., *G. W. von Nawrocki, Berlin.—6th November*, 1882.—(*A communication from A. J. Schaefer, New York.*) 6*d*.

In the head of the cask or vessel is placed a shell or ferule provided with shutting-off socket, which, by the insertion of a suitable tapping cock or tap, turns in such a manner that the passage for the liquid is opened, while, by the removal of the cock or tap from the shell, the passage is closed.

5298. APPARATUS FOR RUNNING METALS SIMULTANEOUSLY INTO SEVERAL MOULDS, *F. Asthöwer, Westphalia.—6th November*, 1882. 6*d*.

This consists in an apparatus for pouring a number of castings simultaneously, the base plate having projections or indicators, upon which are placed the moulds or chills and central standard, in combination with a movable pouring or casting funnel, having a central hollow or depression, into which the metal is poured, from which radial passages lead to the apertures in the bottom.

5300. ELECTRO-PLATING WITH NICKEL AND COBALT, *A. J. Boult, High Holborn.—6th November*, 1882.—(*A communication from J. Vandermersch, Brussels.*) 4*d*.

To increase the thickness and purity of the nickel plating the inventor first adds to the acid bath one or more such acids as benzoic, salycylic, boracic, gallic, and others, to correct impurities. He then adds ten drops, more or less, per litre, of pure or ordinary sulphuric acid.

5302. RAILWAY TICKETS, &c., *A. Ellissen, Finsbury.—6th November*, 1882.—(*Not proceeded with.*) 2*d*.

This relates to means for preventing the use of tickets except on the day for which they are issued, and consists in punching out a part of such ticket at a place which will readily show the date it should be used on.

5303. PURIFYING OR DISINFECTING SEWAGE, *F. Pietri, Berlin.—6th November*, 1882. 6*d*.

This relates to improvements on patent No. 5390, A.D. 1881; and it consists in providing a double filter, in order to allow one to be cleansed without interrupting the process, the channels communicating with the purifying basins being fitted with sluice valves, to direct the flow of sewage to either system as desired. The first basin is divided into two parts by a partition in the form of a grating. The second part of the first basin has a filtering bed of pervious vegetable material, and it is fitted with a cover of peat impregnated with carbolic acid and bi-sulphate of potash, or superphosphate may be used, so as to prevent objectionable gases escaping. The sewage water then passes through a sieve to a channel, into which organic chlorides are introduced to prevent fœtid fermentations, such channel being connected with a zigzag channel, emerging into a wide basin, small quantities of sulphate of alumina and lime milk being added before the sewage enters the latter channel. Another filter bed of raw limestone mixed with peat is used to weaken the action of the sulphate of alumina. A paddle or brush wheel is caused to rotate, so as to mix the purifying agents with the sewage. In the large basin is a bed of peat rubbish mixed with coarse limestone rubbish.

5304. DYNAMO-MOTOR MACHINES (*sic.*), *H. Mayhew, Bedford-square.—7th November*, 1882. 10*d*.

This relates to an electric motor and a dynamo machine in which the magnetic force is made to act at right angles to the axes of the electro-magnets, and produces a rotary motion or, according to another method, an oscillating motion.

5305. PENCIL-CASE HOLDERS, &c., *C. A. Drake, London.—7th November*, 1882.—(*Not proceeded with.*) 2*d*.

The object is to adapt pencil-cases or other articles to receive a number of postage stamps, and holding them ready for withdrawal by unwinding them from the pencil-case.

5306. LOOMS FOR WEAVING, *J. F. Brown, Glasgow.—7th November*, 1882.—(*Not proceeded with.*) 2*d*.

This relates to looms with several shuttles regulated by cards, the object being to facilitate the throwing in and out of the shuttles in the case of complicated patterns. Several rows of holes are formed in the cards, each forming part of a different series giving a certain rotation in the order of the shuttles. The fingers which regulate the shuttle boxes are so mounted that their ends are enabled to be directed to one row or other of the holes, and are actuated by a jacquard acting upon a wiper or cam attachment bearing against the under side of the fingers.

5307. VELOCIPEDES, &c., *R. E. Phillips, Anerley.—7th November*, 1882. 8*d*.

This relates, First, to an improved grip treadle for holding the feet of the rider; Secondly, to a clutch for instantly and equally driving both wheels backwards as well as forwards, and which will allow either wheel to overrun the other and allow of the treadles being kept stationary for use as foot rests; Thirdly, to an improved brake to bear both on the periphery of the wheel and upon a drum on its axle; Fourthly, to an improved head to prevent vibration; Fifthly, to a luggage carrier; and Sixthly, to an alarm apparatus.

5308. CLEANING GRAIN, *W. R. Lake, London.—7th November*, 1882.—(*A communication from L. Gathmann, Chicago, U.S.*) 6*d*.

This relates to disc brush grain cleaners in which the disc brush is opposed to a perforated working face, such as wire netting. The inventor claims, First, the combination with an opposing disc brush having its bristles rearwardly inclined with reference to the direction of rotation, of a perforated working face with one or more convolute ribs running from the centre to or towards the circumference in the direction of motion of the brush; and Secondly, in a disc brush drain cleaner, a disc brush with rearwardly inclined bristles, and provided with furrows in its working face, in combination with an opposing face of wire netting and a fan.

5309. ENVELOPES, *W. R. Lake, London.—7th November*, 1882.—(*A communication from A. C. Fletcher, New York.*) 6*d*.

This relates to envelopes which may be used as letter sheets also, and which combine a back carrying one or more wings, a sealing flap, and a folding flap carrying one or more wings located on one side or end thereof, the last wing serving both to aid in gauging the line where the sheet is to be folded between the back and the folding flap, and to prevent the withdrawal of the latter after sealing.

5310. COOKING RANGES, *J. G. Whyte, Bo'ness, Linlithgow, N.B.—7th November*, 1882. 6*d*

The range is fitted with a revolving fire basket actuated by means of side handles. The ash pan is arranged a few inches below the fire basket, and the space underneath utilised as an auxiliary oven. A compound damper regulates the direction of the flame through the oven flues.

5311. LOOMS FOR WEAVING, *T. Blackhurst, Preston.—7th November*, 1882.—(*Not proceeded with.*) 2*d*.

This relates to improvements in the construction of dobby or jacquard mechanism, in which the lattice barrels are caused to revolve in stationary bearings and act directly upon the hooks, whilst the general arrangement of working parts is simplified.

5312. GAS STOVE FOR HEATING WATER FOR BATHS, &c., *J. Bartlett, Regents' Park.—7th November*, 1882. 6*d*.

The body is preferably cylindrical, and has a double case, with a non-conductor of heat between. In the lower part is a circle of gas jets, and above it is a horizontal pipe, or a set of pipes connected by cross branches. A number of helical twisted tubes ascend from the pipe to a shallow receptacle at top. The water is admitted at bottom, the water tap and gas tap being connected so as to be opened and closed simultaneously. A flue is arranged at the top of the body.

5313. REGULATING THE STEAM SUPPLY TO STEAM ENGINES, *C. D. Abel, London.—7th November*, 1882.—(*A communication from A. Guhrauer and R. C. Wagner, Budapest, Hungary.*) 6*d*.

A steam cylinder has its piston so connected to the valve gear or expansion gear of a steam engine as to regulate the admission of steam by the motion of such piston, which is also so connected to the sleeve of a centrifugal governor as to move in precisely the same manner and to the same extent as the latter.

5314. SHAPING MACHINES FOR DRESSING METAL PLATES, *J. Wetter, New Wandsworth.—7th November*, 1882.—(*A communication from E. Berger, Leipzig.*)—(*Not proceeded with.*) 2*d*.

This consists chiefly in the application of a platform capable of turning on its axis and serving to hold the article to be treated by the machine, such platform being mounted on a sliding table and provided with the usual cramps, jaws, or holders, while the cutting tool is fixed to a disc which can be turned in its plane, and is mounted on a slide, which can be raised or lowered by an endless screw fixed to another slide movable horizontally.

5315. INSULATING COMPOUNDS, &c., *J. Wetter, New Wandsworth.—7th November*, 1882.—(*A communication from R. S. Waring, Pittsburg, and J. B. Hyde, New York.*) 4*d*.

The inventor envelopes wires in a shield of cotton threads, and then subjects the whole to a heat exceeding 212 deg. Fahrenheit, after which it is immediately dipped in insulating material and then covered with lead by a special apparatus. The insulating compound and method of carrying out this invention, together with the apparatus used, are described in the specification.

5316. MANUFACTURE OF SILICIOUS COPPER AND SILICIOUS BRONZE, &c., *J. C. Mewburn, London.—7th November*, 1882.—(*A communication from L. Weiller, France.*) 4*d*.

This relates to the manufacture of silicious copper and silicious bronze suited for making electric conducting and other wires, machinery, parts of machinery, and guns, and it consists in improvements on patent No. 1821, A.D. 1882, by substituting in certain cases for the materials for producing the sodium necessary during the operation an amount of sodium combined with tin when it is required to make silicious bronze, with copper when it is required to make silicious copper, or even directly with bronze in special cases.

5317. STARTING AND STOPPING GEAR FOR TRAMWAY CARS, *P. G. Hepworth, Clapham.—7th November*, 1882.—(*Not proceeded with.*) 2*d*.

This relates to an arrangement of gear in combination with a coiled or barrel spring for starting and stopping tram-cars, the apparatus being so arranged that the coiling or winding of the spring shall be effected by one of the car axles, whilst the resistance of the spring in unwinding serves to stop the car.

5318. BOLTING MILLS, *W. R. Lake, London.—7th November*, 1882.—(*A communication from J. Mills, Perre Haute, U.S.*) 10*d*.

This relates to centrifugal bolts or reels. The inner rotating part or flyer is in the form of a close barrel, a few inches less in diameter than the outer case and the blades attached to the flyer which closes the space between them and prevents the material falling to the bottom. In order to cause the speed with which the material moves through the machine, to vary the flyer blades are made shorter than the drum and set at the rear end for about one-third the length, at a less incline spirally than the remaining portion of the drum surface. The invention further relates to means for inducing a current of air from front to rear between the bolting reel and the flyer or drum, so as to carry out the light fibrous substances; and also to an arrangement of two or more bolts on a single portable frame, or having moving parts actuated from a single "drive" or connected to deliver one into another.

5319. COMBING WOOL, COTTON, &c., *J. H. Whitehead, Leeds.—7th November*, 1882. 6*d*.

This relates to improvements on patent No. 232, A.D. 1877, and consists in providing a horizontal shaft with end excentrics coupled to slides, to which the dabbing brushes are attached.

5321. DIGGING MACHINERY, *F. Proctor, Stevenage.—7th November*, 1882.—(*Not proceeded with.*) 2*d*.

This relates to digging machines in which forks or other implements to turn up the ground are operated when the machine is drawn along by a rope actuated by suitable means.

5323. MANUFACTURE OF EXPLOSIVE PYROTECHNICAL AND ANALOGOUS SUBSTANCES OR COMPOUNDS, *R. Hannan and E. J. Mills, Glasgow.—8th November*, 1882.—(*Not proceeded with.*) 2*d*.

The ingredients of the explosives are yellow or red prussiate of potash, or a mixture of both nitrate of potash, chlorate of potash, and animal or vegetable charcoal, or other suitable ground carbonaceous substance.

5324. ORNAMENTATION OF GLASS, *A. J. Nash, Wordsley.—8th November*, 1882. 2*d*.

This consists in applying finely-divided metal to a glass bulb, which is then placed in a diamond or other mould which will form a pattern in relief upon the surface, after which the article is again coated with glass.

5325. COUPLING OF VEHICLES, *H. P. Hogton, Manchester.—8th November*, 1882.—(*Not proceeded with.*) 2*d*.

Each end of the vehicle has a link carrier, hinged to an arm on a rock shaft, provided with end levers, which when operated lift the link and advance it, so as to pass over the hook of the next carriage.

5326. OPENING AND CLOSING CARRIAGE DOORS, &c., *W. H. St. Aubin, Bloxwich.—8th November*, 1882.—(*Not proceeded with.*) 2*d*.

The object is to enable drivers of carriages to open and close the doors without leaving their seat, by means of a system of levers and rods actuated from the seat and connected to the doors.

5328. MATCH-BOX HOLDERS, *J. A. Francis, London.—8th November*, 1882.—(*Not proceeded with.*) 2*d*.

The object is to allow of the insertion of a box of matches, and simultaneously with the depression of the match-box cover the inner box containing the matches is pushed upwards.

5329. PORTABLE BAKING OVENS, *C. D. Abel, London,—8th November*, 1882.—(*A communication from G. Taddei, Italy.*)—(*Not proceeded with.*) 2*d*.

The oven, intended particularly for military use, consists of two chambers, one within the other, the outer one forming a fire-box and the inner one the baking chamber. The oven is mounted on wheels and is drawn by horses.

5331. WATCHES, *F. Wirth, Frankfort-on-the-Main.—8th November*, 1882.—(*A communication from G. Speckhart, Germany.*)—(*Not proceeded with.*) 2*d*.

This relates to means for winding up the main spring, and adjusting the hands without a key; and consists in the use of sliding, push, or pull buttons or knobs, inserted through the central circumference of the case, and communicating with the main spring arbor, and with the arbor of the hands by suitable mechanism.

5333. BOTTLE STOPPERS, *J. J. Varley, Brixton.—8th November*, 1882.—(*Not proceeded with.*) 2*d*.

This relates to the construction of an expansible stopper, suitable for stoppering bottles of ordinary construction.

5334. MACHINERY FOR DECORTICATING OR SCOURING RICE, &c., *J. H. C. Martin, Walthamstow.—8th November*, 1882.—(*Not proceeded with.*) 2*d*.

This consists of a drum or cylinder with a conical bottom revolving within a case or cover of similar form, the top and bottom of which are fixed whilst the cylindrical part thereof is slowly rotated.

5335. TOOL HOLDERS, *J. F. Allen, Brooklyn, U.S.—8th November*, 1882.—(*Complete.*) 4*d*.

This consists in combining with the shank or holder, fitted to receive the cutting tool in a suitable opening, the cutting tool and a wedge, fitting by means of corresponding irregular surfaces into each other, so as to prevent the movement of the tool, and perfectly secure and fasten the same through the wedge into the holder.

5336. BEATING OR WHIPPING EGGS, CREAM, &c., *G. Kenworthy, Huddersfield.—8th November*, 1882.—(*Not proceeded with.*) 2*d*.

A handle is secured to a conical spiral spring, and by moving the handle up and down the substance to be treated is beaten by the spring.

5337. APPARATUS FOR MIXING AIR AND COMBUSTIBLE VAPOUR FOR LIGHTING, AND BURNERS FOR SAME, *G. A. Schoth, London.—8th November*, 1882. 6*d*.

The inventor claims in an apparatus for mixing and combining of air and combustible vapour, the construction, arrangement, and combination of vessel for containing hydrocarbon liquid, and the employment of tubes and a slide operated by a rod for mixing, and regulating the combination of air and vapour. Other improvements are claimed.

5338. WARMING THE CARRIAGES OF RAIL AND TRAMWAYS, AND FORMING PIPE CONNECTIONS OF RAILWAY BRAKE AND COMMUNICATING APPARATUS, *T. Perkins, Hitchin.—8th November*, 1882.—(*Not proceeded with.*) 2*d*.

This relates to the means for employing steam to warm carriages, and it consists in the couplings for connecting the pipes.

5339. DISTRIBUTING SEED, ARTIFICIAL MANURE, SAND, &c., *J. H. Wood, London.—8th November*, 1882.—(*A communication from Messrs. McLean Brothers and Rigg, Melbourne.*) 6*d*.

The seed or other substance is placed in a hopper closed at bottom by a circular feed plate with two radial slots, one side of each of which is vertical and the other inclined, so as to bring the feed all to one side of a line drawn through the centre of the plate, thereby preventing the machine from sowing in front. The feed plate can be turned so as to make the machine sow more or less to the right or left, to counteract the effect of a cross wind on the seed. To distribute the seed two horizontal discs are fixed one over the other, and are capable of turning loosely round a vertical axis below the hopper. On the axis flat-blade springs are mounted between the discs, and actuate the latter by bearing on triangular blocks jointed to the discs. The seeds enter the space between the discs by a top opening, and are cast outwards as the disc revolves. A regulator operated by the resistance of the grain is also described.

5341. TELLURIANS, *A. M. Clark, London.—8th November*, 1882.—(*A communication from J. Spicer, Maryland, U.S.*)—(*Not proceeded with.*) 2*d*.

This relates to instruments for showing the operation of the causes of day and night and of the seasons. The earth is caused to move in an orbit, the plane of which is at an angle of 23½ deg. to the axis of the sun, the earth being suspended at a point corresponding to the North Pole, and depending upon its gravity to keep its axis vertical or parallel with that of the sun during its entire revolution round the sun.

5342. MACHINES FOR PREPARING WIRE FOR SECURING CORKS OR STOPPERS IN BOTTLES, &c., *H. H. Lake, London.—8th November*, 1882.—(*A communication from O. R. Chaplin, Boston.*) 1*s*.

The object is to provide a machine for manufacturing from a coil of wire, a complete bottling wire by successive operations, and without the intervention of hand labour. The operations performed by the machine are the cutting, looping, twisting, and depositing of the wire.

5343. GILL STOVES, &c., *C. J. Henderson, Edinburgh.—9th November*, 1882.—(*Not proceeded with.*) 2*d*.

This consists in covering the gills with sheet iron, except along a part of the top, and raising the body of the stove about a foot from the ground so as to leave a space under the gills and enclosed except at front, so that a current of air can enter at bottom, and passing upwards escape at the open part at top. A curved double smoke pipe is provided so as to purify the escaping smoke, and if necessary a fan blower can be employed to create a rapid current.

5344. REGENERATIVE GAS FURNACES, *W. Hackney, Swansea, and J. W. Wailes, Wednesbury.—9th November*, 1882. 6*d*.

This consists in constructing the combustion or working chamber of a regenerative gas furnace detached from and independent of the regenerator chambers, and connecting it to these by means of comparatively light and portable gas and air pipes.

5345. DRAWING COMPASSES, *J. Brookes, Sheffield.—9th November*, 1882.—(*Not proceeded with.*) 2*d*.

This relates more particularly to beam compasses, and consists in joining two bars together by an ordinary joint, and fixing a point on one end and a pen or pencil at the other. Near the joint of the arm is a leg with a roller at its lower end, so as to serve as a central support in whatever position the arms occupy.

5346. INCANDESCENT ELECTRIC LAMPS, *J. Jameson, Newcastle-on-Tyne.—9th November*, 1882. 4*d*.

This relates to means for increasing the efficiency, &c., of the filaments of incandescent lamps by keeping them supplied with more or less attenuated hydrocarbon gas, the deposition of carbon from which compensates for the dissipation due to the incandescence. The inventor provides a supply of filaments in each lamp, together with an apparatus for cleaning off carbon deposited on the interior of the glass, according to his patent No. 4439, 12th October, 1881.

5347. SMOKELESS STOVES AND GRATES, *R. Crane, Surrey.—9th November*, 1882.—(*Not proceeded with.*) 2*d*.

The object is to provide grates for burning bituminous coals without producing smoke, and consists in making them in the form of a vase and standing it in the fireplace recess. To it are attached side arms or hoppers to ensure the fire being replenished with coal from the bottom.

5348. COP WINDING MACHINERY, *J. Place, Leeds.—9th November*, 1882.—(*Not proceeded with.*) 2*d*.

This relates to the guide wires over which the thread is conducted to be formed into a cop, and consists in the use of glazed porcelain or other tubes fitted on to square forms made to receive them on the guide wires, and the threads pass over these instead of over the bare wires.

5350. DRIVING GEAR FOR VELOCIPEDES, &c., *H. Thresher, Finsbury Park.—9th November*, 1882.—(*Not proceeded with.*) 2*d*.

When applied to a tricycle the driving wheels are loose on the main shaft, which carries a disc with notches for each wheel, and with them levers engage; such levers also engage with a flange on the hub of the driving wheel. For varying the speed, the pedal shaft is connected to the main shaft by chain gear, two sets being employed, either of which can be thrown out of gear by a suitable clutch.

5349. MINERS' SAFETY LAMPS, *T. Thomas, Glamorgan.*—*9th November*, 1882. 6*d*.

The object is, First, to reduce the risk of explosion by surrounding the gauze with shields to break the force of currents of air which ventilate mines, and which are liable to contain explosive gas; Secondly, to make miners' lamps self-locking; and Thirdly, to extinguish them simultaneously with the act of opening them.

5351. APPARATUS FOR SIGNALLING ON RAILWAYS, *R. Clay, London.*—*9th November*, 1882.—(*Not proceeded with.*) 4*d*.

This relates to apparatus whereby signals are exhibited on the engines by the agency of the signalmen.

5352. PAPER-HOLDER FOR USE IN WATER-CLOSETS, *B. Schoof, Germany.*—*9th November*, 1882.—(*Not proceeded with.*) 2*d*.

This consists in placing a pile of loose sheets of paper in a box and causing them to be pressed up by a spring, and the top sheet removed through an opening in the front of the box.

5353. CARBONS FOR ELECTRIC LIGHTING, *H. C. B. Shalders, New London-street.*—*9th November*, 1882. 2*d*.

The inventor takes moss peat of the genus *sphagnum*, such as is imported from Rhenish Prussia, cleanses it, first dries and then calcines it. The material is then ground to powder and sufficient syrup of sugar added to make a paste. The mixture is then compressed in moulds and submitted to a high temperature.

5355. STAYS AND CORSETS, *M. G. Totterdell, Landport.*—*9th November*, 1882 6*d*.

This relates to arranging fastenings for stays and corsets, First, so that they do not project from the surface of the busk and so cause undue wear to outer garments; and, Secondly, to prevent the upper or lower fastening becoming detached while fastening the others by arranging them vertically instead of horizontally.

5356. HYDRAULIC ACCUMULATORS, *W. Smith, Aberdeen.*—*9th November*, 1882.—(*Not proceeded with.*) 2*d*.

The object is to dispense with the weight or load on the rams of hydraulic accumulators, and it consists in substituting therefor the elastic pressure of air or the springs equilibriated or made uniform by means of levers.

5357. FOLDING OR COLLAPSIBLE BOXES, AND MACHINERY FOR SCORING OR CREASING PAPER BOARDS FOR FORMING SUCH BOXES, *A. M. Clark, London.*—*9th November*, 1882.—(*A communication from W. H. H. Rogers, Brooklyn, U.S.*) 6*d*.

The box blank is formed with flaps, one cut to form two locking heads or tabs, and the other with a slit to receive the tabs. In the machine for scoring the blank, the score is made by compression between a head having a guillotine action and a ribbed bed, the material being scored by two successive blows produced by suitable cams.

5358. TRANSPORTABLE BAKING OVENS, *E. A. Brydges, Berlin.*—*9th November*, 1882.—(*A communication from D. Grove, Berlin.*) 6*d*.

This relates to baking ovens, so arranged as to be capable of being readily placed on a carriage. The baking operation is continuous, the material being charged by sheet metal plates running on rollers. The baking compartment is heated by hot air guided around the fire-box by canals, and then circulating round the walls and crown of the baking compartment. The walls are double, and a non-conductor interposed between them.

5369. VELOCIPEDES, *J. Noad, H. Blackwell, jun., and H. B. Bunkell, London.*—*10th November*, 1882. 2*d*.

The object is to obtain increased power in the use of the feet on treadles, for which purpose each treadle, instead of being applied directly to the cranks, is applied to a separate bar, one end of each of which bars can slide in or on the fork, while each bar receives the end of a crank, and towards its outer end each receives a treadle.

5370 PACKING FRESH MEAT, &c., TO PREVENT DECOMPOSITION, *W. P. Thompson, Liverpool.*—*10th November*, 1882.—(*A communication from Dr. M. Closset, Belgium.*) 4*d*.

The meat is placed in cases, and air exhausted by a pump, after which an antiseptic liquid is introduced, such as alcohol, vinegar, or a solution of borax in water. The liquid is then forced out by a gas containing no oxygen, and which will not act upon the meat, and the case closed.

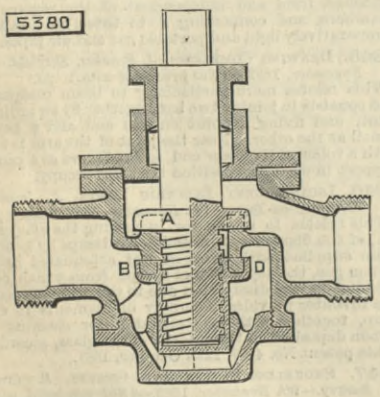
5379. LUBRICATORS, *W. L. Wise, London.*—*11th November*, 1882.—(*A communication from E. Baudel, Paris*).—(*Not proceeded with*). 2*d*.

A feeding vessel containing the lubricant communicates with a cylindrical passage below, between the extremities of same. One extremity is closed by a small valve acted upon by a spring, and behind which is the outlet tube leading to the surfaces to be lubricated. In the passage near the opposite end is a small piston, the rod of which is acted upon by the engine.

5380. VALVES AND COCKS, *F. P. Preston, J. T. Prestidge, E. J. Preston, A. T. Cornish, and W. G. Simmons, Deptford.*—*11th November*, 1882. 8*d*.

The objects are to prevent leakage, to enable the stuffing-boxes to be repacked under pressure, and improve the construction and efficiency of valves. The drawing shows a double-seated valve, the upper valve formed on the spindle, the lower part of which

5380



is screw-threaded and works in the lower valve B, guided in the bottom cover C to prevent turning. The bottom of valve A and the top of valve B seat themselves respectively on the top and bottom of a partition D.

5384. COMPOSITION OF JOURNAL AND OTHER BEARINGS, *A. M. Clark, London.*—*11th November*, 1882.—(*A communication from F. E. Canda, New York.*) 4*d*.

This consists in the use of an amalgam of mercury with bronze, copper, tin, lead, or antimony for the formation of journal or other bearings.

5396. APPARATUS FOR GRINDING LAWN MOWER CUTTERS, *T. H. Gillott, Royston.*—*13th November*, 1882. 6*d*.

This consists in an apparatus for grinding lawn mower cutters of the combination of a slotted hollow shaft or sleeve, threaded spindle, and nut, the said nut being connected to the grindstone through the slot in the sleeve.

5401. APPARATUS FOR REMOVING BURRS, &c., FROM WOOL, *A. J. Boult, London.*—*13th November*, 1882.—(*A communication from F. Muller, Germany.*—(*Not proceeded with.*) 2*d*.

This relates to the arrangement of an endless feeding apron and a set of rollers.

5402. STEAM WINCHES AND CRANES, *W. Allan, Sunderland.*—*13th November*, 1882. 6*d*.

This relates to the construction of steam winches with the steam cylinders enclosed within another casing, whilst the crank shaft is above the top plate of this casing and enclosed by a hood at its ends geared to the barrel which is carried by brackets on the outside of the casing.

5404. MACHINERY FOR WINDING PAPER INTO ROLLS, *G. W. Osborn and Dr. W. Yates, Chelsea.*—*13th November*, 1882. 6*d*.

This relates partly to an arrangement whereby whilst one roll of paper is being formed or wound upon the spindle, the ends or edges of another roll previously formed or wound upon that spindle can be "knocked up" or straightened.

5405. EXTENSION RULE OR GAUGE, *J. F. Stephens, Bristol.*—*13th November*, 1882. 6*d*.

This relates to the construction and arrangement of the rule graduated so as to form a combined rule and gauge.

5406. PUNCHING AND RIVETTING MACHINES, *J. D. Morrison, Gateshead.*—*13th November*, 1882.—(*Void.*) 2*d*.

This relates to the construction of the cylinder containing the ram, so as to form a strong guide on which slides a strong arm or leg carrying the punching or rivetting tool.

5408. TREATING TEXTILE MATERIALS WITH LIQUIDS, *J. Wetter, New Wandsworth.*—*13th November*, 1882.—(*A communication from O. Obermaier, Bavaria.*)—(*Not proceeded with.*) 2*d*.

This consists essentially in forcing by means of a pump a continuous current of liquid into a perforated tube, rising inside a cylindrical or prismatic receptacle in which the material to be treated is placed.

5410. STEAM STEERING APPARATUS, *J. Duncan, London.*—*13th November*, 1882. 4*d*.

A direct steam-steering gear is arranged to stand over the rudder head or on the bridge, being connected to the tiller by a lever on the machine or appa-

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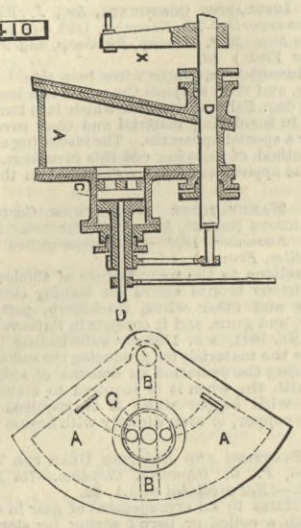

ratus worked in a circular direction. A quadrant-shaped steam cylinder A is used and fitted with circular automatic valve C. All chains and ropes are dispensed with, the tiller lever X being secured to the axis of the piston.

5412. MANUFACTURE OF BISULPHITE OF SODA, *E. Carey and F. Hurter, Widnes.*—*13th November*, 1882. 6*d*.

This consists in the manufacture of bisulphite of soda by the employment and treatment of monohydrated carbonate of soda by subjecting the same to the action of sulphurous acid gas.

5415. VELOCIPEDES, *F. Weldon, London.*—*13th November*, 1882.—(*Not proceeded with.*) 2*d*.

The object is improvements in velocipedes, so that by coupling together in suitable manner two or more driving wheels propelled as in the ordinary bicycle with or without their trailing wheels, two or more persons may propel the machine, one rider only preferably being required for steering.

5419. APPARATUS FOR MARKING OR SCORING IN CARD PLAYING, *G. F. Redfern, London.*—*14th November*, 1882.—(*A communication from Mr. Klein, Vienna.*) 6*d*.

This relates to a frame provided with rods, upon which a number of balls are caused to slide.

5423. STEERING VESSELS, *W. Pepper, Kingston-upon-Hull.*—*14th November*, 1882. 6*d*.

This relates particularly to steam-steering apparatus, the object being to simplify construction and improve the working. The slide valves are abolished, and a valve of special construction admits the steam to two cylinders, and is mounted on the steering wheel axle under the control of the steersman. By the use of this valve the compensating gear ordinarily employed is also abolished. In the drawing A is the frame and B the chain drum mounted on shaft C, which also carries a worm wheel D, actuated by a worm F on a transverse shaft carrying discs at either end actuated by the cylinders H. The steering wheel I is mounted on an axle J fitted with pinion K gearing with a wheel

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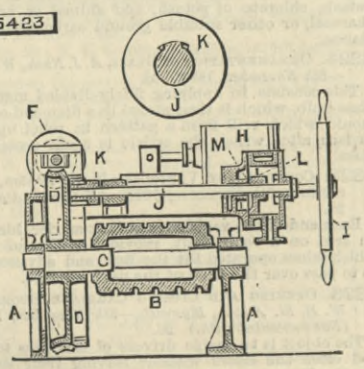

formed on the worm wheel D. A disc valve M is mounted on axle J and works in the valve-box L of the cylinders H, such valve having ports for the exhaust and inlet of both cylinders. By turning the wheel I a lead is given to the valve, and steam admitted to cause the apparatus to work in the required direction. To prevent the steersman overrunning the engine with the valve a stop arrangement is provided. The pinion K has an enlarged keyway to receive a feather on shaft J, and limits the movement of such axle.

5424. LITHOGRAPHIC PRESSES, *R. B. Hayward, London.*—*14th November*, 1882.—(*Not proceeded with.*) 2*d*.

This consists in substituting a stone roller on a stone of a cylindrical form for the flat stone at present employed.

5425. ENVELOPES, *R. B. Hayward, London.*—*14th November*, 1882.—(*Not proceeded with.*) 2*d*.

This relates to a means for preventing the surreptitious opening of the envelopes.

5436. MANUFACTURE OF PUTTY, *G. A. Biddis, Newbury.*—*14th November*, 1882.—(*Not proceeded with.*) 2*d*.

The method of manufacture consists essentially in grinding Bath or other stone with linseed oil, and then thickening by the addition of whiting to form putty.

5437. PRESERVATION OF MILK, *M. E. and O. E. Pohl, Liverpool.*—*15th November*, 1882. 6*d*.

This relates to the construction of apparatus for preserving milk in large quantities.

808. MANUFACTURE OF ANIMAL CHARCOAL, *J. G. MacFarlan, Richmond.*—*20th February*, 1882.—(*Not proceeded with.*) 2*d*.

This consists in the supplemental use of two special acid scrubbers, which receive the uncondensed gases from ordinary condensers and fixing all the ammonia; in applying steam jets to the scrubbers at certain points, so as to render the working continuous; the dilution of the sulphuric acid used to a certain specific gravity, thus ensuring the highest results as to time and production of salt; the substitution of steam evaporators for pans; the use of cast iron or fireclay retorts, with a drying chamber above, and with or without an exhaust, and the use of silicate of soda for filling the pores of fire-clay retorts and producing a glaze; the substitution of ivory black as a lute; and the application of superheated steam at certain points and certain periods intermittently during the process of carbonisation. An improved model of working is also described.

1347. DYNAMO-ELECTRIC MACHINES, *H. H. Lake, London.*—*13th March*, 1883.—(*A communication from G. W. Fuller, Norwich, Conn., U.S.*) 6*d*.

This relates to improvements in the dynamo described in the inventor's former patent, No. 1313, dated 12th March, 1883. In the present case the annular armature core, instead of having the polar prominences upon its periphery and sides, is composed of

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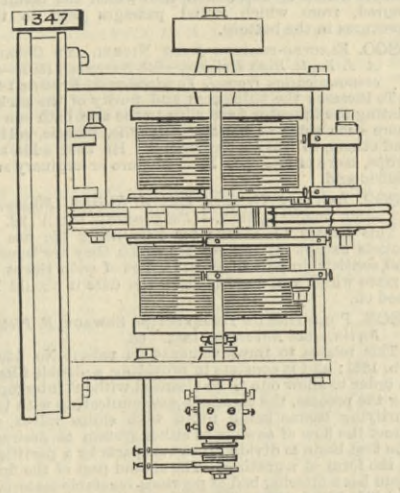
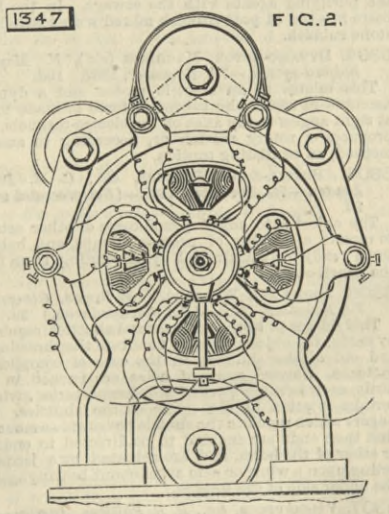


two long segments of iron, secured to two short segments of non-magnetic material, and in the two circles of rotating field magnets. The magnets of like polarity adjoin each other, and are united by common pole pieces, those on either side of the axis being of opposite polarity. The armature core, which is in the form of a flattened ring, is suspended in the bight or bights of one or more cables, hung over a suitably elevated loose pulley—see Fig. 2—and is prevented from swaying laterally by means of good guide rollers acting through the spaces between the stationary coils upon the convex portions of the cables embracing the

1347 FIG. 2.



core. The core is thus carried round by the attraction of the rotating field magnets, and its division into segments of magnetic materials causes the establishment in it of permanent poles at the ends of the segments. The coils of magnets and armature are in the same circuit. A peculiar commutator and brushes are employed. The machine is illustrated herewith, Fig. 1 being a side elevation, and Fig. 2 an end elevation.

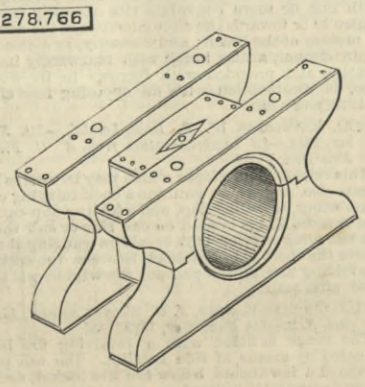
SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

278,766. LINK BOX FOR STEAM ENGINES, *Hiram Blood, East Cambridge, Mass.*—*Filed March 14th*, 1883.

Claim.—A link box for steam fire engines having its

278.766



exterior and interior bearing surfaces composed of raw hide, substantially as set forth.

278,830. EXTENSION TABLE, *Robert W. Taevner, West Bay City, Mich.*—*Filed April 8th*, 1881.

Claim.—(1) The combination, in an extension table, of three supporting sections, on one of which rests the central portion of the flexible top formed of slats whose ends run in spirally formed guides J, attached to and forming part of the end supports, substantially as and for the purpose specified. (2) In an extension

278.830

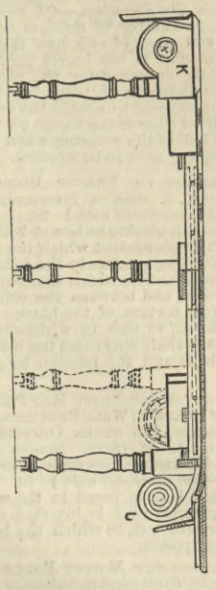
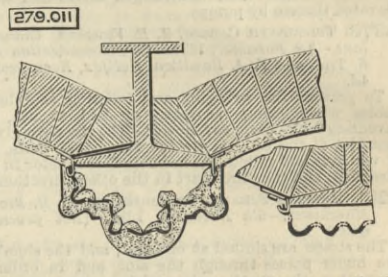


table made in sections and having a flexible top, as described, and in combination with said sections and top, the side plates K, fastened one at each side of the outer sections of the table, said plates being provided with internal spiral webs J, forming guides for receiving the edges of the flexible top, substantially as specified.

279,011. FIREPROOFING AND FURRING DEVICE, *George B. Phelps, Washington, D.C.*—*Filed January 10th*, 1883.

Brief.—A hollow metallic base or form for the moulding, and of substantially the same contour in

279.011



cross-section, is secured to the ceiling beneath the beams by hooked hangers arranged at intervals and engaging with slots in the sides of the form.

CONTENTS.

PROPOSALS have been put forward in Ceylon for a narrow-gauge line of railway for the local accommodation along the Ratnapura-road as well as for the abandonment of the existing broad-gauge system in all future hill extensions of the main line.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending June 30th, 1883:—On Monday, Tuesday, and Saturday, free from 10 a.m. to 10 p.m., Museum, 10,113; mercantile marine, Indian section, and other collections, 4837. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. to 6 p.m., Museum, 2335; mercantile marine, Indian section, and other collections, 1433. Total, 18,718. Average of corresponding week in former years, 18,884. Total from the opening of the Museum, 22,148,572.