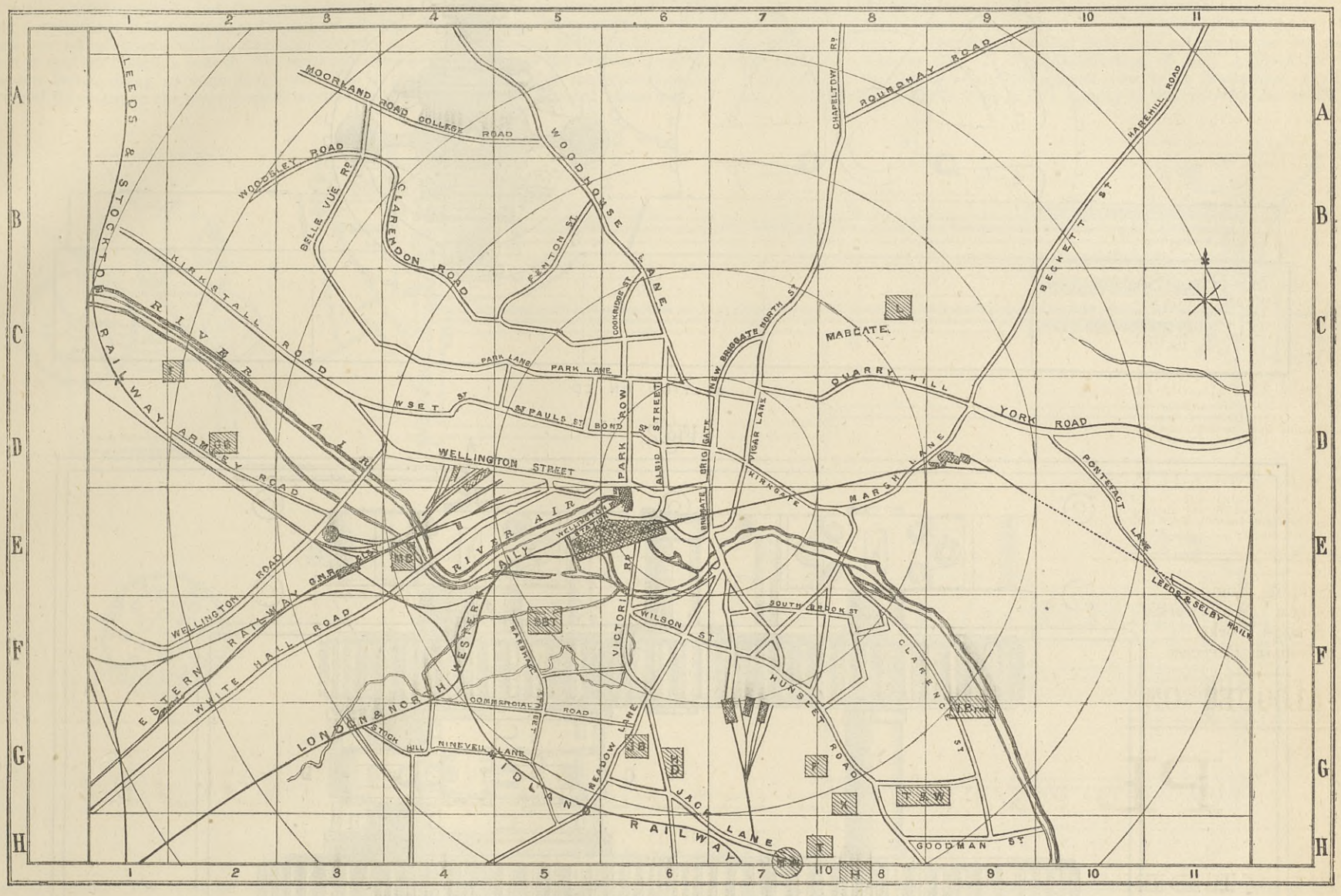
VISITS IN THE PROVINCES.

MONKBRIDGE IRONWORKS, LEEDS.

As we mentioned in our impression of the 7th inst., the Monkbridge Ironworks, E4 on map, are the property of Messrs. Kitson and Co., and are much engaged on railway tires and material. In entering the works we soon come to a set of rolls worked through the medium of Kitson's hydraulic friction reversing clutch. The arrangement adopted is that illustrated by the engravings, page 40, and after trial of the clutch, extending over several years, Messrs. Kitson and Co. put down a second one. The construction of a satisfactory reversing clutch thrust when pressure is applied; and H H^1 are hydraulic pipes from the valves to the cylinders. To work the reversing gear, water under pressure is passed from an accumulator, to which the cylinders $e\,e^1$ are connected by suitable pipes H H^1, so arranged that the pressure can be applied by hydraulic valves to either cylinder e or e^1 alternately or shut off both at once. If the pressure be applied to the cylinder e, the friction-plate E is forced up against the wheel B, holding it firmly between the thrust collar G and itself. The wheels being in motion, the shaft A will now revolve in the direction of the wheel B by the driving pins F F^1 passing through the clutch C. By reversing the valves the pressure is released from the cylinder e and designed for the purpose, the crane running on the lower members of heavy longitudinal girders supported on columns, the upper members of the girders carrying the roof. This has been specially designed by Mr. W. Ainslie, engineer to the Monkbridge Works, and is illustrated in general outline with the crane, in the engravings below.

In another part of the works are being erected a pair of Berryman's feed-water heaters of the largest size yet made. These will receive the exhaust steam from all the engines and hammers in the works, and though the steam will in some cases be carried from a considerable distance, it is confidently anticipated that considerable economy will result from their use. The reheating furnaces are heated



SKETCH MAP OF LEEDS, SHOWING POSITION OF ENGINEERING WORKS.

Kitson and Co., marked K on space G8; Monkbridge Works, M B on E4; Joshua Buckton and Co., J B on G6; Leeds Forge Company, F on C2; S. Lawson and Sons, L on C8; Greenwood and Batley, G B on D2; Smith, Beacock, and Tannet, S B T on F5; Hathorn, Davey, and Co., H D on G6; Fowler and Co., F on G7-8; Taylor Bros., T Bros. on G9; Tannet and Walker, T W on G8-9; Manning, Wardle, and Co., M W on H7; Hunslet Engine Co., H on H8.

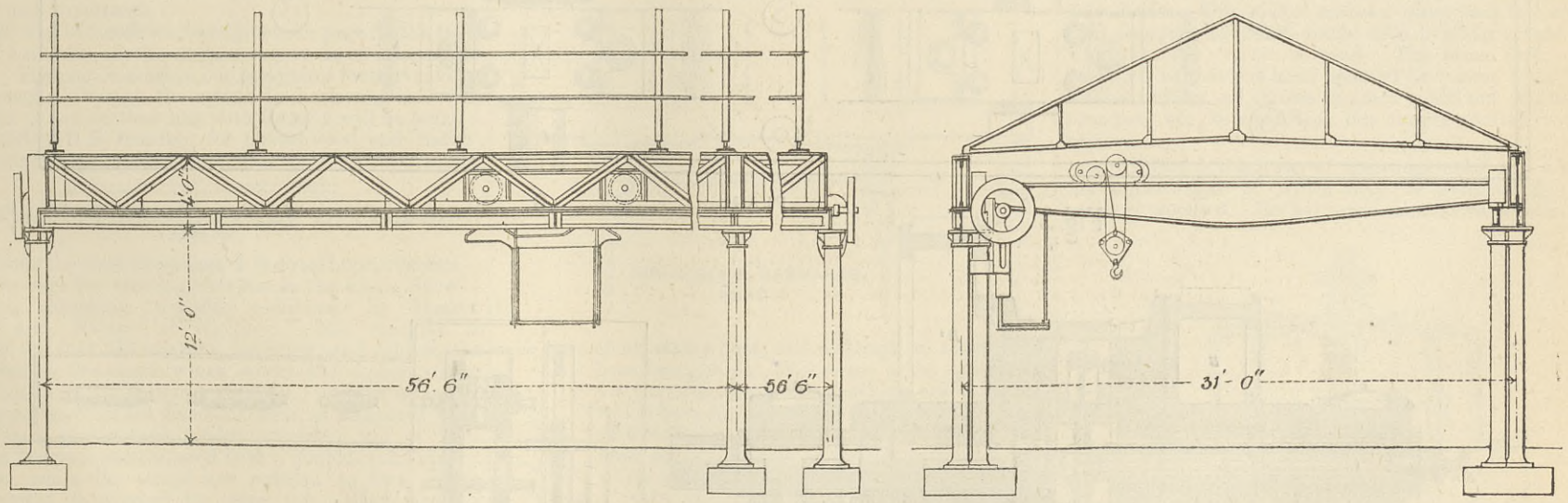


PLATE MILL SHED AND CRANE, MONKBRIDGE WORKS, LEEDS.

has been effected within a very few years. Great strength of parts has been necessary, but as the other parts of the reversing gear have necessarily to be of great strength and weight, a little weight in the clutch is of little importance, while the saving in time and in engine wear and tear is very considerable. Amongst the best of these clutches is that used by Messrs. Kitson and Co. and the Weston friction clutch used by Messrs. Steel, Tozer, and Hampton in their steel works, near Sheffield. At the Monkbridge Works a very small stream of water is kept constantly running on the clutch to prevent heating. In our illustrations A is the reversing shaft, which is bored up the centre at one end to receive the water pipes, and made square for the reception of the driving clutch C; B B^1 are spur driving wheels running in opposite directions, being geared in the ordinary way with three other wheels, and having flat surfaces on their inner sides; C is the driving clutch made in halves and bolted together on the square of the shaft A; D D^1 is an annular piston fastened to the driving clutch; E E^1 are friction plates with hydraulic cylinders $e\,e^1$ cast on and made to slide freely on the shaft A; F F^1 are driving pins fitted so as to slide through the driving clutch, but attached by cotters to the friction plates E E^1; G G^1 are collars to take the applied to the cylinder e^1, which pulls the friction-plate E off the wheel B and forces the friction-plate E^1 against the wheel B^1 and holds it firmly between the thrust collar G^1 and itself; the shaft A will now revolve in the direction of the wheel B^1 by the driving pins and clutch as before. By shutting the pressure off both cylinders the friction plates E and E^1 are set at liberty, and having no hold upon the wheels B and B^1, the reversing shaft A stands while the wheels B and B^1 continue to revolve upon it.

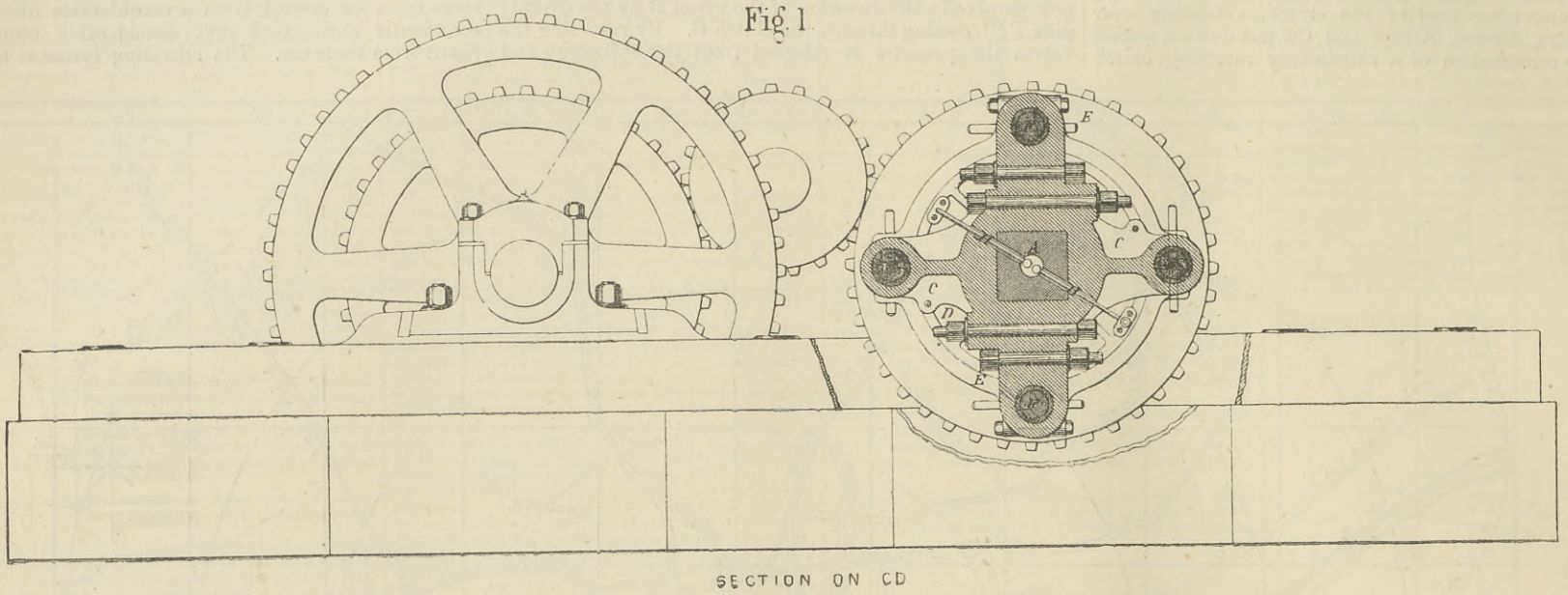
The accumulator and valves are placed in any convenient position relative to the reversing gear, and in the Monkbridge Works is employed for working, amongst other things, a direct-acting hydraulic crane on a large wrought iron gantry running on wheels on the mill floor, and spanning the whole of the reversing gear and the mill train, so as to lift out and change rolls with little labour and little loss of time. A little further on, and as a new part of this plate mill, is a fine high-speed travelling crane commanding a number of shearing machines for heavy work, such as locomotive side plates. The crane is worked from a square shaft turned by a small vertical wall steam engine at each end, and under the command of the man working the crane from a pendant platform. The shop or shed in which this crane is erected has been specially by gas made in Wilson's gas producers. The same producers are employed for heating the crucible steel furnaces, and though Siemens' open-hearth furnace is employed for steel making, Wilson's producer is preferred to make the gas therein consumed.

MESSRS. BUCKTON AND CO.'S WORKS, LEEDS.

In the Well House Foundry, the entrance to which is in Meadow-lane, G6 on map, will be found a great many tools of great interest in use and in construction. Messrs. Buckton and Co. have so long been celebrated for excellent design and workmanship in their tools that it is unnecessary to say anything of these points in the machines we may refer to. In the works is a very large number of machine tools for all purposes, and most of them are of recent construction, for Messrs. Buckton so fully appreciate the value of plenty of tools of the best construction that, unlike the proverbial shoemaker, they make for themselves as well as for their customers, and hence they have tools for everything which can be done by machinery. A noticeable feature in the modern machinery is the adoption of frames and beds, so constructed as to make the machines independent of their foundations. In the older days the satisfactory working of a machine tool,

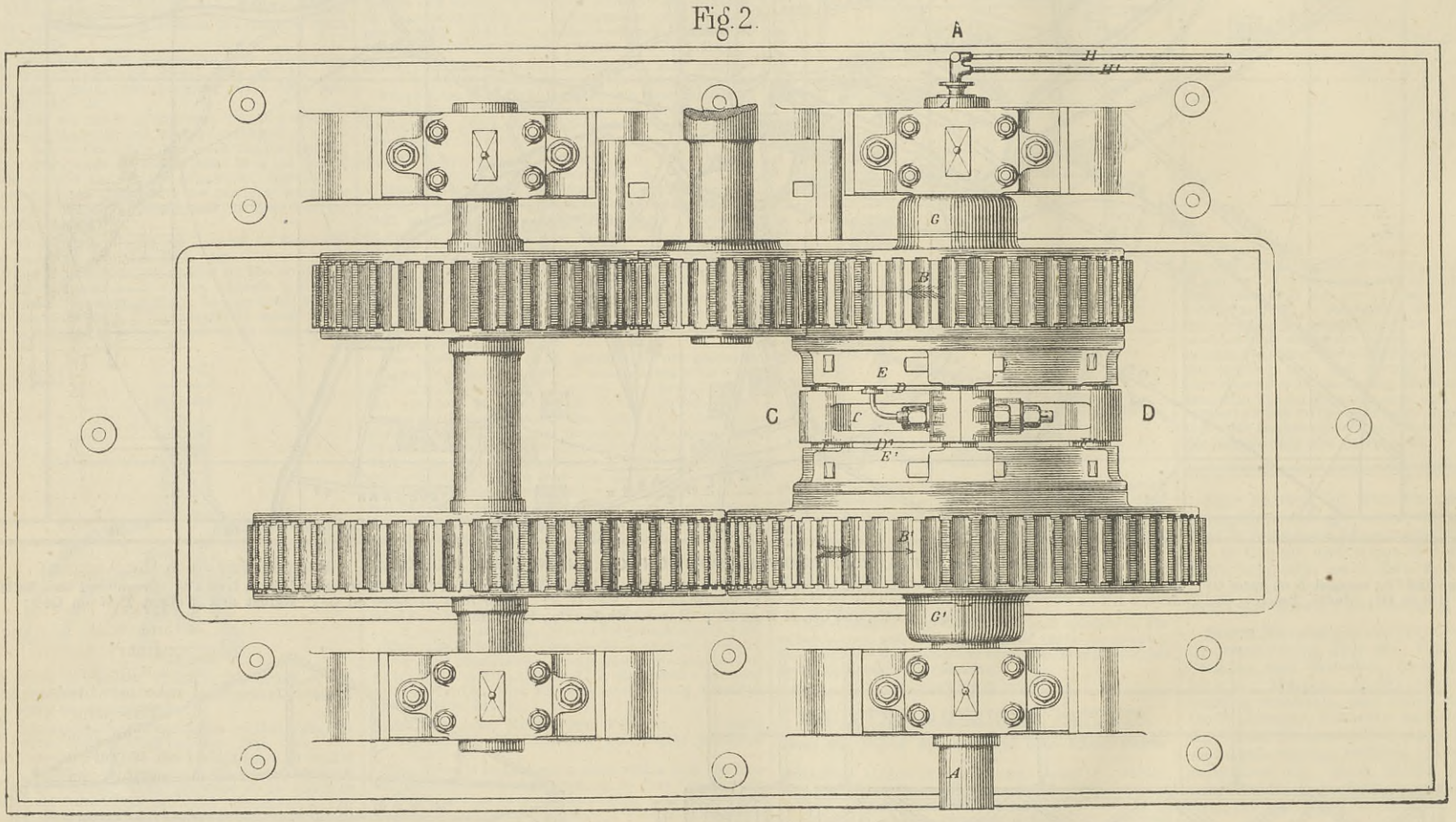
especially if of large size, depended very much on the foundations and the care with which the several parts were attached to these and to walls, and in some cases roof beams also. This is now seldom the case, and machines are tested before sending them out by simply connecting them by a strap to some of the works' shafting, or by means of the small special engine attached to the machine itself. A strong machine was thus being tested when we were in the works for paring the ends of steel rails. Steel rails, it tion is a very large planing machine, to plane 12ft. 6in. wide, and carry a casting weighing 30 tons. The travelling bed alone of this machine weighs 15 tons. In the V bed of this machine, as in one fixed in the works, a number of recesses are made at intervals and partly filled with oil, in which runs a pair of small wheels which take up and distribute oil on the bed as the travelling bed runs over them. This is not, perhaps, new, but is worth mentioning, because its advantage can be seen in these works, come by placing a planed board under the strap, which is always more or less inclined, in such a position as to leave the strap perfectly free when tight, but to support it when it flaps about at the time of the reversal or tends to do so. The board is coated with a mixture of blacklead and tallow, and this expedient causes the strap to work smoothly, and has so reduced the breakage of straps, that on one machine which was previously continually stopping to repair these, has now been working for four years with a strap

Fig. 1.



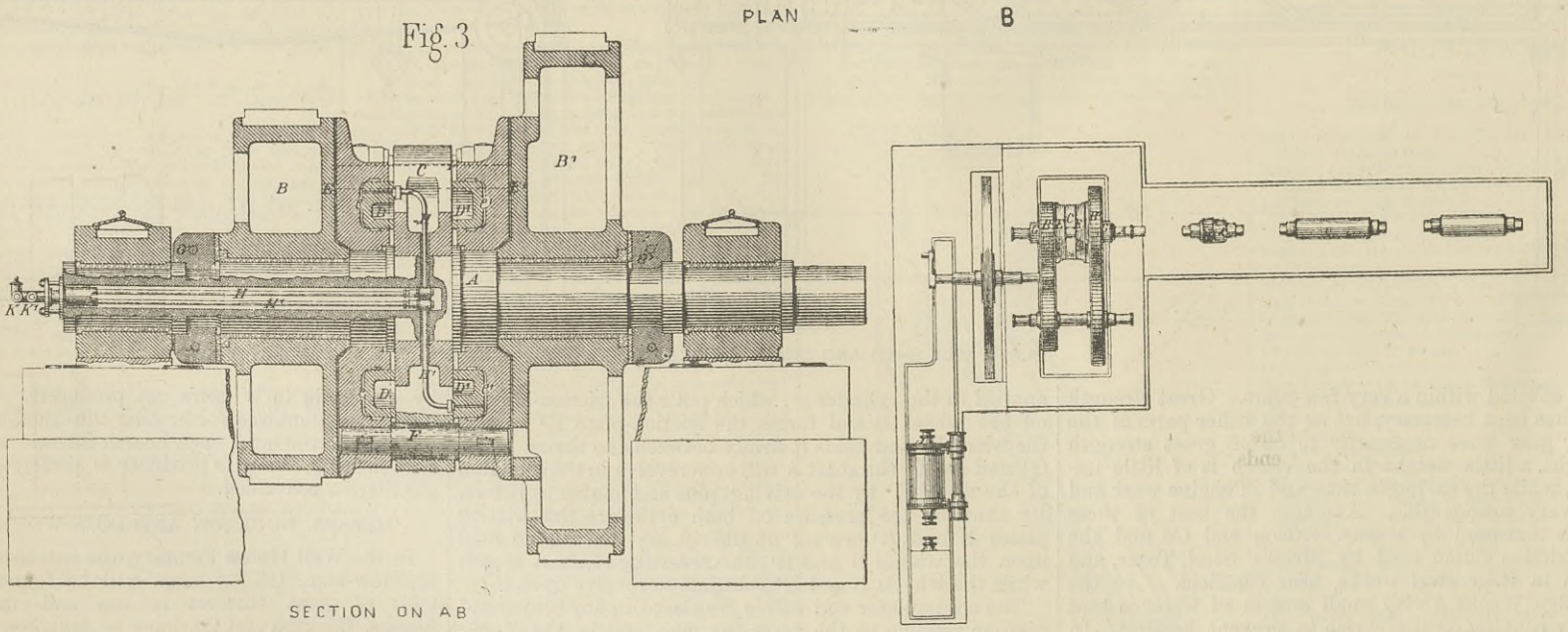
SECTION ON CD

Fig. 2.



PLAN B

Fig. 3



SECTION ON AB

KITSON'S HYDRAULIC ROLLING MILL REVERSING CLUTCH.—(*See page 39.*)

seems, cannot always be cut off in the rolling mill with sufficient approximation to the specified length, because the contraction of steel rails after leaving the rolls is greater than with iron rails, and as a comparatively small difference in the temperature of the rail when leaving the rolls and cut off with the hot saw, after leaving which the contraction is considerably over 2in. and in some cases 3in., makes enough difference in length to cause rejection by the inspector, a machine has been made for doing this cheaply by means of revolving cutters.

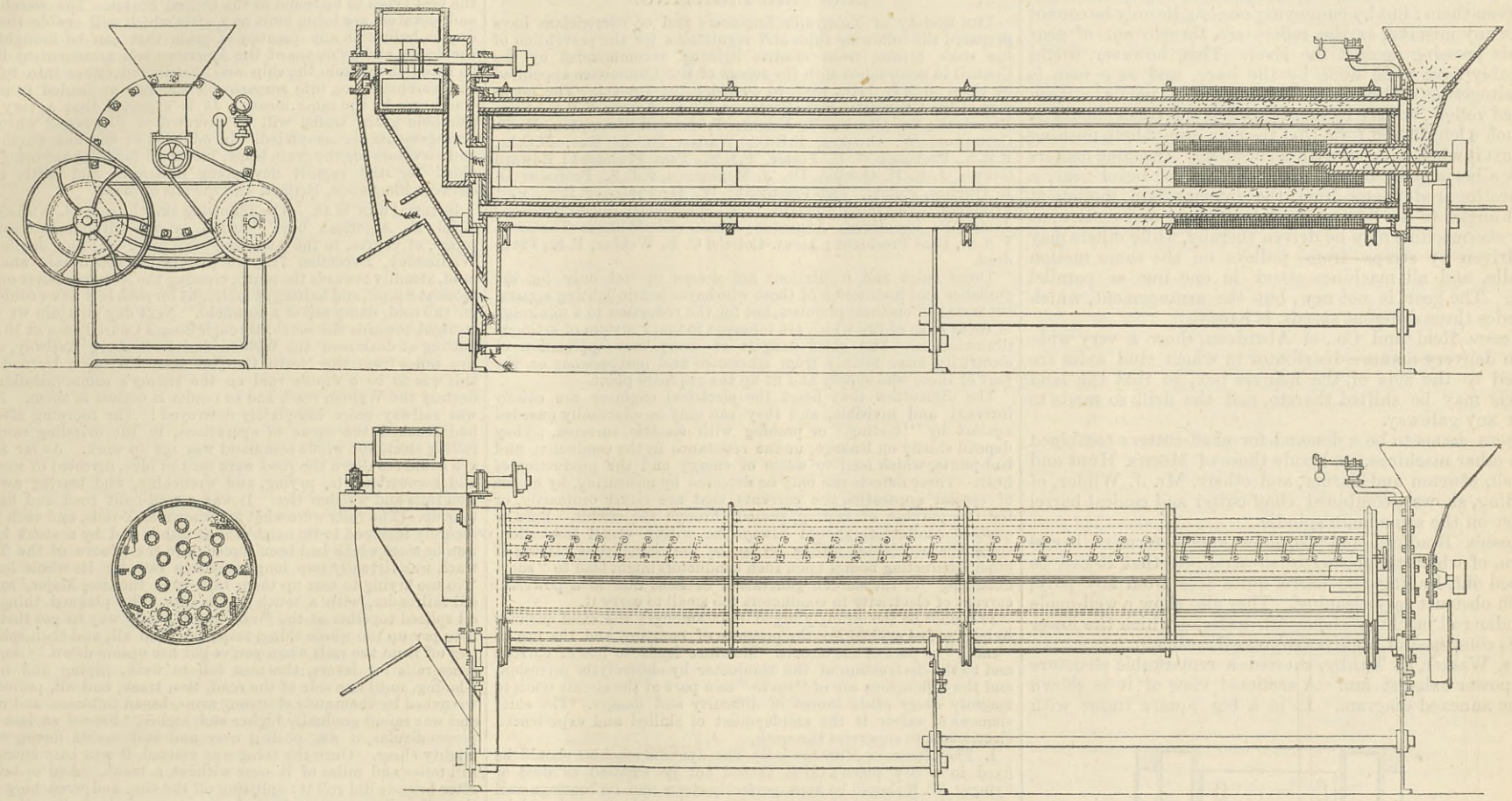
Amongst other notable machines in course of construc- where the beds of a machine so fitted are as smooth as when put to work, while those of all other machines are more or less grooved. The device, moreover, has the advantage that it secures the effectual lubrication of the V's when the machine is working on a very short cut, which cannot be done with the ordinary means of lubrication. All who have had experience in the working of heavy planing machines know how great is the wear and tear of straps owing to the flapping which takes place at every reversal of the motion. This excessive wear Mr. Wicksteed, of the firm of Buckton and Co., has over- that had been rejected as not strong enough for the machine.

A large lathe, to take in a 14ft. wheel or a heavy shaft, is in course of erection. The bed is 45ft. in length, and is in two parts, the joint being made of about double the depth of the other part of the bed, so as to secure perfect rigidity under the hogging tendency of a heavy piece of work supported between two centres at such a height from the bed. This lathe bed is of great width, and the rest is worked by double racks, so that there is no tendency to cross-corner sticking.

Some special lathes are being made for rigger or pulley turning. Instead of turning the pulley by fixing it on a mandril, the "dithering" or shivering under the operation which accompanies this process, especially with light pulleys, is avoided by first boring out the boss and turning the edges; then the pulley is rigidly held by the edges by special clamps, the central position being obtained by means of a cone which enters the hole in the boss.

Some special machinery is being made for Messrs. Steel, Tozer, and Hampton for automatically moving the rail and other billets from heating furnaces to breaking-down and finishing rolls and saws. Messrs. Steel, Tozer, and Hampton have carried this system out already with considerable completeness and success, so that visitors have to keep a sharp look-out for white-hot billets roaming about their works unaccompanied; but the new apparatus is a further development of the system, and is in part a bridge, so that one set of billets will be toddling one way and another in another direction over it. We must leave these works, but before doing so must direct attention to the fine pair of jib cranes in the main foundry worked by wall engines and belts. The operator stands on a platform against the engines, and by three levers works the cranes with the greatest precision for any work. The visitors will also find in the works a new form of testing machine, designed by Mr. Wicksteed, and possessing points of novelty and importance.

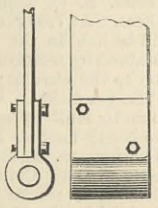
In the map of Leeds we have given, on page 39 the positions of a number of the engineering works of interest are shown. The map is marked out in squares for convenience in reference. Thus, in the square in horizontal line with the letter O and vertical line with figure 2 will be found a space marked G B, standing for Greeenwood and Batley, and so on. The names are enumerated at the foot of the map.



WALWORTH'S STEAM CORN DRYING MACHINE.

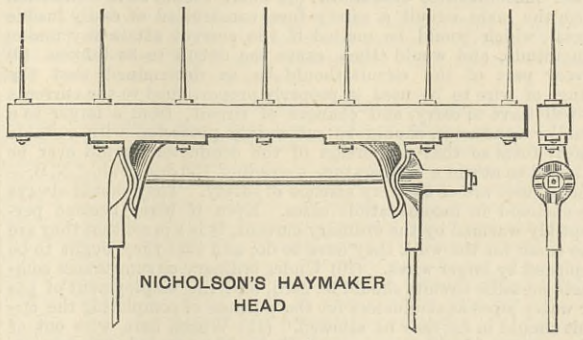
MISCELLANEOUS EXHIBITS AT THE READING SHOW.

AMONGST the most important of the real improvements—for there were few striking novelties in the whole Show—was the thrashing machine exhibited by Messrs. Nalder and Nalder, of Wantage. This machine is arranged so that the shakers, jog-board, and riddles, are all driven by the crank which works the shakers, there being but one crank in the machine. By this means at least seven bearings are dispensed with, as compared with an ordinary single-crank shaker machine, and at least fourteen bearings as compared with a double-crank shaker machine, while the straps are reduced to two. This improvement is effected by using the shaker-boxes as connecting rods for driving the shoes. The machine exhibited has five shaker-boxes, three of these being held by flexible joint attachments at their lower ends to the lower shoe, their upper ends being free, while the other two are similarly connected, but at their upper ends, to the jog-board, their lower ends being free. The shoes are suspended by flexible wood hangers fixed at their upper ends, but carrying a joint at their lower ends, as shown by the annexed woodcut. These hangers are wider than is usual, and Messrs. Nalder and Nalder find that they work better than those fixed at both ends and having a double or contrary flexure at each stroke. The bearings at the bottom are so wide that they may run for years without any rattling. It may, of course, be said that the single crank is rather heavily worked, but the several parts so well balance each other that it is questionable whether the crank wear will be greater than usual, while the machine certainly runs very smoothly, and probably with considerably less power. This point was not, however, tested at the Show; something called a trial was made by the judges before the award of a silver medal was made.



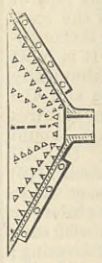
Messrs. James Walworth and Co., of Bradford, exhibited one of Mr. Walworth's machines for drying wheat, barley, oats, malt, rice, and other grains, or for drying and treating other matters and materials preparatory to grinding or when ground, as illustrated below. To the end frames of the apparatus are secured steam chests connected by long metal steam tubes. On each side of the steam chests, and on the tops of the frames, bearers are fitted through which shafts pass and work. On the shafts are secured grooved pullies, in which work angular projecting rings, the latter being cast on the top of broad rings, having angular brackets to which are secured flat bars for the purpose of lifting and turning the grain, seeds, &c. Some of the flat bars ars actuated by wheelgear, and by a small hand wheel in order to obtain any desired angle, and give more or less speed to the delivery of the grain, seeds, or other material operated upon. A worm is fitted in the tubular casting in the centre of the steam chest to deliver the grain into the circular revolving casing fitted into the rings working on the grooved pulleys. This casing revolving round the heated steam pipe, or tube, keeps turning and agitating the grain, whilst the flat bars keep lifting and turning it, and a fan exhausts the heated air, dirt, or vapour from the revolving circular casing as the operation of drying, cleaning, and dressing proceeds.

Messrs. W. N. Nicholson and Sons, of Newark, show a



NICHOLSON'S HAYMAKER HEAD

new form of haymaker head, and although so many have been brought out, this seems to be quite new. To the rake head two castings are attached, which have surfaces of double curvature, similar surfaces being given to the castings on the tine head arms. A bolt is threaded through the whole as herein shown, a spiral spring in the box or tube on the right-hand arm head being threaded on at the same time and held by a nut and washer. The tension put upon this spring by the nut and bolt determines the resistance which the tines offer to the crop being turned. This head is simple, ingenious, and good. The same makers show a disc pulper, in which the disc is made slightly dishing or conical, so that the roots are better held in the pulper hopper and cannot so well dance round.



PULPER DISC.

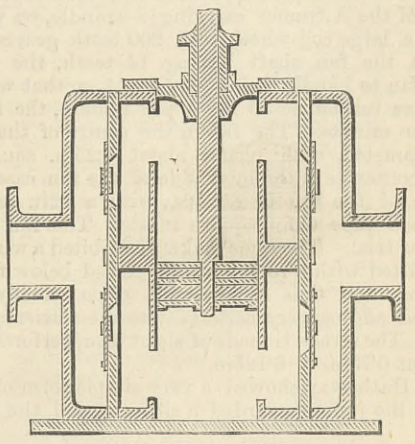
Messrs. Gibbins and Robinson, late P. and H. P. Gibbins, Wantage, also showed a thrashing machine, in which an exhaust fan is placed at the end of the awner to draw off dust and smut. The fan is fixed on the awner spindle at the extreme end of the awner, where the corn leaves for the second dresser immediately under the awner. At the end of the awner is a wire partition, through which the exhaust fan draws air, and all the wheat beard, dust, and smut. These often find their way into the "best corn" sack, but by effecting this dressing in the awner itself there is less to be done in the second dressing riddles, and by the corn miller, and the screen has only to act as a separator or sampler, the thirds and seconds, as well as the firsts, being, the makers assert, rendered marketable as they leave the thrasher.

The Bristol Wagon Company exhibited, amongst other things, a four-wheeled cattle van with flexible wheel base. Both axles move on a central locking bolt, and are connected by cross ties, so that when one axle is moved by the shafts so as to take up a position radial to a curve, the other axle does the same, the motion of either axle being small as compared with that of the fore axle of an ordinary four-wheeled vehicle. All the four wheels may thus be of the same size. In the cattle van exhibited the shafts are attachable to either end, and both ends open, so that cattle enter one end and leave by the other, and do not have to back out. The ends of the springs are fitted with friction wheels bearing on locking plates instead of having rubbing surfaces. The wheels are large and the draught light, and the bed is very low, cranked axles being used. The same design is being applied by the makers to omnibus construction.

Messrs. Follows and Bate show a lawn mower 6in. wide for 21s. It is a modification of their Anglo-American machine, and though not new, is an illustration of what may be done in this country in the manufacture of cheap and good machines, against which the American manufacturers have no chance.

Messrs. Gower and Son, of Market Drayton, show a seed drill with telescope tins and with a round nose tubular coulter instead of the ordinary flat coulter with side cheeks. This coulter makes a wider seed bed, and the seed dropping down, the round tube is wider spread than when the flat coulter is used. The same drill is also arranged so that one hand lever at the same time raises all the coulters and throws the seed barrel out of gear, the seed-box not being lifted, but simply pulled a little backward.

Mr. Edward Margrett, of Reading, exhibited a pump, the construction of which may be gathered from the annexed woodcut. He has made them more especially for use in connection with Norton's tube wells, having found that the pulsation of the water caused by the working of ordinary pumps resulted in the loosening of sand at the well bottom, and when not in sand it caused the water to become turbid with washings of the material surrounding the well bottom by the irregular movement imparted to it. The pump consists of an open-ended cylinder within a rectangular box fitted with flap valves and covers held on by bolts and nuts. The valves are large, and the pump not very likely to get choked with anything that can be pumped at all. The pumps are made with 4½in., 6in., and 8in. cylinders, and a pair of the largest has lately been fixed at Beaumont College, near Windsor, for supplying a large swimming bath through 700ft. of horizontal piping and on a 26ft. lift. The same exhibitor shows a filter for filtering large quantities of water, as for a village



MARGRETT'S PUMP.

supply, where water is often turbid, or being rain water, offensive from other causes, and from its construction it would seem to remove impurities generally as well as any filter of its kind. The filter consists of a galvanised tank about 2ft. 6in. long by 2ft. wide and 2ft. deep, containing a perforated stone ware cylinder enclosing a silicated carbon or porous stone jar holding about two gallons. From this a tube passes through the tank and is connected with a draw off cock. The annular space is filled with prepared filtering material, generally fine granular granite or other chippings.

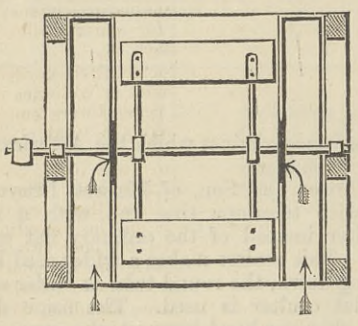
Messrs. Powell Bros. and Whitaker, of Wrexham, who are the makers of Kidd's steam pump, which we recently illustrated, exhibit a chaff-cutter, in which they have purposely rejected the arrangement by which one lever may be used to stop, reverse, and alter the speed of the rollers, and thereby the length of cut, and instead employ separate levers, the one next the arm of the man feeding being for stopping and reversing only, this arrangement being adopted because when one lever only is used, the feeder is for the moment uncertain which way he should move the lever to stop the rollers if by accident he gets his hand between them; but by employing one handle only he cannot make any mistake, as the rollers are thrown out of gear by his pressing against the lever. This, however, would probably have to be done by the knee, and as a man is not altogether cool-headed when he finds his hands between spiked rollers, it may be suggested that this roller should be of such a length and form that the man cannot help pushing against it when he meets with the accident. The same makers show a horse gear, in which, by the use of bevel gear, a connecting rod passes from the intermediate motion at right angles to the line connecting the gear and motion, so that one machine may be driven thereby, while others may be driven by straps from pulleys on the same motion spindle, and all machines stand in one line or parallel lines. The gear is not new, but the arrangement, which includes three different speeds, is handy.

Messrs. Reid and Co., of Aberdeen, show a very wide chain delivery manure distributor in which stud axles are affixed to the side of the manure box, so that the land wheels may be shifted thereto, and the drill so made to enter any gateway.

There seems to be a demand for chaff-cutters combined with other machines, as, beside those of Messrs. Hunt and Tawell, Murton and Turner, and others, Mr. J. Wilder, of Reading, shows a combined chaff-cutter and conical barrel pulper on the same main spindle.

Messrs. Bradford and Co. show a new form of barrel churn, of which the dasher is so arranged that it can be slipped out, leaving the barrel quite free from any parts which obstruct easy cleaning. They also show a well-made calendar roll machine about 4ft. wide, in which the lower roll is composed of highly-compressed cotton.

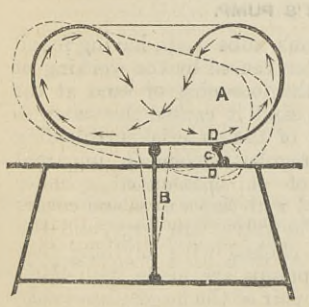
Mr. Walker, of Tithby, showed a remarkable structure as a power exhaust fan. A sectional view of it is shown in the annexed diagram. It is a big square frame with

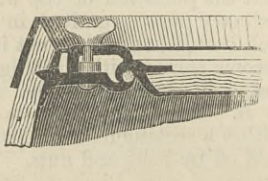


hollow sides, and with one end boarded in. When in use for rick drying and cooling it stands over the exhausting pipe and the air enters the hollow sides, and thus into the fan. The fan is 32in. diameter, 24in. wide, has radial wood blades, and was not entered for trial.

Messrs. Perkins and Co., of Hitchin, also showed a hand fan. The fan case is placed between two wood A standards, the apex of the A frames carrying a spindle, on which is mounted a large cog-wheel with 200 teeth geared into a pinion on the fan shaft having 14 teeth, the ratio of speed of fan to handle being 18·5 to 1, so that when the handles are turned at 50 turns per minute, the fan runs at 925 per minute. The fan in the centre of the case is 21·5in. diameter, with blades about 6·25in. square, but with the corner next the inlet side of the fan case cut off. The price of the fan is £5 10s., with a 12ft. length of square wood pipe 6·5in. square inside. This fan was not entered for trial. The same makers exhibited a winnowing machine fitted with a rotary screen placed below the ordinary sieves, and thus occupying a place usually nearly empty, and adding very materially to the efficiency of the machine. The screen is made of sheet iron, perforated with holes about 0·75in. × 0·125in.

Mr. G. Hathaway showed a very simple form of churn, for which the judges awarded a silver medal, the first, we





believe, ever awarded by the Society for a churn. The design of this churn can be gathered from the annexed diagram. This shows the churn in section. At its centre it is supported on a pair of struts jointed at both ends and at O O is a crank, which has its bearings on the wood frame, while the body of the churn rests in the crank. It will be seen that when this crank is turned the churn has a compound motion imparted to it by its following the motion of the crank, and the rocking motion imparted by its being placed on the rocking supports. This motion causes the cream to follow the directions indicated by the arrows forming the figure ∞, so that the cream dashes through itself twice in each revolution of the crank. The same makers show an ordinary end-over-end tub churn, but with a great improvement in the movable head and its fastenings. Inside the top of the tub and in the ordinary groove is an annealed and galvanised ring of iron shown beneath in section. The head is turned in one piece and is forced into another ring of the section shown, the thin lower edge of this ring being then turned over on to the wood. The joint is made by an india-rubber ring held in the head ring as shown.

THE PREVENTION OF FIRE RISKS WITH ELECTRIC LIGHTING.

THE Society of Telegraph Engineers and of Electricians have prepared the following rules and regulations for the prevention of fire risks arising from electric lighting, recommended by the Council in accordance with the report of the Committee appointed by them on May 11th, 1882, to consider the subject. The members of the Committee were Professor W. G. Adams, F.R.S., Vice-President; Sir Charles T. Bright, T. Russell Crampton, R. E. Crompton, W. Crookes, F.R.S., Warren De la Rue, D.C.L., F.R.S., Professor G. C. Foster, F.R.S., Past President; Edward Graves, J. E. H. Gordon, Dr. J. Hopkinson, F.R.S., Professor D. E. Hughes, F.R.S., Vice-President; W. H. Preece, F.R.S., Past President; Alexander Siemens, C. E. Spagnoletti, Vice-President; James N. Shoolbred, Augustus Stroh, Sir William Thomson, F.R.S., Past President; Lieut.-Colonel C. E. Webber, R.E., President.

These rules and regulations are drawn up not only for the guidance and instruction of those who have electric lighting apparatus installed on their premises, but for the reduction to a minimum of those risks of fire which are inherent to every system of artificial illumination. The chief dangers of every new application of electricity arise mainly from ignorance and inexperience on the part of those who supply and fit up the requisite plant.

The difficulties that beset the electrical engineer are chiefly internal and invisible, and they can only be effectually guarded against by "testing" or probing with electric currents. They depend chiefly on leakage, undue resistance in the conductor, and bad joints, which lead to waste of energy and the production of heat. These defects can only be detected by measuring, by means of special apparatus, the currents that are either ordinarily, or for the purpose of testing, passed through the circuit. Bare or exposed conductors should always be within visual inspection, since the accidental falling on to, or the thoughtless placing of other conducting bodies upon such conductors might lead to "short circuiting" or the sudden generation of heat due to a powerful current of electricity in conductors too small to carry it.

It cannot be too strongly urged that amongst the chief enemies to be guarded against are the presence of moisture and the use of "earth" as part of the circuit. Moisture leads to loss of current and to the destruction of the conductor by electrolytic corrosion, and the injudicious use of "earth" as a part of the circuit tends to magnify every other source of difficulty and danger. The chief element of safety is the employment of skilled and experienced electricians to supervise the work.

I. *The Dynamo Machine.*—(1) The dynamo machine should be fixed in a dry place; (2) it should not be exposed to dust or flyings; (3) it should be kept perfectly clean and its bearings well oiled; (4) the insulation of its coils and conductors should be perfect; (5) it is better, when practicable, to fix it on an insulating bed; (6) all conductors in the dynamo room should be firmly supported, well insulated, conveniently arranged for inspection, and marked or numbered.

II. *The Wires.*—(7) Every switch or commutator used for turning the current on or off should be constructed so that when it is moved and left to itself it cannot permit of a permanent arc or of heating, and its stand should be made of slate, stoneware, or some other incombustible substance. (8) There should be in connection with the main circuit a safety fuse, constructed of easily fusible metal, which would be melted if the current attain any undue magnitude, and would thus cause the circuit to be broken. (9) Every part of the circuit should be so determined that the gauge of wire to be used is properly proportioned to the currents it will have to carry, and changes of circuit, from a larger to a smaller conductor, should be sufficiently protected with suitable safety fuses so that no portion of the conductor should ever be allowed to attain a temperature exceeding 150 deg. Fah. N.B.—These fuses are of the very essence of safety. They should always be enclosed in incombustible cases. Even if wires become perceptibly warmed by the ordinary current, it is a proof that they are too small for the work they have to do, and that they ought to be replaced by larger wires. (10) Under ordinary circumstances complete metallic circuits should be used, and the employment of gas or water pipes as conductors for the purpose of completing the circuit should in no case be allowed. (11) Where bare wire out of doors rests on insulating supports it should be coated with insulating material, such as india-rubber tape or tube, for at least 2ft. on each side of the support. (12) Bare wires passing over the tops of houses should never be less than 7ft. clear of any part of the roof, and they should invariably be high enough, when crossing thoroughfares, to allow fire escapes to pass under them. (13) It is most essential that the joints should be electrically and mechanically perfect. The joint is whipped around with small wire and the whole mechanically united by solder. (14) The position of wires when underground should be efficiently indicated, and they should be laid down so as to be easily inspected and repaired. (15) All wires used for indoor purposes should be efficiently insulated. (16) When these wires pass through roofs, floors, or partitions, or where they cross or are liable to touch metallic masses like iron girders or pipes, they should be thoroughly protected from abrasion with each other or with the metallic masses, by suitable additional covering; and where they are liable to abrasion from any cause or to the depredations of rats or mice, they should be efficiently encased in some hard material. (17) Where wires are put out of sight, as beneath flooring, they should be thoroughly protected from mechanical injury, and their position should be indicated. The value of frequently testing the wires cannot be too strongly urged. It is an operation skill in which is easily acquired and applied. The escape of electricity cannot be detected by the sense of smell as can gas, but it can be detected by apparatus far more certain and delicate. Leakage not only means waste, but in the presence of moisture it means destruction of the conductor and its insulating covering, by electric action.

III. *Lamps.*—(18) Arc lamps should always be guarded by proper lanterns to prevent danger from falling incandescent pieces of carbon, and from ascending sparks. Their globes should be protected with wire netting. (19) The lanterns and all parts which are to be handled should be insulated from the circuit.

IV. *Danger to Person.*—(20) To secure persons from danger inside buildings, it is essential so to arrange the conductors and fitting that no one can be exposed to the shocks of alternating currents exceeding 60 volts; and that there should never be a difference of potential of more than 200 volts between any two points in the same room. (21) If the difference of potential within any house exceeds 200 volts, whether the source of electricity be external or internal, the house should be provided outside with a "switch," so arranged that the supply of electricity can be cut off.

TRIALS OF HAY DRIERS AT READING.—The trials of the hay drying apparatus of which we gave some account in our impression of the 7th inst., have proceeded but slowly until the last two or three days. A rick was made and completed by the Gibbs' hot-air drying machine and a Gibbs' fan and pipe attached. No heating has yet taken place and the fan has not yet been used. A rick was made with the semi-dry hay and partly completed by the Coultas fan, but the fan will probably be put to work on this rick again. A rick was made and the Bamlett hand fan kept at work for some time on it, and this is not yet completed. A rick was also built and the Phillips' hand fan attached ready for work. Other ricks were being built on Wednesday, and more grass is being cut for making experiments with other fans. Seven of the fans were tested by the Society on Wednesday, to the results of which we shall refer in another impression.

IMPORTS OF GRAIN.—The small but rising seaport of Fleetwood, at which large new docks were a few years back constructed, is now undergoing a further transformation at the hands of the railway companies. The Lancashire and Yorkshire Railway Company is pushing on the completion of large grain warehouses and elevators on the American principle, which have, in fact, been constructed from designs prepared by its own officials after a special inspection of the best types to be found in the United States. The warehouses and elevators are being built on a scale which will enable them to deal in bulk with any quantity of grain that can be brought into the docks, and by means of the American belt arrangement it will be lifted direct from the ship and distributed either into tubs in the warehouse or into wagons on the line or loaded from the warehouse by the same means. It is expected that a very considerable grain traffic will be diverted to Fleetwood when the arrangements are completed. In addition to the new warehouses and elevators for the grain trade, increased facilities are being provided for the rapidly developing passenger and cattle traffic between Fleetwood, Belfast, and the Isle of Man.

RAILWAYS IN WAR.—The following sketch from *St. Nicholas* for April, an American boys' journal, is not without interest. It refers, of course, to the American civil war:—"From daylight of Wednesday, December 7th, we marched, through rain and stiff mud, steadily towards the south, crossing the Notaway River on pontoons at 8 p.m., and halting at midnight for such rest as we could find on the cold, damp soil of a cornfield. Next day on again we went, straight towards the south, through Sussex Court-house at 10 a.m., halting at dusk near the Weldon and Petersburg Railway, about five miles from the North Carolina line. We soon learned that this was to be a winter raid on the enemy's communications, to destroy the Weldon road, and so render it useless to them. Never was railway more completely destroyed! The morning after we had reached the scene of operations, in the drizzling rain and falling sleet, the whole command was set to work. As far as the eye could see down the road were men in blue, divested of weapons and accoutrements, prying, and wrenching, and tearing away at iron rails and wooden ties. It was a well-built road and hard to tear up. The rails were what are known as T-rails, and each being securely fastened to its neighbour at either end by a stout bar of iron or steel which had been forced into the groove of the T, the track was virtually two long unbroken rails for its whole length. 'No use trying to tear up them rails from the ties, Major,' said an old railroader, with a touch of his cap, 'The plagued things are all spliced together at the j'ints, and the only way to get them off is to pry up the whole thing, rails, ties, and all, and then split the ties off from the rails when you've got her upside down.' So, with fence-rails for levers, the men fell to work, prying and heave-I-ho-ing, until one side of the road, ties, track, and all, pulled and wrenched by thousands of strong arms, began to loosen and move, and was raised gradually higher and higher. Forced at last to a perpendicular, it was pushed over and laid upside down, with a mighty cheer. Once the thing was started, it was easy enough to roll miles and miles of it over without a break. And so brigade after brigade did roll it; splitting off the ties, and wrenching away the rails. It was not enough, however, merely to destroy the track—the rails must be made forever useless as rails. Accordingly the ties were piled in heaps, or built up as children build corn-cob houses, and then the heaps were fired. The rails were laid across the top of the burning pile, where they soon became red hot in the middle, and bent themselves double by the weight of their ends, which hung out beyond the reach of the fire. In some cases, however, a grim and humorous conceit led to a more artistic use of the heated rails, for many of them were taken and carried to some tree hard by, and twisted two or three times around the trunk, while not a few of the men hit on the happy device of bending the rails, some into the shape of a U, and others into the shape of an S, and setting them up by pairs against the fences along the line, in order that, in this oft-repeated iron U S, it might be seen that Uncle Sam had been looking around in those parts."

INSTITUTION OF MECHANICAL ENGINEERS.—AS already announced, the summer meeting of this Institution will be held at Leeds, commencing Tuesday, 15th August, and the following provisional arrangements have been made. On Monday, the 14th August, the reception room will be open at the Town Hall, from 3 to 7 p.m., for the registration of addresses, issue of programmes, cards, &c. On Tuesday, 15th August, at 10.30 a.m., there will be a general meeting in the Civil Court, Town Hall, when the Mayor of Leeds, Mr. George Tatham, will attend and open the proceedings. The chair will then be taken by the president, Mr. Percy G. B. Westmacott, who will read an address to the members. A selection of papers will afterwards be read and discussed. At 1.0 p.m. luncheon will be provided in the Victoria Hall, Town Hall, by invitation of the Local Committee. In the afternoon there will be visits to works in Leeds and the neighbourhood. Members only admitted, except by special permission of the Local Committee. On Wednesday, 16th August, 10.30 a.m., general meeting in the Civil Court, Town Hall, for the reading and discussion of papers, Mr. Percy G. B. Westmacott, president, in the chair. At 1.0 p.m., luncheon in the Victoria Hall, by invitation of the Local Committee. In the afternoon there will be visits to works in Leeds and the neighbourhood. Members only admitted, except by special permission of the Local Committee. In the evening there will be a conversazione in the Philosophical Hall, by invitation of the Local Committee. Ladies' cards will be issued on application to the local secretaries. On Thursday, 17th August, at 10.30 a.m., there will be a general meeting in the Civil Court, Town Hall, for the reading and discussion of papers, Mr. Percy G. B. Westmacott, president, in the chair. At 1.0 p.m. luncheon in the Victoria Hall, by invitation of the Local Committee. In the afternoon there will be an excursion to Bradford, when the Exhibition of Textile Industries will be visited, and also the works of Messrs. Illingworth and Son, Messrs. S. C. Lister and Co., Messrs. Thwaites Brothers, and others. At 7.30 p.m. the annual summer dinner of the Institution will be held in the Victoria Hall—evening dress. Tickets can be obtained by members for themselves and their friends on application to the secretary, accompanied by a remittance for the amount—25s. per ticket. On Friday, 18th August, an excursion will be made to Hull by special train, provided free by the kindness of the North-Eastern Railway Company. At Hull, visits will be paid to various works, including those of the Hull and Barnsley Railway and Dock Company, by kind invitation of Messrs. Lucas and Aird. The return will be made to Leeds by special train, also provided by the North-Eastern Railway Company. Arrangements will be made for enabling members to leave the return train at the various junctions, so as to take ordinary trains going north and south. During the afternoons of Tuesday, Wednesday, anp Thursday, Messrs. John Fowler and Co. have invited the members to witness in operation their system of ploughing and cultivation by steam. The principal works in Leeds and the neighbourhood will be thrown open in the course of the week.

RAILWAY MATTERS.

THE railway to Government Gums, 410 miles from Adelaide, South Australia, has been completed.

THE contract entered into between the executive and the Government of the State of Guanajuato for the construction of a railroad in Mexico from Penjamo through Siloa to San Felipe has been approved.

THE Railway Rolling Stock Company, of Wolverhampton, have made a profit on the half-year of £3563, out of which the directors propose to pay a dividend at the rate of 3 per cent. per annum on the ordinary shares. There are now 4579 wagons in the possession of the company, and almost at the close of the half-year some satisfactory contracts have been obtained.

ON the occasion of their visit to the Wimbledon camp on Tuesday last, the Prince and Princess of Wales, quitting their barouche near the umbrella tent, entered one of the cars on the camp tramway, drawn by Messrs. Merryweather and Sons' noiseless tramway locomotive, and proceeded to the further end of the grounds accompanied by several members of the council, all expressing themselves very pleased with the arrangements.

THE Preston and Wyre Joint Committee are building a large new passenger station alongside the boats, with roofed-in staircases for high and low water, to enable passengers to embark or land entirely under cover, whilst their comfort on returning from a sea voyage or waiting for a boat is being specially provided for by an arrangement of refreshment and waiting rooms on an extensive scale. For the cattle trade a large number of pens are being provided with subways at a low level, so that the cattle can be landed without in any way crossing the line of rails.

THE Union Rolling Stock Company, of Birmingham, report that their operations during the past half-year have been satisfactory and profitable. Numerous applications for rolling stock have been received, and contracts for over £14,000 have been entered iuto. The accounts for the half-year show a profit of £3800, out of which the directors propose to pay an ordinary dividend at the rate of 10 per cent. per annum, and to place £2000 to the reserve fund. It is proposed to make a call of £4 per share upon the fourth issue of ordinary shares, the whole to be payable by the 1st of January next.

MONDAY last was the fiftieth anniversary of the opening of the Leicester and Swannington Railway. The first train on the line was run on July 17th, 1832, and at that time only one or two other railroads had been opened. A Leicester paper says, "It must be gratifying to Leicester people to know that Leicester men and this neighbourhood are inseparably linked with the commencement of an enterprise which has, in fact, revolutionised the world. A good deal is heard just now of improved brakes, and it may not be uninteresting to mention what has already been pointed out by Mr. C. E. Stretton, in his 'Few remarks on railway accidents,' that as long ago as 1832 George Stephenson invented a brake to act through the medium of the buffer rods. It was used on the Leicester and Swannington line, but appears to have been abandoned, 'in consequence of the difficulty of backing the train.'"

TWO distinct rock drills are used in the Arlberg Tunnel. That on the east side is the Ferroux drill, which has rendered such good service in the St. Gothard; and that on the west the Brandt rotary perforator, which works by water under pressure. It has already given good results at Pfoffensprung, and the inventor guarantees a minimum advance of 2 metres a day, which has been considerably exceeded. The motive power is obtained by water wheels erected in the valley which separates the two slopes of the Arlberg. The following figures give the progress from the commencement, 17th November, 1880, to the end of February last:—Advance of heading, 320 metres = 350 yards; mean daily advance, 3·07 metres = 10ft.; number of blasting operations, 295; advance for each operation, 1·08 metres = 3ft. 6in.; number of shots in each operation, 19; weight of dynamite used for each metre of advance, 22 kilogrammes = say 44 lb. per yard.

AT the end of 1880 the lines constructed by the State reached a total length of 1,089,914 metres; those constructed by companies and bought by the State, 1,378,357 metres; and those constructed by companies and worked by the State, of 323,243 metres; making a total of 2,791,514 metres, or 1731 miles. Of this length, 94·91 per cent. are passengers and 5·09 per cent. exclusively goods lines. The number of stations on 1st January, 1881, was 83 principal and 499 intermediate, making a total of 582. There were 195 level crossings unguarded, and 223 ditto guarded at a yearly expense of 145,000f. = £5800; but in 1880, 14, including three guarded, were suppressed at a cost of 19,850f.=£794. On 1st January, 1881, the number of guards at level crossings was 3966, causing an annual expense of 2,676,960f. = £107,078 8s. There were at the end of 1880, 165 interlocking points and signals, all on the Saxby and Farmer system, except two by Bemelmans and Lamquet. The construction and working of private sidings and branch lines in junction with the State railways was regulated by the decree of 25th October, 1880, which has the effect of increasing their number. There were at the end of 1880, 480 junctions of private sidings with the main line and 42 private stations.

THE Pintsch system of lighting railway carriages is now in use in America. A train of two coaches and a postal car was taken, on the 12th inst., from Jersey City to Turner's and return, to exhibit the light, and is thus described in the *Scientific American*:—"The lamps were supplied with gas compressed in reservoirs under each car, the tubular receiver having a capacity of 344ft. of gas, under compression of 8½ atmospheres, or 127 lb. to the square inch. From this tubes ¼in. in diameter run to the various burners. A regulator, consisting of an ingeniously weighted valve, prevents the gas from flowing too rapidly, and secures an even escapement, despite the varying pressure. The burners are of the fish-tail pattern, composed of steatite, and of about 1ft. capacity per hour. Of these, in the mail car, there were thirteen, each of 17-candle power—Bunsen's photometer—and in the other cars four groups of five burners each, of about the same power. The gas is manufactured by the decomposition of shale oil refuse, and fats generally, and consists mainly of olefiant gas and other heavy hydrocarbons. This is stored under a pressure of ten atmospheres in reservoirs near the track, whence, through stout rubber tubes, the car receivers may be charged in from one to three minutes. On the return to Jersey City, after four hours' burning, the pressure in the reservoirs was found to have been reduced only two-thirds of an atmosphere. It was said that the mail car had been run to St. Louis and back with one supply of gas."

FOR the year ending with May, the record of American railway accidents is as follows:—June: accidents, 73; killed, 31; injured, 78. July: accidents, 102; killed, 38; injured, 122. August: accidents, 129; killed, 31; injured, 67. September: accidents, 144; killed, 56; injured, 227. October: accidents, 131; killed, 31; injured, 133. November: accidents, 133; killed, 50; injured, 120. December: accidents, 113; killed, 36; injured, 96. January: accidents, 137; killed, 41; injured, 198. February: accidents, 88; killed, 23; injured, 69. March: accidents, 99; killed, 29; injured, 101. April: accidents, 81; killed, 18; injured, 61. May: accidents, 94; killed, 24; injured, 86. Total: accidents, 1324; killed, 408; injured, 1358. Total same months 1880-81: accidents, 1403; killed, 379; injured, 1642. Total same months 1879-80: accidents, 869; killed, 205; injured, 731. The averages per day for the month were 3·03 accidents, 0·77 killed, and 2·77 injured. For the year they were, 3·63 accidents, 1·12 killed, and 3·72 injured. The average casualties per accident were, for the month, 0·255 killed and 0·915 injured; for the year, 0·308 killed and 1·026 injured. The averages per month for the year were 110 accidents, 34 killed, and 113 injured, against similar averages of 117 accidents, 32 killed, and 137 injured in 1880-81, and of 72 accidents, 17 killed, and 61 injured in 1879-80. Compared with last year the present year shows an improvement, but it is far behind the previous year's record.

NOTES AND MEMORANDA.

THE following compound for general use as a grease eradicator is recommended by the *Chemist and Druggist*:—Castile soap in shavings, 4 oz.; carbonate of soda, 2 oz.; borax, 1 oz.; aqua ammonia, 7 oz.; alcohol, 3 oz.; sulphuric ether, 2 oz. Soft water enough to make one gallon. Boil the soap in the water until it is dissolved, and then add the other ingredients.

PROFESSOR LOOMIS states that the heaviest rainfall is met with in the rain-belt which surrounds nearly the whole globe lying between the north-east and south-east trade-winds. Mr. W. J. Black, having been engaged in collecting records of rainfall at sea for some time back, gives an estimate of the rates per annum for this rain-belt. That for the Atlantic Ocean is calculated at 133·37in. per annum, that for the Indian Ocean at 80·55in. per annum, that for the Austro-Chinese Seas at 107·96in.; but none has yet been made out for the Pacific Ocean, owing to absence of observation altogether from that quarter.

AT a recent meeting of the Berlin Physical Society Dr. Kaiser showed a moment-shutter for instantaneous photographs in which, on pressing a small capsule with the hand, two pendant valves before the aperture are raised, and meet one over the other. The time during which the light can penetrate by the aperture into the apparatus is 1-20th second; but by a simple alteration in the apparatus, the mechanism can be so altered that the light coming from above—that of the sky and clouds—acts a much shorter time than that from other objects, so that with 1-20 second of illumination, the exposure for the sky is not excessive.

TO cleanse a soiled chamois leather, make a solution of weak soda and warm water, rub plenty of soft soap into the leather, and allow it to remain in soak for two hours, then rub it well until it is quite clean. Afterwards rinse it well in a weak solution composed of warm water, soda, and yellow soap. If rinsed in water only it becomes hard when dry, and unfit for use. The small quantity of soap left in the leather allows the finer particles of the leather to separate and become soft like silk. After rinsing, wring it well in a rough towel, and dry quickly; then pull it about and brush it well, and it will become softer and better than most new leathers.

THE mines inspector for North Staffordshire, Cheshire, and Shropshire, Mr. Thomas Wynne, reports that the number of persons employed in the various mines under his jurisdiction during last year was 24,499 against 22,852 in 1880; the quantity of minerals raised was 8,644,382 tons against 7,576,400 tons; the number of persons employed to each fatal accident was 583 against 476; the number to each life lost was 318 against 206; the tons of mineral raised for each fatal accident were 205,818 against 157,842; tons to each life lost, 112,261 against 68,265. The number of mines was 240 against 245, and the non-fatal accidents were 343 against 321.

FOR some time past Belgian distillers have been using a seed or kind of corn called *Dari* for the production of alcohol, and we believe it is also used to some extent in Ireland. This grain is imported chiefly from Egypt and Syria, and its composition is as follows:—

	Egyptian Dari.	Syrian Dari.
Water	10·05	9·97
Nitrogenous constituents	7·05	9·88
Fat	6·11	3·52
Extract free from nitrogen	74·20	72·22
Husk	0·97	1·63
Ash	1·62	2·18

This dari is, no doubt, the same as the *Dhoura* from which the Nubians make a kind of beer called *bouza*, and as its price is very low, it probably might be used advantageously as a brewing material.

AT the meeting of the Paris Academy of Science on 27th March, M. Jacquelain pointed out that carbon for the electric light should be purer than that obtained by calcining wood; and, if not free from hydrogen, should at any rate, contain no mineral impurities. There are three methods for accomplishing this result:—(1) By the action of a jet of dry chlorine gas directed on the carbon, raised to a light red heat; (2) by the action of potash and caustic soda in fusion; and (3) by the action of hydrofluoric acid on the finished carbons. M. Jacquelain has prepared carbons by all three methods, and has summed up, in a table, the photometric results of his experiments. He comes to the conclusion that the luminous power and the regularity of the voltaic arc increase in direct ratio to the density, hardness, and purity of the carbons. He remarked, incidentally, says the *Journal* of the Society of Arts, that the natural graphitoïd of Siberia possesses the singular and unexpected property of acquiring, by purification, a luminous capacity double that which it has in the natural state, and which exceeds by one-sixth that of pure artificial carbons.

A CORRESPONDENT of the *Moniteur Industriel* refers to the difficulties encountered in tracing upon cloth or calico, especially the difficulty of making it take the ink. In the first place, the tracing should be made in a warm room, or the cloth will expand and become flabby. The excess of glaze may be removed by rubbing the surface with a chamois leather, on which a little powdered chalk has been strewn; but this practice possesses the disadvantage of thickening the ink, besides, it might be added, of making scratches which detract from the effect of the tracing. The use of ox-gall, which makes the ink "take," has also the disadvantage of frequently making it "run," while it also changes the tint of the colours. The following is the process recommended:—Ox-gall is filtered through a filter paper arranged over a funnel, boiled and strained through fine linen, which arrests the scum and other impurities. It is then placed again on the fire, and powdered chalk is added. When the effervescence ceases the mixture is again filtered, affording a bright, colourless liquid, if the operation has been carefully performed. A drop or two must be mixed with the Indian ink; and it also has the property of effacing lead pencil marks. When the cloth tracings have to be heliographed raw sienna is also added to the ink, as this colour unites with it the most intimately of any, besides intercepting the greatest amount of light.

DR. BJERKNES has advanced beyond the results of his experiments shown at Paris. These were chiefly confined to illustrating the static attractions and repulsions of electricity and magnetism, but he has now taken up the subject of electro-dynamic attractions and repulsions. The former effects are shown by brass balls oscillating, or by small drums pulsating near each other in water. These motions are communicated to the balls and drums by pulses of air transmitted from an ingenious air-pump or bellows along india-rubber tubes. A pulsating drum corresponds to a magnetic pole; an oscillating body to a magnet. When two drums are vibrating near each other in like phase, they attract; when in unlike phase, they repel each other. The same holds true of the oscillating balls. The motion-lines round these bodies correspond to the lines of force round magnets, as was demonstrated by a hollow ball oscillating on a stem, and tracing its movements in ink on a glass plate. The more novel part of the experiment, *Nature* says, consisted in representing the attraction between two electric currents flowing in the same direction by means of two cylinders about 5in. long and 1in. in diameter, oscillating round their longitudinal axes at close quarters in the water. The cylinders were oscillated by means of a pulsating drums which communicated its motion to them by a toothed gearing on their ends. Attraction resulted when the oscillations of the cylinders were opposed to each other, and repulsion when they were in the same direction. A square of four oscillating cylinders was also formed, and a fifth cylinder oscillated inside it, the attraction or repulsion exerted on the latter being observed. A hydrodynamic galvanometer was made by placing an oscillating ball beside an oscillating cylinder, the result being a deflection of the ball according to the direction of the oscillation of the cylinder.

MISCELLANEA.

THE FitzGerald incandescent lamp has been exhibited as a street lamp in Westminster Bridge-road by the Phœnix Electric Light Company.

AN interesting pamphlet, entitled "The United States and the Panama Canal," by Mr. Axel Gustafson, of New York, has been published in London by Mr. W. Ridgway. It deals with the political history and prospect of the undertaking.

A NEW Government graving dock, which is to be made at Cockatoo Island, Sydney, at a cost of £150,000, will be excavated almost entirely out of sandstone rock, will be capable of receiving the largest vessel afloat, and it will be lighted by electricity.

AT the anniversary meeting, held at the Royal Institution, on Thursday, July 13th, the Duke of Northumberland in the chair, an address was delivered by Mr. Edward C. Robins, F.R.I.B.A., entitled "The Work of the Sanitary Institute of Great Britain."

A PETROLEUM pipe, constructed from the Couban oil territory over the Caucasus Mountains to Novoroszisk Harbour, on the Black Sea coast, was opened in May last. It is said to be 105 miles long, with a daily capacity to deliver 30,000 puds (about 1,000,000 lb.) of petroleum.

THE revenue of the Tees Conservancy Commission for June amounted to £4571 6s., or at the rate of nearly £55,000 per annum. With such a splendid revenue there is no wonder that the Commissioners are able to do great things, and that the Tees is likely to become of first importance to the country as a navigable river.

AT an important county meeting held at Shrewsbury on Tuesday it was determined to invite the Royal Agricultural Society to hold their show of 1884 in that town. It was explained that at present there were no other competitors for the honour in the field, and a committee was appointed to carry out the object of the meeting.

MESSRS. CHUBB AND SON, the celebrated safe and lock makers, propose to remove the lock works which they have had for fifty years in Wolverhampton, and where they now employ 120 workmen, to their safe-making premises in Old Kent-road, London. It is expected that the removal will take place at the close of this year. The object of the firm is a concentration of their departments.

THE port of Bordeaux, like those of Havre and Marseilles, is, it is said, to be provided with boat elevators for mechanically unloading grain vessels. The steam motor is replaced by an electric motor. This change allows the boats to be employed during the day for unloading grain, while during the night they are changed into lighthouses, for producing a powerful electric illumination of the harbour. These movable electric lighthouses will also serve, during the approaching exposition, for the nautical festivals upon the river at night.

OWING to overwhelming financial difficulties, the friends of Mr. William Conisbee, the well-known inventor and maker of printing machinery and bookbinding plant, have formed themselves into a committee for the purpose of obtaining for Mr. Conisbee as much pecuniary help as possible. Mr. John Esson, Elim Works, Fetter-lane, has headed the subscription list, and will be glad to receive any subscriptions, however small, in favour of one who has done so much to perfect printing machinery and apparatus, but who now seriously wants help. The committee meet on Monday evening next at Anderton's Hotel, at 7 p.m.

A LARGE number of machine tools have been sent this week by Messrs. Scriven and Co., of Leeds Old Foundry, Leeds, to the Elsinore Iron Shipbuilding and Engineering Company, Elsinore, Denmark, for their new works. Amongst other tools Messrs. Scriven and Co., have sent is their new invention—a vertical plate-bending machine, for bending cold steel plates any length for marine boilers, and radial drilling machines, for drilling all the holes in a keel bar at one setting; also slotting machines and large boring machines, for the manufacture of marine engines; large vertical punching and shearing machines, for marine boiler building and shipbuilding; lathes, drilling machines, &c.

MR. J. P. BAKER, the inspector for South Staffordshire and East Worcestershire, reports that 410 mines or collieries were at work during the year, and that 17,887 persons were employed underground, and 5919 above ground, making a total of 23,806, which was an increase compared with the previous year of 313. The quantity of all kinds of minerals raised was 10,421,683 tons, which was an increase upon 1880 of 287,250 tons. There were forty accidents during the year. From these there resulted forty-one deaths, which was a decrease of four on the preceding year; and 300 persons were more or less injured, but only two of them, it is believed, permanently. The low death-rate is remarked upon by the inspector as a most cheering and satisfactory feature.

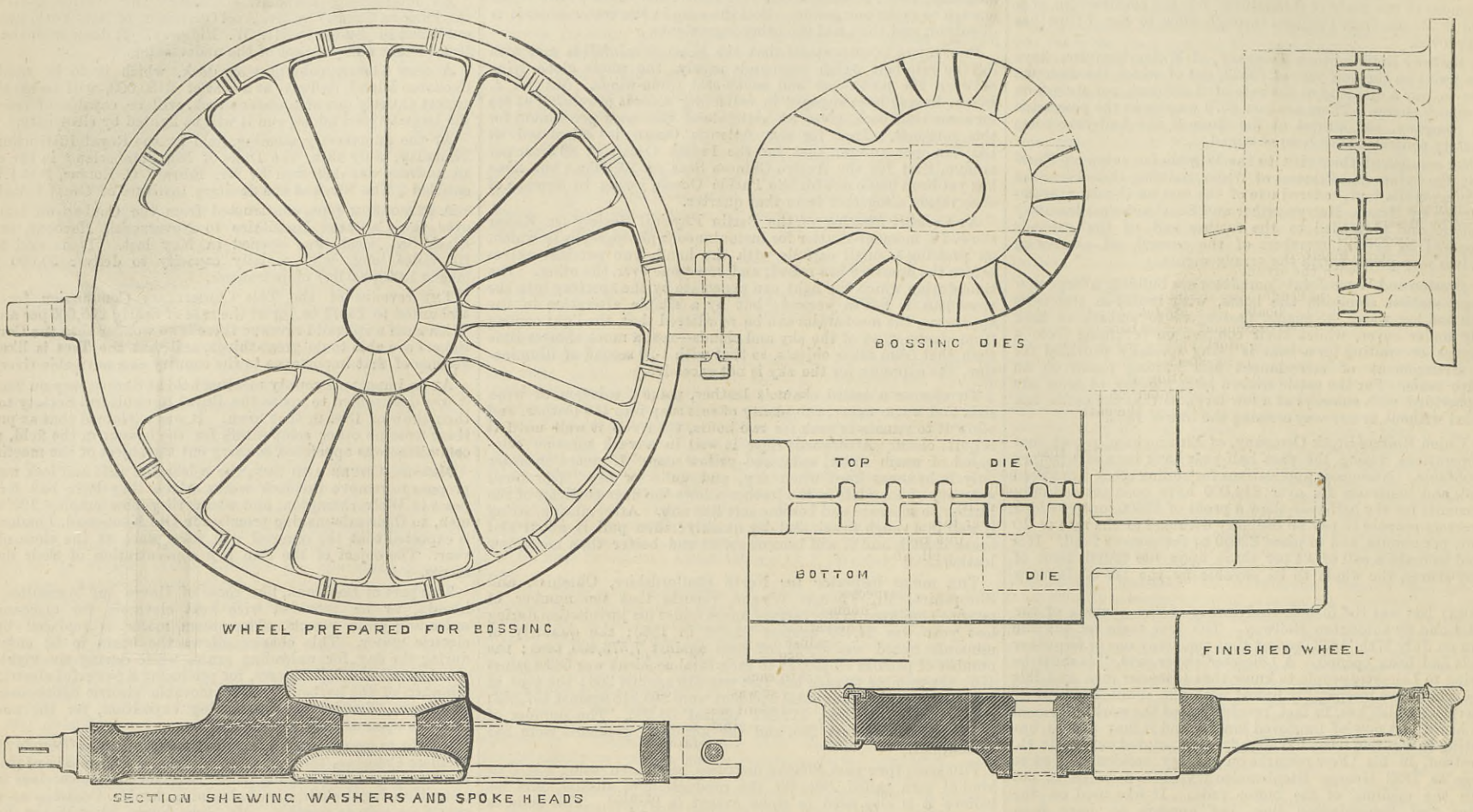
AFTER an installation of four years standing, which has given entire satisfaction and been entirely free from repairing expenses, the firm of J. Bury, dyer and finisher, Salford, has made an addition of two of the British Electric Light Company's Gramme machines. The making up room was formerly lit by ninety gas burners, rendering the atmosphere very unpleasant during night-work. These have been replaced by sixty incandescent lamps. In the room is fixed a regulator, which enables the foreman to put out any number of lights he requires. The dye-house is lit by two Brockie lamps, which enable the foreman to match his colours at night as well as in daylight. The whole of the arrangements were carried out by Messrs. H. Bury and G. Tyndall, electric engineers and agents for the British Electric Light Company, Manchester.

ADMIRAL SIR JOHN HAY and Lord Charles Beresford, captain of the Royal yacht Osborne, recently inspected the working of Messrs. Wilkinson and McGonnell's safety locking apparatus for detaching ships' boats at sea, and wrote certificates that it was one of the best they have seen. It is to be tried on one of the Folkestone-Boulogne steamships of the South-Eastern Railway Company. Inventions to effect the object are legion, and some of them very effective, but not likely to be much adopted unless legal compulsion should secure that result in the future. Mr. McGonnell is the coastguard officer at Folkestone who worked so assiduously for weeks in recovering and burying the bodies from the Grosser Kurfurst, in recognition of which service the Emperor of Germany has since presented him with a gold watch; the Empress of Germany furthermore presented Mrs. McGonnell with a brooch consisting of a Geneva cross in enamel set in gold, since German officers and others were constantly calling at her house for a month or more while the sad work was in progress.

THIS week there has been opened at Worcester with much ceremony a three months' Industrial and Fine Art Exhibition, which in point of size and in some other respects will bear comparison with any recent exhibition which has been held in the provinces. The movement originated with the committees of the Worcester Public Library and School of Art, and it was endorsed by a large and representative public meeting. The exhibits are in a large building at Shrub Hill, formerly used as a locomotive works. There is a superficial area of 54,000ft., and the whole of it is occupied. It is apportioned into a central nave and four courts—two upon each side. The whole of one of the courts is devoted to machinery in motion, and two of the others to industrial exhibits. Among these last are immense samples of iron, cold tied and otherwise manipulated, with the view of showing the excellent texture of the well-known "Round Oak" brands of the Earl of Dudley and that of Messrs. Noah Hingley and Son, of Netherton. The latter firm show a length of cable and bower anchor of a new Cunard steamer now in course of construction at Glasgow. The machinery in motion illustrates mainly the moulding of pottery and the weaving of textile fabrics. The pottery processes are shown by the Worcester Royal Porcelain Company, Limited, while those of weaving derive their illustrations from the Kidderminster carpet trade. The leading machine features of glove manufacture, boot and shoe making, printing, needle manufacture, pin making, the manufacture of butter, the weaving of wire knitting, &c., are also to be seen

WHEEL MAKING BY THE HYDRAULIC PRESS AT THE NORTH BRITISH RAILWAY WORKS.

MR. D. DRUMMOND, LOCOMOTIVE SUPERINTENDENT, COWLAIRS.



Railway wheels, both for locomotives and wagons, are now made at the Cowlairs Works of the North British Railway by hydraulic machinery, with a saving of 50 per cent. over the previous system of hand work; and the successful results achieved led the locomotive superintendent, Mr. Drummond, to the conclusion that the hydraulic press is destined to play a large part in the future production of forgings.

In the first instance, Mr. Chalk, the forge manager, was induced to try the experiment of bossing wheels by the hydraulic press put down for flanging plates; and the result was so satisfactory that a press was put up specially for the purpose by Messrs. Brown Brothers and Co., of the Rosebank Ironworks, Edinburgh, on the system of additional pull-back cylinder, described and illustrated in The Engineer in connection with the Glasgow meeting of the Institution of Mechanical Engineers. Mr. Chalk next improvised a V-ing press for filling up the V-shaped spaces in the rim of the wheel from the cylinder of a disused hydraulic press for forcing wheels on the axle, and a pair of old locomotive frames. This also answered his expectations, so that three special V-ing presses were ordered; and the original one was relegated to the duty of "dabbing" the sections of rim on to the ends of the spokes, which was at first performed under the steam-hammer.

The spokes are roughed-out under the hammer at the rate of 150 a day; and, while one is being finished the heat is brought on for the next, so that there is no loss of time. They are sheared to length, heated, and then upset in a block shaped like the jaws of a vice. While one man is doing this, another is preparing the rim iron, both spoke and rim being heated in an ordinary smith's fire. The sections of rim are then "dabbed on" at the rate of 140 an hour by five men, all strikers—indeed, there is not a smith in the whole wheel department. The spokes are arranged on a plate, and a ring is dropped over them and screwed up tight. Thus held, the centre of the wheel is raised to a welding heat. A couple of washers, roughed out under the hammer from a scrap bloom, are put on to form the boss. The wheel is then put in the bossing press, and a single descent of the ram suffices to effect a thorough weld. The press is capable of bossing 24 wagon wheels in a day; and the eighty welds to ten wheels form a day's work for three men and a boy.

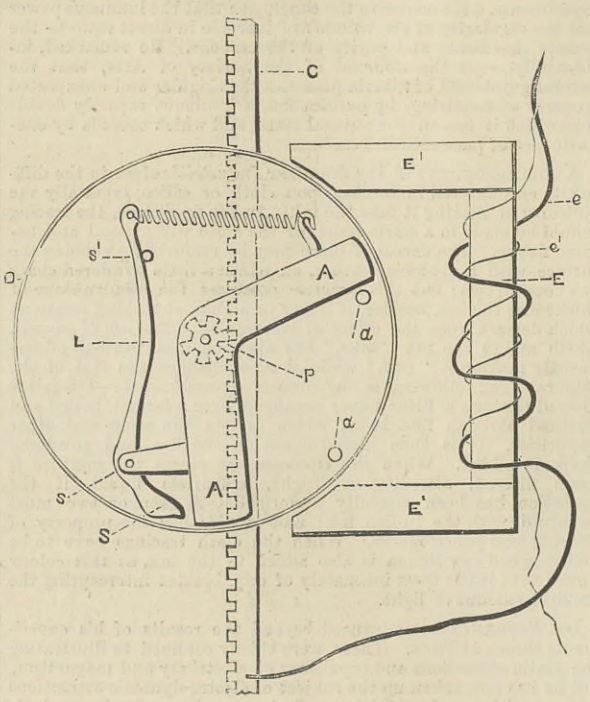
The accompanying sketches show the method and tools adopted for making the driving wheels of locomotives. The three-spoke crank bosses, with or without solid counterweight, are roughly forged by the hammer, and then stamped out under it in special dies, with a second and moderate heat, at the rate of 40 or 50 a day. The spokes are forged under the hammer in special blocks at the rate of 100 a day; they are dished out for receiving the bosses as shown in the section of wheel in progress. When the spokes are put in position in the temporary ring, the wheel is put into a horizontal wheel furnace, and bricks and foundry sand are placed between the spokes to protect them. The blast comes through the axle hole, and is deflected on to the top of the boss by a hood. When a welding heat is attained, the bricks are loosened, so as to fall out on lifting the wheel to form the boss; one washer is put on in the furnace and fixed by a blow or two with the sledge-hammer. The wheel is then turned over, and the other washer put on, when the boss is welded up in the press between the dies shown in sketch. The bossing of engine wheels, which formerly cost 28s. by hand, is now done for 14s. in the press.

Including wheels, 100 tons of forgings are turned out every fortnight; and of the 250 men in the forge department, all are on piecework except two who are engaged in repairing tools. The system of stamping out parts under the hammer is being largely applied with considerable saving in cost. Draw hooks and hinges are stamped out by a striker in three or four blows at the rate of 150 a day; they are then dressed by a smith at about 60 a day, and are finished in dies under the steam hammer, with plenty of water to fetch off the scale. In the case of hinges for covered vans, the lugs are welded on to a piece of flat bar, in special tools, at the rate of sixty a day. Shackles for the screw couplings of carriages are turned out at three half-pence for the two eyes; and spanners are stamped out of bar iron at 4d. for the two ends and welding in the middle. Hand-rail ballusters are finished in dies under the hammer, and put on black, without being touched by a file or machine.

We are indebted to Mr. D. Drummond, locomotive superintendent of the North British Railway, and his forge manager, Mr. Chalk, for the sketches and for the above interesting particulars as to cost and manufacture.

THE "DIAMOND" ARC LAMP.

There are so many arc lamps now competing for public favour that it is difficult to get a distinctive name for each. The designer generally christens his lamp with his own name, or rather it becomes customary to call it by the inventor's name—thus the Jablochkoff, Siemens, Brush, Crompton, &c. Are these to be followed by the Diamond, Pearl, Ruby lamps, as well as the Sun lamp, and so on? Have the hundred-and-one designers of these lamps ever carefully studied the problem they have sought to solve? It seems not or they might have



seen that the mere designing of an arc lamp is not the be-all and end-all of the requirements of an arc system. However, just now we have to describe a piece of apparatus, not to discuss the details of a problem. The "diamond" lamp is made from the designs of Mr. C. D. Haskins, of New York, one of the foremost electricians in America. It is simple, and when exhibited at 374, Euston-road, seemed to burn steadily. The arc lamp has a future before it, but not so grand a future as the incandescent lamp. At any rate, whatever be its utility, fewness of parts and simplicity of construction must have their weight, and Mr. Haskins' lamp possesses in this direction some advantages. In it the lower carbon is fixed, and the feeding mechanism applied only to the upper carbon. The figure will enable the reader to understand the mechanism. The toothed rack C carrying the upper carbon holder gears into the pinion P fastened to the centre of the disc or drum D, which rotates as the carbon ascends. Gravity is the acting force to lower the carbon. The downward movement is regulated by a brake applied to the rim of the disc, and as the disc may have a large diameter, a small force is sufficient for the purpose of regulation. The brake, in fact, acts at the end of the long arm of a lever. The brake is shown at S, the end of the bent lever L is pivotted at s to the armature A A. This armature is pivotted at the centre of the disc D, and moves freely under the action of the poles E^1 E^1 of the electro-magnet E. On account of the manner in which the armature A A is hung between the poles of the magnet E, a very slight attraction serves to deflect it, and as the leverage with which the attractive force acts upon the armatures decreases as it approaches the poles, the magnetic pull varies uniformly throughout the entire movement, instead of being subject to a violent variation, as is the case when an armature approaches the poles in the line of the magnetic attraction. The core of the magnet E is wormed with a thick, e, and a thin, e^1, wire. The main current goes through the former, while the latter acts as a shunt around the arc. The action of the lamp is thus described: When the carbons are together, by far the greater part of the current goes through e. The armature is attracted and carries with it the brake, which clamps against the rim of D. Any further motion of the armature slightly rotates the disc and thus raises the upper carbon, establishing the arc. As the arc lengthens the current weakens, the action of the magnet on the armature decreases, and gravity lowers the carbon. When the position in which the lever L at its upper end bears against the stud s^1, the brake is released and the carbon free to slide down. The lamp is said to adjust itself to the current. If the current is weak the disc is rotated to an exceedingly slight extent and the arc is very short; if, however, the current is strong the attractive force is greater, the disc moves further, and the arc is proportionately lengthened. When only the coil e is on the magnet, the light remains constant with a constant current only. If the current fluctuates the lamp does so likewise. To counteract this the coil e^1 is used. It provides a path for the current around the arc, and as the arrangement provides for the currents in the coils opposing each other, the action is somewhat similar to that of a governor or regulator. If any abnormal resistance occurs in the main circuit the whole current goes through coil e^1, the armature remains unattracted, and the upper carbon falls rapidly into contact with the lower, when the arc is re-established as above described.

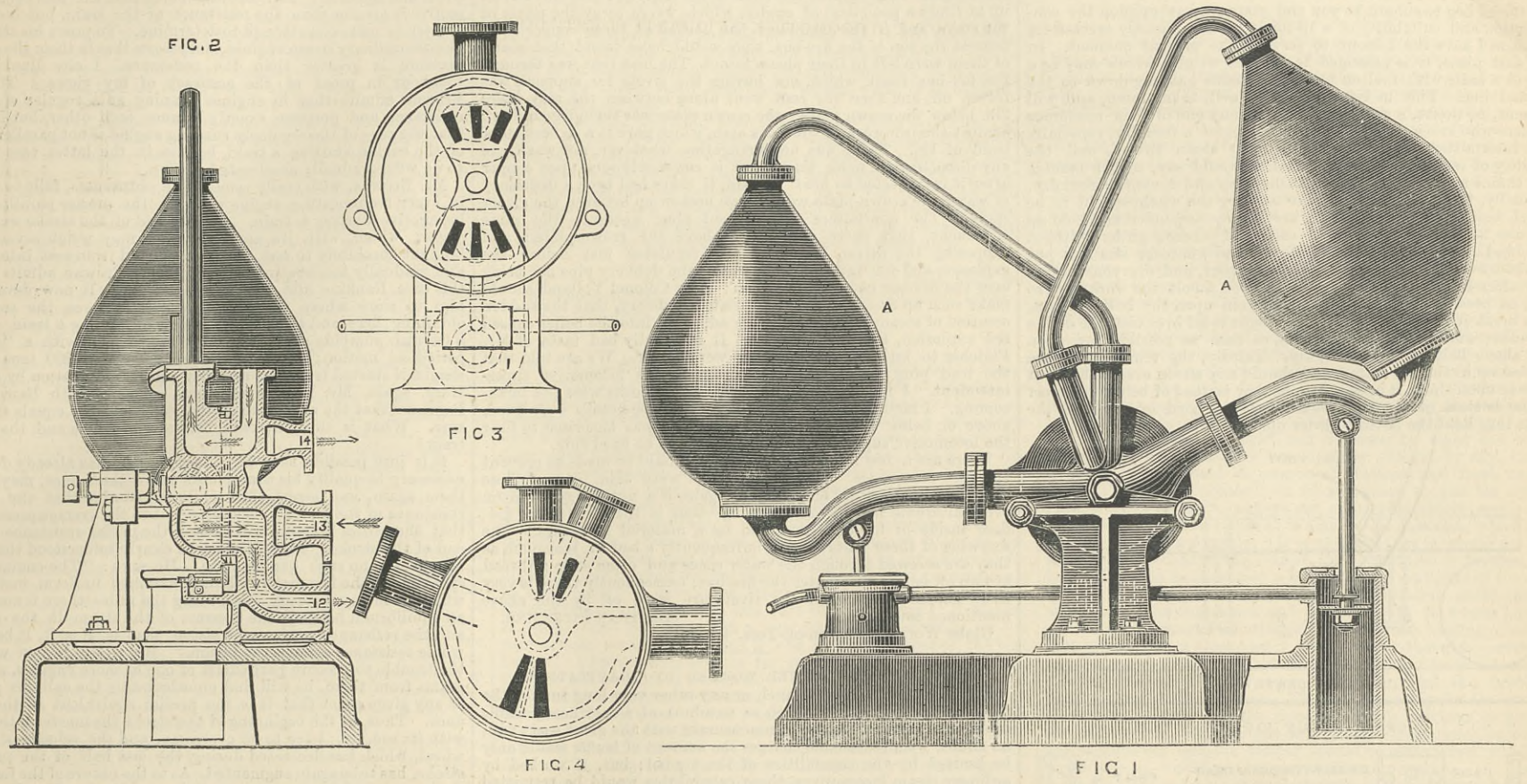
THE NIEDERBAUM SWING BRIDGE, HAMBURG.

In our impression for June the 23rd we commenced a description of a remarkable low-pressure hydraulic swing bridge in Hamburg. We give now at page 48 the first of a series of engravings illustrating this bridge. We shall reserve our description until we publish more engravings. It will suffice to say now that Fig. 1 is a general elevation of the structure; Fig. 2 is a plan of Fig. 1 showing the bridge open; Fig. 3 shows the site of the bridge between the Niederhafen and the Binnenhafen, opening off the North Elbe; Figs. 4 and 5 show details, the explanation of which will follow in due course.

New Railway.—The new line constructed by the Great Northern Railway Company between Leicester and Tilton was officially inspected on Wednesday by Major Marinden, R.E., on behalf of the Board of Trade. The line is about eleven miles in length, joining the Great Northern and London and North-Western joint section from Market Harboro' to Nottingham, and opening up the Leicester and Lincolnshire district.

Fire Protection of Haslar Hospital.—A new double-cylinder steam fire-engine, supplied by Messrs. Merryweather and Sons, of Greenwich and Long-acre, for Haslar Hospital, was tried at the hospital a few days ago. The engine is precisely similar to those supplied to her Majesty's Dockyards at Gosport, Portsmouth, Chatham, Deptford, Devonport, and for Gibraltar and Hong Kong, &c., in connection with the War-office; an engine of exactly the same size and type is also stationed at Canterbury Cathedral, and threw a jet of water 10ft. over the highest tower, or a total height of 320ft. from the ground, this being the best performance of a steam fire-engine on record. The engine has the "Field" drop tube boiler, and is capable of throwing 620 gallons per minute. The tests undertaken were of a very severe character, and we believe gave every satisfaction to the authorities.

THE FROMENTIN BOILER FEEDER.



THE accompanying engraving illustrates a French boiler feeder of the well-known "Bird fountain" type, which is now being introduced by Mr. Hayes, of 27, Leadenhall-street. We have seen the feeder at work on a single-flued stationary 20-horse power boiler, and it undoubtedly performs very well indeed. By reference to the accompanying illustrations, which represent the apparatus proper, it will be seen that Fig. 1 is a front elevation of the apparatus, Fig. 2 being a cross section through the same showing the steam and water passages; Figs. 3 and 4 are separate and detailed views of the two discs, Fig. 3 being stationary on the one fixed to the bed-plate, and Fig. 4 represents the movable disc, or that to which the two bottles are attached, whilst the boiler feeder is placed above and resting upon the brickwork of the boiler. The water supplied to this apparatus reaches the same from a small supply tank, the tank itself being supplied from the ordinary water service pipes or large overhead tank to be found on most works where steam power is used. The admission of water into this small open tank is regulated in the usual manner by a ball cock tap; when the water is preferred hot before going into the boiler a coil may be placed in this tank, and the exhaust steam from an engine passed through the same in the usual way, as whether hot or cold feed is used the apparatus works equally well, and can take the water at any temperature, no matter how high.

The Fromentin feeder is mainly composed of two pear-shaped vessels or "bottles" A A circular in cross section, and each holding about 12 gallons, these two bottles being connected to the central disc by means of two sets of pipes, those communicating between the upper part of the circular disc and the top of the two bottles being for steam, whilst the pipes connected to the bottom of the same are for the passage of the water into and out of the apparatus. The steam finds its way from the boiler through the former pipes just referred to alternately into each bottle each time the apparatus moves or makes a stroke, this taking place whenever the water level in the boiler is lower than the end of a dip pipe inside the boiler, the function of which is to supply steam to the apparatus whenever by evaporation the end of the pipe has become unsealed by the fall of the water level in the boiler. This steam supply pipe finds an inlet to the apparatus at 11, Fig. 2; the outlet for the return non-condensed steam and water to the tank above is at 14, Fig. 2; the water supply inlet to the apparatus at 13 and the delivery to the boiler at 12, the water passing into the boiler through an ordinary check or back pressure valve in the usual manner, the arrows at each of the passages in Fig. 2 giving the direction of both steam and water.

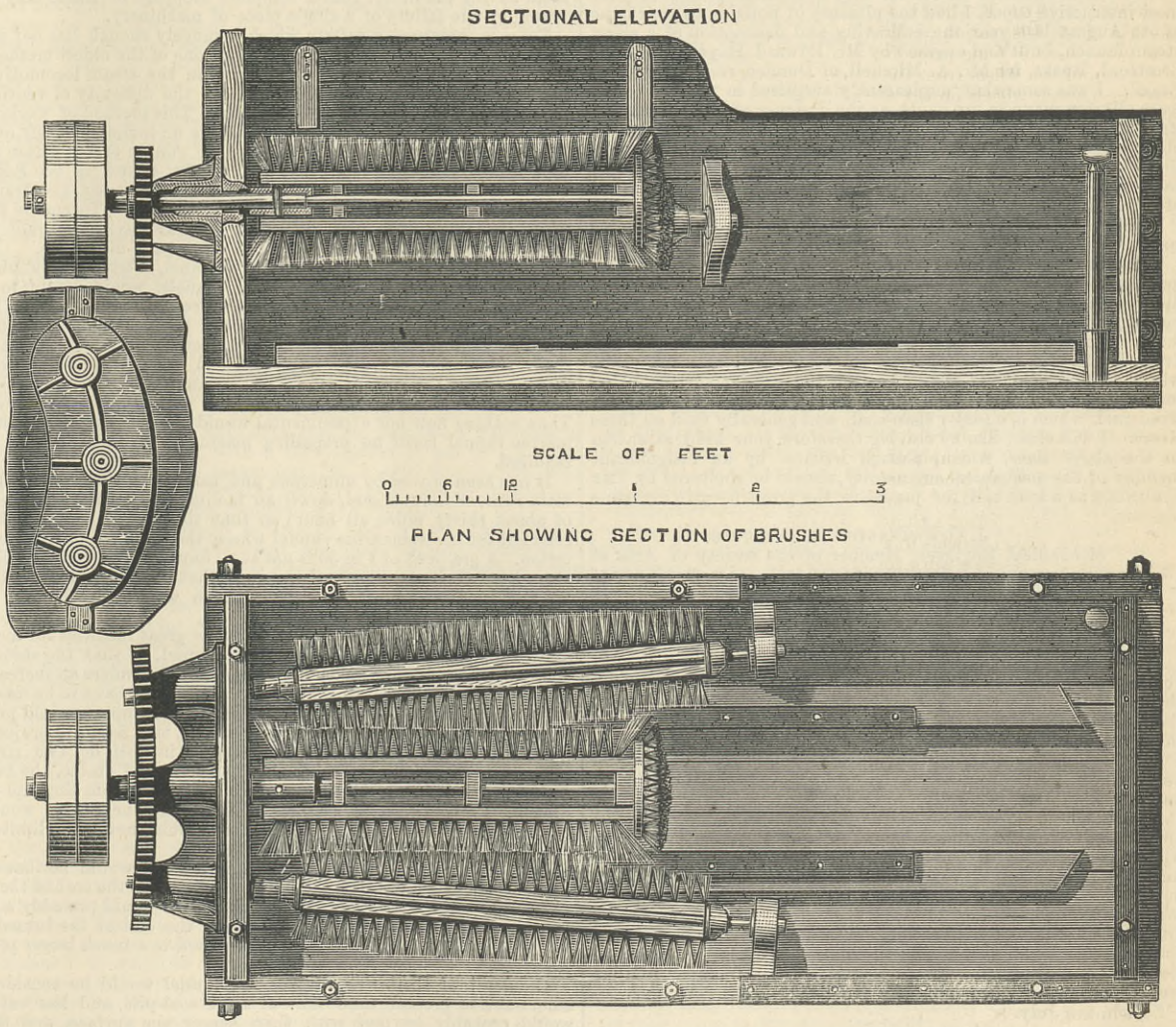
In Figs. 3 and 4 it will be observed that there are two sets of ports or apertures, those at the upper side being for the passage of steam, whilst the lower ones fill the same duty with the water which is delivered to the boiler. The movement or stroke given to the apparatus is just sufficient to open and close these apertures or ports. The two cylinders, one under each bottle in Fig. 1, contain water, and a loose fitting piston, which being connected by rods to the arms or water pipes attached to the two bottles, serves to act as a buffer or cushion to the loaded bottle when descending. The stroke is about 10in., and is adjusted by means of the pistons in these cataract cylinders. The apparatus moves or makes one stroke on the average about every three or four minutes, but its action being purely automatic, and its function to maintain a constant level of water in the boiler, the number of movements in a given time must necessarily depend upon the rate of evaporation.

The general action of the apparatus may be stated to be as follows:—We will suppose the feeder has just made a stroke or movement, in consequence of the now lower bottle having whilst uppermost been filled—and thus become the heavier of the two—with water from the small supply tank, whilst at the same time the opposite bottle whilst lowest has been emptying a portion of its contents into the boiler; this state of things has, however, been now reversed, and, as seen in Fig. 1, the lower bottle is now open to the boiler, and the water level in the latter being slightly lowered by evaporation, steam passes at once into this lower bottle, which is now full, and presses on the surface of the water with a force due to the boiler pressure, the water gradually passing out of this bottle by way of the pipe on the bottom of same into the boiler through the delivery pipe and check valve, the flow of the water into the boiler from the apparatus being simply due to the elevation of the same above the level of the water in the boiler, which should be about 3ft.

It may also be as well to explain that when the water level in the boiler is at its maximum, or say when the lower end of the steam dig pipe is sealed, that steam is then of course no longer able to pass up the pipe into the bottles, this state of things continuing until by evaporation the water level has again lowered sufficiently to unseal this pipe. It is whilst the water is at the maximum level that certain returns of water from the boiler take place into that bottle then in communication with the boiler, through one or other of the steam pipes attached to the upper ends of the bottles, the steam which had previously found its way into the bottle having condensed, and left the latter partially empty, but the vacuous space being soon filled again by these rapid returns of water from the boiler. This reversal of current through the pipes, and the intermixture inside the bottles of the water of a higher temperature direct from the boiler, with that already remaining in the bottle, is stated to be productive of highly beneficial results, as it not only keeps all the ports, pipes, bottles, &c., clean internally and free from all scale or deposit of any kind, but also lends material aid by way of preventing incrustation in the boiler itself, the solids contained in the feed-water being precipitated in the bottles, under the action of a higher temperature before admission to the boiler, and thus scaling or incrustation inside boilers fitted with this self-acting feeder being, it is claimed, greatly diminished, if not in most cases entirely prevented.

POCOCK'S RAILWAY MILK DRUM WASHER.

THE READING IRONWORKS COMPANY, ENGINEERS, READING.



THE accompanying engraving illustrates an ingenious machine exhibited at Reading for cleaning "railway churns;" in other words, the large cans in which milk is sent by rail to London. A silver medal was awarded to this machine by the Royal Agricultural Society. It consists of a wooden water tank, in which are placed three rotating brushes. Two of these cleanse the outside of the can, while the third is revolving inside of it. The outer brushes are of stiff bass, while the inside one is of bristles. The outer brushes are set at an angle to suit the incline of the can. A can may be thoroughly cleaned by this machine in about one minute. It has been well tried in London and elsewhere with the most satisfactory results.

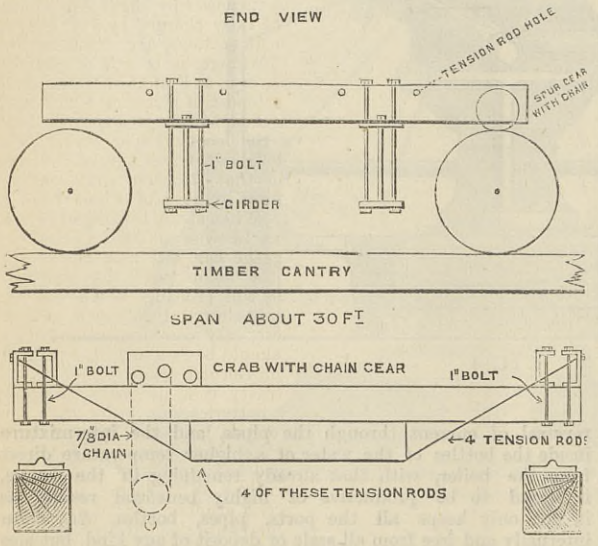
ELECTRIC LIGHT.—One of the earliest practical applications of the electric light on a large scale was for lighting the express and baggage rooms and platform at the Paris station of the Paris, Lyons, and Mediterranean Railroad in 1877. After a year's trial it was so approved that it was extended to other parts of the station and to the Marseilles station of the same road where the electric lights have been used ever since.

LETTERS TO THE EDITOR.

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

FOUNDRY TRAVELLERS.

SIR,—I beg to submit to you and your readers' opinion the construction and suitability of a 10-ton traveller recently erected for the firm I have the honour to serve at the present moment. In the first place, it is arranged to lift the weight, which may be a box or a ladle with molten metal, by chains hanging down to the ground line. This in itself is a great evil, to my mind, and will present, no doubt, a grave objection to any one of your numerous readers who know practically the working of a foundry, especially the intermittent motion accompanying chain lifting, and the liability of making "pie," as printers would say, of the moulds the chains might catch in the journeys up and down the foundry. Secondly, the girders, which have to carry the whole weight to be lifted, besides its own crab, &c., are simply suspended and held up by four bolts, 1in. diameter, at each end of each girder, without any kind of gussets or stays whatever, and whatever strain is put on the traveller these bolts have to support, and everyone knows how often in screwing a nut up tight upon a bolt the workman, as near as possible, puts the breaking strain upon the bolt—in fact, does break it; and very often the weight is all over one side of the traveller, and the whole strain is, as near as possible, put upon the above bolt at one end only. Thirdly, the tension rods are carried up in the top frame, and should any strain ever be brought to bear upon them, it appears to me that instead of being a support to the bottom girder, they would tend to bend or shear off the bolts that hold the bottom girder up.



I enclose a rough sketch of this traveller, and trust some of your readers will answer the questions which I ask, and which are, shortly:—(1) Is such a traveller fit for foundry work at all, taking all the conditions of a foundry into consideration, especially the necessity of at times great rapidity of motion? (2) What is the safe working load to put upon a 1in. bolt, seeing that all the strain may have to be supported at one end of these girders? (3) Are the tension rods any use to give support to the traveller if called into requisition?

I trust that what I have written may not be of too simple a nature for you or your readers to waste their valuable time upon.

July 1st. HENRY JOHNSON.

STEAM LAUNCH FOR BRAZIL.

SIR,—As an humble subscriber and a constant reader of your most instructive paper, I had the pleasure of noticing in your issue of 5th August last year the engraving and description of a screw steam launch, built and engined by Mr. Edward Hayes, of Stoney Stratford, Bucks, for Mr. A. Mitchell, of Dundee, residing at Para, Brazil. I was somewhat unpleasantly surprised in not seeing the least allusion made to my name, as the designer of the launch and its machinery, not through any vain desire of inflating my obscure name, but simply and justly from a sense of disapprobation to misapplied rights. The design represented in the engraving was drawn by me, with the exception of the boiler, which instead of "return multitubular," as shown in my drawing, is a "locomotive," which, besides the inconvenience of requiring a large space on board, is by no means more economical.

The efficiency of "return tubular" boilers for launches of this description is beyond dispute, and the substitution, besides other disadvantages, had the gross one of disturbing greatly the centre of buoyancy, which has found a remedy only in the vulgar employment of ballast. I have no doubt this defect would have been avoided had the builder adhered to my original plan of boiler, whose type is capable of a large heating and grating surface, offering, moreover, a spacious furnace and combustion chamber for wood fuel, which is cheaper than coal, and generally used on these rivers. I will close, Sir, by craving therefore your kind attention to the above lines, which, though written by an insignificant member of the mechanical community, should be sheltered by THE ENGINEER as a loud call for justice to the proverb—give everyone his due.

J. C. FERNANDES DO NASCIMENTO,
Mechanical Engineer, Member of the Society of Arts of London, and Superintendent-engineer in the Shops of Messrs. Boulhora and Co., Para, Brazil.

THE ST. GOTHARD RAILWAY.

SIR,—I have read with much interest the article contained in your issue of June 2nd relating to the St. Gothard Railway. Had the gradient 1 : 10 been admitted, the line would have been considerably shortened, the spiral tunnels avoided, and consequently the total expenditure a lower one; but it is beyond any doubt that a steeper gradient than the one decided upon—25 : 1000—would have proved very inconvenient to work a considerable traffic and heavy trains on the line. In this I perfectly agree with Mr. C. G. Ethelston. The expenses for keeping the north and south approaches of the St. Gothard Tunnel in working order during the winter season will no doubt be rather high. It is not to be forgotten that these portions of the line lie between high and steep mountains. The works protecting the line from avalanches and torrents have been most cleverly carried out, and enormous difficulties conquered with much skill; but future experience in the working of the line may perhaps show that occasional interruptions of traffic by heavy snow storms—rather frequent in that region—can scarcely be completely avoided. HENRY WALKER.

Zurich, 4th July.

THE THORNABY BOILER EXPLOSION.

SIR,—In your issue of last week you gave particulars of the North-Eastern Railway boiler explosion at Thornaby Ironworks Junction. I went to examine the boiler with a view to ascertain from what cause such an occurrence took place. Colonel Yolland, reporting on the accident, says the crown of the fire-box became over-heated from want of water, and when thus weakened was unable to resist the pressure caused by the sudden creation of steam upon water being admitted into the boiler. Mr. Lavington Fletcher, who made an official examination on behalf of the two coroners, as some of the men died in different counties—there were two inquests—stated in his evidence that the crown of the firebox was corrugated, and, being Christmas time, the men were probably drunk.

In the sectional elevation of your illustration is shown the fire-brick arch, by means of which the flames are projected with considerable force against the front of the fire-box; and this carries up at times a good deal of cinder, which wears away the rivets of the stays, and if the examiners had looked at those copper stays nearest the top of the fire-box, they would have found that many of them were left in their places intact. The first rent was through the fire-box front, which, not having the rivets for support, was forced off, and then the rent went along between the stay holes 2in. below the crown plate; the crown plate was then driven down against the ironwork of the brick arch, which gave it a deflection or bend of 1in. There was no corrugation whatever, nor was there any discoloration more than what is commonly seen upon copper after it is subjected to heat. Again, if there had been a deficiency of water the crown-plate would have broken up between the girder stays. The non-failure of the lead plug warrants the same statement, that there was water above the crown-plate; and supposing the driver had used the regulator just before the explosion and was injecting cold water, the delivery pipe not being over the fire-box could do no harm. Why Colonel Yolland should make such an assertion to substantiate his theory, that the sudden creation of steam upon water being admitted into the boiler caused the explosion, I cannot imagine. It is equally bad taste of Mr. Fletcher to intimate that the men were drunk. We are told that the lead plug was removed by order of the locomotive superintendent. I may also add that the gauge cocks were not forthcoming. I inquired what height the lower gauge cocks were fixed, above or below the crown-plate level, and was surprised to hear the locomotive superintendent say there was no fixed rule.

There are a few improvements which should be made to prevent the like recurrence. The girder stays were 4⅜in. deep; these should be made fully 6in. deep. Again, if a nut was screwed on every alternate bolt before rivetting—that is those above the fire-door inside of fire-box—it would be a material safeguard. The screwing of these bolts is not unfrequently a bad fit, inasmuch as they are screwed through the water space and often strip a thread or two off before they enter the fire-box, consequently there is very little support left when the rivets are worn off by the above mentioned cause. JONATHAN PICKERING.

Globe Works, Stockton-on-Tees, 4th July.

THE CHANNEL TUNNEL WORKED BY GRAVITATION.

SIR,—In the Channel Tunnel, or any other very long tunnel, the mode of working must be such as to admit of a very heavy traffic in order to earn an income commensurate with the great cost; and, no doubt, with reasonable charges the amount of traffic would only be limited by the capabilities of the tunnel; but, if worked by ordinary steam locomotives, these capabilities would be restricted by the difficulties of ventilation.

Mr. G. J. Morrison, in a paper read before the Institution of Civil Engineers in 1876, estimated that, by employing a considerable amount of artificial ventilation, about twelve trains in each direction per day could be drawn through the Channel Tunnel by ordinary steam locomotives in air rather worse than that of the worst parts of the Metropolitan Railway, and that the limit would be twenty trains each way per day.

M. Thomé de Gamond, who spent a lifetime in studying and advocating the project of a Channel Tunnel, estimated its cost at £7,200,000. To pay a dividend of 6 per cent. on this, the clear net profit would require to amount to £432,000 per annum. At twelve trains each way per day, or 7440 trains per year of 310 days, the proportionate amount for each train would be about £58, or at twenty trains per day about £34 per train. These heavy charges would render it difficult to compete with sea carriage, and they could only be reduced by increasing the number of trains.

In order to avoid the smoke from the locomotive, and so allow of the passage of a greater number of trains, many modes of working the Channel Tunnel have been proposed, such as the rope, atmospheric, pneumatic, air locomotive, electric, and other systems, some of which are not actually known to work satisfactorily, the others being actually known not to work satisfactorily; most of them having the defect that a complete stoppage of traffic may be caused by the failure of a single piece of machinery.

There is, however, a system which strangely enough has not yet been proposed, notwithstanding that it is one of the oldest methods of working a railway, certainly older than the steam locomotive, and that it is one which perfectly avoids the difficulty of ventilation caused by the smoke of the engines. This method of working is that of allowing the trains to run down an incline by their own weight, as the trains at one time used to run in one direction on part of the Blackwall Railway, and in the tunnel of the Edinburgh and Granton Railway, in both of which cases the trains were drawn in the opposite direction by a rope. To enable the traffic to be worked in both directions by gravitation it would be necessary to have two tunnels inclined in opposite directions.

In the case of tunnels under the Channel, a train, in running down through one of the submarine tunnels, would attain to a considerable depth, from which it would require to be drawn up by power through a tunnel under the land; but, as this land tunnel could be ventilated by any requisite number of shafts, the ordinary steam locomotive could be used, and this has been proved by experience to be the best of all known means of propelling a train, and is indeed a very economical means of obtaining motive power. Thus nothing new nor experimental would be used, and in the submarine tunnel itself no propelling machinery whatever would be required.

It has been proved by numerous and careful observations that a train runs, without steam, down an incline of 1 in 100 at a speed of about thirty miles an hour; so that this would be a suitable gradient for the submarine tunnel where the trains work by gravitation. A gradient of 1 in 50 is not at all unusual, and can be easily ascended by a locomotive and train; so that this would be suitable for the land tunnel, the length of which would thus be half of that of the submarine tunnel.

One of a pair of tunnels would afford as great facilities for locomotive traction as would an ordinary tunnel, so that the second need not be made until deficiency of ventilation renders an increase of traffic impossible, when a second would equally have to be made if the first were an ordinary tunnel. Thus two tunnels would probably soon be required in any case; indeed, two separate projects are at present before the public, and if, instead of two rival tunnels, each capable of carrying a very limited traffic, the two companies were to combine—one making a tunnel from England to France, the other from France to England—these two would together carry a very heavy traffic, its amount not being limited by difficulties of ventilation.

The additional cost of the gravitation tunnels would be that of the land tunnels, or rather the difference between the cost of these and of the same length of surface line. This would probably add something approaching to 50 per cent. to the cost of the tunnels, but the number of trains could be increased in a much larger proportion.

The depth of the lowest part of the tunnel would be considerable, but not greater than that of some coal-pits, and less water would probably be met with than nearer the surface, and the gradients would afford facilities for draining the main tunnels.

JOHN MACKENZIE, A.M.I.C.E.

62, Leadenhall-street, E.C., July 8th.

[We publish our correspondent's letter because his suggestion is ingenious, but the fact that travellers between England and France would have to plunge over 1000ft. into the earth would not add to the attractions of the Channel Tunnel.—ED. E.]

THE FOUNDATIONS OF MECHANICS.

SIR,—To quote Mr. Browne's own words, with slight modifications, from his letter which appeared in your last impression, p. 3, "It is surprising that your correspondent does not see that the sentence quoted from Rankine was his own condemnation." The point at issue between us is that I assert that the resistance offered by a train to a locomotive is precisely equivalent to the pull of the engine, action and reaction being, on Newton's well-known law, equal and opposite. Mr. Browne holds that the pull of the locomotive is greater than the resistance of the train, but how much greater he makes no attempt to determine. To prove his statement he cites ordinary steam engines, and asserts that in them the cylinder pressure is greater than the resistance. I cite Rankine and Pambour in proof of the accuracy of my views. Then Mr. Browne admits that in engines running at a regular speed the resistance and pressure exactly balance each other, but he holds that the case of the regularly running engine is not parallel to that of the engine starting a train, because in the latter case we have to do with gradually accelerated motion.

Mr. Browne, with really remarkable obtuseness, fails to see that in every reciprocating engine we have the precise parallel of the locomotive starting a train. At each end of the stroke we have a piston, which, with its appurtenances, may weigh several tons, brought absolutely to rest, and then started from rest into motion at a gradually accelerating velocity. Mr. Browne admits that in this case Rankine and Pambour are right. It now devolves on him to show where the difference lies between the conditions obtaining here and those which obtain in starting a train. Again, a Cornish pumping engine is a machine working with a "uniform periodical motion;" at each stroke as much as 200 tons of dead weight is started from rest and put into rapid motion by degrees. Here, again, Mr. Browne of course coincides with Rankine and Pambour that the resistance of the piston exactly equals the pressure. What is the difference between this case and that of the train?

It is just possible that Mr. Browne, who has already found it necessary to qualify his statements more than once, may qualify them again, and assert that while he admits that the average resistance of the piston is exactly equal to the average pressure, yet that the *initial* pressure will exceed the initial resistance at each end of the stroke. Now, it must be clearly understood that Pambour makes no such qualification. He says: "The engine—he is speaking of the locomotive—having attained uniform motion—by which he means a steady speed along the rails—there is necessarily an equilibrium between the pressure of the steam in the cylinder and the resistance against the piston, that is, P = R, R being the whole resistance against the piston." But if Mr. Brown will take the trouble to procure particulars of one or more engines, and diagrams from them, he will find on calculating the cylinder pressure at any given point that it is the precise equivalent of the resistance. Thus, at the beginning of the stroke the inertia of the piston with its rod, &c., have to be overcome, and the velocity of the fly-wheel, which has decreased during the last half of the preceding stroke, has to be again augmented. As to the nature of the forces and the amount of them, concerned, I would refer Mr. Browne to "Rigg's Treatise on the Steam Engine," where he will find them handled in a masterly manner.

But apart from all practical illustration, it can be shown in a moment that the principle of the conservation of energy cannot be true if Mr. Browne is right. He assumes that the steam pressure is greater than the resistance. But the resistance overcome is the measure of the work done; but the force expended being greater than the work done, there must be a loss. For instance, let the resistance of a train to being started diminish continually in any ratio, say 10, 9, 8, 7, 6, while the tractive force is 11, 10, 9, 8, 7. Then it is evident that the whole resistance in any given distance—a foot or a mile say—will equal 10+9+8+7+6 = 40, while the force expended will be 45, because by the conditions the distances passed through by the force and resistance in a given time are always the same. The difference between 40 and 45 represents dead loss, because it has not been expended in overcoming a resistance. How does Mr. Browne reconcile this with Carnot's theorem? Again, a force according to your correspondent is expended, but not in overcoming a resistance. Is this force got for nothing? If Mr. Browne attempts to assert that it is stored up in the moving body, to be given out again when that body is brought to rest, then it must be expended by that body in overcoming a resistance. Thus we have a force expended in the first instance against no resistance, and yet creating in a moving body a power of overcoming a resistance at second-hand, so to speak, so that the body derives, according to Mr. Browne, a power of overcoming a resistance from a force, which that force, also on his own showing, could not possibly have imparted to it. Really Mr. Browne requires his readers to possess a faith which would move mountains.

Let us assume, however, that Mr. Browne is right, and that the resistance offered by a train to an engine is less than the pull of the engine. In this case it is evident, I should think, to the most obtuse mind that the strain on the draw-hook of the engine is greater than the strain on the draw-hook of the first carriage. This being so, will Mr. Browne once for all say how much less it is under the following conditions: Weight of engine and tender, 60 tons; weight of train, 200 tons; speed acquired in 15 seconds, 44ft. per second. I have no trouble whatever in calculating what the strain on the draw-hook at the back of the tender will be at any given moment. I must ask Mr. Browne to tell me what the strain on the draw-hook of the first carriage will be? There is not a line in his treatise on "The Foundations of Mechanics" which will help me or anyone of his readers to the required figures. Of course I make the strain on both hooks the same. If it is not the same, surely the fact must have been ascertained long since, and formulæ for calculating such things must exist. Where am I to look for them? Mr. Browne knows perfectly well that nothing of the kind is in print, and that he himself, excellent mathematician as he is, is quite incapable of reducing his theory to figures; nor can he cite a single instance out of all the experiments which have been tried in France to ascertain by the aid of the dynamometer the resistance of trains, wherein the strain was greater on the hook of a given carriage than it was on the next hook of the next carriage.

As I am asking Mr. Browne questions, perhaps he will favour me with a reply to the following:—A piston devoid of weight and mass is at the bottom of a tall cylinder. There is no pressure of air on the top of it, and the piston moves without friction; in a word, it is quite incapable of offering any resistance. If steam of 10 lb. absolute boiler pressure is suddenly admitted below that piston, will Mr. Browne kindly state what its pressure will be during the time the piston is ascending, say, 10ft.?

Your correspondent having admitted that in an engine moving with a regular periodical motion the pressure exactly equals the resistance, immediately afterwards disputes this, and asserts that "by manipulating the point of cut-off we can make the average pressure vary as we like from the initial pressure down to a small quantity quite independently of the resistance." As a matter of fact this is just what we cannot do, and I challenge Mr. Browne to cite a single case in which it has been done or in which it is possible to do it. If it could be done, why on earth should engineers use average cylinder pressures of 40 lb. or 50 lb. when a pressure of a few ounces would suffice? If Mr. Browne will give the subject a few minutes thought, he will see the absurdity of his proposition. It is perfectly well known to all engineers that the average pressure is fixed by the resistance to be overcome. I do not expect Mr. Browne to take my word for it,; let him ask any competent engineer, say Mr. E. A. Cowper or Sir Frederick Bramwell, and they will at once confirm my statement. Does he not know that when engines are too lightly loaded they cannot be worked economically? The cut-off must take place too early, and the steam must be expanded too much. The idea that the average pressure in a cylinder is independent of the resistance, involves one of the most startling errors I have ever seen in print in the pages of a scientific journal. His words, however, are precise, and admit of no qualification; neither can they be explained away. He has no resource left but to retract them, and as I have no doubt they were penned hastily and without due thought, this I hope your correspondent will do.

I come now to the next point—the effect of heat on ice. Mr. Browne deals in surprises. The assertion that it was possible to impart heat to ice without melting it or making it hotter, surprised me at all events. Mr. Browne has since explained that he did not mean this—that he referred to melting ice. But he now says, "I am sorry that I cannot take 'Φ. Π.'s' word that the act of melting is nothing more than the moving of the water molecules, or that the internal motion of a liquid is greater than that of a solid." Mr. Browne forgets that ice is more bulky, weight for weight, than water, consequently when it melts its molecules must move in order that they may rearrange themselves in a smaller space. Will he, bearing this in mind, assert that motion does not take place when a lump of ice is thawed? Mr. Browne, in quoting Balfour Stewart anent the motion which is measurable by a thermometer, overlooks the circumstance that we are dealing with two kinds of motion—one, that of heat, the other, that due to liquefaction, to the rearrangement of the molecules, and this motion can no more be measured by a thermometer than can the velocity of a railway train or the speed of the wind. This is just the point your correspondent fails to see, viz., that the heat which produces liquefaction is converted into work, and is, of course, not competent to affect a thermometer. But work cannot be done, Mr. Browne ought to see, according to his own definitions, unless the molecules are moved against a resistance; and I quoted for his benefit Rankine's formula for ascertaining the amount of this work. But Mr. Browne quietly ignores this, and passes over Rankine in silence. This is not honest. Yet he cannot escape from the fact that work cannot be done without motion, and if energy is expended in liquefying ice, then motion different from heat motion must be imparted to its molecules; but if this be true, then Mr. Browne is wrong. He cannot refute Rankine, so he ignores him. Is this fair? Is this the line of argument (?) which a man doing his best, as he ought to do, to place the truth before his readers, ought to adopt? I leave your readers to judge between us. "N.B," writes Mr. Browne, "I do not assert that the work done in liquefying water is not reproduced in some way." Am I to suppose that Mr. Browne has got a new theory of "work" without motion?

If Mr. Browne will bear in mind Clerk-Maxwell's definition of heat as something which may be dealt with as though it could be poured from one vessel into another, he will see that the internal motion of a pound of water *may* be greater than that of a lump of iron at a red heat, his own statement to the contrary notwithstanding. Of course it is not fair to compare iron at one sensible temperature with water at another, a fact which your correspondent has overlooked; but the quantity of heat motion in a pound of iron at 900 deg.—a dull red—happens to be just about the same as that in a pound of water at 70 deg., so that in this case Mr. Browne's argument falls to the ground.

As regards the equations F M = R, I can gather nothing from Mr. Browne's arguments but that he regards force "F" and "M" motion as equal to "R" resistance. He has been contending all along that force is greater than resistance, and that the difference is represented by motion, at least so I have understood him.

I take it for granted that Mr. Browne's desire is to arrive at the truth, and to set it before his readers. That is my desire. There is no reason why the discussion between us should not be conducted to a useful end with perfect good temper on both sides, and I hope Mr. Browne will admit that he cannot leave this letter unanswered. In his treatise on "The Foundations of Mechanics," I maintain that he has not only perpetuated old errors, but introduced a new error of vital importance. He has entirely failed to comprehend Newton, and has endeavoured to make him say what he never said. Is he aware that Newton was so fully impressed with the belief that matter was absolutely inert that he attributed gravitation to the direct operation of a Divine Will? Yet Mr. Browne does not hesitate to assume that Newton believed that two molecules would attract each other. I may add that up to the present moment Mr. Browne has left entirely untouched my argument that if two bodies can attract each other they can create motion and energy. This theory of attraction lies at the root of his papers. They rest on it, and far from being calculated to direct thought in the proper direction, they are more calculated to mislead than any other treatise on the subject with which I am acquainted. To his enunciation of certain well-known laws, data, theories, and formulæ, no possible exception can be taken. I none the less respect your correspondent's work because I hold that he is mistaken. His errors are not so much his own as the result of that vicious system of teaching the foundations of mechanics, against which I have long contended, and the effects of which, I hope, he will one day shake off. Φ. Π.

London, July 10th.

STEAM TRAMWAYS AT LILLE.

SIR,—I should consider a great favour if you would kindly give some space in your honourable paper to the few remarks I wish to make on this subject, a problem of such considerable public interest, but which has not been solved yet. According to your statement, the line is now worked by five Carel's steam and fifteen Francq's hot water engines, and yet with a rolling stock so complete, as probably only six to eight engines are in daily service, the traction working expenses run as high as 10d. per mile. I am much struck at such very expensive working, which does not seem to speak in favour of steam traction as regards expenses; the more so as the line having been relaid seems to be now in perfect working condition, which was not the case when the Tramway Traction Company did the service with the Hughes engine. Weakness in permanent way and machinery caused engines and permanent way to knock one another to pieces. Under such difficult conditions the running charges of the steam traction amounted to from 6·85d. to 7·04d., while the cost for the heavy ordinary and extraordinary repairs caused by the accidental breakdowns of the engines ranged from 2·42d. to 2·89d. per mile. With the defects of the permanent way and those of the machinery removed, the working expenses, inclusive of all repairs and maintenance, could, in my opinion, fairly be maintained at 6·685d. to 7·04d., everything included. Out of the twelve Hughes engines at hand, eight were in daily service for sixteen to eighteen hours per day, and got during such long hours of service, on such a heavy moving road, with heavy steep gradients, so over worked, that often several engines got disabled per day, and there was no time left for them for rest and thorough repair. There were also no such easy communication from station to station as there is now by means of the telephone. The Hughes engine ran also quite in the centre of Lille, without showing steam in town, while out of town permission for its free escape was given. Nevertheless, the director, Mr. Muller, and the engineer, Mr. Martillau, assisted greatly in trying to work the line successfully. The regulations made with the Tramway Traction Company as the traction contractors, accompanied by heavy fines for the slightest defect in the service, were enacted with the utmost and unexampled severity. The Lille Tramway Company is now doing the service itself, and I suppose affords to itself all facilities. I can, therefore, not understand the reason why, in spite of all the improvements and facilities effected, the working expenses are higher than with the Hughes engine. These facts, I think, draw a favourable comparison between the Hughes engines and those at present employed, as also between the former and the present steam service. In reference to your article, "Visits in the Provinces," in which the working expenses of steam trams are mentioned to be 4½d. per mile, I beg to say, that this price is so low, that I think it can only occur exceptionally and under very favourable circumstances. If steam traction is done at the same rate as horse traction, say at the rate of 6½d. to 7½d. per mile, the tram companies will have the benefit of using two cars whenever required without increase of cost, carrying always more passengers, and at places where horses can only be used by great sacrifice, or not at all. It is proved that steam will always produce better receipts than horse traction. As to the latter, especially in hilly countries or steep gradients, I cannot help mentioning that it is shocking to see the horses hauling such heavy loads uphill under the most strenuous efforts. Your own report in this number from the Reading Tramways confirms the statement, as I have also seen it elsewhere, and at Sunderland. The hard work on the hilly roads was still increased through the rolling stock running stiff for want of its maintenance in proper working condition—the least to say of it. I have seen horses ill and dying, as I learned, from hard work, and from overwork. If the parties interested in horse traffic would remember that the introduction of railways increased the services of horses—as it will be similarly with steam traction on tramways—its introduction would not find with them such enormous opposition, and everybody would be glad to see the horses freed from such killing work, to be utilised to a more suitable one.

With strong, well-laid, and solid-bedded lines to support the heavy weight of the trams, and with powerful, strong-built engines, both fulfilling the conditions of working tram lines, steam will undoubtedly take its place as the best available motive power on tramways for the present time. As to the conditions which permanent way and engines should fulfil to make steam traction a success, I will not enter into them, having, I fear, already greatly trespassed on the space you kindly accorded to these lines.

H. CONRADI,
Former Manager of the Paris, Lille, and
18, Golden-square, W. Sunderland Steam Tram Lines.
July 10th.

BREWING IN ENGLAND.

SIR,—Your illustration of a malthouse by H. Stopes and Son, I think, must have some errors either in the number of quarters or the figured dimensions of the building. Having had some years' experience of brewery and malthouse construction, I cannot see how the number of quarters can be either grown or dried on the floor space allowed in H. Stopes and Son's design, that is allowing only 86ft. per quarter for withering floors, and 8ft. for kiln drying floor, taking one floor; but if both floors can be used then only 16ft. is allowed per quarter. We in this town allow 200ft. and 22ft. to 27ft. respectively. The latter area depends upon the maltster's idea. Some dry at 13in., and some as little as 8in. thick. Steep grain once in four days, this is the time allowed for drying; therefore you will see that the floor space for growing must be large enough to have three steepings on at the same time, that is according to the system in this part of the country. If Messrs. H. Stopes and Son have got a new principle of working, as per your article, we in Burton are a long way in the rear of the best system. I have seen a scheme for growing barley 2ft. 6in. thick, but it is not considered a success.

The only "novel introduction" that I see is the double drying floor, and to make use of this you must be able to load as thick as the one below, or one floor cannot keep time with the other, and it is very doubtful if this can be done to advantage. Both this floor and the dispersing flues below will check the upward current, this being the main principle in drying more than the high temperature. The enclosed furnace is not new. The withering floors are not adapted for retaining an equal temperature over the three, the bottom will be slow, and the top will be very much so, on account of the high roof containing so much more cubic space to be heated by the grain before it has the desired effect in winter season. The tall roof over the kiln is following the old system of a brick cupola, without the non-conducting material and consequent loss of heat. The hot-air chamber, contracted in size, is a decided improvement upon the old open kiln fire-room. This has been at work some six or seven years in this town, but the flues are not any advantage, because of the obstruction to clearing away all dust and coomb which accumulates in the hot-air chamber, and not any saving in fuel. This is my experience, having seen both tried under the same management and conditions.

Burton-on-Trent. BREWER'S ARCHITECT.

GAS *v.* ELECTRICITY.

SIR,—We must all feel very much indebted to your correspondent, Mr. Saxon Snell, for giving us so clear a statement of the relative costs of the electric light and the gas light when applied for indoor illumination and upon a reasonably large scale. So many bewildering statements are made as to their relative costs, and we are constantly promised to be supplied with the electric light at a less cost than that of gas, that any authentic statement like this cannot be over-estimated. The great value of the electric light for certain purposes cannot be doubted, and Mr. Saxon Snell fully acknowledges this; but it is in its universal application to indoor illumination that its promoters, in my opinion, claim too much for it. It so happens—for well-known reasons—that generally when light is most required warmth is also urgently needed, and it is in this respect that the electric light is so deficient, and the gas light possesses the great advantage over its rival; and as your correspondent has called attention to several modes of utilising gas without suffering any inconvenience therefrom, perhaps you will allow me to state some results which I have obtained with the "Sanitary" gas stove, now being introduced by Messrs. Strode and Co., of London.

In a room measuring only 10ft. × 8ft. × 8ft. I have been able to consume gas at the rate of 8½ cubic feet per hour, and to maintain a difference of 27 deg. between the indoor and outdoor temperatures, without the usual discomfort accompanying the use of so large an amount in so small a space. A ventilation at the rate of 1500 cubic feet per hour was at the same time effected without draughts, and the entire quantity of gas burnt was available for giving light, but being, of course, screened in the daytime.

In another instance I have been able to maintain a difference of temperature of 28 deg. with a consumption of gas of 17½ cubic feet per hour in a room measuring 17ft. × 15ft. 6in. × 10ft., and with a ventilation of 1750 cubic feet per hour, the light from the gas in this case also being available when required.

The above two examples sufficiently bear out Mr. Snell's statements that gas can be utilised, not only without becoming a nuisance, but also with benefits which cannot be obtained by using the electric light.

I ought also to have stated that arrangements exist in the "Sanitary" stove for getting rid of a very large proportion of the heat when only the light, or the ventilation, or both are required, as in very mild weather. The stove has been applied on a very large scale, but sufficient has been said to support my contention, and it is the very high importance to the public of arriving at a correct estimation of the relative values of gas and electricity for household purposes which is my excuse for the length of this communication. W. SCHONHEYDER.

London, July 18th.

NAVIGATION IN IRELAND.

SIR,—In reading the evidence given before the Royal Commission on "the system of navigation which connects Coleraine, Belfast, and Limerick," I am struck by the following:—

Evidence of valuator to Board of Works:—"Q. 3903: Would it not be desirable to have along with the return of the height of the river, a register of the rainfall, by putting rain gauges at the stations?—It would be diffcult to get them kept." "Q. 3904: I don't mean at the locks, but at some of the principal points along the Shannon: Would it not be desirable to have a register kept of the rainfall?—It would no doubt be very desirable; but we have no rain gauges at all on the Shannon."

Evidence of chief engineer to Board of Works:—"Q. 4050: Would you consider it desirable to have rain gauges at different points on the Shannon?—I don't think it is necessary, because in point of fact we have rain gauges. Mr. Symons has been publishing the records of rain gauges all over Ireland for many years."

It would appear from the above that Mr. Symons' system of rainfall registry has been of advantage to the Irish Board of Works; but I have no recollection of seeing the name of that body on the list of subscribers to an enterprise which is supported by voluntary contributions, and is in want of funds.

It is obviously futile to discuss whether floods have been greater or less since the execution of certain works, unless the source of all floods, *i.e.*, rainfall, be also definitely taken into consideration.

July 20th. RHINNS.

LIGHTING CARS BY ELECTRICITY.

A THOROUGH discussion of the use of electricity for lighting trains appears in the *Journal* of the German Railroad Union on the occasion of the Frankfort experiments. The general conclusion is that electric lighting of trains will become practicable when there has been some improvement in the storage of electricity. At the Frankfort experiment a six-horse power dynamo-electric machine in a baggage car was driven from a car-axle. Around the machine and against the sides of the car were placed twenty-four Faure accumulators, which stored the surplus electricity while the cars were running faster than necessary to develope the amount consumed for the lights, but the surplus was not sufficient to light the three cars during the stops. While running the cars were brilliantly lighted with the electricity coming directly from the machine. It is said, however, that the storage of electricity would have been better but for the use of lead not chemically pure in the accumulators. The general conclusions of the writer in the *Journal* of the German Railroad Union are as follows:—

(1) That the lighting of a railroad train, in the present condition of electric science, is not possible by the Faure secondary battery alone; it is indispensably necessary to carry a dynamo-electric machine on the train for such lighting. The dynamo-electric machine can be best and most cheaply driven by the car-axle, and the power of the train by day can be used for generating electricity to be stored for use at night, and its power by night can be used directly. If the batteries become fully charged by day, they can be taken out and held in reserve at stations, and fresh batteries put in the car. Whether it is advantageous to put the dynamo-electric machine in the baggage car, or as at Frankfort, seems doubtful, as a man is then required to attend this machine, which makes electric lighting too costly. It is thought that it would be better to have it attached to the rear of the locomotive or tender, where it could readily be driven by a belt from the rear axle of the engine or tender, and the machine in that situation could easily be attended by the engineman and fireman, both of whom have the necessary mechanical knowledge. When steam heating of cars was first introduced in Germany it was likewise thought necessary to have a special boiler in the baggage car, but now the steam is generally taken directly from the boiler, and the heating is regulated by the enginemen. This will probably be the course of electric train-lighting if the dynamo-electric machine is placed in the baggage car. If it is put there, easy communication between the baggage car and the tender should be established, which, this writer thinks, would not be easy on German trains.

(2) To light a train with electricity it is necessary to provide every car with Faure secondary batteries, in order that a car separated from the train for one or two hours may be well lighted with them. This can be done by the Faure batteries, since ten or twelve elements completely charged are capable of supplying the six lamps and the requisite intensity. With regard to cost, the price of a Möhring dynamo-electric machine sufficient for the largest train is about 425 dols. One Faure element costs, if cheaply constructed, about 10 dols. Since there are five or six lamps in a car, ten or twelve accumulators are necessary, as it requires about two elements to supply one Swan lamp. The lamps are very cheap, costing 25c. to 50c. each. According to this, the equipment of a passenger car for electric lighting will cost about 175 dols., while its equipment for gas lighting costs at least 225 dols. Bearing in mind the numerous gasworks, costing 10,000 dols. to 15,000 dols. each, the gas-pipes and the apparatus for supplying the cars, it is clear that the apparatus for dynamo-electric lighting is by far the cheapest. The impression left by the results of the experiments and investigations is that the solution of the problem of lighting cars by electricity is evidently only a question of time. The Frankfort Royal Railroad Directory is now preparing a new train of six cars of improved construction to continue its experiments. It is thought by some that the final solution will be by the use of Faure accumulators charged by a stationary engine and placed under each car in an iron case, as needed, as compressed gas is now used. This would avoid making a draft on the power of the locomotive, which is often all needed to make time.—*American Railroad Gazette.*

SOCIETY OF ENGINEERS.—Arrangements have been made for a visit of the members and associates of the Society on Wednesday, the 26th inst., to the Anglo-American Brush Electric Light Corporation, Limited, Belvedere-road, Lambeth, S.E. Members will assemble at the Company's works at 12 o'clock noon, and may introduce friends. At the conclusion of the above visit the members will proceed first to the Whitefriars Glass Works, Temple-street, E.C., and then to the Thames Cut-glass Works, 107, Queen Victoria-street, St. Paul's, E.C., both of which establishments will be inspected by permission of the proprietors, Messrs. James Powell and Son, and Messrs. James Green and Nephew, respectively.

A NEW TURRET CLOCK.—Messrs. Bailey, of Manchester, are at present engaged in the manufacture of about twenty large turret clocks, which are being sent to various parts of the world. Two, we understand, are for the Jesuit Church, Spanish Town, Manilla, one of which indicates the time of day at nearly every chief city in the world; and the other will strike the hours and quarters on large bells, in the usual manner. We learn also that this firm has constructed and patented an entirely different clock arrangement to that which has hitherto been known as the modern turret clock. The improvements partly consist of a new arrangement of the various parts, whereby the frame carrying the several shafts is made much narrower than usual. This is obtained by fixing the drums upon which are wound the weight ropes on the ends of the shaft, outside the framing, which, it will be easy to understand, allows of much greater range in the angle at which the ropes may be adjusted, as well as giving greater facility for winding purposes.

INTERNATIONAL ELECTRIC AND GAS EXHIBITION AT THE CRYSTAL PALACE.—An international electric and gas exhibition will be opened in the Crystal Palace, Sydenham, in October, 1882, and continued till the end of Easter week, 1883. English and foreign applications for space should be made to the manager, Crystal Palace, before 1st August, 1882. The principal objects to be admitted are comprised in the following: (*a*) Apparatus used for production and transmission of electricity; (*b*) magnets, natural and artificial, mariners' compasses; (*c*) applications of electricity to telegraphy and the transmission of sounds, to the production of heat, to lighting and the production of light, to the service of lighthouses and signals, to apparatus giving warning, to mines, railways, and navigation, to military art, to fine arts, to electro-chemistry and to galvano-plastic and chemical arts, to the production and transmission of motive power, to mechanical arts and horology, to medicine and surgery, to astronomy, meteorology, geodesy, to agriculture in its application to industries, to apparatus for registering, to domestic uses, lightning conductors; (*d*) apparatus connected with the manufacture of gas, and also models; (*e*) gas apparatus of every kind, and also models; (*f*) gas engines and also models; (*g*) cooking by gas; (*h*) heating by gas; (*i*) chandeliers, burners, private and public gas lamps. Exhibits will be received on and after 15th September until 15th October, 1882. Each exhibitor must consign his goods to an agent at the Palace and arrange for their reception. Exhibitors will not have any rent to pay. A limited amount of engine power will be found for exhibitors of electric light who apply for it before 1st August, so far as the arrangements will admit. The question of medals and certificates will be settled hereafter.

THE NIEDERBAUM SWING BRIDGE, HAMBURG.

(*For description see page 44.*)

Fig 1

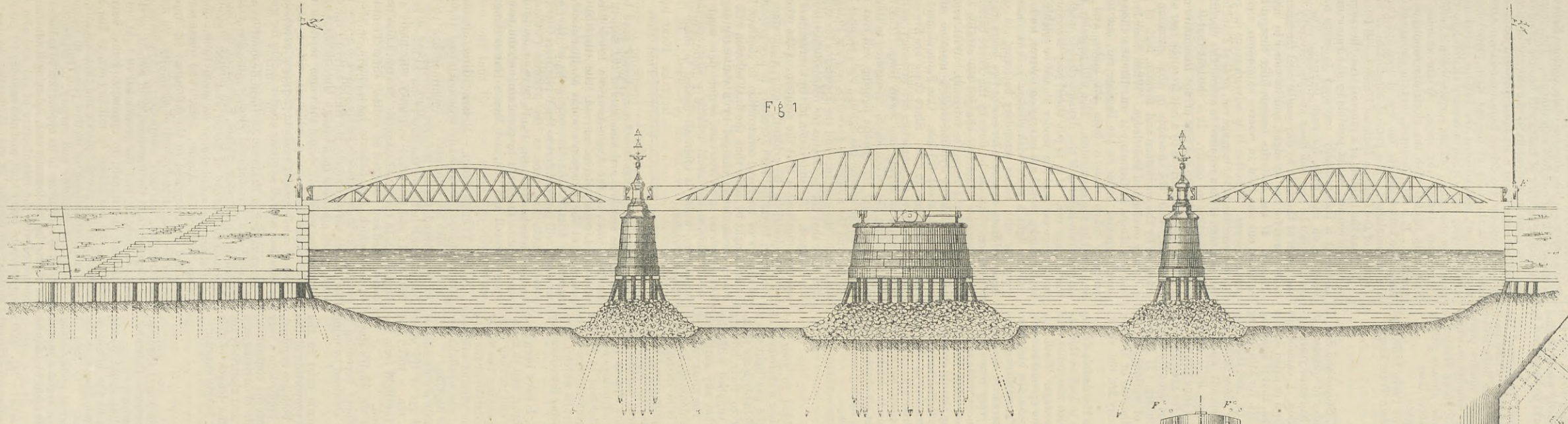


Fig 4

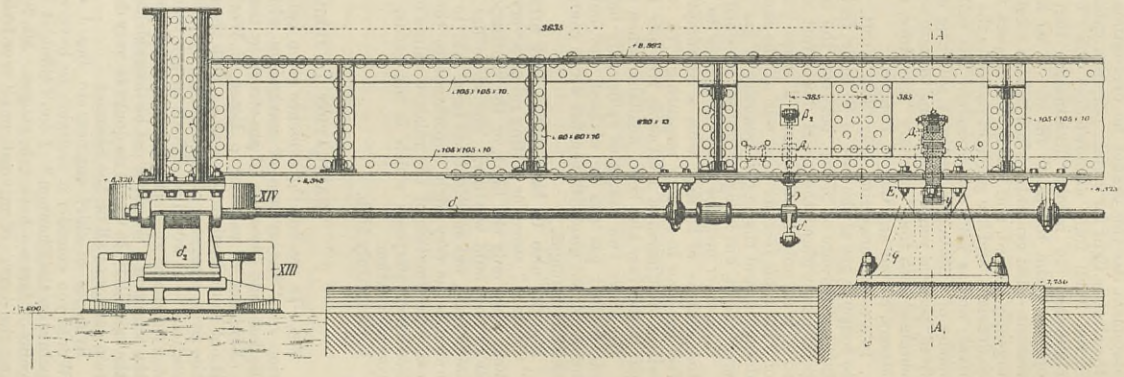
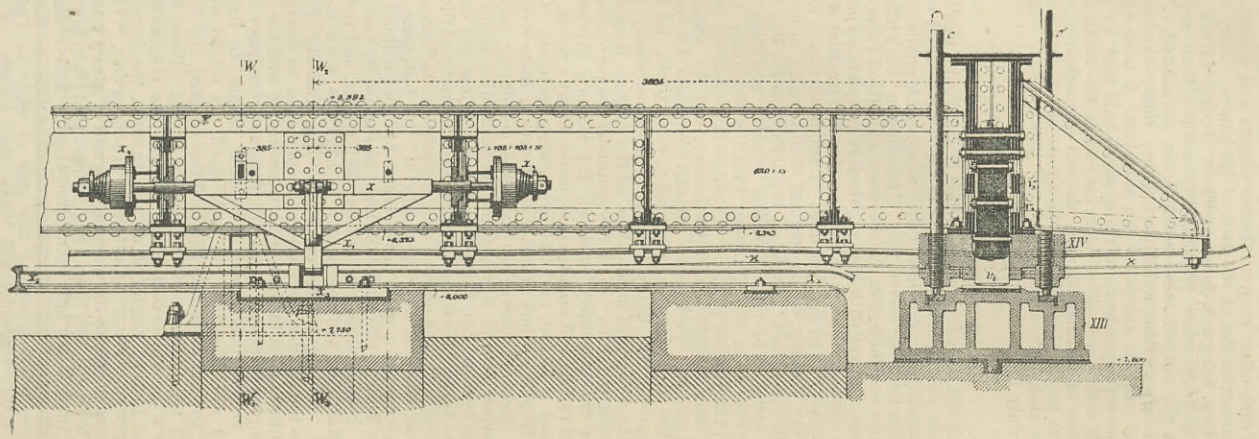


Fig 5



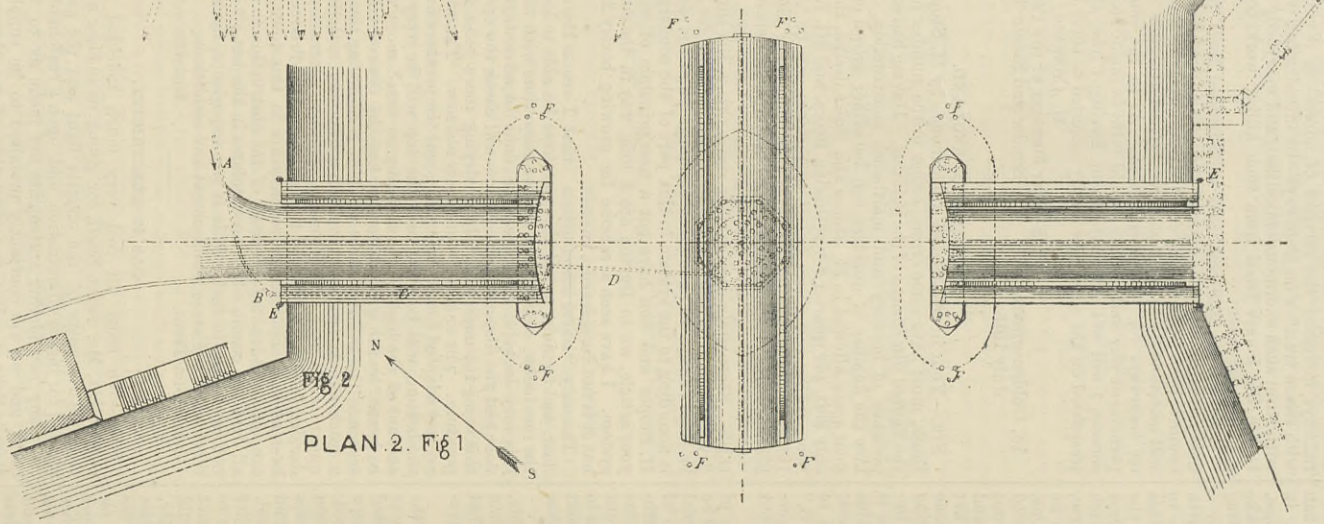


Fig 2

PLAN. 2. Fig 1

Fig 3 SITE OF BRIDGE

FOREIGN AGENTS FOR THE SALE OF THE ENGINEER.

PARIS.—Madame BOYVEAU, *Rue de la Banque.*
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VIENNA.—Messrs. GEROLD and Co., *Booksellers.*
LEIPSIC.—A. TWIETMEYER, *Bookseller.*
NEW YORK.—THE WILLMER and ROGERS NEWS COMPANY, 31, *Beekman-street.*

PUBLISHER'S NOTICE.

*** *Next week a Double Number of* THE ENGINEER *will be published containing the Index to the Fifty-third Volume. The Index will include a Complete Classified List of Applications for and Grants of Patents during the past six months. Price of the Double Number,* 1s.

TO CORRESPONDENTS.

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

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

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

R. S. S.—*The United Telephone Company, Coleman-street, London, E.C., and Messrs. Tasker and Son, Telephone Exchange, Sheffield.*

G. B. U.—*On referring to Symons's "Magazine," we find that the highest recorded shade temperature in England in* 1881 *occurred on the* 15*th of July at Alton, Hants, where the thermometer reached* 101 *deg.*

ENQUIRER.—*No examination of any kind. Any one who thinks proper can write C.E. after his name. It is generally understood, however, that one cannot do so with propriety unless he has been regularly educated as an engineer or is a member of the Institution of Civil Engineers, or some kindred society or institution of repute.*

A SUBSCRIBER.—*The position of the grates in a Lancashire boiler depends on the kind of coal being burned. If the coal is bituminous, a thin fire will sometimes give the best results, and in that case the grates can be kept high, but as a rule the lower the grates the better, for more room is given for the mixture of air with the gases. Where the draught is suitable heavy fires give the highest evaporative efficiency, probably because holes do not burn in the fire. The bars are better covered, and cold air does not get in. It does not follow that because the fire is thick therefore the rate of consumption per hour per foot of grate must be larger than it would be with a thick fire.*

J. B. H.—*So far as we are aware no such furnace crown as that shown in your sketch has been patented or used in England. We much doubt that it would answer. The great difficulty met with in keeping up such furnace crowns is that when heated they expand, and when they cool they contract very much. A new furnace crown* 9*ft. wide will contract as much as* 3*in. the first time it cools down. If such an event occurred to your furnace crown it would at once fall down. When the roof is arched, it rises and falls at the crown as it contracts and expands. We do not think you could get bricks such as you speak of to stand an intense heat, such as that of a plate furnace.*

WALL PAPER PRINTING MACHINERY.

(*To the Editor of The Engineer.*)

SIR,—Can any of your readers give me the address of the makers of machinery for printing wall papers in colours? W. P.

BENDING COPPER PIPES.

(*To the Editor of The Engineer.*)

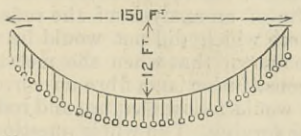
SIR,—Can any reader give me the name of the maker of a bending machine to bend copper pipes up to 5in. diameter without bruising: also of the best steam hammer for all kinds of coppersmith work? H.

Leeds, July 15th.

THE STRENGTH OF WIRE ROPES.

(*To the Editor of The Engineer.*)

SIR,—Wire rope makers say the breaking strain of a 4in. circumference steel wire rope is 41½ tons. At what weight will it break with the load equally distributed so:—



Aberdeen, July 4th. W. J.

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

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

THE ENGINEER.

JULY 21, 1882.

THE COST OF THE ELECTRIC LIGHT.

ALTHOUGH we have repeatedly discussed the question of the relative cost of lighting by gas and by electricity, we have no hesitation in returning to the subject. The capital invested in the shares of electric light companies now, nominally at all events, amounts to some millions of pounds sterling; and although there is for a moment a pause in the floating of companies, each of which is supposed to possess a better system of lighting our houses, factories, and streets, than any other company, the lull must be regarded as temporary. Electric lighting has established itself in the world, and it will, doubtless, go on approaching nearer, day by day, to perfection. But there are certain more or less anomalous and apparently incomprehensible facts about the dealings of companies and individuals who profess to supply the plant for electric lighting, which require more explanation and consideration than they have yet received. Mr. Saxon Snell's letter, published in our last impression, can hardly be passed by without notice. As it stands it is no doubt a damaging indictment, and, unless some qualifying arguments can be advanced, it is to be feared that electric lighting must be pronounced so much dearer than gas that the latter will always beat the former out of the market. The case cited by Mr. Snell may be regarded as a standard case. A large public building—a workhouse in short—had to be lighted. The gas bill was close on £800 a-year. Mr. Snell said to various companies, "I want this place lighted by electricity as well as it is lighted now by gas. Do it in any way you think proper. In the rooms I must have incandescent lamps. In the lobbies and corridors you may, if you please, put in arc lamps." There were practically no restrictions of any kind; but the tenders were so high that it was out of the question to accept any of them, and so the building still depends on gas for its illumination. No case with which we are acquainted has occurred more favourable to the electric light, for the price paid per thousand for gas is very high, and the tendering companies were left to their own devices. Are we, therefore, to assume that electricity must be condemned as a lighting agent? In our opinion nothing of the kind.

Again, let us take the case of the City of London. At a meeting of the City Commission of Sewers, held on Tuesday, a report was brought up from the Streets Committee on their proceedings relative to the applications made for an extension of the experiments in electric lighting. They stated that Colonel Haywood had prepared plans for further experimenting in electric lighting, not only in the east but also in the north and west of the City, and it was agreed to form four districts for the purpose of inviting tenders for such work. They submitted an abstract prepared by the engineer of the tenders received, from which it appeared that the cost for twelve months, including the fixing of machinery, lamps, &c., ranged in the first district from £2190 to £5750, as against £551, the present cost of gas; in the second district from £2350 to £4270, as against £363 for gas; in the third district from £2470 to £3800, as against £341 for gas; and in the fourth district from £2920 to £4350, as against £612 for gas. Some of the companies coupled with their tender a request to be allowed to light private premises within the districts, and in one case the company offered to make the charge for lighting—irrespective of machinery, &c.—the same as for the gas saved, plus 20 per cent. Looking at the experiments which the Commission had already carried out, and the great cost of extending them, as shown by the offers then submitted, the Committee were not prepared to recommend the Court to proceed further in the matter at present. We are not surprised to find that the report was agreed to.

In the case cited by Mr. Snell we are clear of all complication concerning the relative amount of light given by the two systems, arc and incandescent. Mr. Snell only wanted electricity to give him as much light as gas; where he had a 16-candle burner he wanted a 16-candle incandescent lamp, and so on. Even the arc lights in the corridors were not compulsory; whether they were used or not was a question for the would-be contractors to say. Thus, then, the question of cost was based on equal photometric values. When we come to look closely into the matter we find that the gas company asked Mr. Snell only to pay for gas, but the electric light companies asked him to pay for more than electricity; for example, one item in the plant account was an engine of, we understand, 60-horse power. The difference between the gas companies and the electric light companies is that in all cases the latter have to supply and the customer has to pay for plant, in the shape of a steam engine and dynamo; while the former do not sell plant, but only the product of their plant; a strict analogy might be drawn between the case cited and public and private brewing. Let us suppose that in Mr. Snell's workhouse a great deal of beer was drunk—we do not suppose there is, but we make the assumption for the sake of illustration—Mr. Snell might think it would be better that the place should have home-brewed beer; so he asks for tenders, and finds that he will have to put down a complete little brewery, with engine, grist mill, &c. &c. He then counts up the price, and discovers that the cost of the home-brewed beer is frigtful as compared with that of the beer supplied by Messrs. Hops, Sacher, and Co. The beer itself is not so expensive. If only it were not weighted with the great capital outlay and the interest on that capital, he would do very well. For example, take Mr. Snell's own figures, and cut out £2000 extra capital invested in electrical plant, and we save £300 a year. There is also something to be said about the coal bill. Assuming that his engine used 3 lb. per horse per hour—it ought not to need more—it would indicate 243-horse power, but with the incandescent lamp 200 candles can be had per indicated horse-power. Did Mr. Snell really want 48,600 candles, equal to 3037 burners? It may, of course, be urged that someone must pay for the plant, and that it really is paid for by the consumer; but although we admit this to be true in a sense, its effects are qualified in two ways. In the first place, the consumer does not pay any lump sum, but only a small percentage, so to speak, on the cost of each pint of beer he buys; and in the second place the capital employed by Messrs. Hops, Sacher, and Co. is very large—£250,000 or so—and the cost of making beer is, with the splendid plant at their disposal, not half that of making beer at home. The money invested by Messrs. Hops, Sacher, and Co. is used to infinitely greater advantage than would be the two or three thousand pounds invested by the parish authorities in a small private brewery. If these things are borne carefully in mind it will be seen where the electric light is at a disadvantage; and the weak place discovered, it becomes at once possible to deal with it.

The truth is that so long as expensive plant has to be provided by the consumer, electricity cannot compete with gas in cost. If each householder were obliged to have his own private gasworks, gas lighting would be non-existent. Even where several householders in a sense club together to make one gasworks do for all, as in the case of small towns, it is well known that the price of gas is very high. There are very few works making 25,000 to 30,000 cubic feet per day which can supply gas at less than 7s. 6d. to 8s. per thousand, but the great metropolitan companies can supply it at a good profit at 3s. and 3s. 4d. per thousand. In certain instances towns of even some magnitude have abandoned the use of gas in street lamps and taken up petroleum instead. The remedy for the present defect in electric lighting lies in establishing large centres where electricity will be manufactured and sent out to the consumer just as gas is now, wires being used instead of pipes This truth has long been well known to many electricians, but the putting up of such manufactories has been retarded by certain adverse conditions. In the first place, certain eminent authorities stated that electricity for lighting could not be conveyed save through conductors of vast capacity. This is now known to be, in one sense, a complete mistake, although certain difficulties do arise with incandescent lighting the moment the resistance of the wires approaches that of the lamps. Secondly, the electrical companies had no Acts of Parliament, or, in fact, any *locus standi* whatever in a legal sense. They could not lay down wires in streets or take any steps to distribute electricity, but the Electric Lighting Bill has now passed the House of Commons, and matters assume a far more favourable aspect for the electric lighting companies. We may expect to find the example set by Edison followed on a large scale. In the neighbourhood of Holborn there is laid a network of wires, and any householder residing within the range of this net can have electricity laid into his house like so much gas. In this way it will soon become possible for the consumer to fit up his house with lamps as seems to him right and proper, and the beginning and end of his disbursements will be a payment of so much a lamp per annum to the lighting company, the company supplying new lamps as old lamps break or wear out; the householder will not then be troubled by the expenditure of capital. He will not have to employ a man to look after his engine and dynamo. In short, he will have no capital outlay, and we have very little doubt but that electricity can be supplied by suitably organised companies for a less cost, light for light, than gas.

It must not be forgotten that Mr. Snell's dealings were with the incandescent light, and this must, under all circumstances, be much more expensive than the arc light. It does not seem to be possible to reduce the price to the consumer of the incandescent lamp below 5s., and assuming that it lasts 1000 hours without breaking, this represents about ·06d. per hour for, say, twenty-five candles, or seventeen hours for 1d.—let us say 2d. per week per lamp. This is apparently not much, but it mounts up when a considerable number of lamps are used. It is also very doubtful whether it is fair to take 1000 hours as the duration of an incandescent lamp. That they will last so long, and even longer, without breaking is quite certain; but long before they have been at work for 1000 hours a deposit of carbon begins to take place on the inside of the glass, which tells injuriously on the distribution of the light. If Mr. Snell had made his comparison between gas and the arc lamp, he would have had the figures much more favourable to electricity than those he actually obtained, always providing that he was content to accept the increased light he would obtain as compared with gas as an equivalent for his outlay. But setting aside this question, we may say, once for all, that the results of our own inquiries all tend in the same direction, namely, that electricity cannot compete in cost with gas under ordinary circumstances so long as the consumer has to put up his own steam engine and dynamo. There are, of course, plenty of places where electricity supersedes gas on its merits, as, for instance, at the Savoy Theatre, Weston's Music Hall in Holborn, and the City Temple. In the former case the theatre provides its own complete plant; in the latter the electricity is supplied by the Edison Company. We have no doubt that the Savoy Theatre could be just as brilliantly lighted with gas as it is now for less money, but the game is in this case worth the candle or, rather, the incandescent lamp. But exceptional cases of this kind prove nothing to the contrary concerning our statement, which is that when incandescent lighting is employed it will cost more than gas, unless the electricity is supplied by a large company with plenty of plant furnishing electricity on a large scale to numerous consumers.

Of course, if the makers of electrical plant would reduce their prices, the conditions might be so far modified that our statement would also require modification. Whether the arc light costs more or less than gas will depend on the value attached to the extra light given. What this value is is a keenly disputed point now, and is likely to remain so for some time to come, but it is beyond dispute that the prices now charged by companies for plant must not be taken as accurate exponents of the true value in an open market of that plant. We have, however, just now to deal with things as they are, not as they will be.

BRIGHTON.

IT has become of late years very much the fashion to pick holes in the reputations of certain of our towns, and those forming our seaside resorts have been more freely the victims of this fashion than those more inland which have no migratory seasons. It is far from our intent to protest against the desirability of free criticism of matters which may concern the health of hard-worked Londoners

and others, who, during the few brief weeks of well-earned holiday, seek the renovation of health by the seaside; but what we must strongly deprecate, is the very trivial and insufficient grounds upon which charges are often based, and which are productive of a far greater amount of injustice and evil than is in any way deserved. Some casual traveller spending a night or two in some marine caravanserai is annoyed, perhaps, by an unpleasant smell, which may, not improbably, only be due to an accidental deposit on the beach, or the temporary disarrangement of a sluice or other drainage apparatus. Forthwith a letter is despatched to some one or other of the daily journals. Paterfamilias is earnestly requested in it to beware of the danger which his little ones will incur if taken to such-and-such a place; and straightway anxious mothers see in imagination their children suffering prospectively from smallpox, diphtheria, and other more or less fatal diseases.

Now what we have sketched above is just now happening in the case of the well-known town, the name of which heads this article; and, familiar as we are with the facts, we are not surprised at the general feeling of indignation which has been aroused among its resident population, who, having long been accustomed to regard their town—and with justice—as one of the healthiest in the kingdom, find it suddenly condemned by a daily paper and a leading medical journal as being so insufficiently and improperly drained as to lead to the fear of the outbreak of infectious disease. Those who know the history of the Brighton town drainage also know well that there are few places where greater attention has been paid to sewers, or a larger relative expenditure incurred, with the object of securing perfect drainage, than at Brighton. It has been our duty, when commenting from time to time upon the condition of the Brighton beach, to write in terms of complaint of the authorities who conduct its municipal affairs; and we cannot, therefore, be thought to possess any bias in their favour when we state, upon our own personal knowledge, that these authorities have been unremitting in their endeavours to keep up the town drainage to the highest standard of efficiency known to modern science. But a few years back the whole sewer system of Brighton was reconstructed at a vast expense, no less an authority than Sir John Hawkshaw having directed the work. The method of discharge by outfall pipes along the sea front, of which just complaint had been made, was entirely abandoned, and a fine main sewer now leads the drainage by gravitation to a point about a mile from the town on the Rottingdean-road, where it is raised by engine power, and discharged well out to sea under such conditions that the disagreeable spectacle of floating sewage is now never seen along the beach line of the town.

But "give a dog an ill name and hang him" is an adage as unfortunately applicable to public places as to individuals, and in this case of Brighton the endeavour to lower its reputation appears to us to have been made with a persistence and recklessness of facts which is much to be deprecated. No wonder that the Brighton Town Council is up in arms, and that its members propose legal proceedings against those who malign their charge without due grounds for doing so. It is all very well for the attackers to say, "Mend your ways, and don't waste your breath;" but when every endeavour has been made, it is hard for flesh and blood to bear quietly onslaughts which can only be refuted by producing evidence which shall have publicity in our law courts. We do not mean to say that the drainage system of Brighton is so perfect as not to possess some of the defects inherent in all systems—and these we propose to comment upon—but certainly they are of a very minor character, and can in no degree justify the energy with which the health-character of the town has been attacked. This last should be judged by the results which are so markedly shown by the Registrar-General's returns. If for years past the mortality of a town—which is largely resorted to by invalids—is shown to have been much below any accepted standard—and that of Brighton has been shown to be so—it is manifest that the ill-effects predicted are no more likely to become apparent now than they have been during the years that the present drainage system has been in operation. Within the last few weeks the municipal authorities at Brighton have called for the opinion of Sir J. Bazalgette, who after having personally inspected all the sewers to which access was possible, has pronounced them to be in a perfectly effective state, and even his long experience is able to offer but very limited suggestions for improvement. Apart from this high authority, we ourselves desire, as we have expressed above our intention of doing, to offer a suggestion which personal experience seems to render opportune. It should be borne in mind, however, that this suggestion is not alone applicable to Brighton, but also to most of the towns with the drainage system of which our personal visits have made us acquainted. The ventilation of the sewers is effected for the most part, we believe, by traps and gratings opening into the streets on the sea frontage. These are kept closed during the day, and no ill effects are then noticeable; but when night comes on they are opened, with the result that those whose pleasure or duty keeps them late abroad do undoubtedly experience bad smells. It would be far better, in our judgment, if ventilating towers were erected at certain points which should keep a discharge going night and day into the upper air; and, better still, if fires were maintained in them, which, while drawing the gases from distant points and so enabling but very few such towers to do the work, would, in addition, consume the major part of such gases.

We have noticed in a recently published paper a letter by Mr. Ellice-Clark, the engineer of the Hove Commissioners, in defence of that separate Corporation, but still integral portion, of Brighton, and fully agree in what that gentleman has therein advanced; but, having in view the enormous growth of buildings in the Hove district of late years, we fear it cannot be said that even Mr. Ellice-Clark's vigilance has been quite equal in all cases to the heavy demand upon it. We do not particularise, because it would be manifestly unfair to do so, and we abstain from generalisation, because it would be even more unfair to judge from a few isolated cases, which should hardly affect the fair reputation of the whole; but instances have been named to us in which the builders of properties would seem, either from ignorance or in wilful and undetected evasion of regulations, to have grossly neglected the proper arrangement of house connections. Whenever the Hove Commission can bring such default to book, we recommend the severest measures possible, and feel sure that no effort on Mr. Ellice-Clark's part will be wanting in such instances. In conclusion, having mentioned the points we believe open to comment and capable of amendment, we may ask—"What do they all amount to?" Is Brighton singular in its liability to such comment, or do the facts in any degree justify the attempt to destroy the reputation of one of our finest towns, which has long been proved upon irrefutable evidence to be one of our healthiest? In the public interest we must protest strongly against a legitimate criticism being extended and lowered into an energetic and mistaken endeavour to depreciate a long-enjoyed reputation. According to the most eminent engineering authorities, the Town Council have done all that can be done to dispose satisfactorily of sewage. The worst that can be urged against them is that the system on which the sewers are ventilated is defective; but Brighton is in this respect certainly not worse off than London or any other large town that can be named, and it remains to be proved that the existence of a smell must be accompanied by the presence of poison. The best authorities on sanitary matters assert that poisonous sewer gas is non-odorous. That the gases smelt now and then in Brighton are not poisonous is fairly demonstrated by the extremely low death-rate of the town. That evil smells are nuisances we freely admit, but even these nuisances the Town Council of Brighton have taken measures to abate.

THE DECAY OF PISTON RODS.

That piston rods are liable to corrosion if they are suffered to remain at rest for a considerable period is well-known, the corrosion taking place at the point of contact between the rod and the brass gland of the stuffing-box. To obviate this action turning gear is always provided by which engines may be moved round at short intervals while the ship is in port. It is also known that the high-pressure piston rod in compound engines is subject to rapid deterioration while at sea unless special care is taken to swab it with some lubricant, such as tallow and oil. If this be neglected the surface of the rod becomes grooved longitudinally, or roughened, so that the stuffing-box cannot be kept steam-tight. The purpose of this article is not to deal with either of these forms of corrosion, but with one totally distinct, and concerning which very little has hitherto been known. A case occurred recently, however, in which the decay of a piston rod nearly led to the total loss of a passenger steamship; and we have good reason to think that many piston rods are now at work which would be found on proper examination in a very dangerous condition. The facts of the case to which we refer are very simple.

On the 18th of April the Albert Victor steamship, the property of the South-Eastern Railway Company, left Boulogne for Folkestone at noon. She is a paddle steamer, 220-horse power nominal. She was built in 1862 at Poplar, and her machinery is of a now old-fashioned type. On leaving the harbour the engines were put at full speed ahead, and she proceeded at the rate of 12½ knots an hour. About twenty minutes after she had left, the starboard cylinder gave way. The chief engineer, who was in the engine-room at the time standing between the two cylinders, immediately shut off the steam from the port cylinder, and when he attempted to shut off the steam from the starboard cylinder the rush of steam from that cylinder prevented him from doing so, and he was obliged to go on deck. After a time he succeeded in getting at the boiler stop valves, and in about three minutes afterwards, the engine-room being cleared, it was found that the cover of the starboard cylinder had been blown off, the side had been blown out, and that the piston rod was out of its position. In the meantime the vessel, being helpless, was drifting before the wind and tide to the eastward, along the coast, and the master immediately communicated with the engineer, and asked him what prospect there was of getting the engines to work again, and was informed that he hoped in about twenty minutes to disconnect the shaft and to work the vessel with the port cylinder. He failed, however, to get the port crank over the centre, and the Albert Victor was in considerable peril for some time, as she was drifting towards the French coast, and the sea was rough. The captain at length dropped anchor, and a tug-boat arrived by which the Albert Victor was towed into Folkestone, arriving about three in the morning. On examination it was found that the piston had become loose on the rod, and when steam was admitted beneath it it was forced violently up the rod, and striking the cylinder cover with great force it smashed it, and broke a portion out of the side of the cylinder as well. There was a Board of Trade inquiry into the circumstances, which resulted in making it perfectly clear that the accident had been caused by the decay of the piston rod. The rod was secured in the piston in a way very frequently adopted still, and almost universally used in marine engines twenty years ago. The lower end of the rod was enlarged to form the frustrum of a cone, with the small end next the crank end of the piston rod. This cone was nearly as long as the piston was thick. Above it was a screw of seven or eight turns, the threads standing up above the rod. The cone made a steam-tight fit in a conical hole bored in the piston body when the rod was put through the piston. A large nut was then dropped down the rod until it engaged in the screw, and by turning this nut the cone was drawn up firmly into the piston. A very good and workmanlike job can be made in this way. It is clear that on the down stroke the cone takes all the strain, and the piston cannot be forced off unless it is first split; but on the up stroke the nut and screw take all the strain, and if the threads stripped the piston would move on the rod. On examination it was found that the screw-thread of the Albert Victor was corroded away. It had decayed, in fact, and the accident which we have described followed as a direct consequence. It was contended during the inquiry that something had got into the cylinder, which the piston struck on the down stroke, and so stripped the thread; but the Commissioner, in giving judgment, repudiated this idea. It came out in evidence, that as far back as 1876 the engines were completely overhauled, and it was then found that one thread of the piston rod screw had been corroded away for a length of about 8in. or 9in., but no importance was attached to this, because plenty of thread remained to hold the rod in its place. There was some conflict of evidence about the condition of the remainder of the screw. One witness said it was pitted; another that not one thread, but several were affected, apparently all in one place; but, as we have said, be this as it may, no importance was attached to the damage which had accrued to the rod, and we have no doubt that unless the mischief had extended there would have been no accident. But it did extend, and we have now to consider how it originated and why it extended.

It will be understood that once screwed down such nuts as we have described are never slacked again save under some exceptional circumstances; consequently they are of iron, as is the piston rod, so that galvanic action between the rod and the nut is not to be anticipated; but, nevertheless, it is certain that in the case of the Albert Victor corrosion of some sort did take place. One of the witnesses suggested that brass from the gland might find its way down the rod and get into the thread in fine powder, but this presupposes a certain considerable amount of slackness of fit in the nut, and we hold this theory to be untenable. The South-Eastern Railway Company, taking warning by the accident, had the pistons of four vessels which had been built in 1861, 1862, and 1865, namely, the Victoria, Alexandra, Albert Edward, and Napoleon, examined, and the result was that in the Victoria and Albert Edward it was found that the threads of both cylinders were defective and required to be renewed. In the Alexandra and Napoleon the thread of one in each. It was also found—and it is a remarkable fact—that in either the Napoleon or Alexandra, we do not know which, the nut was so tight that it had to be split in order to get it off, and it was then found that the screw was in good condition. In one other case where the nut had to be split the screw was quite gone. The fact, therefore, that the nut is tight is no evidence at all that the screw is in good condition. It appears to be almost impossible to form any sound conclusion as to the cause of corrosion. The most reasonable is that the grease used to lubricate the cylinder contains free sulphuric acid, which acid has been used to purify the tallow in a way well known, or it may be that oleic acid does the mischief. Grease works its way by capillary attraction into the threads of screws and nuts, and the supply being kept up, in a series of years the iron would be finally eaten away as described. But plausible as this examination is, it does not take into consideration the circumstance that it is only the piston rod which is attacked, the nut remaining as far as can be learned uninjured. It is generally found, it is true, that when two pieces of iron in contact show symptoms of corrosion, one is found electro-positive to the other; but why in all the five cases cited the nuts should have escaped while the piston rods suffered it is not easy to say. No doubt the piston rods were of forged scrap. Whether the nuts were or were not we cannot say, but there is no reason to doubt that the texture of the two irons must have been different, and the results of an analysis of the rods and nuts which failed and those which did not would be very instructive. If it could be shown that when the metals were identical in chemical constitution and fibre no corrosion had taken place, then it would follow that nut and rod should be made from the same forging. The whole question is one of much interest, bearing on the corrosion of metals in a very important way. For example, what is likely to be the effect of an iron nut on a steel piston rod? The practical lesson taught is that an examination of the piston rod fastenings of a very large number of steamers now afloat would be no more than prudent.

COMBUSTION WITHOUT FLAME.

Solid carbon can be burned without flame and will evolve an intense heat, but it is not generally known that gases can also be consumed without flame. If a coil of fine platinum wire be put in the wick of a spirit lamp, and the lamp lighted, the platinum wire will become red hot. If the flame be now blown out the wire will continue to glow by the combustion of the spirit vapour, much as the wick of a candle glows after the flame is extinguished. Mr. Fletcher, of Warrington, has developed the principle involved with very remarkable results, burning ordinary coal gas without flame and producing an enormously high temperature, He gave practical illustrations of the process at the *soirée* of the Society of Chemical Industry at Owen's College on Thursday week. Taking a ball of iron wire about 3lb. in weight, Mr. Fletcher placed it on a slab of fire-clay, and directing a blow-pipe flame on it for a few seconds, he suddenly blew the flame out. The temperature increased so rapidly that in a few seconds the wrought iron fused and ran into drops, and this temperature was steadily maintained. The room was darkened, but the closest examination did not show a trace of flame, although the fact that the gas was burning was proved by repeatedly relighting and extinguishing it. The same experiment was repeated in another form by directing the flameless heat into a small fire-clay chamber, in which a refractory clay crucible, made specially for nickel melting, was partially fused and worked into a ball like soft putty, the sides of the fire-clay chamber being at the same time fused. The heat was so tremendous that the blow-pipe laboratory which was given up to Mr. Fletcher for the evening was much too hot to be agreeable, in spite of open windows and ventilators. It is certain that such temperatures as obtained by Mr. Fletcher without flame have never previously been obtained with the fuel used, which was nothing more than an ordinary gas supplied through a quarter-inch pipe assisted by an air blast. Mr. Fletcher's views on the subject are very simple. "Flame is not a necessity in chemical combinations and does not exist in the combination of say, platinum and tin, which evolves a tremendous heat, nor does it exist, so far as he has been able to detect, in the explosion of gun-cotton, provided the gun-cotton contains nothing but what in itself is sufficient to form a perfect

combination. The flameless combustion is simply a succession of almost silent explosions ; there is a subdued roar always present, but it is steady and continuous." The increase of temperature corresponding with the reduction of the size of a flame is well known. Mr. Fletcher has only carried it a little further and reduced the flame to nothing, carrying the known theory to its mathematical conclusion, and thereby proving its correctness. We need hardly point out that the process may yet play a very important part in the arts.

THE YORKSHIRE COLLIERIES AND THE HULL COAL TRADE DURING THE HALF-YEAR.

THE official return relating to the tonnage of coal by rail and water from the Yorkshire collieries to Hull during the past half-year presents some striking features. Some of the pits present a large increase, and others a marked decrease. The quantity carried by water during last month was 42,952 tons, and 66,901 tons by rail, or a total of 109,853 tons, against 97,766 tons in the corresponding month of last year. The quantity sent during the six months of the present year was 615,645 tons, as compared with 528,852 tons in the same period of last year, or an increase of 86,793 tons in favour of the past six months. The exports for the past six months amounted to 310,485 tons, or an increase of 91,267 tons. Of the increase in the quantity sent during the six months, eight South Yorkshire collieries more than supplied the extra tonnage. These were Denaby, Wharncliffe, Silkstone, Thryberge Hall, Wath Main, Elsecar, Houghton, Hemsworth, and Monk Bretton. These eight collieries sent during the past half-year no less than 90,442 tons more than in the same period of last year, Denaby having increased its tonnage by 31,668, Elsecar 14,618, and Houghton 15,039 tons. Many leading collieries in both districts show a marked falling off in the six months. The following thirteen collieries, viz., Carr House, Edmunds Frystone, Garforth, Holmes Manvers, Stanhope, Thornhill, Hudson's (Victoria), Wheldale, West Riding and Silkstone, Wombwell Main, Wentworth and Old Silkstone showing a decline of 69,220 tons, when compared with what was sent in the first six months of 1881. The quantity sent last month from some of the leading collieries was as under :—Denaby, 12,852, against 8144 last year ; Boughton Main sent 5733 tons, against 345 tons last year ; from Lindhill 2108 tons were sent, against 1288 tons in June, 1881 ; Carton Wood supplied 1466 tons, against 1264 tons ; Carton Main 2696 tons last month, as compared with 2379 tons last year.

LITERATURE.

The Diamonds, Coal, and Gold of India : their Mode of Occurrence and Distribution. By V. BALL, M.A., F.G.S., of the Geological Survey of India. London : Trübner and Co. 1881.

INFORMATION about the geology of India, especially in relation to its diamond mines, is scattered up and down in various publications, the names of some of which give no clue to the actual contents, as we happen to know, because of having made prolonged researches in the literature of diamonds in the British Museum Library. Strange to say, the records of the Geological Survey of India are incomplete in the national library. Mr. Ball's little book gives, in a condensed form, the main facts relating to diamonds, coal, and gold in India, and it possesses the strong recommendation that, by means of notes, it gives references to numerous books in which more ample details can be found.

The chief diamond fields of the world are those of the Cape and of the Brazils, the yield in India, especially of large diamonds, having declined long ago. Sometimes the Indian diamonds are found in the mud of rivers, and sometimes in the solid rock, usually a kind of puddingstone, the components of which seem to have at one time been subjected to the action of water. The diamonds are obtained by breaking up this rock, and are sometimes smashed in the process ; many are also not detected at first, but are found on again examining old refuse, which probably gives rise to prevalent local ideas that diamonds grow in the dry rock.

Were machinery to be devised for reducing the rock to more or less coarse powder without injuring the diamonds —which might possibly, perhaps, be done by subjecting pieces of the rock to sudden alterations of temperature, supplemented by mechanical treatment, with or without the presence of water—is it not possible that mines abandoned as not worth working by hand might produce a remunerative yield ? In India the mines have been worked by the natives under a system, says the author, which practically amounts to slave labour, and only by such labour, he says, does it seem possible to reduce thefts by the workmen, the actual stoppage of much theft being practically impossible. He also says of diamond mining in India by Europeans :—"The case is in a measure similar to that of manufacturing iron. The native iron smelter, with no expensive plant, manages by a most wasteful process to keep himself alive by making iron. The English company turns out iron by the most approved methods, and after a time goes into liquidation."

If a machine could be devised in which, after lumps of rock were put in at one end, all the substance treated should be under lock and key till the proprietor unfastens the protected parts to find diamonds and powdered stone at the other, the possibility of theft, except when splitting off the pieces of rock from the original stratum, would be prevented. A few days ago a leading article in the *Daily News* indicated that thefts of rough diamonds on a large scale have evidently been going on in the South African diamond fields, and that a partial remedy seemed to be the employment of savages as workers, under stringent rule. Thus experience at the Cape harmonises with Mr. Ball's statements about the Indian diamond fields.

Diamond-bearing rocks extend over wide areas in India. Some have doubtless not yet been discovered ; some have been abandoned as unprofitable to work, whilst in others diamond mining continues.

Rough diamonds are usually dull and rounded, much resembling minute rounded pieces of gum arabic, hence are difficult to discover in heaps of mud and broken rock ; they are easier to find when the mass is wetted, because then their interior brilliancy is more apparent.

Information about the gold and coal of India is briefly and clearly given by the author, with references to larger works for more ample details.

ON TIDES AND TIDAL SCOUR.*

By MR. JOSEPH BOULT, C.E.

[*Concluded from page* 6.]

THE first attempt at improvement was the adoption of dredging by hand, if that can be called dredging, and the continuation of the south bank of the Liffey to Poolbeg lighthouse just within the bar, combined with the construction of the great north wall from the shore at Clontarf to about 1000ft. short of the Poolbeg light, thus leaving an entrance of that width. This work was completed by 1825, and in 1838 the depth of water on the bar had been increased to 10½ft., or by 2ft. since 1822, giving an average of 1¼in. per annum. Between 1838 and 1873 the depth was further increased to 16ft., giving an average annual increase of 1·88in.; the rate for the five years between 1868 and 1873 being 2·4in., and the greatest on record. This increased rate appears to be due to the great increase in the amount of dredging. Mr. Griffith appears to ascribe the deepening of the bar almost exclusively to the great northern wall, the effect of which would seem to be merely that of contracting the sluice through which the upland waters are discharged, after the water level has fallen below half-tide level, that being the height of the southern part of the wall for a length of 500ft. It is obvious that the water which enters the harbour over that part of the wall, and through the gap at Sutton, will return by the same route ; and that the most obvious way now available for increasing the scour over the bar is to increase the capacity of the harbour below half-tide level, or to raise the lower part of the northern wall.

Messrs. Giles and Halpin in their report of 6th May, 1819, explain their reasons for recommending the construction of the great north wall to be the sheltering of the harbour, the prevention of the sand passing from the North Bull into the harbour, and the admission of as large a body as possible of tide-water into the harbour, and its return past the lighthouse within such limits and in such direction as will produce the best scouring power to deepen the bar, combined with the least obstruction to the navigation. They proposed that the wall should extent to the distance of 2000 yards south-east from the shore of Clontarf, and there to commence a parabolic curve towards a point due north of the lighthouse, by which curve the direction of the ebb current would be graduated to a suitable course for effecting the best scour at the entrance and on the bar ; and the proper width of the entrance will be practically determined as the embankment proceeds by its operation upon the currents in the channel.

When Mr. Telford made his report of 16th August, 1822, the wall had been carried for a distance of about 5500ft. to its full height, about 1500ft. further to the level of H.W.N.T., and about 500ft. more to the level of half flood. The effects of the wall were very evident, for the sandbanks inside, having been deprived of their usual supply from outside, had been lowered on the average more than 3ft.; that part of the bar immediately opposite to the harbour mouth had likewise been lowered from 6½ft. to 8ft., and even 9ft.; the western part of the bar, adjacent to the old channel, remaining 7ft. and 7½ft. only. Telford was of opinion that the entrance would still be considerably too wide to produce the full effect of deepening the bar, or forming a perfect and direct channel within the south wall ; and, therefore, strongly recommended the adoption of Mr. Halpin's proposal to add a still further extension of about 500ft., to be carried forward with great caution, observing the effects produced upon the current of the flowing and ebbing tides during the ensuing winter ; the extension, at present, not to be raised above the level of half tide until the effects on the current have been fully and carefully ascertained, after which the most advisable measures for completing this great work, both as to shape, extent, and height, may with propriety be determined.† The mean annual discharge of water is stated to be 51,000 cubic feet per minute ; the limit of tidal range up the river, a weir at Island Bridge three and a-half miles above Ringsend, or eight miles above Poolbeg ; the greatest velocity of the tidal current over the bar at half ebb H.W.S.T. three and a-half miles per hour; but in all tides the velocity diminishes considerably as the stream spreads and enters the deep water east of the bar. The depth of water on the bar H.W.O.S. is 28ft.‡ Mr. Griffith, in his reply to my inquiry made before seeing Mr. Mann's book, informs me that the mean discharge of the Liffey and Dodder combined may be taken as 40,000 cubic feet per minute ; and adds, no accurate gaugings have ever been taken, but the foregoing estimate, he believes, is near the truth. It is very desirable that the mean discharge of all important rivers be accurately ascertained, not only as a basis of comparison with other rivers, but also for determining the utmost amount of scour which can be made available ; the amount actually made use of being as much as is required for the purpose. Before proceeding to review other harbour works, attention should be directed to the excellent method adopted by Mr. Storey for constructing the basement of retaining walls below low-water level without the aid of cofferdams, pumping and staging. Blocks of masonry 29ft. high, 11½ft. long, and 21ft. 4in. broad at the base, are built on a wharf, and about three months after completion are lifted by powerful shears and conveyed to their destination, where each forms 4½ft. in length of the lower portion of the wall as high as low-water level. When a number of blocks has been thus laid in position, the superstructure is carried up to the coping level by tidal work in the usual manner ; the total height of the wall being 45ft. Each block weighs 350 tons.§

In the Clyde the improvements have been specially directed towards widening and deepening the harbour of Glasgow. The general condition of the river appears to have received very little attention. Practically, the channel from Greenock to Glasgow is now level, with the same rise of tide at each end, about 24 miles apart. The works carried out since 1758 have lowered the level of low water 8ft. at the rate of ·84in. per annum; since 1853 the depression has been fully 18in., at the rate of 1in. per annum; the level of high water in 1872 was about 10in. higher than in 1853. The river has been very much widened at Glasgow. A few years since the weir, which, at 120 yards above Albert Bridge, formed the eastern limit of the harbour, was removed, with the effect of lowering rather than raising the level of high water. The weir may have caused a slight local heaping up of tide by its obstruction. The bed of the river above the weir has been lowered some feet, chiefly through the action of floods, the soil carried away having been deposited in the harbour, and thence removed by dredging. Smeaton reported that at Pointhouse Ford, now the western end of the harbour, there were depths at low water of 1ft. 3in., and at high water 3ft. 8in.; and at Hirstpoint, now within the harbour, there were depths of 1ft. 6in. at low water, and of 3ft. 3in. at high water; in 1872 there were 14ft. at low water and 24ft. at high water at each place. Thus the bed of the river has been lowered nearly 13ft. In 1837 springs rose and fell at Port Glasgow about 11ft., and at Glasgow 7ft. At Port Glasgow they are still about the same, but at Glasgow springs now rise 10½ft., neaps 9¼ft.; in 1837 the time of high water was 1 hour 20 minutes later at Glasgow than at Port Glasgow—now 1 hour 5 minutes. In the beginning of the century the difference was three hours. Since 1856 the city has not been inundated ; in that year the water just rose above the quay. In April, 1880, and March, 1881, two floods occurred, the first said to be the greatest for fifty years, and the second heavier still. Both caused a strong current in the river, and the removal of much sand and soil from the upper reaches of the river, which were deposited in the harbour, from which they had to be removed by dredging. After the flood of 1880 it was necessary to dredge 300,000 cubic yards, at the cost of £7500, to restore the harbour to its previous depth ; the flood of this year 1881 would probably render as much dredging necessary for the removal of the silt. During the quarter which ended about the time of the flood, 318,112 cubic yards had been dredged, of which 273,936 yards were new material, and nearly 17,000 yards were deposit. According to Mr. Ure, the ordinary rate of water discharge is 48,000 cubic feet per minute. Since the removal of the weir mentioned above, the influence of the tide has been observed 1400 yards beyond its former range. These particulars are compiled chiefly from a communication to the Inst. C.E., "Proceedings," 1872-3, by Mr. Deas, engineer-in-chief to the Clyde Navigation. I have been favoured by Mr. Deas with copies of his report on the bed and banks of the river Clyde from the site of the weir above Albert Bridge to Westthorn, 1880, and of his quarterly reports, July, 1880, and April, 1881. I have also to acknowledge the courteous assistance of Mr. John D. Parker.

In the river Tay the mean or ordinary discharge is 274,000 cubic feet or 7645 tons of water per minute ; the river is navigable to Perth, which is twenty-two miles above Dundee, and thirty-two miles from the German Ocean. Before the commencement of the works for improving the navigation, which appear to have been confined to a length of nearly 12,000 yards below Perth, the passage was obstructed by certain ridges called fords, which stretched across at different points between Perth and Newburgh, and vessels drawing from 10ft. to 11ft. were unable, without great difficulty, to make their way from Newburgh to Perth during the highest tides. The most objectionable of these fords were about six in number, and the depth of water upon them varied from 1ft. 9in. to 2ft. 6in. at low water, and from 11ft. 9in. to 14ft. at H.W.S.T., so that the regulating navigable depth could not be reckoned at more than 11ft. under the most favourable circumstances. In addition, many detached boulders were scattered over the bottom, and numerous fish cairns of stone and gravel had been constructed by the salmon fishers. The works for improving the navigation, extended over six working seasons, consisted of removing the boulders and fish cairns, and of dredging the fords, harrowing being adopted in some of the softer banks in the lower part of the river ; three subsidiary channels were cut off by embankments, and in the most contracted parts the banks on both sides were excavated below low-water mark so as to equalise the currents. The depths at the shallowest places were made pretty uniform, being 5ft. at low water, and 15ft. at H.W.O.S.; steamers of small draught can now ply at low water, and vessels drawing 14ft. can get up to Perth in one tide with ease and safety. The velocity of the tidal force in this part of the river has been increased more than 1⅞ miles per hour, and the period of its influence at Perth has been extended fifty minutes.

In 1833 spring tides flowed	2h. 20m.
,, ,, ebbed	7h. 0m.
Neap tides flowed	3h. 15m.
,, ,, ebbed	7h. 0m.
In 1844 spring tides flowed	3h. 10m.
,, ,, ebbed	7h. 0m.
Neap tides flowed	3h. 10m.
,, ,, ebbed	7h. 0m.

The fall on the surface of the river from the tide basin at Perth to Newburgh, in 1833 was 4ft., and is reduced to 2ft. Between Dundee and Newburgh the river has not been improved and the tidal phenomena are unchanged.* In respect to the Tay, a remarkable instance of the difficulty experienced in ascertaining facts is presented by the reports of Captain Washington, R.N., and Mr. James Walker, C.E. The former in a report to the Hydrographer to the Admiralty, dated 1st October, 1844, says :—"Tay bar no longer exists, and vessels drawing 24ft. of water may now enter the river and bring up in safety within its shelter at the lowest water of spring tides." Mr. Walker, writing 21st January, 1825, less than four months later, says :—"The general result of the various information I received, and my conviction from that information, is that the depth of the entrance has not varied during the last century and a-half—being 18ft.†

In the Ribble the ordinary discharge of water per minute is 139,935 cubic feet.

Before the improvements were commenced a solid ridge of sandstone, about 300 yards in length, stretched right across the channel about half a mile below Preston ; its surface was from 3ft. to 5ft. above the general bed of the river, and the higher parts of the rock were occasionally left dry during the long droughts of summer. At Lytham, twelve miles below Preston, the ordinary rise of spring tides is 19ft. and of neap tides 14ft.; at Preston the rise of spring tides did not exceed 6ft., and the neap tides did not reach Preston. At "the Chain," about two miles below the town, the level of low water is now left 8in. lower than in 1841, before which time the works had begun to show their effects ; so it may be concluded that the total lowering is between 7ft. and 8ft., and that the tidal range has been increased to the same extent. The tidal propagation has been accelerated upwards of an hour. Training walls and dredging have combined to produce these satisfactory results, through which vessels, to which the navigation was formerly closed at all times, can now get up to the quays at Preston, even at neap tides, with comparative ease and safety.‡

The works on the Tyne are the most important which I propose to bring under your notice ; they extend, as completed, from the outside of the site of the former bar to 2½ miles above Newcastle Bridge, a total length of 13 miles, and they are in progress upwards for a further length of 6¾ miles. The works were commenced in 1853 by enclosing a bight of the river about three miles from the bar, and converting it into the Northumberland Dock of 55 acres of water, exclusive of basin and lock ; it was opened in October, 1857. In 1856 were commenced the piers at each side of the river entrance. They were designed by Mr. James Walker, C.E., for the protection of vessels from the prevalent and destructive N.E. to S.E. gales, and for facilitating the removal of the bar. In 1859 Mr. J. F. Ure, C.E., formerly of the Clyde, prepared a comprehensive scheme for the improvement of the tidal portions of the river, extending from the bar to the boundary stone, Hedwin springs, a distance of 19¼ miles ; the requisite parliamentary powers were obtained in 1861, and the following results realised :—The bar has been removed, and, where formerly there was only a depth of 6ft. at low water, there are now more than 20ft., a depth which is maintained for a considerable width into the harbour. In 1879 the depth of water at the entrance of the Tyne was not less than 22ft. at low water, or 37ft. at H.W.S.T.§ The Narrows, below South Shields, have been widened from 400ft. to 670ft. In Shields harbour dangerous shoals have been removed, and for a length of 8000ft. vessels can moor in a depth of more than 30ft. L.W.S.T., and instead of the tortuous channel through which it was formerly difficult to navigate one vessel at high water, three or four may now be safely towed abreast at any time of tide. Vessels, which formerly were detained for months before the bar could be crossed in safety even at high water, can now leave in any weather in which it is fit to go to sea, at or within a short time of low water. For the whole distance between Shields harbour and Newcastle there is now a depth of 20ft. L.W.S.T., where river steamers drawing 3ft. or 4ft. water used to ground for hours. For 2½ miles above Newcastle the river has been deepened to 18ft. low water, and at Blaydon a depth of 12ft. has been made. In the upper part of the river a new cut, 400ft. wide, has been made through Lemington point, and opposite Blaydon the river has been widened from 150ft. to 400ft., thus enlarging the tidal receptacle. There has not been much alteration in the tidal range, the greatest, 2½ft. is at Hebburn quay, where L.W.S. ebb upwards of 2ft. lower.

In floods the liability to inundation has apparently been

* A Paper read before the Liverpool Engineering Society.

† "Tidal Harbours Commission," Second Report, p. 20.

‡ "River Bars : Notes on the Causes of their Formation and on their Treatment by Induced Tidal Scour, with an Account of the Successful Reduction by this Method of the Bar at Dublin," by J. J. Mann, Assist. Eng. Dublin Port and Docks Board, 1881, p. 84.

§ "Proceedings" Brit. Assoc., 1878, a communication "On Recent Improvements in the Port of Dublin," by BindonB. Storey, M.A., M.R.I.A., M. Inst. C.E., engineer to the Dublin Port and Docks Board.

* "The Principles and Practice of Canal and River Engineering," by David Stevenson, F.R.S.E. Edinburgh : Black, 1872, pp. 230-38.

† "Tidal Harbours Commission." App. C., pp. 226 and 230.

‡ Stevenson, *op. cit.*, p. 186 and pp. 245-7.

§ "The River Tyne, its History, and Resources," by the late James Guthrie : Newcastle-upon-Tyne, Reid. 1880, p. 238.

removed, as the flood line on 10th March last was considerably lower than in the floods of November 1856 and 1861, though at Wylam Bridge, above the boundary stone, the highest level in 1881 was 3in. above that in 1861, and 8in. only below that of 1856. Before 1860 high water at Newcastle Bridge was sixty minutes later than at the entrance of Shields harbour, a distance of about 9½ miles, and at Newburn, about 7½ miles above Newcastle, it was twenty nine minutes later still. In 1879 high water at Newcastle was only twelve minutes later than at Shields, being a gain of forty-eight minutes, and the gain at Newburn is twenty-one minutes.* It does not appear that the mean annual discharge has ever been ascertained. For the interesting information respecting the Tyne, except as specially mentioned, I am indebted to Mr. Philip J. Messent, the acting engineer to the Tyne Commission.†

The beneficial effects of the works referred to may be presented in the works of Mr. David Stevenson, who has summarised them as follows :—(1) To depress the level of low water ; (2) to increase the range of tide ; (3) to accelerate the propagation of the tide through the channel of the river ; (4) to prolong the duration of tide in the river ; (5) to equalise the velocity of the tidal currents, removing rapids and bores ; (6) to add to the beneficial scouring power of the river ; and (7) to increase the navigable depth.‡

It has been shown that in the harbour of Glasgow the bed of the Clyde has been made practically level ; but Mr. Stevenson, speaking from his own experience, suggests that an engineer may calculate on reducing the slope of tidal navigation to about 3in. or 4in. per mile—equal to a gradient of 1 in 15,840 ; and that the gradient should not, if possible, exceed 10in. per mile, which is equal to a gradient of 1 in 6336.§ It is therefore most desirable that all strictures, horizontal or vertical, should, as far as possible, be removed, especially those which abruptly interfere with tidal propagation. Their removal, while prolonging the period of tidal action, will reduce the velocity of tidal currents, and so facilitate navigation, and relieve it from hazardous contingencies.

That the widening or deepening of any part of a river increases its tidal capacity is sufficiently obvious, but the manner in which that capacity becomes available may be worth some consideration. It is usual to say, if the receptacle be provided, the tide will throw into it a larger volume of sea-water ; but that statement is based on the assumption that the tide acts as a wave, and in some situations effects the translation of a large body of water. If the suggestions offered in the first part of this paper are well founded, tidal action, so long as it lasts, is not intermittent, but continuous, whereas all wave action is essentially intermittent ; in the ocean, sea, and river, usually caused by wind. No doubt the rise or fall of the tide is generally accompanied by wave motion, if only a ripple ; but, as before stated, there is in the Irish Sea a spot where the water rises without any current or wave, except such as is due to local and special disturbance, and in very calm weather the tide may be observed to rise upon any shore with scarcely a ripple to break the surface of the water. Therefore, instead of assuming that the tide forces sea-water into an estuary or river, it would appear to be more correct to say the tidal force dams back the fresh water brought down the river, and causes an indefinite number of flushes, or a continuous flush, the place of discharge being momentarily removed higher and higher, until the flush ceases, because the level of the top of a weir is reached. Thus, then, the element in calculating the extent to which a receptacle should be enlarged is the quantity of water discharged by the river in the period during which the tide is rising at any part of the river's course.

The more the course of the weir is left free from obstruction arising from irregularities in the bed or shores of a river, the more rapidly will the tidal force advance up the river and the less inclined will be the plane presented by that force to the descending water, consequently the more rapidly will that water rise, and it will attain to a greater altitude, just as, in a stream, the level above an obstructive boulder is greater than it is above a pebble.

Attention has been drawn to the existence of contrary streams in tidal rivers, arising from the greater specific gravity of salt water as compared with fresh. This was first observed by Mr. Robert Stevenson in 1812, in the Aberdeenshire Dee ; he noticed that the current of the river continued to flow towards the sea with as much apparent velocity during flood as during ebb-tide, while the surface of the river rose and fell in a regular manner with the waters of the ocean. By the use of a hydrophore, Mr. Stevenson ascertained that the salt or tidal waters of the ocean flowed up the channel of the Dee, and also up Footdee and Torryburn, in a distinct stratum next the bottom, and under the fresh water, which continued perfectly fresh and flowing in its usual course towards the sea, the only change discoverable being in its level, which was raised by the salt water forcing its way under. The tidal water so forced up continued salt, and when the specific gravity of specimens from the bottom were tried and compared with those taken at the surface, the lower stratum was always found to possess the greater specific gravity due to salt over fresh water. ‖ Mr. Alan Stevenson, judging from marine productions, considered that salt water in the Tay rose to a very short distance above Mugdrum Island, that is, twenty-five miles from the mouth of the river and ten miles below the tidal limit.¶

I have not been able to obtain any information as to the thickness of the stratum of salt water, though it is impossible to form any accurate idea of the quantity of water forced in from the sea, without the measurements of length, breadth, and thickness. On the assumption that tidal force is exerted as a weir, a small quantity of sea-water would be carried by the force up the river, but in consequence of its greater specific gravity, the water so carried in would have a tendency to the bottom of the weir. There, through irregularities on the bed and sides of the river, it would be gradually mixed with the fresh water until its marine character was ost, the quantity of salt water, always a vanishing quantity, being gradually reduced from the original amount, which, probably, is very small compared with the fresh water brought down the river.

It has been shown that the effect of improving the navigation of a river is to increase the velocity of the power which produces tides, and to diminish the velocity of tidal currents ; and if the currents flow with less rapidity in the same time, it is clear the quantity of water translated by tidal influence must be less, and consequently, that less water is forced into the river from the sea. Thus it follows that the back-water, on which the scour of rivers depends, is so much of the upland waters as is penned back by the weir, until it accumulates to high water, the highest attainable level, and is then discharged. In improving harbours, therefore, the aim should be so to enlarge the receptacle above the weir that it may retain all the water the river discharges during the rise of an ordinary spring tide. If the receptacle is less than will accomplish this, useful water is lost. If it is larger, the cost of the works will probably be more than the value of the water stored, and deposits of silt will be formed. I am disposed, however, to accept the conclusion of the special commission on the Tyne appointed in 1854—"that not only should every river, as observed by Mr. Rendel, be treated according to its own peculiar character, but, strictly speaking, each part of the same river may require different management.**

The comparatively small influence usually ascribed to floods upon the enduring features in the tidal part of a river confirms the opinion that there is no adequate advantage in increasing the means of retaining water beyond the level of O.S.T., because the scouring tendencies of such excessive back-water are to some extent counteracted by the recurrence of tidal opposition. To that circumstance must be ascribed the large deposit in Glasgow harbour after the great flood in March last.

It is important that the amount of back-water should yield the requisite amount of scour before the return of the tide ; any excess tends to cause streams of inconvenient velocity until they are reduced by tidal opposition, and deposit the silt they have taken up to repletion.

What is termed the tide of ebb is generally regarded as the most effective scour, and the principal agent in maintaining the accessibility of harbours. If, however, tides are caused by centrifugal force, the term ebb tide is incorrect, as the downward current of a stream is due to gravity relieved from the opposition of centrifugal force ; that is, the upland waters descend not only during the ebb, usually so-called—that is, until the tidal water subsides to the river's normal level—but also during that further interval until the incoming tide produces slack-water.

* Guthrie, *op. cit.*, p. 237.

† Mr. Messent has most kindly favoured me with his "Description of Works completed and in progress by the Tyne Improvement Commissioners, with "Chart of the River Tyne from the Sea to Wylam," June, 1881 ; and his "Memorandum and Section with reference to the Flood of 10th March, 1881, as compared with similar Floods in 1856 and 1861." 1881.

‡ *Op. cit.*, pp. 227-8. § Ut *supra*, p. 224.

‖ Stevenson, *op. cit.*, pp. 124-6.

¶ "Tidal Harbours Commission, First Report," Q. 423, p. 18.

** "Report of the Commissioners appointed to inquire into the Present State of the Tyne, &c." Presented May, 1855.

PIANOGRAPH-METRONOME.

We illustrate by the accompanying engravings, a very curious invention, now being introduced into this country by Mr. Hodgson, of Paris. It is called the Pianograph-Metronome, and is an instrument for effecting the accurate transcription of all kinds of musical compositions. Machines of this nature have already occupied the attention of mechanical engineers, and attempts in this direction have been made as far back as the last century. In 1747 Creed wrote a memoir in which he endeavoured to demonstrate the possibility of a transcribing instrument. It is said that in 1770 the monk Engranselle successfully constructed a machine of this nature, and in 1774 Jean Frederic Ungher claimed Creed's invention as his own. In the month of August, 1827, Carreyze made a trial before the members of the Institute of France of a Piano-melograph, consisting of a clockwork apparatus, which unwound from one cylinder and wound on another a thin sheet of lead on which were printed certain signs which could be translated into ordinary notation with the help of an explanatory table. About the same time M. Baudouier read to the members of the French Academy a memoir describing another Piano-melograph, but neither the Institute nor the Academy took any action in the matter. Many attempts have since been made, but did not meet with success, for this reason, that besides the imperfect, and in some cases complicated mechanical means employed, up to the present the rhythm and the infinite variations of the unity of movement were overlooked. Sounds, indeed, could be reproduced, but without values, intonations, and modes. Supposing even that such apparatus could have been properly worked, mere dots only could be obtained ; and as even elementary conditions of musical notation are numerous and complicated, they failed entirely to answer the purpose for which they were constructed. In short, a transcribing instrument has only become possible since the application by Messrs. Winkel and Maezel of the chronometer to music, hence allowing time in its unit and fractions of unit to be measured.

The pianograph herein described and illustrated in the accompanying drawings is founded on the principle of the metronome, and the inventor has, therefore, entitled it "the pianograph-metronome." It gives the following results :—The representation of melodious strokes and intervals corresponding to the duration of sounds and rests which have been executed and based on a certain longitudinal unit previously determined and variable for all movements or vibrations of the pendulum ; the movement in which the composition has been performed ; notes, chords, diatonic or chromatic scales, trills, appogiaturas, &c. &c., performed either in the key of G or in the key of F, or in either key when used simultaneously ; the intonation of the note played for each of the seven octaves of the keyboard, natural, flat, or sharp, according to cases with its position on the staff in G or F ; the mode or key in which the piece has been performed—major or minor—with the necessary sharps or flats indicated on the staff ; the accidental sharps, flats, and naturals not belonging to the mode or key actually performed ; the beat or time in which the composition is played, whether in 2/4, 3/4, or 4/4 ; the value of each note or rest for every variation in the position of the weight of the pendulum or balance verge of the metronome from number 40 down to number 208, and this from the semibreve down to the double demisemiquaver for notes, and from the pause down to the sixteenth of the crotchet rest for rests ; notes in the ratio of 3 to 2 or triplets ; the exact value of graces, voluntary pauses, appogiaturas, &c. ; if necessary the change of time or mode during the course of the piece performed ; the instantaneous transposition from the mode actually performed to any other mode as it pleases the composer or the copyist. With this instrument it is not at all necessary that the composer should proceed himself to the copy. Any person, whether possessing or not a knowledge of elementary music, can reproduce on music paper, and, according to the ordinary rules of musical notation, what has been printed by the instrument, and this just as well as if the composer himself had undertaken the work. The pianograph can be used like any ordinary pianoforte, and cannot transcribe but through the working of a hand lever situated on the left-hand side of the keyboard. The instrument admits of continuous impression.

Description of the Instrument.—The instrument consists of three different parts—an upright piano, the printing apparatus, the noting apparatus.

The Upright Piano.—The upright or cottage piano is of the usual form, with the exception of some slight modification of details. The keyboard is a revolving keyboard, and the instrument can be used as an office desk. The metronome is placed on the right-hand side of the instrument.

Printing Apparatus.—The working of this apparatus is founded on the "metronome" and on the "inverted staves" principle. It is divided into four parts, viz., the keyboard with its metronome, the printing nibs or pens, the printing cylinder, the motive power.

Keyboard with its Metronome.—This keyboard is exactly the ordinary seven-octavo pianoforte keyboard. It revolves on a pivot, each key being fitted underneath with a transmitting hammer, so constructed as to preclude any friction or hardness in the note when acted upon. The metronome placed outside is the ordinary Maëzel's chronometer, comprising the different gradations of movement from 40 to 208.

Printing Nibs or Pens.—Two different contrivances have been adopted. The first one shown on our illustration consists of printing nibs or pens in equal number with the transmitting hammers, and therefore with the notes of the keyboard. They are made of two flexible brass plates and run in a parallel direction with the printing cylinder, from which they are equally distant. Ribbons supplied from reels located on the upper part of the pens run between the brass sheets and passing on the foremost part of the nibs, are finally fixed in their position by an adjusting piece situated at the back of the pens. The lower part of the pens, the nibs, and ribbons dip into an ink trough, which can be set in motion upwards and downwards through a handle. The ribbons once impregnated, the nibs through the mere force of capillary attraction remain constantly wet, without however being loaded with ink, and a continuous impression is thus obtained. In the second contrivance the ribbons are replaced by movable castors of a proper diameter and resting on a wet roller. This roller is of the same length as the keyboard, and dips in the ink trough above-mentioned, being fitted on its right-hand side with a toothed wheel driven by the printing cylinder's cog-wheel. The castors always in motion are supplied with ink by the roller, and when acted upon by the transmitting hammers they come into contact with the printing cylinder or matrix paper, and an impression is thus obtained, the circumference of the castors being so calculated as to be equal to the semibreve.

Printing Cylinder.—This cylinder is horizontal and of calculated diameter. It is situated underneath the keyboard, and the paper or matrix which is to receive the impression of the nibs or castors passes round it. Its journals turn on wheels fixed in the case of the instrument. It is provided on its right side with a cog-wheel actuated by another driving wheel, to be hereafter described. It is of the same length as the keyboard, and sets in motion at its lower part two rollers, one of which carries the paper away into the lower part or case of the piano, whilst the other, of smaller size, acts simply as a guide in its fall. The first roller is of special construction, so that the impression of the nibs may not be blotted when the paper passes between it and the cylinder. Counterbalancing levers, the principle of which will be hereafter explained, run along the top part of the printing cylinder ; these levers are done away with when the castors are used. The paper or matrix is supplied from a box at the back of the cylinder, and is self-unwinding.

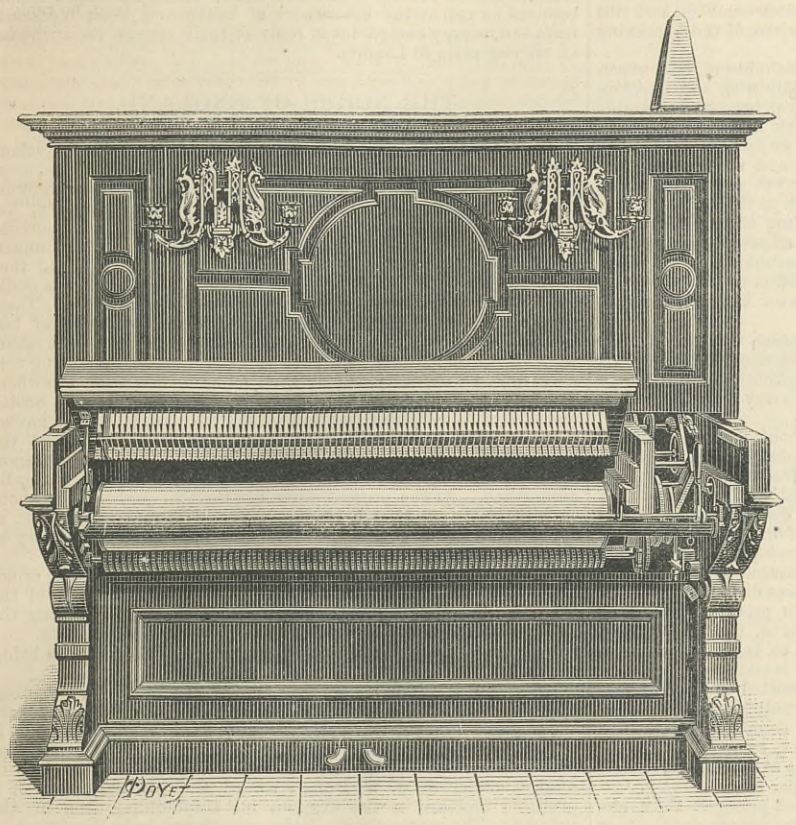
The Motive Power.—The motive power is a clockwork. It is designed to communicate a uniform movement to the apparatus, and is fitted to effect this with a regulator specially constructed. The counterbalancing levers—the explanation of which finds its place here—are situated on the top part of the cylinder, and resting upon it, are actuated by the notes of the keyboard. The weight of these levers on the cylinder is equal to the pressure transmitted from the note when actuated upon through the transmitting hammer and nibs to the printing cylinder, so that when the nibs come into contact with the latter, the weights of the levers thus set in motion lift off the printing cylinder, and the equilibrium between the motive and resisting power is thus maintained, and the movement therefore keeps uniform. The transmitting hammers are besides constructed so that the pressure on the cylinder should always be the same whatever might be the effort produced on the note.

Noting Apparatus.—This apparatus is divided into three parts : a board, the notes indicator, the metronome apparatus. The board forms the front part of the top of the piano, and can be lowered when wanted, so as to be used as an office desk or a drawing-board. The paper or matrix lies closely against its upper surface. The left-hand side of the board is fitted with a notched brass rule. The notes indicator is a flat sliding rule similar to the ordinary drawing rule. Longer than the keyboard, it is divided on both sides into parts corresponding to the notes of the keyboard, and is noted accordingly. On one side are shown the sharps and naturals, whilst on the other are shown the flats and naturals. The left part of the rule—painted blue—represents the key of F, the right part—painted red—the key of G. The musical staves are shown on the rule, so that when the copy is proceeded with one knows immediately if the note played is natural, sharp, or flat, with its right position on the staff. Let us take, for instance, the note *d*. On the keyboard it occupies three different positions, *d* flat on the left, *d* natural in the middle, *d* sharp on the right. Notwithstanding this, on ordinary musical paper one single position is assigned to these three different intonations. For any of these three notes played the rule will indicate the fourth line key of G or the third line key of F, as the case may be. A reglet gives the mode in which the piece has been performed—major or minor—with the necessary sharps or flats shown in their position on the staff—key of F or key of G—whilst another sliding reglet, moving lengthwise on the flat rule above described, hides from view the sharps or flats shown on the staff and sets off the accidentals whether naturals, sharps, or flats, not belonging to the mode actually played. The copyist can therefore (1) Place *d* on the fourth line of the staff key of G ; (2) know whether or not this *d* is shown as sharp or flat at the beginning of the staff, and if being so, that it has been played accidentally as a *d* natural, in which case the rule gives the letter *d* with the conventional sign "natural" written on its right side. This law is a general one, and can be applied to every note, mode, or scale, major or minor, whatever may be the piece performed, either in C major, natural, sharp, or flat, or B flat major or minor. Besides, the flat rule, by means of a peculiar disposition, allows of an instantaneous transposition of the piece to be copied ; such piece having been performed, for instance, in *d* major or minor, can be copied at once in *a* major or minor, and reciprocally, or in any other key.

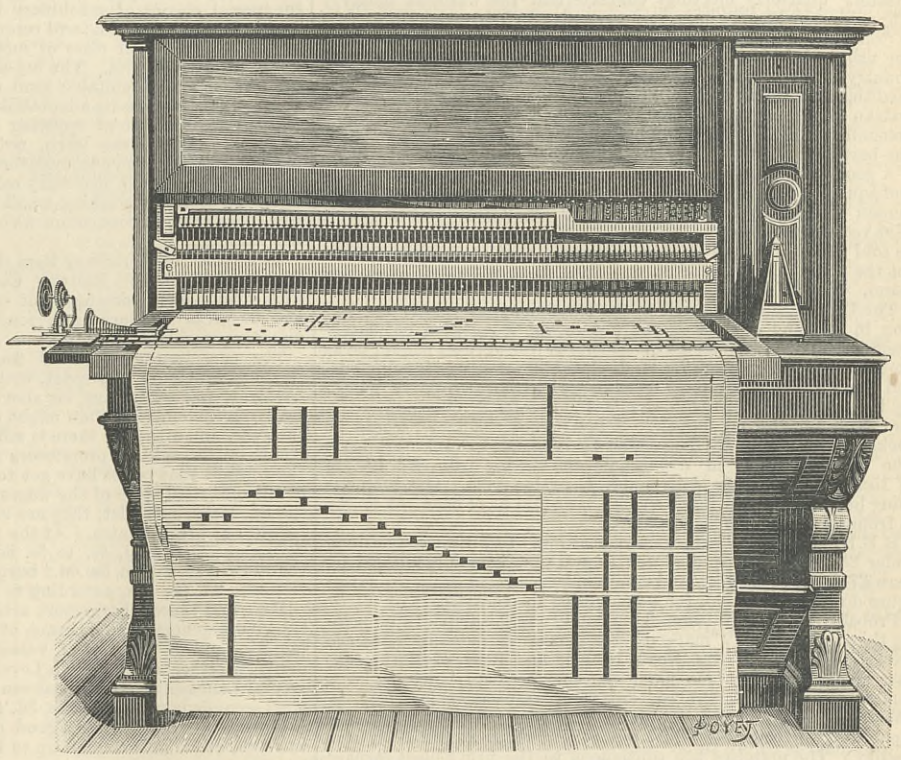
The Metronome Apparatus.—This apparatus gives the values of notes and rests. It is situated on the foremost part of the noting apparatus, to which it is fixed, and can be pushed forward as the rule moves on the board. It is composed of two series of wheels and of a revolving dial. The first series consists of thirty-two toothed wheels of different diameter resting on a common shaft movable lengthwise, upwards, and downwards. Each wheel, the number of teeth of which has been calculated beforehand, corresponds to a certain number of the metronome. Maëlzel, No. 60, which gives one vibration to a second having been taken as a unit. The wheel corresponding to the number chosen by the performer is then used by the copyist, and placed accordingly on the notched brass rule running alongside the board. The shaft of the fusee, besides the thirty-two wheels mentioned, is provided on its left end with a driving wheel setting in motion a second series of three wheels resting on a common axis. These three wheels of calculated diameter, and also movable lengthwise, upwards, and downwards, are used in the copy for indicating the beat or time in which the composition has been played, whether in 2/4, 3/4, or 4/4. At the further end of this axis is a revolving dial fitted with a proper hand, showing in numbers the value of notes from the semibreve and fractions down to the double demisemiquaver, and of rests from the pause and its fractions down to the sixteenth of the crotchet rest. The dial makes one complete revolution for twice the beat or time in which the composition has been played, whether in 2/4, 3/4, or 4/4. The annexed engravings are reproduced from photographs of the instrument itself. The apparatus described has been, as we have said, invented by Mr. A. P. Hodgson, and constructed by the firm Ch. de Rohden, of Paris. It is patented in every country.

Theoretical Description of the Working of the Apparatus. Theory of Values and Rests.—The units adopted in music are the semibreve for notes and the pause for rests. They are each represented by four vibrations of the pendulum. The working of the instrument is based upon this simple mechanical law, that "spaces covered are proportionate to the time in which they are covered." If for a certain tune t the space traversed by the cylinder is s, and if we call n the number of vibrations of the pendulum, we should have the proportion $\frac{t}{n} = \frac{s}{n}$. Let us

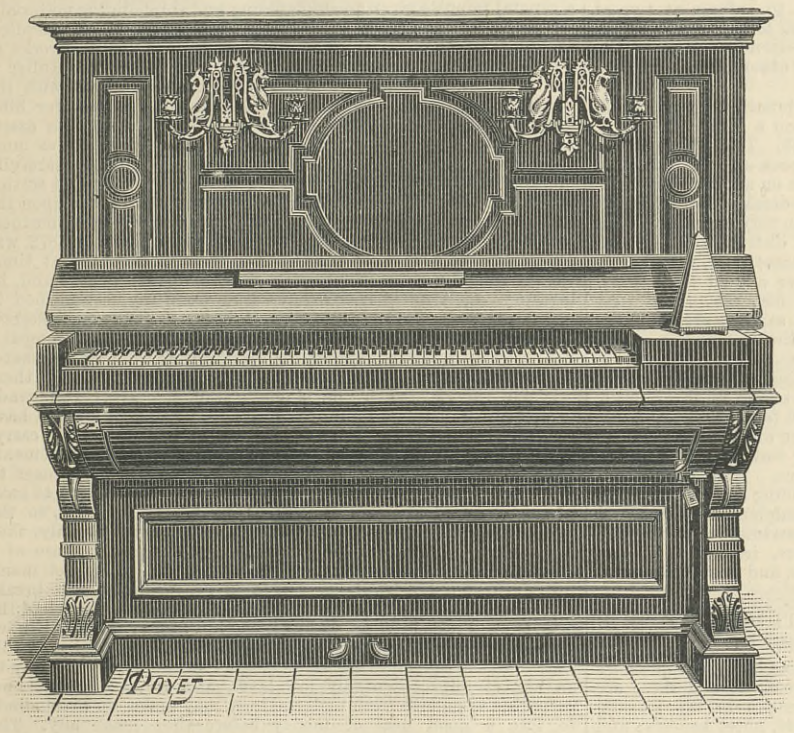
THE PIANOGRAPH-METRONOME.



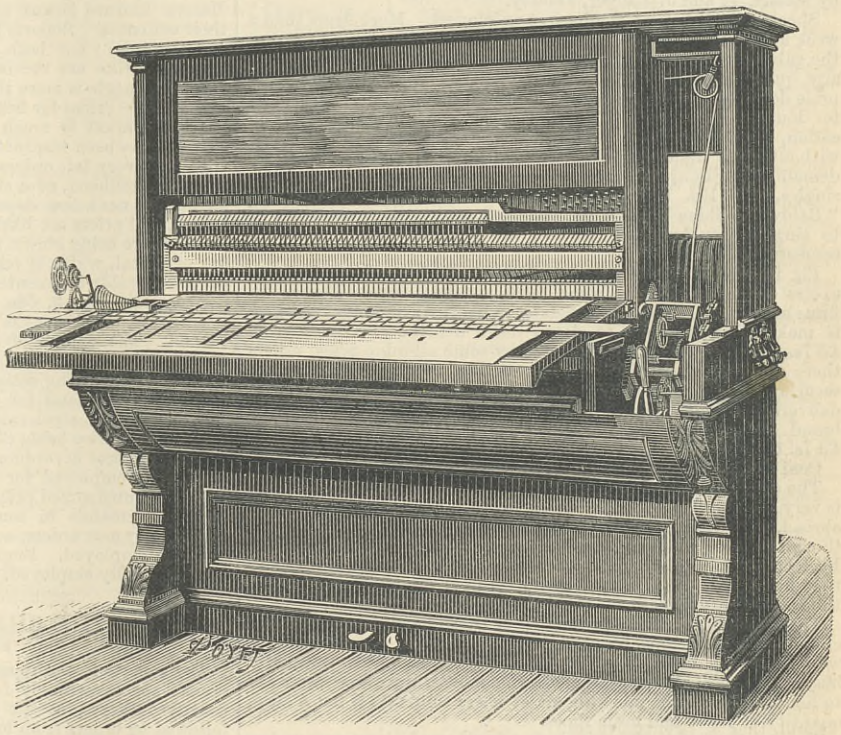
KEYBOARD UP—SHOWING PRINTING APPARATUS AND MOTIVE POWER.



KEYBOARD DOWN—NOTING APPARATUS



FRONT VIEW WITH KEYBOARD DOWN.



KEYBOARD DOWN—SHOWING NOTING APPARATUS AND MOTIVE POWER.

now suppose t equal to four vibrations of the pendulum, and the cylinder set in motion, calling s the space covered during that time, it will then be equivalent to the semibreve or its fractions according to the value of t. What is said for the semibreve and its fractions may be applied to the pause and its fractions, with this difference, that the musical stroke on the cylinder will be replaced by proportionate empty spaces or intervals. Thus it will be seen that the double demisemiquaver and the double demisemiquaver rest, being the sixty-fourth part of the semibreve or pause, the space covered on the cylinder will be represented in both cases by $\frac{s}{64}$ equivalent to $\frac{t}{64}$. Then for one certain position of the weight of the pendulum the copy of values, of notes, and rests can be easily made. But as everyone knows, the semibreve and pause may change indefinitely, according to the variations of the unity of movement; that is to say, according to the position of the weight of the pendulum. Let us take, for example, the weight distant from the axis of suspension of the pendulum equal to $\frac{1}{m}$, the space or s covered by the cylinder during the time $\frac{t}{m}$ will be $\frac{s}{m}$, that is to say, that s, or the unit of space representing the semibreve, varies proportionately with every value of m. To obviate this difficulty one out of two contrivances might have been resorted to. The first one would have been to provide the motive power of the apparatus with a movable fusee, that is to say, with a set of toothed wheels of different diameters acting separately and at will upon the wheel or pinion of the printing cylinder, so that the space covered should have been always the same or s would be invariable, whatever might have been the value of m. The second contrivance, which is the one adopted in the instrument as being less difficult of execution and more practical, has been to do away entirely with the fusee in the motive power, and to have it shifted to the noting apparatus, rendering at the same time s variable for every position of the weight of the pendulum or every value of m. In the first instance the speed of the cylinder was variable according to the piece performed to have s invariable, in the second one the speed of the cylinder remains invariable to have s variable. For m equal to 1, 2, 3, 4, &c., the copyist has only to choose the proper wheel of the fusee corresponding to the movement of the piece performed, as indicated on the apparatus itself, and so on for every value of $\frac{1}{m}$. The number 60 of Maëlzel's metronome giving one vibration to a second; this number multiplied by four, with the position of the weight of the pendulum corresponding to $m = 1$, has been taken as a unit of movement equivalent to the semibreve or pause, and is the basis of the instrument.

Theory of Intonations.—In order to simplify the noting apparatus for intonations, the pianograph does not admit more than thirty modes, twenty-eight being diatonics and two chromatics, that is to say, that any natural mode—major or minor—for each tonic may be altered by taking the same tonic *less* a semitone, and not *plus* a semitone. Let us take, for instance, *d*. The instrument will show *d* natural, major or minor, and *d* flat—*d* less a semitone—major or minor. It sets aside *d* plus the semitone, or *d* sharp, as uselessly complicating the noting process. Besides, it follows in this respect the rules of ordinary musical notation—*d* sharp major or *d* sharp, *e* sharp, *f* double sharp, *g* sharp, *a* sharp, *b* sharp, *c* double sharp, *d* sharp, gives two double sharps *f* and *c*. It is therefore much more simple to have *d* sharp major suppressed altogether and to take in its stead *e* flat, or *e* flat *f g a* flat, *b* flat, *c d e* flat. This latter mode, though different theoretically, is not so practically, as one can easily see by comparing the two *e* flat, as any other note in the pianograph, is considered as *e* natural less one semitone, and *e* sharp is *e* natural plus one semitone. As scales proceed by tones and semitones in the following order for major keys $2 . \frac{1}{2} . 3 . \frac{1}{2}$, and for minor keys $1 . \frac{1}{2} . 2\frac{1}{2} . 2$, and besides, the distance between every axis of each note on the keyboard being invariable, it has been possible to contrive the noting apparatus accordingly, so that the instrument should indicate:—First, the key in which the piece has been played with the necessary sharps and flats on the staves; secondly, the natural notes; thirdly, the accidental notes; the whole of the system being based on the tonic or final note shown on the printed paper or matrix. The pianograph establishes no difference of sounds as given by the vibration of a sonorous string between a diminished chord or an increased one—that is to say, that a major third when diminished giving *e* flat and the second major increased giving *d* sharp, there is no difference in the printing process between *e* flat and *d* sharp; and further, any accidental notes, sharp or flat, are shown by the instrument as *sharp* if the piece performed is in a sharp or natural key, and as *flat* if the piece has been played in a flat key, whether the chord is an ascending or an inverted one. Let us take, for instance, a piece played in *c* natural with an accidental chord *d, f* sharp, *a*, the inversion of which is *d, a, f* sharp, in both cases we shall have *f* sharp instead of *g* flat given by the instrument; the sound being the same on the pianoforte, the composer is afterwards at liberty, if he thinks proper, to alter the sign in the copy according to the laws of harmony, though practically there is actually no difference. The same can be said of any upward or downward scale, either diatonic or chromatic. This general rule can thus be set down:—That in the pianograph for every mode or key indicated as sharp or natural on the staves, any accidental notes or chord in the course of the piece performed will be shown as *sharp*, and for every mode or key indicated as flat on the staves any accidental note or chord will be shown as *flat*.

With this apparatus the composer has only to play what he pleases. The printed paper produced will enable any clerk to produce the composition in the shape of ordinary written music sheets.

METROPOLITAN SEWAGE.—The Royal Commission on Metropolitan Sewage Discharge met on Tuesday at 20, Great George-street. Present:—Lord Bramwell in the chair, Sir John Coode, Professor A. W. Williamson, Dr. de Chaumont, Dr. Stevenson, Mr. James Abernethy, and Dr. W. Pole, secretary.

LEEDS FIRE BRIGADE.—The Leeds Fire Brigade, without assistance from the makers, have recently tested one of Shand, Mason, and Co.'s improved No. 4 equilibrium steam fire-engines, supplied to the Corporation in April, 1882, with the following result:—At 10.25 a.m. on the 30th ult. Superintendent Baker received a telegram from the chief clerk's office, "Fire at the Town Hall." The tender was at once despatched, and the new steamer followed, both being accompanied by a number of fireman. On arrival at the Town Hall, the Mayor, Alderman Addyman—chairman of the Fire Brigade Committee—the members of the Watch Committee, and the chief constable, Mr. A. B. Nott-Bower, were waiting its arrival. The engine arrived at the Town Hall in 2 min. 20 sec. after receiving the order to turn out, and it was got to work from the fountain with the view of ascertaining the height the steamer could throw the water. Steam was got up in 8 minutes, and in 9 minutes water was thrown through a $1\frac{1}{8}$in. jet 40ft. or 50ft. above the spire of the Town Hall from the parapet under the clock. Subsequently a $1\frac{3}{8}$in. jet was worked from the ground in front of the Town Hall, and water was sent on to the dome above the clock, which is 225ft. from the ground. Four $\frac{7}{8}$in. jets were then brought into action, and water was thrown above the clock face. In each of the above trials the steamer worked with the greatest steadiness and regularity, ample steam being maintained throughout. The committee expressed themselves highly satisfied with the performance of the steamer. A number of bystanders witnessed the proceedings, and frequently remarked that water was never thrown to such a height in Leeds before.

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

(*From our own Correspondent.*)

Greater firmness than is mostly usual a week after the iron-masters' quarterly meetings characterised the business to-day—Thursday—in Birmingham, and yesterday in Wolverhampton.

Colonial requirements are very considerable. The iron is needed for using up by the colonists and also for employment in this country in engineering constructions, and in less important commodities required in India, in Canada, and in South Africa. Antipodean requirements, however, are less active. The general home demand steadily improves. The agricultural engineers are amongst the best buyers.

A good miscellaneous demand is experienced for small rounds and squares; angles are sought for, but plates, narrow and broad, remain comparatively quiet; yet a few small lots of best plates have recently come out. Sheets of nearly all qualities may still be sold; but the make is so considerable that it is impossible to get the prices which would at one time have attended a like demand.

The United States, as well as the Dominion, are taking finished iron in growing quantities, yet not in the quantities but lately deemed certain if the strike of American ironworkers should be as protracted as it has proved. High-class horseshoe iron is going out, and there is a better inquiry for baling strip and petroleum hoops. By the makers baling strip orders are in greater favour than orders for hoops for the oil barrels. A few lots of the latter would be booked at £7 15s. to £8, delivery in Liverpool. Yet there are firms who were yesterday in Wolverhampton asking from £7 10s. to £7 15s. for baling strip delivered in the same port. Gas tubing is being here and there inquired for. It could have been got to-day at from £5 17s. 6d. to £6 upwards.

B.B.H. and similar bars were very strong at £7 10s., and nothing under £8 2s. 6d. was quoted for Round Oak bars. Medium bars were £7 down to £6 15s., and common bars ranged from the latter figure down to £6 7s. 6d. for a favourable specification.

Probably no finished ironmaking concern in the district approaching the grade of the "marked" bar houses is more active at the present time than Messrs. Noah Hingley and Sons, of Netherton, near Dudley. For bars in particular they are experiencing a large demand, and the Australian orders are especially satisfactory. This activity has necessitated an extension of their producing capability, and they have laid out a new works at Old Hill, near Dudley. The premises are contiguous to the firm's blast furnace plant and collieries, and this week the forge has been started. A portion of the new plant has been built and put into working order by Messrs. T. and J. Badger, Dudley.

Sheets are, as before, the busiest in request. More firms than a week ago decline now to quote to immediate buyers. Now that the galvanisers are asking a rise of 10s. per ton, there are scarcely any quotations for singles alone which run below £8 10s. The price does not secure business in other than exceptional instances, for doubles are still to be had, where there is a favourable specification, at £9 upwards, and latens are procurable at £10 10s. without much difficulty. For high-class singles £9 is confidently demanded. Stamping sheets of the "Severn" brand are £12 for singles, £13 10s. for doubles, and £15 for trebles. For the "Baldwin-Wilden" brand of "one B" quality the quotations as to singles, doubles, and trebles, are £13, £14 10s., and £16 respectively.

Pig iron is in ample supply. Recent purchases have been in excess of requirements in some cases, so that certain Derbyshire firms are being requested to reduce deliveries; and one local firm is making preparations to damp down a furnace. While from £3 7s. 6d. to £3 10s. is being quoted by some all-mine firms, others there are who still accept £3 5s. A few foundry qualities are securing a rise of from 1s. 3d. to 2s. 6d. per ton for prompt deliveries. Hematites are stronger upon the week. The Tredegar brand is quoted up 2s. 6d. per ton, making ruling quotations £3 7s. 6d.

Coal is plentiful, with just a shade of hardening tendency.

The demand for springs and axles for coach and wagon building is very brisk. The orders of most value, however, are those from abroad. Australia, South Africa, and India are large buyers, though at the moment the Indian demand is checked by the Eastern complications, merchants refusing to give out the orders they hold. All the principal manufacturers are busy, and prices, though low, are firm.

The necessities of the Army and Navy Departments, in the matter of stores for the troops, continue to make hardware manufacturers who are in the habit of supplying Government needs unusually busy. New orders for cooking utensils, stoves, and other wares are to hand. One of the most urgent of these contracts is for a large quantity of horse and mule shoes.

The secretary of the Birmingham Chamber of Commerce makes known that a treaty has been ratified between England and Portugal, placing this country upon the "most favoured nation" footing.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—The iron market here continues very firm, with only a moderate business doing, but although buyers seem to be holding back from the recent advance in prices which represents about 3s. per ton upon some of the district brands of pig iron coming into this market, makers show no anxiety to press sales, and even where good orders might be secured by slight concessions there is no disposition to give way.

Lancashire makers of pig iron who have made little or no alteration in their prices during the recent upward movement of the market are now showing a tendency to stiffen. During the week they have been booking more freely at their old rates of 45s. to 46s. less 2½ for forge and foundry qualities delivered equal to Manchester, and they are now quoting 45s. 6d. to 46s. as their minimum figures, with orders coming in on the basis of this slight advance.

District brands of pig iron, such as Lincolnshire and Derbyshire, are without alteration. Buyers are unable to place orders under 47s. 4d. per ton less 2½ delivered here, but this figure is being taken, although sellers in some cases are asking 48s. 6d. to 49s. less 2½, but the business being done is not large. Middlesbrough iron continues altogether out of this market except for odd special lots, and north country makers do not seem at all anxious to press sales in this district, where at one time a large business was done.

In the finished iron trade a fair business continues to be done, and makers generally seem to be tolerably well supplied with orders. Prices are steady at £6 7s. 6d. to £6 10s. for bars, £6 10s. to £6 15s. for hoops, and £8 5s. to £8 10s. for sheets.

With regard to the engineering branches of trade, prospects do not seem to be quite so good as they were. From well-informed quarters and from my own personal inquiries I hear that new inquiries have fallen off considerably during the last week or two, and the explanation generally put forward is that the unsettled feeling produced by the state of affairs in Egypt seems to have given a check to the commencement of new work. For the present, engineering works in this district are not materially affected by the cessation of inquiries, as they have mostly sufficient orders in hand to keep them going for some time to come. Locomotive builders and tool makers especially are busy, and in many cases are working overtime. Machinists are also fairly well off for orders, although these are chiefly on foreign account, and largely for India, and the general engineering trades are also fairly busy. Railway carriage and wagon builders have plenty of work in hand, both on home accounts and for export. As regards employment, the reports issued by the various branches of the Amalgamated Society of Engineers continue satisfactory. From all the important Lancashire centres trade is returned as good, and in the Manchester and Salford district the number of men actually out of employment is less than 2 per cent. of the entire membership of the Society. Men for locomotive works and tool shops continue scarce, but there is not quite the same pressure for pattern makers, and this fact tends to bear out the reports I hear elsewhere of the slackening off in the quantity of new work given out.

I have previously noticed the demand which has of late arisen for special classes of machinery in connection with the development of electric lighting, and recently there has been a considerable inquiry for the small class of motors to work in connection with accumulator batteries. The hot-air type of engine has apparently been considered a suitable kind of motor, and there have been many inquiries as to its adaptability; but as yet nothing has been done in the direction of applying this engine to the accumulators. In fact, so far as I can learn, notwithstanding the great deal of talk of working from accumulators, there is at present no reliable basis upon which the necessary calculations could be made, either for constructing or working small engines, either of the hot-air or any other type, in connection with accumulator batteries for electric lighting.

As another local railway item, I may mention that the Lancashire and Yorkshire Railway Company has decided to proceed with a complete re-arrangement of the Blackburn Station, which has in great measure been rendered necessary by the recent disastrous accident.

The condition of the coal trade is without material change. Business continues very quiet, with supplies plentiful and collieries, with very few exceptions, on short time. Trade is, however, not really more depressed than might be expected with the season of the year, and although there is still a good deal of low selling to secure orders, colliery proprietors as a rule seem to have made up their minds that prices have got to their lowest point, and in view of the unsettled state of the wages question caused by the strike in the St. Helen's district, they are in many cases disinclined to sell forward at present rates. At the pit's mouth prices remain about as under: Best coal, 8s. to 8s. 6d.; seconds, 6s. to 7s.; common round coal, 4s. 9d. to 5s. 6d.; burgy, 3s. 9d. to 4s. 6d.; and slack, 3s. to 3s. 9d. per ton, according to quality.

Here and there a little more activity is reported in the shipping trade, but generally this branch of business continues very unsatisfactory, and a scarcity of vessels is still complained of. For delivery either at the High Level, Liverpool, or at the Garston Docks, Lancashire steam coal can be bought at 6s. 6d. to 7s., and good seconds house coal at 8s. 3d. to 8s. 6d. per ton.

For made cokes there is a good demand, and prices at the ovens are firm, at 9s. for common up to 11s. and 12s. per ton for the best qualities.

There are now something like 4000 men out on strike in the St. Helen's district against a reduction of 10 per cent. in wages which Messrs. Richard Evans and Co. attempted to enforce at two of their collieries. Reports have been current as to the probability of a compromise; but both sides seem very determined, and as the men on strike are receiving support from other districts, a protracted struggle is more than probable.

Barrow.—Prices for hematite pig iron are practically unchanged, but the market is much firmer in tone, and a large amount of business has been transacted during the week. I am able to state that some very fair orders for pig iron have been secured, and there is every likelihood, of a still further business on an extensive scale during the next few days. All round the demand is well maintained, and prices are likely to advance again very shortly. Extra furnaces are being blown in throughout the district, and the output of metal, which is very heavy at the present time, will shortly be considerably augmented. No. 1 Bessemer quoted at 57s. 6d. per ton net; No. 2, 56s. 6d.; No. 3 forge, 55s. 6d., f.o.b. west coast ports, three months' deliveries; mixed samples are quoted at 54s. 6d. The export of metal to the Continent and America is very large, and will continue on the same extensive scale till the close of the shipping season. Stocks are being worked off, owing to the heavy demand for iron, which is in excess of the output. The demand for steel rails is animated, and fair orders are being secured, the price being £5 15s. per ton. The mills are very busy, and the amount of orders which are held by makers will keep the mills fully employed for some time to come. Iron ore in good request at unchanged prices. Raisers are finding some difficulty in meeting demands in some cases. Iron shipbuilders have not secured any new orders, and some of the departments are not very actively employed. Engineers, boilermakers, ironfounders, and others steadily employed. Coal and coke firm and in good demand.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

The reports from the seaside watering-places and other pleasure resorts are exceedingly favourable as to weather, and these are usually followed by an exodus of townspeople to the seaside, followed by orders from lodging-house keepers, hotel keepers, and general merchants for hardware, cutlery, and plated goods. Visitors, however, are said to be fewer in number than last year. At Scarborough alone, where the season began last Saturday, there are said to be 1000 fewer than at the corresponding period of last year. The comparatively empty apartments and hotels cause orders to be limited, and I am told that the seaside and watering-place requirements generally this year are lighter even than last season, which was one of the lightest seasons on record.

From the different districts the harvest prospects are favourable. In spite of rain in some parts, the hay on the whole has been well got, and the outlook both for cereals and grain is generally very promising. On another good harvest the trade of the country largely depends. Makers of agricultural machines who attend the various shows tell us that orders are coming in more freely, and that they find farmers more hopeful than at any time since 1878. Firms engaged in the production of implements of husbandry and machines of all kinds, as well as others in gardening tools, have been well employed during the whole season, and in several instances are working overtime. The demand, though largely for foreign parts, is also caused in a great measure by farmers at home and others renewing their plant.

There has been very little change during the week in the leading staple trades. The Egyptian difficulty has again caused considerable uncertainty as to the ivory sales at London and Liverpool. Supplies are bound to be less, owing to the absence of the qualities which usually come by Alexandria and the Suez Canal. The general business with the East will also be temporarily disturbed, but affairs have been so severely strained in Egypt for a long time that a feeling of relief is now felt at our Government by its vigorous action being committed to a strong policy with or without France or any other country. It is felt that any change was preferable to the chronic crisis which has so seriously unsettled business, and our merchants and manufacturers anticipate that after order has been restored, and the Khedive firmly re-established in authority, there will be a revival of some consequence in Egyptian and kindred trading.

Colliery firms continue to complain of the prices they get for fuel, and every week arrangements are made—by individual action, not by united organisations—for the reduction of the output. All that can be done in this way, however, is but as a drop in the bucket, the number of new collieries opened during the inflated years having been so greatly in excess of any increased demand for the commodity. The miners' agents are endeavouring to persuade the men into rejoining the Yorkshire and other Unions, telling the miners that low wages and partial employment are mainly due to the employers having neglected to restrict the output in time, and refusing to combine to compel the consumer to pay more money for his coal. The miners do not accept this kind of teaching as readily as they once did, and the agents have rather an uphill time of it.

Meanwhile the masters have a hard time of it to earn more than the cost of working their pits. In many cases this is not done, and the employers, tired at last of working at a loss, have arranged to set down their collieries till more favourable times comes round. Winter stocking by metropolitan and other consumers commences at the end of this month and during August, and this will give a slight fillip to the trade in house coal. There has been no reply received as yet by the coalowners of South and West Yorkshire from the railway companies in reply to their request for a revision of railway rates to London.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

An upward movement has at last taken place in the Cleveland pig iron market. On Tuesday last the ironmasters met as usual before 'Change. They decided not to raise officially their minimum price of 43s. 6d., f.o.b., for No. 3 quality, prompt delivery, but believing the "bears" were now virtually vanquished, and noticing the firmness of the Glasgow market, they came to a verbal understanding to try for another 6d. per ton. The event proved they were not wrong in their judgment, for the higher figure was easily maintained, and several large transactions took place at it. These were mainly with consumers direct. The heavy failure of last week—noticed at length below—had a strengthening effect rather than otherwise; for all who have purchased of the defaulting firm must now, of necessity, supply their requirements from elsewhere at the prices of the day. The difference in value between Scotch and Cleveland pig iron is also steadily increasing. After having been only 4s. per ton, it has increased to 7s. per ton. At the former difference Cleveland iron was actually dearer in Glasgow than native iron, and therefore shipments thither naturally diminished. At the present difference the two qualities are about equally costly to Scotch consumers; and should it increase, as appears likely, then a renewal of this important traffic may be expected to ensue.

Warrants cannot now be purchased under 44s. 6d. per ton, or 6d. more than makers' iron, as holders take a sanguine view of the immediate future. Connall's stocks have diminished during the week by a further 496 tons, leaving in the stores 120,412 tons.

The foundry trade is still very quiet, most of the founders being short of orders.

In the finished iron trade prices remain firm at previous figures. Plates are still £6 15s. to £7 in trucks Middlesbrough; and bars and angles £6 2s. 6d. to £6 7s. 6d. less 2½ per cent. discount. It is not unlikely that manufactured iron will rise in value shortly, partly on account of the rise in wages which will take place in August, under Sir J. W. Pease's award, and partly because of a probable increase in the demand for shipbuilding iron in the autumn. The reason for the latter expectation is to be found in the certainty that the British harvest will prove a poor one this year, and that the American will prove an abundant one. This means heavy imports, demand for grain ships, higher freights, and a general impulse given to shipbuilding and shipbuilding materials.

The suspension of Mr. C. E. Muller, iron merchant, of Middlesbrough, and sole ostensible proprietor of the Erimus Steelworks at South Stockton, was announced on the 12th inst. Mr. Muller is one of the most popular and respected men connected with the northern iron trade, and the deepest sympathy is felt for him. The amount of his liabilities is put at £200,000, and of his assets available for unsecured creditors at £3000, but these figures must only be taken as conjectural in the absence as yet of any carefully prepared statement of accounts. Mr. Muller, when he first settled in the Cleveland district—a great many years since—was upon the staff of Messrs. Bolckow and Vaughan. He then set up in business on his own account as iron merchant, and about the year 1872 was reputed to be a man of considerable means. About that time, when a sanguine spurt of enterprise was dominant in Cleveland, he invested largely in the new Erimus Iron Company, established to work out the Danks process, and became chairman thereof. When, after a brief and unfortunate career, the company was wound up, Mr. Muller, as mortgagee as well as shareholder, took the works into his own hands and kept them idle for several years. Early last year the steel rail trade seemed to be highly remunerative, and he determined to have the plant so altered and extended as to make it fit for carrying on the acid Bessemer process. The engineering arrangements were made under the supervision of Mr. S. Godfrey, engineer to Messrs. Bolckow, Vaughan, and Co., Limited, and are said to have been very complete as far as they went. Owing, however, to the rolling mills having been originally intended for iron only, they were found too light for heavy steel rails, and so only those of a comparatively light section could be rolled. This was manifestly always a disadvantage. Even in rolling light rails breakdowns were unduly frequent from the same cause. But had the price of steel rails kept up, it is possible Mr. Muller and the Erimus Company might have been carrying on, and in good credit, to this day. On the contrary, the value of steel has lately fallen away to an almost unprecedentedly low level, and those who are now preparing to go into fresh undertakings may make up their minds to lose a good deal of money before they make any. The fact that Messrs. Bolckow, Vaughan and Co.'s engineer was permitted to design works for an apparently competing firm, whilst he was still in their service, has been frequently noticed. The conclusion generally arrived at was that the two firms were not really in competition, or such permission would scarcely have been given. It is believed by many that the larger firm was in some way interested in the smaller, and that there was an understanding as to a selection and division of orders, so as not to compete. This belief, whether correct or not, no doubt tended to help the credit of the Erimus Steel Company very much latterly. What the facts really are, will no doubt come out at the official creditors' meeting. The Erimus Steelworks, although re-constructed with a view to the eventual adoption of the basic process, should it stand the test of time, never really got so far as to take it up seriously. It is thought by many that the works, now that they have stopped, will not be re-started until they are so altered as to be able to manufacture steel of Cleveland instead of hematite pig iron.

The annual report of the Skerne Ironworks Company, of Darlington, has been published. Though better than the last, it is not a very encouraging one. The gross profit realised is slightly over £3000, or about 1 per cent. on the turnover. No dividend can be declared, as, after paying interest to the preference shareholders, the remainder must be devoted, as far as it will go, towards wiping out the heavy loss of the year before. The directors insist strongly on the need for more capital. They ask for £12,500 as additional floating capital, and a similar amount to enable them to put down new steel-making plant, which they say would turn out 200 tons per week of steel plates. They think the latter are now in sufficient demand to warrant this. Mr. Theodore Fry, M.P., retires from the chairmanship, as he cannot afford any longer to give the necessary time to direct the affairs of the company.

By mutual consent Mr. Charles M. Newcomen retired on the 30th ult. from the firm of Fox, Head, and Co., iron manufacturers, of Middlesbrough. The concern will, in future, be carried on under the same style by the remaining partners, Messrs. Theodore Fox and Jeremiah Head. Mr. Newcomen has been a partner in the firm since its commencement, nineteen years ago, but has never taken any active part in the management.

By mutual consent the firm of Ianson, Armstrong, and Co., iron merchants, of Middlesbrough, has been dissolved. This firm has for some years done a considerable business in manufactured, as well as pig iron, and were well known, especially in the Midland and North-Western Counties. Mr. J. M. Armstrong will receive assets and pay liabilities.

A new company, called the "Criterion Steel Company," has been established in Middlesbrough by Messrs. J. B. Jenkins and A. S. Jones, for the purpose of making tool steel of the highest quality. It is stated that the process is a new one, and that the quality of the product is equal to Mushet's steel, and will be offered at three-fourths the price thereof. Time will prove whether facts and professions are in accord; meanwhile every encouragement should be given to a new industry.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

THE amount of business in the manufacturing departments of the iron trade has been small this week, in consequence of the annual summer holidays, most of the works in Glasgow and the surrounding towns being idle. The home trade continues active. The stocks in Connal's stores are some 400 tons smaller than they were a week ago.

The warrant market was closed from Thursday till Tuesday, owing to the holidays. At the close warrants were 50s. 2d. cash, and 50s. 4d. one month. The market reopened on Tuesday forenoon very strongly, and there was an extensive business done at 50s. 4d. to 50s. 11d. cash, and 50s. 7½d. to 51s. 1½d. one month. The tone was easier in the afternoon, with business from 50s. 11d. to 50s. 8½d. cash, and 51s. 1½d. to 50s. 10½d. one month. There is now a much greater tendency to speculation in the market. A great desire was shown on Tuesday to purchase warrants. Business was done on Wednesday at 50s. 9d. to 51s. cash, and 51s. 1½d. one month. To-day—Thursday—a good business was done between 50s. 9½d. and 51s. cash, and 51s. 2d. one month.

There has been an exceedingly good demand for makers' iron, and although the prices are somewhat irregular, a marked advance has taken place, the quotations now being as follows:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 62s.; No. 3, 56s.; Coltness, 66s. and 56s. 6d.; Langloan, 64s. and 56s.; Summerlee, 61s. and 54s.; Calder, 60s. and 53s. 6d.; Carnbroe, 55s. and 52s.; Monkland, 52s. and 50s. 6d.; Quarter, 52s. and 50s. 6d.; Govan, at Broomielaw, 52s. and 50s. 6d.; Shotts, at Leith, 63s. and 56s.; Carron, at Grangemouth, 52s.—specially selected, 55s.—and 51s.; Kenneil, at Bo'ness, 51s. 6d. and 50s. 6d.; Glengarnock, at Ardrossan, 55s. and 52s.; Eglinton, 52s. 6d. and 51s.; Dalmellington, 52s. 6d. and 51s. 6d.

Large exports of manufactured iron have taken place with the past week from the Clyde, including £25,700 of machinery; £6700 sewing machines; £53,000 worth of other manufactured articles, exclusive of £15,000 worth of steel manufactures for Canada and the United States. An order for 3600 tons of cast iron pipes and fittings for the waterworks at Brisbane, Queensland, has just been secured by Messrs. D. G. Stewart and Co., of Glasgow, the price being somewhat under £8 per ton delivered in Queensland.

The coal trade is, of course, quiet, on account of the holidays, but there is abundance of orders to be implemented at their close.

The miners of Motherwell district have held a meeting, at which they resolved to form a local association and appoint an agent, and that the funds of the association should be devoted only for local purposes and kept separate from those of the National Association. It was asserted that over-production was entailing the greatest evils upon the miner and his employer, and that until some system was adopted to counteract it, the position of the miner could not be improved.

WALES & ADJOINING COUNTIES.

(From our own Correspondent.)

THE progress of the Bute Dock Bill is being watched with the greatest interest, and up to the date of my letter the unbiassed opinion is that the promoters have the best of it. The local support has been strengthened considerably by the action of the opposition, which would favour the injury of Cardiff as a port, rather than give in its adherence to the Bill.

The coal trade has been very buoyant during the past week, the proceedings in Egypt having given a decided impetus, especially amongst the favoured coalowners who have old and important connections with that part of the world.

I am glad to hear that there is a prospect of an improved output in Harris's Deep Navigation Colliery. Timbers have been found quite useless at the extreme depth of this pit, and arching by masonry is now being carried out, so that in a little time the manager hopes to bring up the output to what it should be—1000 tons per diem. The quality of the coal is such that there is a large demand for it.

I throw out a query to the mining engineers of Glamorgan:—Where is the centre of the Glamorgan Coal Basin? The old notion has been that it is tolerably close to the Aberdare Junction Railway station, but an authority who has made close and repeated trials during the sinking of the deepest pit in Glamorgan, namely, Harris's Deep Navigation, maintains that it is a mile or more to the east, and close to the village of Nelson. The matter is one that should be decided.

The iron and steel trades are brisk and prices firm, although the anti-Irish feeling threatens to make the duties of managers of ironworks more difficult. At Tredegar work has been seriously interfered with, and in Dowlais and also at Cardiff there have been fears of similar risings. Fortunately the action of the authorities has been prompt. At Dowlais on Saturday last the police force was doubled, and groups were not allowed to gather in the street.

The tin-plate trade is not quite so brisk. By the failure of a London house, I hear that a Swansea firm has lost £3000. The times are not good enough for these losses to be endured without leading to concentration of business and limiting of credit.

The resolution passed at the Birmingham quarterly meeting to lift prices 1s. per box will, I hear, be inoperative here, the tendency during the last few days having been to decline.

The Gorseinon Tin-plate Works in liquidation are to be dispersed by auction next week. The works are quite new, and on the line of the London and North-Western.

THE Geneva correspondent of the *Daily News* telegraphs that the St. Gothard Railway bids fair to prove a financial success. The receipts in June were 600,000f. They are expected to reach this month a total of 750,000f. The States interested have now paid the full amount of their subsidies. The final instalment of 6,000,000f. was paid by Italy a few days ago.

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.

11th July, 1882.

3274. DRIVING GEAR, J. H. Johnson.—(*G. Strong, U.S.*)
3275. CONDENSING ENGINES, A. Robertson, West Ham.
3276. MUSICAL INSTRUMENTS, B. Mills.—(*C. Conn, U.S.*)
3277. STOPPING RUNAWAY HORSES, B. J. B. Mills.—(*J. Goudet and G. Durozad, Lyons*)
3278. BURNISHING MACHINES, H. J. Haddan.—(*C. J. Blakeley, Wisconsin, U.S.*)
3279. ELECTRIC LAMPS, J. S. Beeman, London.
3280. TAPS and VALVES, A. Wightman, Sheffield.
3281. ELECTRICAL CONDUCTORS, F. Jacob, London.
3282. FASTENING LIDS, &c., J. Ingleby.—(*Berlin-Anhaltische Maschinenbau-Actien-Gesellschaft and G. Liegel, Stralsund.*)
3283. CLEANING WHEAT, S. Pitt.—(*C. Gratiot, U.S.*)
3284. FISH-PLATES, W. R. Lake.—(*J. Goodridge, U.S.*)
3285. INDICATING LENGTH of CLOTH, J. Darling, Glasgow, and J. Darling, Shotts.
3286. PREVENTING CORROSION, A. Bennet, Todholes.
3287. AUTOMATIC APPARATUS, W. Cheyne, Briton Ferry.
3288. BRAIDING MACHINES, W. R. Lake.—(*F. Veerkamp, C. Leopold, and W. Darker, Philadelphia.*)
3289. HARNESS, R. and B. Garrington. Darlaston.
3290. CLEANING PLANTS, J. Jebb.—(*D. Burr, U.S.*)
3291. MUSICAL INSTRUMENTS, G. Downing.—(*M. Gally, New York.*)
3292. FIRE-BOXES, W. R. Lake.—(*R. Walker, U.S.*)
3293. CIGARETTES, W. Lake.—(*C. and W. Emery, U.S.*)
3294. REGULATING SPEED, A. Boult.—(*R. Brown, Paris.*)
3295. DISTRIBUTING INK, W. Lake.—(*A. Doane, U.S.*)
3296. SECONDARY BATTERIES, A. M. Clark.—(*G. Planté, Paris.*)

12th July, 1882.

3297. BREECH-LOADING GUNS, A. N. Gavard and H. Millon, Paris.
3298. OLEFIANT GAS, A. Collingridge, Paris.
3299. SECURING GLOBES, H. T. Harvey, Wandsworth.
3300. HOIST, B. Williams, Cardiff.
3301. PREVENTING CORROSION, T. S. Webb, London.
3302. ROLLER MILLS, T. Bouwens & T. Voss, London.
3303. SECONDARY BATTERIES, F. W. Durham, New Barnet, and P. Ward, Fulham.
3304. CIRCULATING WATER, J. P. Halket, London.
3305. AMMONIA, J. Rickman & J. Thompson, London.
3306. SCRAPERS, A. Lowcock, Shrewsbury, and J. Taylor, Salford.
3307. ROTARY ENGINES and PUMPS, P. Goldschmidt, G. Hahlo, and A. Heussy, Manchester.
3308. DYEING COTTON, G. W. von Nawrocki. —(*G. Fagenburg, Sweden.*)
3309. POLES and NETS, H. Richardson, Liverpool.
3310. TUBULAR ELEVATOR, C. de Winter, Paris.
3311. PRESERVING SKINS, &c., J. C. Mewburn.—(*La Société Guillemin et Compagnie, Paris.*)
3312. WATER-LEVEL INDICATOR, G. R. Hugon.—(*J. R. Lefèvre and P. Renaux, Paris.*)
3313. FOLDING CHAIRS, L. Field, Birmingham.
3314. INVALIDS' TABLE, T. Hansell, St. Albans.
3315. COATING WIRE, W. Lake.—(*T. Wallace, U.S.*)
3316. CONDUITS, W. R. Lake.—(*A. Knandt, Prussia.*)
3317. RAILWAY BRAKES, J. Imray.—(*A. Wenger, Paris.*)
3318. UTILISING ELECTRIC ENERGY, &c., I. L. Pulvermacher, London.
3319. HIDES and SKINS, W. R. Lake.—(*J. Rowe, jun., and C. F. Perkins, U.S.*)
3320. SAFETY APPARATUS, A. Clark.—(*V. Mason, U.S.*)
3321. STACKING HAY, E. R. Salwey, Gravesend.

13th July, 1882.

3322. ELECTRIC CURRENTS, J. M. Munro, Glasgow.
3323. WINE, &c., J. H. Loder, Leiden, Holland.
3324. GAS STOVES, C. Portway, Halstead.
3325. FOLDING BEDSTEADS, A. C. Henderson.—(*E. F. Boyer, Paris.*)
3326. VELOCIPEDES, F. Beauchamp, Edmonton.
3327. SHEET METAL, H. J. Haddan.—(*K. Schmid, Bern.*)
3328. LAMPS, C. W. Siemens, Westminster.
3329. REPRODUCING DESIGNS, W. Bruce, Midlothian.
3330. ELECTRIC LIGHTING, S. Pitt.—(*E. T. Starr and W. J. Peyton, U.S.*)
3331. ELECTRIC CIRCUITS, J. R. Gibson, London.
3332. BOXES, A. Millar, Glasgow.
3333. PURIFYING METALS, A. Clark.—(*C. Edwards, Paris.*)

14th July, 1882.

3334. DYNAMO-ELECTRIC MACHINES, R. Matthews, Hyde.
3335. TELEPHONES, S. M. Yeates, Dublin.
3336. HARVEST-SAVING APPLIANCES, E. O. Greening and E. D. Barker, London.
3337. TEMPLES, J. Holding, Manchester.
3338. CLAY PRESS TRAYS, J. Brindley, Burslem.
3339. ARC LAMPS, R. E. B. Crompton, London.
3340. SECURING GLASS, A. Drummond, Edinburgh.
3341. TENON CUTTING, J. H. Hirst, Leeds.
3342. ALKALI SALTS, F. Wirth.—(*Farbfabrik, vormals Brönner, Frankfort-on-the-Main.*)
3343. BETA NAPHTHYLAMINE-SULPHO ACID, F. Wirth.—(*Farbfabrik, vormals Brönner Frankfort-on-the-Main.*)
3344. WINDOW BLIND, W. S. Laycock, Sheffield.
3345. CUTLERY, J. E. Beal, Sheffield.
3346. BOOTS and SHOES, W. Lake.—(*W. Alden, U.S.*)
3347. SANITARY PIPES, P. L Noel, Cardiff.
3348. ARTIFICIAL CREAM, BUTTER, and CHEESE, H. J. Haddan.—(*D. H. Burrell and W. Cooley, U.S.*)
3349. ELECTRIC LAMPS, J. S. Beeman, London.
3350. ELECTRIC LAMP HOLDERS, J. Beeman, London.
3351. SHUNTING ELECTRIC CURRENTS, J. S. Beeman, London.
3352. IRON and STEEL, J. M. Bennett, Glasgow.
3353. BRICK MAKING, G. Dalton, Leeds.
3354. PIG IRON, J. Bennett, Glasgow.
3355. SUPPLYING ELECTRICITY, T. J. Hadford.—(*T. A. Edison, New Jersey.*)
3356. VARNISHING, W. R. Comings, London.
3357. LACE, F. E. A. Büsche, Westphalia.
3358. BELL TRAPS, A. White and J. Evans, London.

15th July, 1882.

3359. ARTIFICIAL CREAM, J. V. den Bergh, London.
3360. REVERSIBLE SIGNALS, J. H. Sullivan, London.
3361. GLAZING BAR, T. Hughes, Market Drayton.
3362. COMBS, W. Spowage, Nottingham.
3363. PERAMBULATORS, C. E. Gibson, Birmingham.
3364. ARTIFICIAL HIPS, &c., A. and G. Child, London.
3365. ANTISEPTIC, H. Haddan.—(*C. Aschman, Belgium.*)
3366. SMOKE FLUES, H. J. Haddan.—(*Mechernicher Bergwerks-Actien-Verein, Rhenish Prussia.*)
3367. PRINTING MACHINES, E. de Pass.—(*Klein, Forst, and Bohn, Germany.*)
3368. SLICING BREAD, J. Erskine, Newton Stewart.
3369. PREVENTING EXTINCTION of GAS, &c., J. B. Thompson, New Cross.
3370. INDICATING FIRE, E. Edwards.—(*B. Carré, Rouen.*)
3371. PULLEYS, H. A. Williams, Lincoln.
3372. VALVES, J. W. Restler, Nunhead.
3373. SAWING METALS, J. H. Johnson.—(*H. Twyssuzian, Paris.*)
3374. WIRE NETTING, D. Peres.—(*F. Hentze, Germany.*)
3375. MOTIVE POWER, H. Robinson, Manchester.
3376. LAWN TENNIS RACQUETS, A. J. Altman, London.

17th July, 1882.

3377. VELOCIPEDES, T. Smallwood and E. W. Cooper, Coventry.
3378. RAISING and STEERING, H. Meinecke, Breslau.
3379. SEWING MACHINES, J. Forbes, New York.
3380. HAULING, W. Ayrton and J. Perry, Finsbury.
3381. EXTRACTING SHUTTLES, W. H. Beck.—(*D. P. Contamine, Paris.*)
3382. ELECTRIC LIGHT APPLIANCES, H. J. Haddan.—(*H. A. Seymour, Washington.*)
3383. ICE, H. J. Haddan.—(*T. S. Rankin, U.S.*)
3384. CUTTING HELICAL GROOVES, H. J. Haddan.—(*J. Martigoni, Germany.*)
3385. ELECTRIC ARC LAMP, L. A. Groth.—(*C. P. Jürgensen, Copenhagen.*)
3386. COMBINED KNIFE, FORK, and SPOON, L. A. Groth.—(*F. Praunnegger, Graz, Austria.*)
3387. FILING SAW BLADES, L. Groth.—(*J. Hansen, Sorö.*)
3388. BOOTS & SHOES, G. Rate & T. Chattaway, Leicester.
3389. UTILISING TIDAL POWER, T. Gaman, Liverpool.
3390. CANDLE HOLDERS, C. Kiebel, Folsong, Germany.
3391. WIRE, T. Morgan.—(*E. I. Levavasseur, Paris.*)
3392. FIRE-BRICKS, F. Glaser.—(*F. C. Burgers and C. Otto, Germany.*)
3393. ELECTRIC LAMPS, J. D. F. Andrews, Glasgow.
3394. COVERING BOILERS, &c., E. Leadbetter, London.
3395. ROPE, &c., H. Lake.—(*H. Evans, New York.*)
3396. PRINTING in COLOURS, J. Davies, Hatcham, T. A. Middleton, Staines, and W. G. White, Deptford.
3397. DRYING CROPS, J. Hooper, Great Torrington.
3398. TRANSPARENT PATTERNS on GROUND GLASS, D. Reich, Berlin.
3399. ABSORBENT PAPER, A. Gutensohn, London.

Inventions Protected for Six Months on Deposit of Complete Specifications.

3283. CLEANING WHEAT, S. Pitt, Sutton.—A communication from C. L. Gratiot, St. Louis, U.S.—*11th July*, 1882.
3291. MUSICAL INSTRUMENTS, G. Downing, Chancery-lane, London.—A communication from M. Gally, New York.—*11th July*, 1882.
3292. STEAM BOILER FIRE-BOXES, W. R. Lake, Southampton-buildings, London.—A communication from R. L. Walker, Boston, U.S.—*11th July*, 1882.
3315. COATING WIRE, W. R. Lake, Southampton-buildings, London.—A communication from T. Wallace, Ansonia, U S.—*12th July*, 1882.
3319. HIDES and SKINS, W. R. Lake, Southampton-buildings, London. — A communication from J. Rowe, jun., Ballardvale, and C. F. Perkins, Brookline, U.S.—*12th July*, 1881.
3330. DISTRIBUTING ELECTRIC LIGHT and POWER, S. Pitt, Sutton.—A communication from E. T. Starr, Philadelphia, and W. J. Peyton, Washington.—*13th July*, 1882.
3348. ARTIFICIAL CREAM, BUTTER, and CHEESE, H. J. Haddan, Kensington, London.—A communication from D. H. Burrell, New York, and W. Colley, Waterbury, U.S.—*14th July*, 1882.

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

2843. VENTILATORS, R. Munn, Glasgow.—*12th July*, 1879.
2846. POLISHING YARN, H. Heywood and J. Holland, Tonge.—*12th July*, 1879.
2921. SHARPENING DRILLS, W. F. Smith and A. Coventry, Salford.—*18th July*, 1879.
2869. SCRAPING DOWN WEEDS, J. McKidd, Caithness.—*15th July*, 1879.
2872. DYEING SILK, B. J. B. Mills, London.—*15th July*, 1879.
2962. PIPE JOINTS, A. M. Clark, London.—*21st July*, 1879.
2661. SEPARATING MATTERS, J. A. Stephan, Madeley.—*1st July*, 1879.
2860. HYDROCARBONS, S. Pitt, Sutton.—*14th July*, 1879.
2916. CARDING ENGINES, G. and E. Ashworth, Manchester.—*17th July*, 1879.
2922. PUMPS, T. and G. Wilson, Glasgow.—*18th July*, 1879.
2882. FURNACES, E. Brooks, Bradford.—*16th July*, 1879.
2890. SEWING and EMBROIDERING, W. E. Gedge, London.—*16th July*, 1879.
2915. TROUGH CLOSETS, T. Holroyd, Leeds.—*17th July*, 1879.
3052. DENTISTS' CHAIRS, S. Pitt, Sutton.—*26th July*, 1879.
3220. BEDSTEADS, E. Lawson, R. G. Hodgetts, and H. Lea, Birmingham.—*11th August*, 1879.

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

2560 MEAL and FLOUR, T. Muir, Glasgow.—*17th July*, 1875.
2581. DISTILLING, A. L. Normandy, London.—*20th July*, 1875.
2590. PRINTING METAL PLATES, R. Barclay, London.—*20th July*, 1875.

Notices of Intention to Proceed with Applications.

Last day for filing opposition 4th August, 1882.

493. ASBESTOS, C. J. Allport, London.—*1st February*, 1882.
797. DISTRIBUTING MANURES, F. Robinson, Bradley.—*18th February*, 1882.
1113. STENCH-TRAPS, R. Pearson, Kingston-upon-Hull.—*8th March*, 1882.
1116. COCKS, &c., A. Gutensohn, London.—*8th March*, 1882.
1120. HOISTS, T. L. Hall, Manchester.—*8th March*, 1882.
1143. SPRING HINGES, E. P. Phillips, London.—*9th March*, 1882.
1148. CUT NAILS, J. Maynes, Manchester.—*9th March*, 1882.
1165. CLEANSING TUBES, T. Marshall, Greenwich.—*10th March*, 1882.
1176. SPOON, T. F. D. Heap and J. Rettie, London.—*10th March*, 1882.
1181. PRUNING, &c., J. Ridal, Crosspool.—*11th March*, 1882.
1182. BOTTLING WATERS, J. T. Hayes, Walthamstow.—*11th March*, 1882.
1189. PURIFYING COAL-GAS, W. Watson, jun., Leeds.—*11th March*, 1882.
1192. FOLDING, &c., W. R. Lake, London.—A communication from E. J. Toof.—*11th March*, 1882.
1194. RUFFLING, &c., W. R. Lake, London.—A communication from E. J. Toof.—*11th March*, 1882.
1195. ELECTRIC CIRCUITS, W. Thompson, London.—A com. from M. H. Kerner.—*11th March*, 1882.
1202. STEAM BOILERS, H. J. Haddan, London.—A communication from W. H. Harris.—*13th March*, 1882.
1212. GAS, A. W. L. Reddie, London.—A communication from E. Bouilliez.—*13th March*, 1882.
1217. BLEACHING FIBRES, N. J. Holmes, London.—*14th March*, 1882.
1220. CHLORINE, C. Wigg, Liverpool.—*14th March*, 1882.
1222. TRANSMITTING MESSAGES, H. H. Lake, London.—A com. from A. L. Parcelle.—*14th March*, 1882.
1223. MALTING, &c., A. Perry, Roscrea.—*14th March*, 1882
1233. NEEDLE-WOVEN TAPESTRY, A. J. Boult, London.—A com. from C. T. Wheeler.—*14th March*, 1882.
1235. ROUSING BEER, H. Long, Bristol, and H. Aplin, Redfield.—*14th March*, 1882.
1240. SEWING LEATHER, W. Hollingworth, Bradford.—*14th March*, 1882.
1256. LOOMS, L. Greenwood, Hawick.—*15th March*, 1882.
1261. PRESERVING ORNAMENTS on GLASS, E. Cutler, Birmingham.—*15th March*, 1882.
1327. TRANSMITTING ELECTRIC CURRENTS, L. Crossley, Halifax, J. F. Harrison, Bradford, and W. Emmott, Halifax.—*18th March*, 1882.
1342. GLASS, C. A. W. Schön, Hamburg.—A communication from G. Leuffgen.—*20th March*, 1882.
1446. MULES, &c., J. Wain, Manchester.—*25th March*, 1882.
1450. SIPHON BOTTLES, H. H. Lake, London.—A communication from E. Musitzky.—*25th March*, 1882.
1463. DRESS of DIVERS, W. H. Skipper, London.—*27th March*, 1882.
1585. NEUTRALISING, &c., PRODUCTS of COMBUSTION of COAL GAS, J. F. Allan and W. B. Adamson, Glasgow.—*1st April*, 1882.
1607. DOOR-LOCKS, J. Mathisen, Christiania.—*3rd April*, 1882.
1664. DISTRIBUTING TICKETS, J. Lawson and J. Sirech, Bordeaux.—*6th April*, 1882.
2063. FIRE-ARMS, H. H. Lake, London.—A communication from J. Schulhof.—*2nd May*, 1882.
2235. COLOURING MATTER, J. H. Loder, Holland.—*11th May*, 1882.
2600. ACTUATING BRUSHES, J. Haigh, W. Dean, and T. W. Mitchell Bradford.—*2nd June*, 1882.
2769. DYNAMO-ELECTRIC, &c., MACHINES, J. Imray, London.—A communication from P. Jablochkoff.—*13th June*, 1882.
2936. SOAP SHEETS, G. F. Redfern, London.— A communication from H. Buczkowski.—*20th June*, 1882.
2939. VALVE-COCKS, T. S. Truss, London.—*21st June*, 1882.
2946. PRODUCING AZO-COLOURS, C. Holliday, Huddersfield.—*21st June*, 1882.
2966. LAWN TENNIS, W. Brookes, Manchester.—*22nd June*, 1882.
2972. HAT, A. Gros and C. Salbreux, France.—*22nd June*, 1882.
3036. DYNAMO-ELECTRIC MACHINES, W. E. Ayrton and J. Perry, London.—*27th June*, 1882.

Last day for filing opposition, 8th August, 1882.

1200. MINCING MACHINES, F. D. Vœux, London.—A communication from R. Huebner.—*13th March*, 1882.
1219. SMITH'S FORGE, W. Roberts, South Wales.—*14th March*, 1882.
1238. METALLIC FASTENERS, H. Andrews, Birmingham.—*14th March*, 1882.
1243. LOOMS, J. C. Fielden, Manchester, and R. H. Harrison, Dukinfield.—*14th March*, 1882.
1253. LABELS, S. Arnold, Kentish Town.—*15th March*, 1882.
1254. TELEGRAPH RELAY, J. Ebel, New Charlton.—*15th March*, 1882.
1268. FIRE-BARS, M. H. Watts and E. Swindells, Macclesfield.—*16th March*, 1882.
1289. PERAMBULATORS, W. H. St. Aubin, Bloxwich.—*17th March*, 1882.
1297. PRINTED FABRICS, J. Imray, London.—A communication from T. Grison.—*17th March*, 1882.
1301. METALLIC BOXES, G. F. Griffin, London.—*17th March*, 1882.
1302. ELECTROLIER, R. Brougham, London. —*17th March*, 1882.
1310. BOBBIN-NET MACHINES, W. Beck, London.—A communication from W. Dawson.—*17th March*, 1882.
1317. METALLIC CAPSULES, H. Kaltwasser, Hamburg.—*13th March*, 1882.
1322. DRYING PRINTING, H. Mathieson, London.—*18th March*, 1882
1323. TRANSFERRING DESIGNS, H. Mathieson, London.—*18th March*, 1882.
1331. TIRES, J. Haynes, Barnsley.—*18th March*, 1882.
1338. HELMETS, &c., J. W. Towell, London.—*18th March*, 1882.
1359. BRAKES, H. Ivey and J. H. Craddock, London.—*21st March*, 1881.
1369. METAL DRUMS, H. D. B. Wall, Liverpool.—*21st March*, 1882.
1395. LAMPS, J. Lucas, Birmingham.—*22nd March*, 1882.
1402. BOILERS, J. Imray, London.—A com. from F. Deloye and A. Guebhard.—*23rd March*, 1882.
1420. ICE, R. P. Pictet, Geneva.—*24th March*, 1882.
1522. FLUSHING SEWERS, J. B. Denton and G. Butler, London.—*29th March*, 1882.
1579. LOCKS, D. Summerfield, Birmingham.—*31st March*, 1881.
1602. RING SPINNING FRAMES, A. M. Clark, London.—A com. from J. B. Rolland.—*1st April*, 1882.
1645. ROLLING BARS, A. Riche, London.—*5th April*, 1882.
1671. EXTINGUISHING FIRES, P. A. Compte de Sparre, Paris.—*6th April*, 1882.
1766. FINISHING ENDS of TUBES, S. Fox, Leeds.—*13th April*, 1882.
1771. STEEL, &c., S. Fox and J. Whitley, Leeds.—*13th April*, 1882.
1801. MOTIVE POWER, T. C. Boutet, Paris.—*15th April*, 1882.
2261. FERULES, W. H. Beck, London.—A communication from A. A. Rolland.—*13th May*, 1882.
2363. TOBACCO-PIPES, J. Stanley, Manchester.—*19th May*, 1882.
2403. PRINTING FRAMES, P. M. Justice, London.—A communication from G. S. Street.—*22nd May*, 1882.
2447. OPENING, &c., WINDOW CURTAINS, R. Henry, Edinburgh.—*24th May*, 1882.
2547. THRASHING MACHINES, J. Johnson.—A communication from M. Epple and Co.—*30th May*, 1882.
2807. SECONDARY BATTERIES, L. Epstein, London.—*14th June*, 1882.
2984. STEAM ENGINES, G. Rodger, Barrow-in-Furness.—*23rd June*, 1882.
3006. PRESERVING MILK, H. W. L. O. von Roden, Hamburg.—*24th June*, 1882.
3018. SHEEP-SHEARS, C. Burgon, Sheffield.—*26th June*, 1882.
3062. JOINT, W. R. Wynne, London.—*29th June*, 1882.
3064. INGOTS, &c., A. Longsdon, London.—A communication from F. A. Krupp.—*29th June*, 1882.
3066. SIGNAL APPARATUS, W. Stroudley, Brighton.—*29th June*, 1882.
3087. LOOMS, J. Dodd, Oldham, and W. Adam, Kidderminster.—*30th June*, 1882.
3108. SECONDARY BATTERIES, H. J. Haddan, London.—A com. from C. F. Brush.—*1st July*, 1882.
3128. ELECTRIC LOGS, R. M. Lowne, Finchley.—*3rd July*, 1882.
3187. REGULATING SUPPLY of AIR, R. Brandon, Paris.—A com. from A. Howatson.—*6th July*, 1882.
3283. REDUCING, &c., WHEAT, S. Pitt, Sutton.—A communication from C. L. Gratiot.—*11th July*, 1882.
3330. ELECTRIC LIGHTING, S. Pitt, Sutton.—A communication from E. Starr & W. Peyton.—*13th July*, 1881.

Patents Sealed.

(List of Letters Patent which passed the Great Seal on the 14th July, 1882.)

5517. SMOKING CHAIR, J. Sothcott, Bayswater.—*16th December*, 1881.
110. TREATING FISH, C. Pieper, Berlin—*9th January*, 1882.
167. DYEING FELT, J. Allan, Barnsbury.—*12th January*, 1882.
212. CORKING BOTTLES, K. F. C. Petersen, Hamburg.—*16th January*, 1882.
217. PREVENTING FOULING of ANCHOR-CHAINS, &c., T. Cockshott, East Greenwich, and H. M. Goodman, Catford.—*16th January*, 1882.
233. RING-SPINNING, E. Clarke, Todmorden. — *17th January*, 1882.
235. SCREW-PROPELLERS, R. Griffiths, Bayswater.—*17th January*, 1882.
248. INHALATION CHAMBERS, W. A. Barlow, London.—*17th January*, 1882.
251. RECORDING INSTRUMENTS, R. Pickwell, Kingston-upon-Hull.—*18th January*, 1882.
259. FLOATING VESSELS, R. Richards, Manchester.—*18th January*, 1882.
267. HOISTS, &c., J. Lindley, Manchester.—*19th January*, 1882.
292. RUDDERS, H. Lumley, London.—*20th January*, 1882.
294. HEATING FLUIDS, G. H. Nussey and W. B. Leachman, Leeds.—*20th January*, 1882.

321. BRACE-BUCKLES, T. Walker, Birmingham.—21*st January*, 1882.
376. PIANO-ORGANS, C. D. Abel, London.—25*th January*, 1882.
390. TERRETS, W. R. Lake, London.—26*th January*, 1882.
438. DECORATING PAPERS, J. Imray, London.—28*th January*, 1882.
454. METALLIC BRUSHES, G. and E. Ashworth, Manchester.—30*th January*, 1882.
460. CONVERTING FIBRES into PAPER-PULP, F. Bauman, Budapesth.—30*th January*, 1882.
470. DYEING, &c., W. W. Richardson, Leeds.—31*st January*, 1882.
472. DYNAMIC COOLING, H. E. Newton, London.—31*st January*, 1882.
540. DYNAMO-ELECTRIC, &c., MACHINES, J. D. F. Andrews, Lanark.—3*rd February*, 1882.
594. WASHING, &c., FABRICS, H. L. Wilson and J. Clegg, Accrington.—7*th February*, 1882.
804. PRESERVATIVE COMPOSITIONS, W. C. A. Holzapfel, Newcastle-upon-Tyne.—18*th February*, 1882.
943. OBTAINING CURRENTS of ELECTRICITY, H. E. Newton, London.—27*th February*, 1882.
960. METAOXYBENZALDEHYDE, J. A. Dixon, Glasgow.—28*th February*, 1882.
1185. CLARIFYING SYRUPS, S. Pitt, Sutton.—11*th March*, 1882.
1211. OBTAINING ELECTRIC CURRENTS, H. E. Newton, London.—13*th March*, 1882.
1430. OBTAINING POWER, A. M. Clark, London.—24*th March*, 1882.
1548. SECONDARY BATTERIES, W. B. Brain, Cinderford.—30*th March*, 1882.
1627. SEPARATING BODIES from EARTHS, B. Tillett, Leytonstone.—4*th April*, 1882.
1724. COLOURING MATTERS, J. Erskine, Glasgow.—12*th April*, 1882.
1820. SAVING LIFE, D. R. Jones, Carmarthen.—17*th April*, 1882.
2213. TREATING SKINS, A. M. Clark, London.—10*th May*, 1882.
2248. MEASURING ELECTRICAL CURRENTS, T. Varley, Walthamstow, and H. B. Greenwood, London.—12*th May*, 1882.
2303. DRYING WALL PAPER, A. M. Clark, London.—16*th May*, 1882.
2399. SEWING MACHINES, A. A. Fisher, San Francisco, U.S.—22*nd May*, 1882.

(*List of Letters Patent which passed the Great Seal on the 18th July*, 1882.)

17. INCREASING EFFECT of FUEL, G. D. Peters, London.—2*nd January*, 1882.
275. EXTRACTING GOLD, &c., L. F. Gowans, London.—19*th January*, 1882.
278. TREATING PATIENTS, W. A. Barlow, London—19*th January*, 1882.
282. SPADE, N. W. Wallace, H.M. King's Royal Rifles.—19*th January*, 1882.
286. PORTABLE, &c., FORGES, L. C. Gomant, Paris.—19*th January*, 1882.
289. SECONDARY BATTERIES, J. Humphrys, Norwood.—20*th January*, 1882.
293. HOOK-FASTENER, J. McKenny, Dublin.—20*th January*, 1882.
296. STOVES, F. H. F. Engel, Hamburg.—20*th January*, 1882.
298. COPYING PRESSES, F. H. F. Engel, Hamburg.—20*th January*, 1882.
305. ELECTRIC LAMPS, J. N. Aronson, London.—21*st January*, 1882.
311. TREATING SUBSTANCES, H. Y. D. Scott, Sydenham.—21*st January*, 1882.
316. TELEPHONE TRANSMITTERS, E. G. Brewer, London.—21*st January*, 1882.
317. TROUGH CLOSETS, J. Holroyd, Leeds.—21*st January*, 1882.
318. CHECKING MONEY, J. Kaye, Kirkstall.—21*st January*, 1882.
349. BOOTS and SHOES, H. Loads, Norwich.—24*th January*, 1882.
359. ELECTRIC LAMPS, J. N. Aronson, London.—24*th January*, 1882.
502. MARINE BOILERS, A. Gibb, Greenwich.—1*st February*, 1882.
505. DRESSING STONE, J. D. Brunton, London.—1*st February*, 1882.
533. REDUCING GRAIN, A. W. L. Reddie, London.—3*rd February*, 1882.
537. BURNER, B. Verity, St. Pancras.—3*rd February*, 1882.
553. CASES of CARTRIDGES, T. R. Bayliss, Northfield.—4*th February*, 1882.
576. ROLLERS. W. Barford, T. Perkins, and E. J. Chambers, Peterborough.—6*th February*, 1882.
601. RIBBED FABRICS, C. H. Openshaw and C. H. Rothwell, Bury.—8*th February*, 1882.
687. TELEPHONE SYSTEMS, A. M. Clark, London.—11*th February*, 1882.
882. MATCH and FUSEE-BOX, G Simons, Bow.—23*rd February*, 1882.
1538. LOOMS, C. H. Hodgson and J. Broadley, Bradford.—30*th March*, 1882.
1554. TREATING GRAIN, E. Beanes, Hackney Wick.—30*th March*, 1882.
1563. THRASHING MACHINES, A. W. Mantle, Germany.—31*st March*, 1882.
2026. REFRIGERATOR, W. R. Lake, London.—28*th April*, 1882.
2102. STEAM GENERATORS, J. I. Thorneycroft, Chiswick.—4*th May*, 1882.
2109. REPEATING FIRE-ARMS, P. Mauser, Germany.—4*th May*, 1882.
2110. CARBONATE of SODA, S. Pitt, Sutton.—4*th May*, 1882.
2128. REGULATING ELECTRIC CURRENTS, W. Arthur, London.—5*th May*, 1882.
2168. FILTERS, G. Macaulay-Cruikshank, Glasgow.—9*th May*, 1882.
2197. ANCHORS, C. Martin, Brighton.—10*th May*, 1882.
2238. FURNACES, J. H. Johnson, London.—11*th May*, 1882.
2374. SPOOLS, &c., W. R. Lake, London.—19*th May*, 1882.
2388. COMBING WOOL, C. D. Abel, London.—20*th May*, 1882.
2416. ELECTRIC BATTERIES, H. H. Lake, London.—22*nd May*, 1882.
2430. CALCINING KILNS, J. T. Raynes, Llysfaen, and B. D. Healey, Brighouse.—23*rd May*, 1882.
2470. ALARM CLOCKS, W. R. Lake, London.—24*th May*, 1882.

List of Specifications published during the week ending July 15th, 1882.

3023, 8d.; 4891, 4d.; 5091, 4d.; 5131, 6d.; 5169, 6d.; 5323, 6d.; 5339, 6d.; 5343, 8d.; 5351, 6d.; 5379, 6d.; 5396, 6d.; 5397, 6d; 5401, 4d.; 5404, 6d.; 5408, 2d.; 5417, 4d.; 5419, 6d.; 5420, 2d.; 5430, 4d.; 5431, 6d.; 5432, 4d.; 5436, 10d.; 5437, 6d.; 5441, 6d.; 5442, 6d; 5443, 4d.; 5444, 6d.; 5445, 4d.; 5446, 6d.; 5448, 2d.; 5449, 6d.; 5451, 6d.; 5452, 8d.; 5453, 2d.; 5454, 4d.; 5455, 6d.; 5457, 6d.; 5458, 2d.; 5459, 2d.; 5460, 6d.; 5461, 2d.; 5462, 2d.; 5466, 6d.; 5467, 6d.; 5469, 6d.; 5470, 2d.; 5471, 6d.; 5472, 6d.; 5474, 2d.; 5475, 6d.; 5476, 2d.; 5479, 2d.; 5480, 8d.; 5481, 4d.; 5482, 6d.; 5484, 2d.; 5485, 2d.; 5486, 4d.; 5487, 6d.; 5488, 2d.; 5489, 6d.; 5490, 6d; 5491, 6d.; 5494, 2d.; 5495, 2d.; 5497, 4d.; 5499, 4d.; 5500, 2d.; 5501, 6d.; 5502, 2d.; 5503, 2d.; 5505, 6d.; 5506, 2d.; 5507, 2d.; 5509, 2d.; 5510, 2d.; 5511, 6d.; 5512, 2d.; 5513, 6d.; 5514, 6d.; 5515, 2d.; 5516, 2d.; 5518, 6d.; 5521, 4d.; 5522, 2d.; 5526, 2d.; 5527, 2d.; 5528, 2d.; 5529, 2d.; 5530, 6d.; 5531, 6d.; 5534, 4d.; 5535, 2d.; 5537, 6d.; 5540, 2d.; 5541, 6d.; 5544, 6d.; 5548, 6d.; 5551, 6d.; 711, 2d.; 996, 6d.; 1066, 4d.; 1844, 8d.; 1865, 6d.; 1933, 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.*

3023. LATHE OR MACHINE TOOL, &c., *J. A. Armstrong, Blackheath.—9th July*, 1881. 8*d.*

An attachment is used consisting of a series of geared wheels carried by a frame, which can be readily fixed to the slide rest saddle. The said geared wheels are actuated by a shaft between the lathe centres, and which passes through collars in the geared wheels provided with key way and feathers, and may be driven in the same manner as the lathe. One of the geared wheels is fitted with an adjusting crank pin, which may be used to give a direct reciprocating motion by a connecting bar to the lower slide of the slide rest, but by preference actuates a vertical vibrating slotted lever to produce a quick return stroke to the shaping arrangement by means of a connecting link or toothed sector and rack. In combination with the above may be added a vertical drill of any suitable construction, and the slotted lever and crank pin be arranged to provide an adjustable self-acting feed to the drill. The vibrating slotted lever may also be fitted with arms to actuate a fret saw.

4891. PREPARATION OF GRAIN FOR USE IN BREWING, DISTILLING, &c., *J. Fordred, Tottenham.—8th November*, 1881. 4*d.*

A material nearly resembling malt is produced by taking any suitable grain or cereal and torrefying or partially torrefying it, barley being generally preferred for the purpose.

5091. GENERATING HEAT FROM GAS OR OILS, &c., *H. Defty, Middlesbrough.—22nd November*, 1881. 4*d.*

This consists, First, in the superheating of air and gaseous carbon; and Secondly, in the construction of a double chamber, coils, and radiating substances.

5131. APPARATUS APPLICABLE TO SEWING MACHINES FOR OVERCASTING, *J. Imray, London.—24th November*, 1881.—(*A communication from A. Boisard, Paris.*) 6*d.*

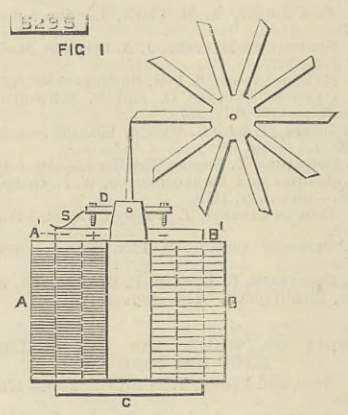
In addition to the needle and shuttle, a hook is employed, having a series of movements given to it, such that it passes through the hole of the sewing table, and turning under the edge of the fabric it seizes a loop of the shuttle thread; it brings this loop up above the fabric, and turns it into a position such that the needle descends through the loop, which, being then let go by the hook, is drawn tight by the passage of the shuttle through the bight of the needle thread below the fabric.

5169. APPARATUS FOR REGULATING THE SPEED OF ENGINES, *W. W. Girdwood, Poplar.—26th November*, 1881. 6*d.*

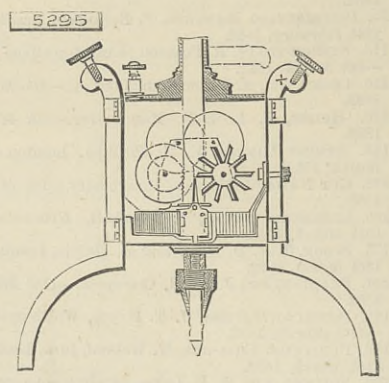
This relates to the combination of mechanism and arrangement of parts forming, together with a light hollow wheel containing liquid, a suitable regulator for the working of steam engines.

5295 IMPROVED MECHANISM FOR REGULATING THE FEED OF ELECTRODES IN ELECTRIC LAMPS, *H. E. Newton, London.—3rd December*, 1881.—(*A communication from A. I. Gravier, Paris.*) 6*d.*

The object of this invention is to ensure the release of the clockwork of a photo-electric regulator by means of a very small and constant differential action. To accomplish this, the inventor mounts two bobbins A



B on base C, having cores A^1 B^1, and an armature D of very light construction, and provided on either side of its axis of oscillation with limiting screws, as shown in Fig. 1. Spring S acts as a counterweight. Bobbin A, of fine wire, has a large resistance: bobbin B, of thick wire, a small resistance. B is placed in main circuit of lamp, A in a shunt from the main



circuit. When the main current varies, the spring S will lift the armature and lock the clockwork, unlocking it again when the balance of resistance has been restored. Fig. 2 shows the invention applied to a Serrin lamp.

5323. CUTTING MACHINES FOR THE CASES OF CARTRIDGES, &c., *W. Lorenz, Carlsruhe.—6th December*, 1881. 6*d.*

This relates to a machine wherein the cartridge cases and other articles are held at their middle while the two ends thereof are acted upon simultaneously by cutting, broaching, and expanding tools.

5339. CHECKING AND INDICATING THE RECEIPT AND WITHDRAWAL OF MONEY, *A. J. T. Wild, London.—6th December*, 1881. 6*d.*

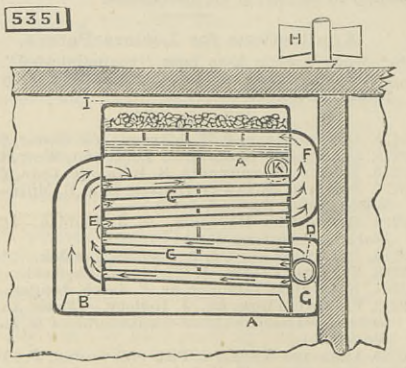
This relates to the employment of a rotating wheel provided with pockets of the size of the largest coin, beneath which is a series of conduits or passages corresponding in number and size to the varieties of coins to be received, the first being of the exact size of the smallest coin and the last of the largest coin of the series.

5343. KILTING, PLAITING, OR PLEATING MACHINES, *G. Browning, Glasgow.—7th December*, 1881. 8*d.*

The objects are to provide improved means for giving motion to the feeding, pressing, and ironing rollers and the kilting blade, and for adjusting the extent of the motions thereof; for giving the rubbing action to the ironing roller; for lifting the kilting blade at each back stroke, and for keeping the said blade in its raised position, to give unkilted spaces between the kilts either by mechanism worked by hand or worked automatically by the machine, also for putting the pressure upon the top roller.

5351. WARMING AND VENTILATING, &c., *T. Rowan, Coleshill-street.—7th December*, 1881. 6*d.*

In the arrangement shown in the drawing for introducing fresh warmed air into railway carriages, A A represent the case of a lamp B. The case is suitably fixed to the side or end of the railway carriage C C are tubes or passages passing through the lamp case A, and opening into chambers D, E, and F, the chamber D being in communication with the external air by



means of the tube or pipe G, provided with a trumpet mouth or cap H at its upper end. I is a filtering box containing water and coke or other filtering medium. A partition or deflector causes the heated air to circulate around the air tubes C C. K is an opening leading to the discharge funnel for the escape of the products of combustion from the lamp.

5379. VENTILATING SHIPS, BUILDINGS, &c., *J. C. Baker, Liverpool.—9th December*, 1881. 6*d.*

This relates to the ventilating of enclosed spaces by means of a flue or pipe with numerous orifices, whose capacity for conducting air is approximately proportionate at any given point throughout its length to the area of the orifices it has to serve.

5389 METALLIC ALLOYS OR COMPOUNDS, *G. A. Dick, London.—9th December*, 1881. 4*d.*

This consists, First, in the manufacture of improved alloys or compounds formed by combining iron and copper or iron and any of the usual alloys of copper with tin or spelter, by the employment of phosphuret of iron containing only sufficient phosphorus to deodorise any oxides contained in the copper or alloys thereof, and also a definite quantity of iron; Secondly, in the manufacture of alloys or compounds formed by combining iron with excess of phosphorus combined with alloys of copper and tin or spelter; and Thirdly, in the manufacture of alloys or compounds formed by iron, phosphorus, lead, and alloys of copper with tin or spelter.

5390. PURIFYING OR DISINFECTING SEWAGE, *F. Petri, Berlin.—9th December*, 1881. 6*d.*

This relates to the process of chemically and mechanically purifying sewage to enable it to be discharged into rivers, &c., and consists in passing it through a bed of filtering material consisting of vegetable matter, such as charcoal covered first with a layer of small turf soaked in a solution of carbonic acid or salicylic acid and water, and then with a layer of bisulphate of potash mixed with leaves, shavings, or chaff, the liquid sewage being delivered below the top layers. The sewage then passes through gravel and wire gauze, and is mixed with acids or chlorides to destroy organic matter it may still contain, and after passing through chalk or other substance to neutralise any excess of acid, finally passes through a bed of gravel. Special apparatus is described for carrying out the different operations.

5391. CESSPOOLS, *W. R. Lake, London.—9th December*, 1881.—(*A communication from L. Mouras, France.*) 6*d.*

A vessel of suitable size and form is rendered water-tight, and the sewage pipe leads into the upper part thereof and is arranged vertically, a bent pipe being provided at the other end for the discharge. The vessel empties itself automatically when full of water, at which time on any matter falling in through the sewage pipe the same volume of water is expelled through the discharge pipe, the part so discharged being always liquid, holding in solution a certain quantity of substances proceeding from the decomposition and disaggregation of the fœcal and other matters at the bottom of the cesspool. Rain and waste water is caused to flow through the cesspool so as to constantly carry on the decomposition. The lower end of the discharge pipe leads to the sewer and dips slightly below the low-water mark therein.

5392. PRODUCING MUSICAL SOUNDS, *J. O. Spong, London.—9th December*, 1881.—(*Not proceeded with.*) 2*d.*

A series of cords of various lengths are attached to a disc, vane, or rotator arranged over gas jets, or caused to revolve by any other suitable means. These cords carry cork or other balls, which on being carried round come in contact with bells or other musical or sound-giving apparatus.

5394. DRIVING VELOCIPEDES, *Rev. R. H. Berens, Chislehurst.—9th December*, 1881.—(*Not proceeded with.*) 2*d.*

This consists in a novel and simple mode of driving velocipedes and other vehicles, in keeping the centre of gravity of the "load" as low as possible, and utilising the action of gravity on the load as the source of motive or driving power.

5397. APPARATUS FOR HEATING AIR AND GASES, *W. Whitwell, Stockton-on-Tees.—9th December*, 1881. 6*d.*

The furnace oven or chamber and the iron case which encloses it are formed in a tall vertical cylinder, which may be of a circular or elliptical or oval form in horizontal section. The interior of the cylinder is divided into two equal halves by a vertical partition wall. The top of each half or division is covered with a semicircular or other form of arched roof of brickwork, the arch passing across from the central partition to the curved outer wall.

5398. TUBES OR BARRELS OF MEDICAL SYRINGES, *T. and W. J. Nicholls, London.—9th December*, 1881. 4*d.*

This consists essentially in manufacturing the tubes of syringes from celluloid.

5399. GAS, *J. Laycock and T. Clapham, Keighley, Yorks.—9th December*, 1881. 6*d.*

This relates to apparatus for scrubbing and washing gas so as to remove ammonia and other impurities and purify the gas, and it consists of a vessel in two parts, the bottom to receive water and the top for the passage of the gas. In the bottom vessel are fitted divisional plates to form separate water chambers, and on the top are flanges to receive the cover, which is bolted on air-tight. The cover is semicircular, and end plates are fitted to it and to the bottom vessel so as to close the ends. Through the vessels passes a shaft carrying a short tubular casting for each chamber, to which are secured radial arms. On the tops of these arms, at a distance from the cover, are secured sectional parts of a ring, and in the spaces between such parts are fitted buckets with holes at the bottom. Also on the shaft in each compartment are two other tubular castings with flanges a certain distance apart, and forming revolving screens, being filled in with wood, small coke, cork, or other suitable material kept in by wires secured from one radial arm to the other.

5401. APPARATUS FOR USE IN CUTTING OUT GARMENTS, *W. P. Thompson, Liverpool.—9th December*, 1881.—(*A communication from A. Bornet, Dijon.*)—(*Not proceeded with.*) 4*d.*

The apparatus serves to take the rigorous form of the body upon which it is adapted. The apparatus is then developed, and serves in this state as a pattern for cutting the clothing.

5404. COVERING AND PROTECTING THE SURFACES OF STEAM BOILERS, &c., *S. Schumann, Glasgow.—10th December*, 1881. 6*d.*

The inventor claims the constructing of hair, wool, or other fibrous materials, or of such materials mixed with pulverised earths, clays, minerals, coke, and charcoal materials heretofore used in the improved felted or "lap" and bag-like band, cordage, or gasket coverings, for and their application to the surfaces of steam pipes, boilers, and other articles.

5408. ARTIFICIAL FLOWERS, &c., *P. H. Klein, Adelphi.—10th December*, 1881.—(*A communication from G. Bittner, Munich.*)—(*Not proceeded with.*) 2*d.*

This relates to machinery for, First, covering the wire stem with silk or thread; Secondly, attaching springs or tufts of any desired kind at the required intervals; Thirdly, preventing the silk covering of the stem from unwinding by gum applied to the parts of the stem where it is to be cut off; and, Fourthly, cutting off the stem with the springs attached at the desired points.

5405. SOFT METAL PIPES, *W. Cooke and D. Mylchreest, Liverpool.—10th December*, 1881.—(*Not proceeded with.*) 2*d*

The object is to produce soft metal pipes sufficiently elastic to enable them to expand and so preventing their bursting when the water or other liquid in them freezes, and it consists in forming the pipes with longitudinal or spiral grooves.

5406. DECOMPOSING COMMON SALT AND OTHER CHLORIDES, &c., *J. G. Willans, West Hampstead.—10th December*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to the decomposition of salt or other chlorides by means of silica, and to the treatment of the resulting silicates and also their applications.

5407. AN IMPROVED MANUFACTURE OF COMPOUNDS FOR ELECTRICAL INSULATION, *W. Abbott, Limehouse, Middlesex.—10th December*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to improvements on Field and Talling's patent (No. 1938, of 1875) for an insulating compound of ozokerit and india-rubber, which enabled said compound to be thoroughly vulcanised and hardened.

5408. APPARATUS FOR THE PRODUCTION OF ILLUMINATING GAS FROM HYDROCARBON OILS, &c., *J. F. G. Kromschröder, Westminster.—10th December*, 1881.—(*Void.*) 2*d.*

This relates to the construction of a burner and appliances connected therewith in such a manner that the heat of the burner shall be utilised to vaporise the hydrocarbon oil, and that the said oil may be fed with regularity and in a state of division to allow of easy vaporisation, and further to a particular construction of joint in the supply pipes.

5409. INDICATORS FOR GAS METERS, &c., *C. I. and F. Edmondson, Manchester.—10th December*, 1881. 6*d.*

This relates to indicators with more than one dial, the object being to form them so as to be readily read without liability to error. Each spindle is fitted with a wheel having as many teeth as there are numerals on the dial, and provided with a pin that, on each complete revolution, moves forward the succeeding finger one division. A circular plate with a slot in it and a circular plate with projections are provided to keep the spindle from turning until the preceding spindle has completed a revolution.

5410. PREPARING, SPINNING, DOUBLING, AND WINDING COTTON, WOOL, &c., *W. Sumner, Preston.—10th December*, 1881.—(*Not proceeded with.*) 4*d.*

This relates to improvements in the mode and arrangement for making a drag traveller presser for a yarn drag and yarn carrier to bobbin spool or cop adaptable to ring frames for preparing, spinning, and winding; also to an improved arrangement of yarn guide for ring, fly, or cop spinning, preparing, doubling, or winding frames; to the manner of fixing the position of the thread guides; to the manner of fixing a ring, hoop, or cop of metal upon the top of the ring spinning or doubling spools or bobbins; to means for adjusting a self-containing spindle to the proper height as the footstep wears; and, lastly, to an arrangement for making a self-contained spindle adaptable for spinning, roving, intermediate or slubbing spindles in ring frames.

5411. ADJUSTABLE SPANNERS, &c., *B. Godfrey and F. Brittain, Sheffield.—10th December*, 1881. 6*d.*

The adjustable spanner is formed in three principal parts, the body and fast jaw, the sliding jaw, and the handle. The handle screws into the body, and can be turned by hand. The loose jaw is fitted into the body and slides to and from the fast jaw at an angle of about 30 deg. This sliding jaw has a shoulder, against which the end of the screwed handle bears, and it is of sufficient width to allow for all change in position as it is moved forward by the action of the screw, which is turned round by hand. A spring placed inside the head of the spanner acts against the opposite side of the shoulder and forces the jaws apart when the handle is drawn back.

5412. SPINNING AND PREPARING MACHINERY, *J. W. Smith, Bradford.—10th December*, 1881.—(*Not proceeded with.*) 2*d.*

The object is to obtain more draught in preparing and spinning machines, and as applied to gill boxes the machines are arranged with additional gills and rollers mounted in the line in which the fibre is travelling, and regulate the speed of the additional gills and rollers in relation to the others, that the fibre is draughted to a greater extent than when passed through machines of ordinary construction.

5413. BLOW PIPES, *T. Fletcher, Warrington.—10th December*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to gas blow pipes, and has for its object the simultaneous regulation of the supply of both gas and air by the movement of a single lever or handle.

5414. SCUTCHING MACHINERY, *E. Schenson, Strand.—10th December*, 1881.—(*Not proceeded with.*) 2*d.*

The material is passed between endless bands passing in the same direction and provided with breaking or scraping appliances formed to grip and bend the material, and arranged on the bands so as to come opposite one another.

5415. BUCKLE, *C. H. Eden, Manchester.—10th December*, 1881.—(*Not proceeded with.*) 2*d.*

The buckle is stamped or otherwise formed from sheet metal, and has two slots for the passage of the article. Each hole is of semi-elliptical form, and they are separated by a bar, the lower end of which is roughened or formed with spikes.

5416. ABSORBING THE SULPHUROUS GASES GIVEN OFF BY FURNACES, &c., *F. M. Lyte, Putney.—10th December*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to improvements on patent No. 3443, A.D. 1881, and consists in employing the hydrate of zinc oxide, or one of the hydrates of the oxides of iron, in place of the hydrates of magnesium or aluminium for absorbing the sulphurous acid contained in the gases given off by furnaces, calcining kilns, and ovens.

5417. CONSTRUCTION OF STEAMERS, &c., *W. H. Marks London.—10th December*, 1881. 4*d.*

The ship is constructed more in the form of a raft than a ship built according to the ordinary method. The upper part contains the decks, cabins, engines and other parts, and to this upper part are attacheda number of perpendicular supports holding a frame To this frame air-tight drums are attached.

drums are provided with floats similar to the floats of ordinary paddle-wheels.

5418. IMPROVEMENTS IN THE ARRANGEMENT OF ELECTRICAL APPARATUS ON RAILWAY TRAINS, *J. E. Liardet, Brockley, and T. Donnithorne, London.*—10*th December*, 1881. 6*d.*

This relates to a combination of dynamo machines placed in a portion of the train, and driven by gearing from the axle of a carriage; this supplies current to secondary batteries, which in turn feed electric lamps, or supply current for other purposes.

5419. LOCKS, *G. H. Chubb, London, and H. W. Chubb, Chislehurst.*—10*th December*, 1881. 6*d.*

This relates to the construction of locks so as to prevent the bolt being withdrawn in the event of the interior of the lock being destroyed or partially destroyed.

5420. SAFETY APPARATUS FOR FIRE-ARMS, *W. H. Beck, London.*—12*th December*, 1881.—(*A communication from Y. C. M. Tassel, Paris.*—(*Not proceeded with.*) 2*d.*

This consists in applying to the trigger guard two side plates or flaps hinged to the front part thereof, and closing laterally against the sides of the said trigger guard, so as to enclose and protect the triggers placed therein.

5421. TRUSS BARS FOR RAILWAY BRAKE APPARATUS, *S. Alley, Glasgow.*—12*th December*, 1881. 6*d.*

This consists in forming the main member of the truss-bar or frame of channel or U-section iron and the two minor members of a single bar of square or round iron. The link piece for the middle is formed with an eye through which the bar for the two minor members is passed, the eye being then welded on the bar and the two parts of the bar bent to the proper inclinations, their ends being bent so as to become parallel to the main member and placed in the channel at the ends, which is then closed and welded upon them.

5422. SUBSTITUTE FOR CARDBOARD, *H. J. Haddan, Kensington.*—12*th December*, 1881.—(*A communication from Dumoulin, Pequegnot et Roux, Lyons.*) 2*d.*

This consists of a material composed of wood veneer, and ordinary cardboard, a sheet of one forming a core and a sheet of the other being secured by glue on both sides of it.

5427. COLOURING MATTERS SUITABLE FOR DYEING AND PRINTING, *J. A. Dixon, Glasgow.*—12*th December*, 1881.—(*A communication from Dr. E. Koenig, Germany.*) 4*d.*

This consists, First, in the production of colouring matters from the mono-acetyl compounds of the primary and secondary aromatic monamine bases by heating them in presence of a dehydrating agent; Secondly, the production of colouring matters from the said acetyl compounds by heating them in admixture with the salt of a primary or secondary aromatic monamine, or with the acetyl compounds of a primary or secondary aromatic monamine base in presence of a dehydrating agent; Thirdly, the production of alkalised dye stuffs; and Fourthly, the production of sulpho-acid dye stuffs, being the sulpho-acids of the colouring bases obtained as above described.

5429. GELATINE AND GLUE, *J. H. Johnson, London.*—12*th December*, 1881.—(*A communication from A. J. Huet, Paris.*) 4*d.*

This consists in exposing the animal matter to be used for manufacturing glue or gelatine to the action of chloride of aluminium, so as to preserve it in a fresh condition.

5430. IMPROVEMENTS IN TELEPHONES, *A. W. Rose, Hatton-garden, Middlesex.*—12*th December*, 1881. 4*d.*

This invention consists in the employment of a compound diaphragm, the central portion of which is made of thin material and the outer portion of a comparatively thick material.

5431. IMPROVEMENTS IN TELEPHONES, *A. W. Rose, Hatton-garden, Middlesex.*—12*th December*, 1881. 6*d.*

This relates to telephone receivers in which sounds are received by disturbing the statical charge of a circuit. Instead of constructing the receiver with two diaphragms fixed in a case at a short distance from one another, the inventor employs a rigid disc divided into two parts which are separated by insulating material. One half of the disc is connected with the secondary wire of an induction coil, and the other half with earth or a return wire. Opposite this divided disc is a metal diaphragm secured at its edges and arranged at a short distance from the disc. The secondary current passes from line to one half of the disc, across to the diaphragm and back to the other half of the disc, and thence to earth. By this means two positive semi-vibrations of the diaphragm are obtained for each electric propulsion, and consequently better articulation.

5432. IMPROVEMENTS IN TELEPHONES, *A. W. Rose, Hatton-garden, Middlesex.*—12*th December*, 1881. 4*d.*

This relates to a microphonic transmitter, and consists in the combination with the compound microphone of a thin vibrating diaphragm of mica or other material in substitution of the ordinary rigid wooden board. The diaphragm may be in connection with all the carbon buttons, or only the centre one; it is attached to the mouthpiece by its edges.

5436. MACHINE GUNS, &c., *J. G. Accles, Hartford, Connecticut, U.S.*—13*th December*, 1881. 10*d.*

The inventor claims, First, an improved feeder in which the cartridges are supported between spiral or helical guides, and are driven by a rotary propeller along such guides to the point of delivery; Secondly, a hopper having guiding inclines projecting from its under side, and entering similar grooves in the receiver to guide the cartridge in its place in the receiver; Thirdly, a receiver having projections gearing with and driving the propeller, by which the cartridges are brought into the gun; Fourthly, a sliding extractor with the pusher behind it actuated by a cam surface.

5437. COUNTERS FOR MULES, *D. and F. H. Orme, Oldham.*—15*th December*, 1881. 6*d.*

This relates to a mule counter provided with a vibrating worm wheel or worm segment which engages with a worm secured to a mule rocking shaft and which actuates a vibrating or reciprocating lever or part which acts upon a wheel or pinion to give motion to the indicating mechanism.

5441. PUMPS, &c., *H. J. Haddan, Kensington.*—18*th December*, 1881.—(*A communication from D. S. Chapin, Massachusetts, U.S.*) 6*d.*

This relates to a pump composed of two or more tubular pistons, provided with semi-conoidal valves, and also of three or more barrels arranged to operate with such pistons and valves.

5442. ROWLOCKS FOR BOATS, *E. C. Martin, Ipswich.*—13*th December*, 1881. 6*d.*

This consists in connecting a boat rowlock by a sliding and swivelling joint to a plate fixed to the gunwale, so that the rowlock when it is not in use can be turned and slid downwards and inwards, leaving the gunwale clear.

5444. BOOTS AND SHOES, *W. R. Lake, London.*—13*th December*, 1881.—(*A communication from W. Comey, Westboro', Mass., U.S.*) 6*d.*

One feature of the invention consists of a turned shoe having its sole channelled from or near the edge inwards and united to the upper by a line of stitches passing through the upper and through that part of the sole under the channel flap. Other features relate to the machinery for sewing boots and shoes.

5443. APPARATUS EMPLOYED IN STEAMING AND BOILING WOVEN FABRICS, *H. Webster and J. Clegg, Dewsbury.*—13*th December*, 1881. 4*d.*

In the drawing, A is the cistern for containing water, in the bottom of which are fixed a series of pipes B, provided at intervals with nozzles C, which support the hollow perforated rollers D upon which the cloth is wound. The upper ends of the rollers D are closed, so that when steam is forced into them through the series of pipes E and B it penetrates through the fabric, and causes the water in the cistern to boil, and so the fabrics are steamed and boiled

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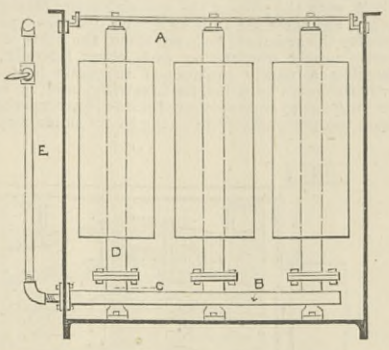

simultaneously. When necessary to cool the fabrics, the hot water is let off and cold water injected through the series of pipes E and B, and forced through the perforated rollers into the fabric.

5445. IMPROVEMENTS IN GALVANIC BATTERIES, AND IN THEIR APPLICATION TO ELECTRIC LAMPS, *O. C. D. Ross, Camberwell, Surrey.*—13*th December*, 1881. 4*d.*

The inventor employs a carbon zinc battery, and uses small lumps of amalgamated zinc in the zinc cell, by which means he exposes a larger surface for chemical action. In the carbon cell he employs hydrochloric acid, either pure or diluted with about one-fifth of its volume of water, but its action must be strengthened by the addition of about 5 to 10 per cent. of some powerful oxidising agent, such as nitric or nitrous acid. In the zinc cell he uses sulphurous or hydrochloric acid diluted with from 8 to 20 parts of water. The inventor claims the above battery, and also the arrangement of a secondary battery between the above battery and electric lamps.

5446. GAS FITTINGS, READING LAMPS, &c., *J. J. Royle, Manchester.*—13*th December*, 1881. 6*d.*

This relates to a removable fitting capable of being suspended from the burner of a gas chandelier bracket or other gas fitting, so as to bring down the lighted burner nearer to the table or floor, and which burner, being surrounded by a suitable shade or reflector, thus diffuses the light where it is most required and dispenses with the necessity of having so many lights burning in the apartment at the same time.

5447. GLOVE FASTENING, *J. Hinks, T. Hooper, and F. R. Baker, Birmingham.*—13*th December*, 1881. 6*d.*

This consists of a fastening for gloves in which no slit is formed at the wrist, which is made big enough to admit the hand, and is then folded over and secured by means of two plates of sheet steel hinged together at one end and fastened at their outer ends to the wrist of the glove.

5448. SENSITIVE PAPER, &c., *W. T. Morgan, Greenwich.*—13*th December*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to the manufacture of sensitive paper and to blocks, pads, or tablets of the same, for photographic purposes.

5449. TWISTING OR SPINNING SILK, &c., *H. H. Lake, London*—13*th December*, 1881.—(*A communication from A. Bertholon, Charmes, France.*) 6*d.*

This relates to various improvements in machinery for twisting, spinning, or throwing silk or other fibrous materials.

5451. IMPROVEMENTS IN SECONDARY BATTERIES, *J. Pitkin, Clerkenwell, Middlesex.*—13*th December*, 1881. 6*d.*

The improvement consists in forming each electrode of a mass of very thin turnings or shavings of lead in a crumpled condition, packed in an open frame of wood, and enclosed in a covering of felt stretched over it on each side, to retain the lead in place, and allow it to be acted on by the liquid. The electrode

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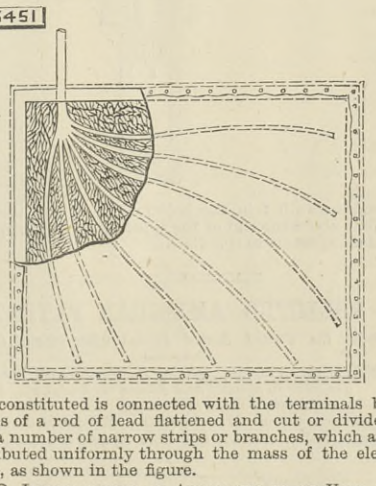

thus constituted is connected with the terminals by means of a rod of lead flattened and cut or divided into a number of narrow strips or branches, which are distributed uniformly through the mass of the electrode, as shown in the figure.

5452. IMPROVEMENTS IN APPARATUS TO BE USED IN CONNECTION WITH ELECTRICAL BATTERIES FOR CHARGING THE SAME, &c., *W. R. Lake, London.*—13*th December*, 1881.—(*A communication from J. F. Aymonnet, Paris.*) 8*d.*

This relates to apparatus for charging and discharging batteries, and for maintaining the liquid in them at a constant height automatically; also to the provision of a disinfecter for batteries giving off bad gases.

5453. PRESERVING MILK, *H. W. L. O. von Roden, Hamburg.*—14*th December*, 1881. 2*d.*

The inventor claims in the process of preserving milk in bottles or other vessels the method of excluding air prior to sealing, which consists in covering the milk with a film or layer of edible oil during the first heating, then removing the same, stoppering, and reheating.

5454. REPAIRING, PROTECTING, SOLEING AND HEELING BOOTS AND SHOES, *J. Lewis, Birmingham.*—14*th December*, 1881. 4*d.*

This relates to the new manufacture and method of preparing, shaping, and perforating pieces of leather for protecting, repairing, soleing and heeling boots and shoes, and the means and appliances for effecting the same.

5457. SEPARATING THE DUST MIXED WITH THE AIR DISCHARGED FROM MILLSTONES, PURIFIERS, &c., *R. Howarth, Rochdale*—14*th December*, 1881. 6*d.*

This consists, First, in the manner of fixing and working filtering material, so as to cause it to be turned inside out, and the production of a better vacuum on the dust laden side of the flannel or filtering material, whereby the dust is more completely removed from off the filtering material and admits of a better air passage; Secondly, automatically locking the dust exit opening, and the locking of the door whenever the dust-laden air is being blown into the compartment with which they are connected.

5455. SCREW PROPELLERS FOR SHIPS, *J. Taylor, Birkenhead.*—14*th December*, 1881. 6*d.*

The inventor claims the construction and arrangement of a wrought steel plate, or wrought iron or

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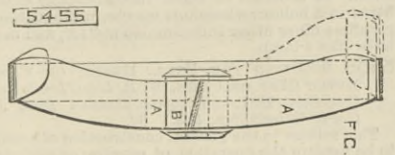

FIG. 1.

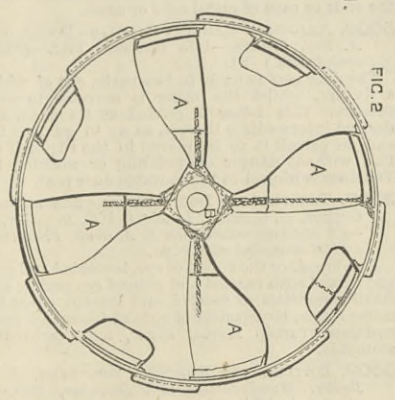

FIG. 2.

other metal plate propeller, having a boss frame B and blades proper A of wrought steel or wrought iron or other metal plates, and an outer ring with vanes attached thereto.

5458. LOOMS FOR WEAVING, *J. Kenyon, Blackburn, and E. Deakin, Darwin.*—14*th December*, 1881.—(*Not proceeded with.*) 2*d.*

The objects are, First, to regulate the taking-up motion so that a greater number of picks may be put in any given length of cloth when required; and Secondly, to obtain an improved method of fitting the pegs in the lags of the dobbies.

5459. KNIFE CLEANING MACHINES, &c., *E. M. Knight, Manchester.*—14*th December*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to improved bearings for the shafts or axles of the rollers, and to an improved trough or apparatus for containing the emery employed in cleaning the knives, and to improved apparatus employed in the driving or rotation of the cleaning rollers and brushes.

5460. FENCES, GATES, &c., *D. Rowell, Westminster.*—14*th December*, 1881. 6*d.*

This relates to the construction of the longitudinal or perpendicular rails of the fence.

5461. DIVIDING OR MEASURING AND WEIGHING DOUGH, *J. W. W. Drysdale, Glasgow.*—14*th December*, 1881.—(*Not proceeded with.*) 2*d.*

The dough is forced through a tubular vessel provided with a contracted nozzle at the end, and where it is cut off into lengths.

5462. ARTIFICIAL LIGHT APPARATUS FOR PHOTOGRAPHIC PURPOSES, *E. T. de Banzie, Glasgow.*—14*th December*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to the construction of lamps, particularly designed to enable full-length portraits or groups to be taken by means of the light without producing shadows, or strongly contrasting light and shade.

5466. LOCKS AND LATCHES, *W. and S. Bash and N. S. Damsa, Manchester.*—14*th December*, 1881. 6*d.*

The principal feature of novelty is that the "sliders" of the lock (which are acted on by the key or by the handle) project through the case of the lock, and themselves form the bolt or latch which secures the same, so that the sliders are the only moving parts of the lock.

5467. EXPANSIBLE AND CONTRACTING APPARATUS FOR THE MANUFACTURE OF BARRELS OR CASKS, *J. Campbell and J. T. Swainston, Limehouse.*—14*th December*, 1881. 6*d.*

This relates to an apparatus capable of expansion and contraction within certain limits by suitable appliances within itself to receive internal or lining hoops and staves or sheets of timber for the manufacture of barrels or casks, having parallel sides on which other hoops can be affixed in the usual manner if desired, the whole being secured while the cask is upon the apparatus.

5468. IMPROVEMENTS IN TELEGRAPH OR TELEPHONE CONDUCTORS, *J. Imray, London.*—14*th December*, 1881.—(*A communication from J. M. Stearns, jun., Brooklyn, U.S.*) 4*d.*

To overcome induction effects the inventor folds up a thin sheet of copper along with the insulated conductors in a zig-zag manner, so that portions of this metal are everywhere interposed between each conductor and those next to it. This metal sheet is at numerous points connected to earth.

5469. GAS MOTOR ENGINE, &c., *F. W. Crossley and H. J. Holt, Manchester.*—14*th December*, 1881. 6*d.*

The drawing is a longitudinal section showing so much of a gas engine as is necessary to illustrate the application thereto of that part of the invention

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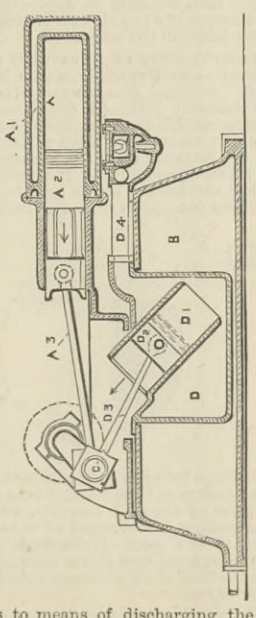

which relates to means of discharging the exhaust and introducing a fresh charge of combustible mixture. A is the working cylinder surrounded by its water casing A^1, and fitted with its piston A^2, which is linked by the connecting rod A^3 to the crank O, the whole being mounted on the foundation frame or base B, which may constitute a water casing as shown. The machine is provided with the usual ports and slide for admission and ignition of the gaseous mixture. D is a chamber in which at the required part of the stroke of the engine a partial vacuum is produced by the outstroke of the piston D^2 in the cylinder D^1, this cylinder being placed at an angle, so that as piston D^2, which is linked by the connecting rod D^3 to the crank C, is moving rapidly outwards when the working piston A^2 is approaching the end of its outstroke, the chamber D communicates by a passage D^4 with the casing of a slide fitted at the side of the cylinder, and also through a check valve with an exhaust pipe, to which also there is another communication by a branch pipe from the casing of the slide.

5470. IMPROVEMENTS IN GALVANIC BATTERIES, *C. Mauris, Westbourne Park, Middlesex.*—14*th December*, 1881.—(*A communication from A. Thomas, Nantes, France.*)—(*Not proceeded with.*) 2*d.*

The elements are in the shape of semicircular discs perforated with numerous holes, and are fixed on an axis from which they are insulated. The axis can be revolved so that only a portion of the plates are submerged in the exciting liquid, or they can be withdrawn altogether.

5471. COLLARS FOR HORSES, &c., *T. Loveday, Islip.*—14*th December*, 1881. 6*d.*

The invention consists in making the collar of a light metal or other strong, tough frame or base, and affixing thereto on the part next the animal a series of springs upholstered over like an ordinary mattress or clean bottom.

5472. STOPPERS FOR BOTTLES CONTAINING AERATED WATERS, *N. Fritzner, Berlin.*—14*th December*, 1881. 6*d.*

This relates to a stopper for bottles having a channel or passage for the admission and discharge of liquid, and fitted with a spring pusher or piston for actuating a valve, by which means the said channel may be opened or closed and the bottle be filled or emptied.

5474. TIP-VANS OR WAGONS, *H. Vickery, Camberwell.*—14*th December*, 1881.—(*Not proceeded with.*) 2*d.*

The object is to so construct, arrange, and combine the parts of the vans or wagons, as that the bulk of the contents shall be carried considerably lower than in such vans or wagons as at present constructed, and well to the rear of the centre of motion, so that the tipping or tilting of the van or wagon body, and emptying of the contents, may be more speedily and easily effected than as hitherto.

5475. WHEELS FOR TRAMWAY AND RAILWAY VEHICLES, &c., *G. L. Scott, Manchester.*—14*th December*, 1881. 6*d.*

This consists essentially of a wheel having a rim

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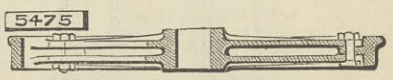

cast with snugs, which enter between the ends of pairs of arms which are cast upon a hub, the parts being secured together by means of bolts.

5476. APPARATUS FOR USE IN THE FELTING OF HAT BODIES, &c., *G. Atherton, Stockport.*—14*th December*, 1881.—(*A communication from G. Yule, Newark, U.S.*)—(*Not proceeded with.*) 2*d.*

This relates to apparatus wherein rollers are employed in the felting or planking of hat bodies and other articles.

5478. HAND STAMPS FOR DATING, &c., *E. M. Richford, London.*—14*th December*, 1881. 6*d.*

This consists in a hand stamp for dating, &c.; the employment in combination with a slotted guide or die-plate, of type wheels of india-rubber; Secondly, in moulding or casting and vulcanising india-rubber type wheels in tightly closed moulds; and Thirdly, the construction of the moulds consisting of a radially chambered or sunk plate in combination with sunk type or matrices fixed therein, and a suitable covering plate.

5479. TRANSMITTING MOTIVE POWER, &c., *A. Lafargue, Kensington.*—14*th December*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to improvements in mechanism or apparatus for transmitting motive power by converting reciprocating rectilinear motion into continuous circular motion.

5480. EMBROIDERING APPARATUS FOR SEWING MACHINES, *W. R. Lake, London.*—14*th December*, 1881.—(*A communication from F. H. Chilton, New York.*) 8*d.*

This relates partly to an embroidering apparatus for sewing machines, consisting of the presser foot having a laying device, and the hook pivotted in near relation to the vertical line of centre of the sewing needle, and connected with the rod which passes rearward, and is actuated by the rocking lever to have a longitudinal sliding movement, in combination with the eye-bar adapted to have a simultaneous movement with the said hook in a different direction thereto, and so deliver the embroidering thread to the hook.

5481. IMPROVEMENTS IN SECONDARY BATTERIES, *D. G. FitzGerald, Brixton, Surrey.*—14*th December*, 1881. 4*d.*

The inventor employs carbon in the form of fragments in direct contact with each other at one or more points, whilst the interstices between them are filled with lead in a state of division or with an oxide of lead, such as red lead, or with an insoluble salt of lead such as the sulphate. The carbon fragments may be first coated with lead by immersing them in a solution of a salt of that metal, such as the acetate, and subsequently reducing the metal by heating without access of air, or electrolysis. In the construction of a cell the carbon fragments are divided into two portions, each of which is in contact with a plate of carbon to which a terminal is attached. The two portions are prevented from coming into contact by the use of a diaphragm of felt or other material. The inventor also claims the use of the mixture of carbon fragments with lead in a state of fine division, or an insoluble compound of lead in conjunction with a tube or vessel of carbon or lead, perforated with apertures which are closed with or covered by a porous material.

5482. BLASTING CARTRIDGES AND EXPLOSIVE CHARGES, &c., *R. M. Gardiner, Westminster, and G. Trench, Faversham.*—14*th December*, 1881. 6*d.*

The object is to so prepare blasting cartridges and explosive charges generally as to render them water and damp-proof.

5484. BICYCLE AND TRICYCLE VELOCIPEDES, *A. Lafargue, Kensington.*—15*th December*, 1881.—(*Not proceeded with.*) 2*d.*

One part relates to means of converting a bicycle (at will) into a tricycle. A Second part relates to a new form of saddle; and a Third part relates to the construction of an india-rubber stirrup or treadle.

5485. MATCH BOXES OR RECEPTACLES, *M. Wilson, Peckham Rye.*—15*th December*, 1881.—(*Not proceeded with.*) 2*d.*

The invention consists in providing the boxes or receptacles with a hollow slit cover over the striking surface, for the purpose of preventing the ignited particles or sparks of the match or fusee head from being thrown off into the room or upon the person.

5486 REPRODUCTION OR PRODUCTION OF COPIES OF PICTURES, &c., *A. A. Hely, South Lambeth.*—15*th December*, 1881. 4*d.*

The designs are first obtained upon plates, blocks, stones, or types, generally termed "moulds," a separate mould being used for each colour, which is placed in any suitable pressing machine and charged with its respective pigment. A canvas is then stretched on a frame and coated with oil or varnish paint of the colour required for the ground of the picture. The vacant space inside the stretcher, under the canvas, is filled up by a removable wooden block. The canvas is then placed in a press, face to face with

a mould, when, upon the pressure being exerted, the pigment deposited upon the face of the mould becomes permanently impressed upon the face of the canvas.

5487. GAS ENGINES, *W. Watson, Leeds.—15th December*, 1881. 6*d.*

This refers to the application and employment of earthenware in the construction of cylinders, pistons, and piston rings of gas engines, instead of iron or other metal as heretofore.

5488. WORKING GRAPPLE BUCKETS AND FORKS, *J. C. Thompson, Kingston-upon-Hull.—15th December*, 1881.—(*Not proceeded with.*) 2*d.*

The invention relates to an arrangement by which the slack of the releasing chain is hauled in, while the bucket or fork is raised the opening of the bucket or fork effected automatically, and the bucket or fork in descending draws out the releasing chain.

5489. BOTTLES FOR FACILITATING THE COUNTING OF DROPS OF LIQUIDS DISCHARGED THEREFROM, *F. Wirth, Frankfort.—15th December*, 1881.—(*A communication from H. Lamprecht, Gnarrenberg, and G. Hirdes, Bremen.*) 6*d.*

This relates to a bottle provided at its neck with a lip or spout on one side, and with an aperture through a projection on the opposite side, in combination with a stopper having two inclined faces, or with a cork or other suitable stopper.

5490. IMPROVEMENTS IN ELECTRIC LAMPS, *W. R. Lake, London.—15th December*, 1881.—(*A communication from J. A. Mondos, Neuilly, France.*) 6*d.*

This invention consists of an arc lamp, in which the arc is struck and the carbons regulated by the current itself, without any clockwork. The illustration explains how this is done. When the current passes armature F is attracted, and the lower carbons

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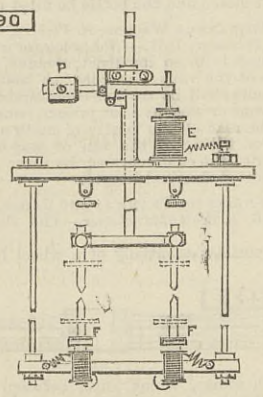

separated from the upper ones. P is a counterweight, connected with which is a stop mechanism for holding the upper carbon, which is governed by the armature of the electro-magnet E.

5491. GRINDING AND SHARPENING WIRE CARDS FOR CARDING ENGINES, *A. W. L. Reddie, London.—15th December*, 1881.—(*A communication from W. Decker, Saxony.*) 6*d.*

The object is to provide for a more perfect grinding of ready-made wire cards or strips to be used in carding engines, so as to form the end of each wire, or both, into a long and sharp point, instead of a short and somewhat blunt point as heretofore.

5494. IMPROVEMENTS IN SECONDARY VOLTAIC CELLS, *J. W. Swan, Newcastle-on-Tyne.—15th December*, 1881. 2*d.*

This relates to forming the plates for secondary batteries. The inventor takes plates of lead, corrugated as described in his previous patent, No. 2272, dated 24th May, 1881, and exposes them to the combined action of acetic acid, carbonic acid, and atmospheric air, which results in the formation of carbonate of lead on the plates. After this action has taken place to a sufficient depth, a portion of the plates being left unacted upon, he subjects them to the action of electrolytic hydrogen by making them the cathode of an electric generator. The plates are then made up into cells as usual in Planté's cells.

5495. PRODUCING TRANSPARENT, SEMI-TRANSPARENT, OR OPAQUE SHEETS WITH WORDS OR DESIGNS THEREON, *S. V. Emery, Canonbury.—15th December*, 1881. 2*d.*

Gelatine, for example, is melted and run on a piece of glass, by preference, having the desired words or design cut or moulded thereon, so that the gelatinous substance may run thereon, and when dried and taken from the mould a transparent, semi-transparent, or opaque flexible sheet with the desired words or design thereon in relief will be produced.

5497. APPARATUS TO FACILITATE THE CARRIAGE OF BOXES, &c., *C. A. Carus-Wilson, Grenville-place.—15th December*, 1881. 4*d.*

This relates to a frame for carrying boxes, &c.

5499. IMPROVEMENTS IN MEASURING AND RECORDING ELECTRIC CURRENTS AND IN THE APPARATUS EMPLOYED THEREIN, *J. W. Swan, Newcastle-on-Tyne.—16th December*, 1881. 4*d.*

This relates to improvements in an electric meter described in patent No. 5004, taken out by the present inventor on the 1st December, 1880. The first improvement consists in avoiding the necessity for branch wires from each lamp and the meter, by taking the main conductor, or a shunt from it, round the several electro-magnets which determine the engagement of the pawls with the counting apparatus, and adjusting the springs which counteract the pull of these electro-magnets, so that when the current for the supply of one lamp is passing through the main wire or shunt, only one magnet armature will be attracted, and so that the number of magnet armatures rendered operative by any current shall correspond with the number of lamps lighted. Another improvement consists in arranging the motor which actuates the counting mechanism so as to commence action simultaneously with the coming into action of any of the electro-magnets. This is accomplished by the use of a solenoid in the circuit of the main wire or in a shunt from it, so arranged that the position of its core will vary with the strength of the current passing, and so connect the motor and counting mechanism as to cause the rate of counting to vary as above indicated. It also relates to a means of combining an automatically variable resistance connected in series with an electrolytic cell, and in multiple arc with the lamps, arranged so as to give a reciprocating motion to a balance beam connected with the counting mechanism.

5500. SPRING BALANCES, *R. Lamont, Kilmarnock.—16th December*, 1881.—(*Not proceeded with.*) 2*d.*

The object is especially to reduce the amount of the oscillating or vibrating action.

5501. PNEUMATIC AND OTHER RAILWAYS, &c., *T. W. Rammell, London.—16th December*, 1881. 6*d.*

One part relates to the manner of arranging the machinery and connecting air ways, as well as those for the supply and escape of the air, and of applying the pressure in the working of two or more sections of such railways. Another part relates to the form of the tubular way. A Third part relates to the method of placing and fixing the permanent way within the tubular way when cast iron is employed. A Fourth part relates to the carriage employed.

5502. METALLIC CARTRIDGE CASES, *G. Kynoch, Witton.—16th December*, 1881.—(*A communication from A. Butler, Munich.*)—(*Not proceeded with.*) 2*d.*

This relates to means of securing the wads in metallic cartridge cases without the use of any adhesive substance, or without having to bend or otherwise deform the mouth of the cartridge.

5503. FIRE-LIGHTER, *J. Milne, Edinburgh.—16th December*, 1881.—(*Not proceeded with.*) 2*d.*

This fire-lighter consists essentially of a wick, preferably of asbestos or other incombustible material, fitted in a holder, wherein it may be impregnated with paraffine oil or other inflammable matter, and made to burn like a lamp.

5505. SECURING THE ENDS, HEADS, OR CAPS ON METAL CANS OR CASES, *W. R. Lake, London.—16th December*, 1881.—(*A communication from J. M Clark, Wilmington, U.S.*) 6*d.*

This relates to the general construction of a machine to be used in the operation of capping or soldering on the ends or caps of metal cans or cases.

5506. ADJUSTING RAILWAY CARRIAGE DOORS, &c., *S. A. Say, London.—16th December*, 1881.—(*Not proceeded with.*) 2*d.*

The door post is made in two parts, one of which is a fixture, whilst the other is movable to and fro thereon. This latter is guided at its ends, and if desired intermediate thereof, so as to guide it firmly and yet permit it to be moved in the required direction without danger of twisting or working loose. The door is hinged to the movable door post.

5507. TREATMENT OF INGREDIENTS AS SUBSTITUTE FOR COFFEE, *H. Gardner, London.—16th December*, 1881. —(*A communication from E. A. Grote, Freudenberg.*) —(*Not proceeded with.*) 2*d.*

Rye-bread, or the dough of rye, is roasted and ground and mixed with roasted and ground rye grains, adding small quantities of roasted and ground cocoa shells, coffee beans, bicarbonate of soda and caramel, made of molasses, turnip leaves, sugar, and carbonate of ammonia.

5509. BOTTLES, AND STOPPERS FOR SAME, *F. S. S. Darby, Wandsworth.—16th December*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to means of stoppering bottles in an air-tight manner without corks or wire.

5510. CASTORS FOR BEDSTEADS, &c., *S. H. Barnett, Notting-hill.—16th December*, 1881.—(*Not proceeded with.*) 2*d.*

According to one arrangement, a frame constructed with a peg hole and with two or more horns, carries a pin that forms the axis of the wheels, which are threaded on such axis with washers between one another and between themselves and the horns.

5511. ASCERTAINING THE PITCH OF SCREW PROPELLERS, *D. B. Hutton, Poplar.—16th December*, 1881. 6*d.*

The instrument consists essentially of two legs and an arm capable of forming respectively the perpendicular, the hypothenuse, and the base of a right-angled triangle, inverted or otherwise, and provided with a spirit level plummet or equivalent, whereby the pitch of a propeller blade at any given diameter may be determined.

5512. APPARATUS FOR LAYING-OFF A SHIP'S COURSE ON A CHART, &c., *R. H. Hughes, Liverpool.—16th December*, 1881.—(*Not proceeded with.*) 2*d.*

The apparatus consists, First, in a compass card as ordinarily used; Secondly, in a bracket centred in the centre of the card and capable of revolving thereon, and carrying a slide block on the bracket at some distance from the centre; Thirdly, a ruler with a slot parallel to its side, in which slides the aforesaid block, the slot being so placed in the ruler that the edge of the ruler shall exactly come over the centre of the card.

5518. IMPROVEMENTS IN APPARATUS TO BE USED IN TORPEDO OPERATIONS AND IN SEARCHING FOR SUBMERGED BODIES, &c., *C. A. McEvoy, Adelphi, Middlesex.—16th December*, 1881. 6*d.*

The apparatus consists of a box to be sunk in the water containing two bobbins of wire, supported by a cable containing insulated wires connected as shown to the coils on the bobbins. The apparatus at the surface of the water consists of a battery, and two bobbins similar to those in the other box. The wire on one of the bobbins of each pair constitutes a primary coil, and that on the other a secondary coil, in which currents are produced by induction. In the secondary

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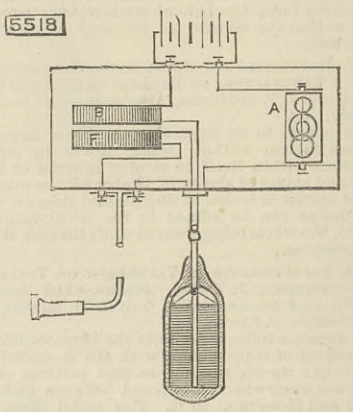

circuit is placed a telephone. Combined with the battery is an interrupter A. For operation, the smaller box is lowered into the sea until it lies at the bottom. A current is then sent through the primary circuit, and the distance between the bobbins B and F is adjusted until no sound is heard in the telephone. The small box is then drawn slowly along the bottom. When any metallic body is approached by it, the balance between the two circuits is disturbed and loud sounds are heard in the telephone.

5551. IMPROVEMENTS IN ARMATURES FOR MAGNETO-ELECTRIC AND DYNAMO-ELECTRIC MACHINES, &c., *J. H. Johnson, Lincoln's-inn-fields, Middlesex.—19th December*, 1881.—(*A communication from W. W. Griscom, Philadelphia, U.S.*) 6*d.*

The improvements refer more particularly to armatures of the Siemens type, but are applicable to the poles of all other armatures. The invention consists in dividing extremities of the armature into two or more sections concentric with each other, one or more

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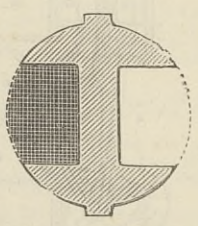

of such sections being at such a distance as to utilise the magnetic lines of force which fill the space between the two poles of the field magnets, whilst the other section or sections are arranged so as to pass in close proximity to the poles of the field magnets. The illustration explains how this is done; it represents a transverse section of an armature constructed according to this invention.

39. COLOURING MATTERS FOR DYEING AND PRINTING, *J. A. Dixon, Glasgow.—4th January*, 1882.—(*A communication from Dr. C. Kœnig, Germany.*) 2*d.*

This consists in the conversion of paraleucaniline and of its homologues into colouring matters of the rosaniline series by heating the salts of paraleucaniline, and of its homologues with the hydrates of metallic oxides, such as the hydrated oxide of iron.

931. IMPROVEMENTS IN DYNAMO-ELECTRIC MACHINES, *A. M. Clark, London.—25th February*, 1882.—(*A communication from H. B. Sheridan, Cleveland, Ohio, U.S.*) 6*d.*

The object of this invention is to produce a machine in which the current induced in the armature will be without wide breaks and nearly continuous. The field magnets are made oblong in cross section, and arranged in two series in a circle around the armature shaft, with the poles of the opposing series facing each other, and arranged at a sufficient distance apart to receive the armature between them, the holes of each series nearly overlapping each other laterally, and forming a nearly continuous magnetic field. The armature core is a hollow iron ring, and is nearly rectangular in cross section. Its sides converge slightly from the periphery of the ring to its inner side. In

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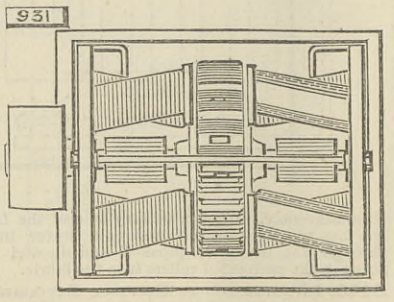

the periphery of the armature core are formed a number of openings, and in the inner side a corresponding number. Upon the sides projections are formed, the outer surfaces of which converge, so as to be parallel with the sides of the body of the said armature. These projections form pairs of grooves, in each of which is wound a single helix of insulated wire. The outer end of one helix and the inner end of the other are joined, and both are connected with one section of the commutator. Our illustration shows a plan of the machine partly in section.

996. MACHINES FOR SEWING FLAT BUTTONS TO FABRICS, &c., *R. H. Brandon, Paris.—1st March*, 1882.—(*A communication from The Morley Sewing Machine Company, Boston, U.S.*)—(*Complete.*) 6*d.*

This relates to the details of construction of a needle feed sewing machine, in which an eyed needle and a hook needle are used in combination with a loop carrier operating above the work and at right angles to the vertical line in which the needles move when they pass through the fabric, the object being to sew buttons on the fabrics by carrying a double thread from the underside of said fabric up through a button and across that part of the button between the holes therein, and thence down through the fabric, and so sewing on one button after another in a line with a continuous thread, and to feed said fabric along to place said buttons at any desired distance one from the other.

1066. LUBRICATING AND CLEANSING SPINDLES FOR SPINNING AND DOUBLING, *T. Watson, Paisley.—6th March*, 1882. 4*d.*

This consists essentially in cutting or otherwise

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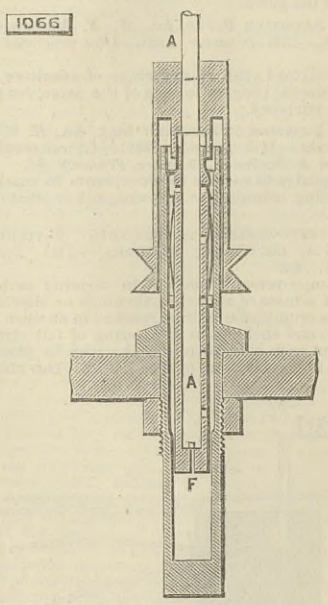


making a slit F in the bottom end of the bush to a little above the end of the spindle, for the admission of oil upwards to spindle A.

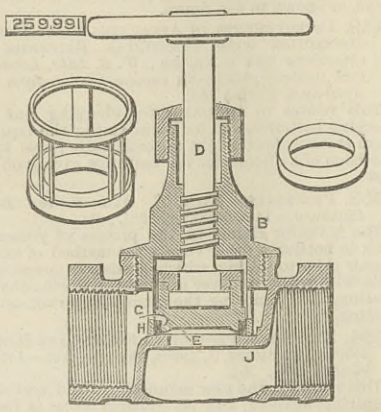
SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

259,991. VALVES, *Edwin R. Tomlinson, Stratford, assignor to himself and Edwin G. Burnham, Bridgeport, Conn.—Filed March 24th*, 1882.

Claim.—(1) A valve having a flat-faced seat J, in combination with a flat disc E, and a loose ring or

259,991



removable seat G, as and for the purpose set forth. (2) In globe or other valves having a flat seat J, a flat-faced disc E, in combination with a loose ring or removable soft-metal seat G, and a guide H, as and for the purpose described. (3) A valve having a flat seat J, and provided with a cap B, in combination with a stem D, carrying a flat-faced disc E, a loose ring or removable soft metal seat G, and a guide H, as set forth.

260,015. PILE FOR USE IN THE CONSTRUCTION OF WHARVES AND OTHER STRUCTURES, *R. M. Franklin, Galveston, Tex.—Filed October 1st*, 1881.

Brief.—A pile consisting of a hollow central metal and wood end sections, the lower one of the latter having an orifice connecting with the chamber in the metal section. Ferules on the ends of the metal section receive the ends of the wooden sections, which

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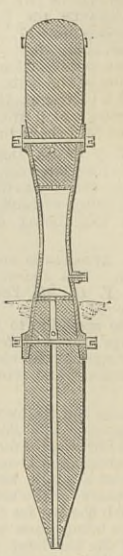

are secured by bolts having split heads to receiv brace-rods.

260,029. ELECTRIC LIGHT, *Philip O. Jenkins, Washington, D.C.—Filed September 28th*, 1881.

Claim.—(1) The combination of the enclosed carbon or other electrodes of like refractory and conducting capacity, their surrounding body of refractory non-conducting substance, the intermediate connecting-piece, which connects the two carbon points or electrodes, and the closely fitting caps of conducting material placed in close contact with the carbons and carbon-investing body, whereby the ingress of air is prevented and electrical contact with the carbon ends

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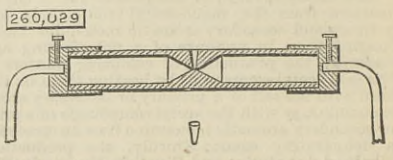

is maintained. (2) The combination of the carbons and their enclosing body, the former fitted air-tight within the latter and the latter provided with a small conical orifice, and the conical or wedge-shaped plug adapted to fit said orifice so as to exclude the air from contact with the carbons, substantially as and for the purpose set forth.

260,040. ELASTIC CUSHION FOR CUTTER-BARS, *Serring C. Megill, Chicago, Ill.—Filed October 7th*, 1881.

Claim.—In a mowing machine, the elastic cushion A, in combination with the cutter-bar, rod, flanged

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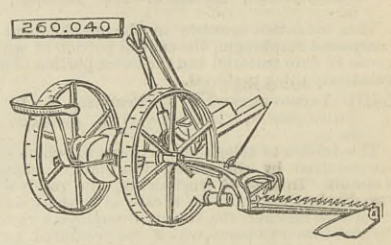

collars, and bracket, constructed and arranged to operate substantially as and for the purpose set forth.

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