STEAM ENGINES AT THE ROYAL AGRICULTURAL SOCIETY'S SHOW.

INASMUCH as there does not appear to be anything to be gained by introducing novelties in the construction of steam engines, very little need be said concerning the engines exhibited at Reading. We cannot see that an advantage would be secured by naming each individual firm exhibiting; and stating that the engines it showed "were admirable specimens of their kind," so we shall confine our remarks to the few examples of steam machinery which are either new in themselves or newly adopted by individual firms. For some time past all inducements to improve on existing types have been practically withdrawn. Makers are as busy as they possibly can be. They can sell their engines faster than they can turn them out, and there are no prizes to be won; nor is there any standard of excellence to which the general public can appeal. They must take engines as they come. No doubt in one sense this is an extremely satisfactory arrangement; unfortunately it cannot last for ever. Very second-rate firms indeed are rapidly learning how to impart to a portable engine all the external characteristics which have hitherto been associated with excellence; and the average purchaser who enters the implement yard at Reading would find it very difficult indeed to find the difference between the productions of the best Lincolnshire firms and those of other establishments which we shall not name. Again, there are rising firms of great merit which are doing their best, and that with success, to turn out really first-class machinery. Both parties are likely to prove dangerous to those who are content to live on a past reputation; and the day is probably not far distant when those who are now most averse to public competition under the auspices of the Royal Agricultural Society will be the first to clamour for it, that the public may learn what is and what is not a good engine. It may startle some persons to know that not one of our great firms now makes for sale as economical a trade engine as it could make. We do not mean to imply that the ordinary Lincolnshire commercial portable engine is not well worth its cost; but we do assert, and that plainly, that any purchaser who came with a good order in his hand and asked for a really excellent engine, could be supplied with something very superior to the ordinary commercial portable. He would have to pay extra, but the engines he would obtain would be well worth the difference. At the present moment, indeed, there are firms who are quietly supplying this kind of demand. They are selling two classes of engines, and they are finding daily that the purchaser is able and willing to pay a little more for a better article than usual, and some of the older firms will discover, perhaps, that trade has in this way been slipping out of their hands. They will not find this out until there is a depression in business, and then some shops will remain working while others will rest. Public competition, if it did nothing else, taught engineers what their competitors were able to do. However, as we have said, at the present moment every one is busy making and selling engines such as have been seen at every Show for the last four or five years, and this reduces what we have to say on the subject of steam engines at the Reading Show to a minimum.

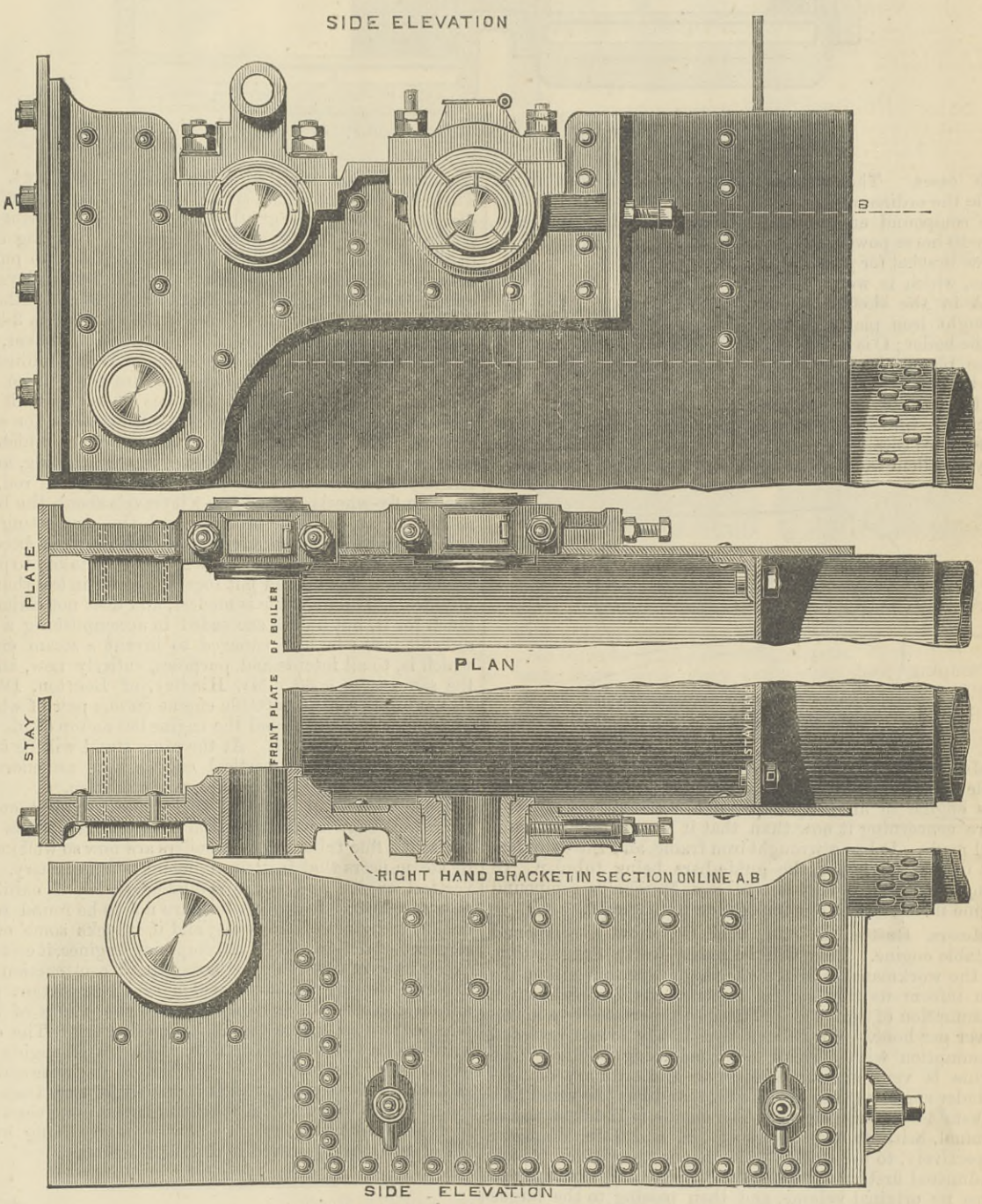
As regards portable engines of the simple type, we may say at once that we have found nothing worth calling attention to, save one by Messrs. Burrell, of Thetford. This engine has been designed by Mr. Frederick Burrell, and is the strongest portable engine we ever saw. Possibly it is the strongest engine of the kind ever built. The cylinder stands on the fire-box in the usual way. The guide-bars are of cast iron, two only being used, one above and the other below the piston-rod, and they are unusually strong and stiff. They are supported near the end furthest from the cylinder, and not at that end, in a way first introduced, we believe, by Mr. Stroudley in locomotive practice. Indeed Mr. Frederick Burrell has followed Mr. Stroudley's example in many respects, and especially in giving enormous wearing surfaces. In various matters of detail, such as the construction of the feed-pump, the simple arrangement of the regulator, and so on, this engine really leaves nothing to be desired. The one drawback—if it be a drawback—is that it weighs about 2 cwt. more than engines of its nominal power, 8-horse, usually do. The repairs of such an engine should be, for years to come, almost nothing; and we have no hesitation in saying that this is an engine altogether to be commended; like Lady Jane, in "Patience," not beautiful but massive.

As regards the other portable engines shown, our readers must rest content with the statement that they are no better and no worse than those shown at Derby last year, with the exception that in one or two cases we find that small firms are apparently abandoning serious errors of design, and improving their workmanship. Whether the engines they exhibit are as good as they look we have no means of judging. We fancy they are, because this improvement is no doubt, in the majority of cases, the result of an honest desire to make a good engine.

In traction and ploughing engines there are a few novelties. For example, Messrs. John Fowler and Co., of Leeds, show a compound engine of this type for the first time. This engine is really nothing more than an ordinary double-cylinder engine, with one cylinder larger than the other. There is, of course, no additional complication. This engine is fitted with a drum for working on the double system. As regards the saving effected in fuel as compared with the ordinary simple engine, very careful experiments have been carried out which we understand show that it amounts to about 25 per cent. in coal, and 22 per cent in water. This last is a very important item indeed. Of course the ordinary ploughing engine works almost without expansion, so that the saving is due not so much to compounding as to expansion; but an advantage of much importance is gained in that the exhaust is almost noiseless, and the regular turning by the two pistons makes the engine very steady when at work.

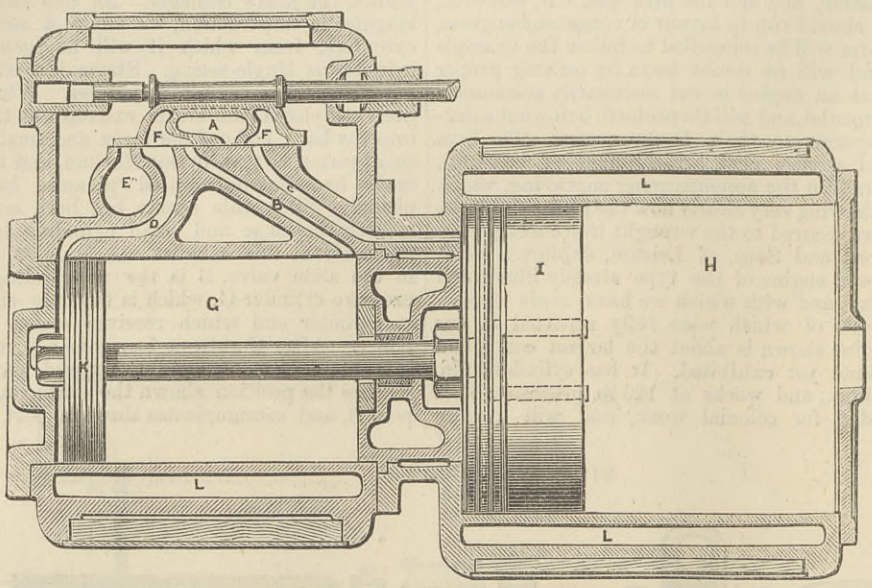
Messrs. Aveling and Porter, of Rochester, exhibited, it will be remembered, last year at Derby, a new compound engine. They have carried out a series of experiments with this engine, extending over a considerable period as a result, and have entirely abandoned compounding. They inform us that nothing worth having is gained in fuel as compared with their ordinary engines, and assert that when a saving such as 20 per cent. is effected, it is only because the engine with which the comparison is made was a very bad one. We venture to think, however, that the method of compounding used by Messrs. Aveling and Porter was to blame, and not the principle. If, however, the public taste should run in favour of compound engines, the Rochester firm will be compelled to follow the example of its fellows, and will no doubt learn by making proper experiments that an engine is not necessarily economical because it is compound, and will thenceforth bring out something much superior to their Derby engine. The firm have introduced a very neat arrangement of bearings, which we illustrate in the accompanying engraving, which explains itself, showing very clearly how the plummer blocks in one casting are secured to the wrought iron cheek plates.

Messrs. Garrett and Sons, of Leiston, exhibit a semi-portable compound engine of the type already illustrated in THE ENGINEER, and with which we have made experiments, the results of which were fully reported in our pages. The engine shown is about the largest compound engine of the kind yet exhibited. It has cylinders 9in and 13in. by 12in., and works at 120 lb. pressure; it is specially intended for colonial work, and will readily indicate 50-horse power. Messrs. Garrett are, however, making engines of the same type to indicate 100-horse power, and such engines are being eagerly purchased by colonists who have to pay long prices for coal. They also exhibit two portable engines fitted with their patent furnace arrangement, which consists, it will be remembered, of a fire-bridge, composed of a pair of folding doors lined with fire brick, and springing from the level of the fire-grate to within a few inches of the crown plate, and a row of tubes conducting streams of air firstly through the smoke-box, and afterwards through the water space of the entire length of the boiler, and discharging them in a highly-heated state into the gases of combustion as they are turning over in the narrow aperture between the top of the fire-bridge and the corrugated crown of the fire-box. This arrangement is very thorough and practical, and we are not at all surprised to find it stated not only by Messrs. Garrett, but by practical men who have been using engines fitted with this arrangement for some months, that a saving of fuel amounting to 15 per cent. has been effected, even where good coal has been the fuel. Messrs. Garrett inform us, however, that it is with inferior fuels, and especially with straw, which is in many countries the only fuel available for portable engines, that the most startling results are to be obtained; and, although it may appear to the uninitiated that, where a material is almost valueless, the object of economy in the use of that material as fuel may not be of great importance, those who have seen or experienced the labour attendant on the use of so fiery a fuel as straw under a blazing sun, will at once appreciate the merits of an invention, the result of which is to increase the amount of water converted into steam by any given amount of straw fuel by some 25 per cent. Close to this stand will be found a compound portable engine by Messrs. Burrell, of Thetford; it has been designed by Mr. Frederick Burrell and Mr. Burall, the firm's manager. As this engine is somewhat singular in construction, we annex a section through the cylinders, from which it will be seen that the large cylinder is single-acting. Steam is first admitted to the forward end of the small cylinder. When the stroke has been completed, the steam exhausts at the same moment into the back ends of the large and small cylinders. The small piston is then in equilibrium, and the next stroke is made by the unbalanced pressure behind the large piston. When this stroke has been completed the ends of both the large and small cylinders are opened simultaneously to the exhaust. A, page 20, is the steam port in the slide valve, B is the port leading into the high-pressure cylinder G, which is the only side of the piston or cylinder end which receives steam direct from the boiler. After the steam has gone a portion of the stroke it is cut off and allowed to expand, and when the valve reaches the position shown the steam returns through the port B, and communicates through port D to the opposite end of the cylinder G. The high-pressure piston is then in equilibrium, the pressure acting on one side of the piston being equal to the pressure on the other. The reduced pressure also acts, through the ports F, in the valve communicating with the port C on the large piston I, which gives the return stroke. F is the exhaust port; the exhaust takes place with the port F in the slide valve open over the port E. The exhaust takes place from the back of the piston I and piston K by the ports at B and D. L L are the jackets; H is the low-pressure cylinder. The packing between the cylinders, which requires no attention for a very long time, is composed of copper wire gauze worked into square rings, and is found perfectly tight without requiring any screwing up, the steam pressure acting through the space around the piston rod, and pressing the packing home. The pistons are fitted with Ramsbottom's springs, and the low-pressure piston is very deep, so as to give a large wearing surface as it acts in the place of the ordinary crosshead. The cover of the cylinder H has a long slot, so as to allow oscillation of connecting rod. This is almost the only form of compound cylinder that could be put on a portable engine to be worked with one connecting rod, one crank, one excentric, one slide valve, &c., so that there are, it is claimed, no more parts than in the ordinary engine, while, at the same time, a long connecting rod is retained. The accompanying diagram shows that the steam is worked to advantage. This engine is 10-horse power nominal, but it is mounted on a 7-horse power nominal boiler. We are informed that as the result of a very careful



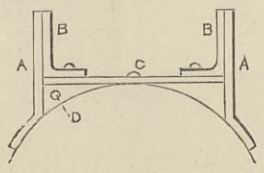
MESSRS. AVELING AND PORTER'S TRACTION ENGINE.

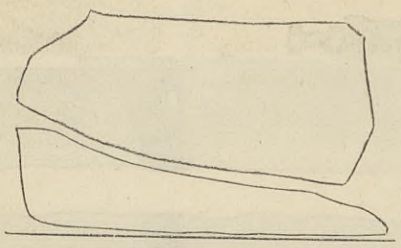
trial of the compound engine against an ordinary 10-horse power engine made by the firm, the compound engine made 18,000 revolutions against a given brake load, and lost no water in the gauge glass, while the non-compound made but 15,000 revolutions against the same load, and lost an inch of water, the same weight of coal being used in



BURRELL'S COMPOUND ENGINE.

both cases. The compound pumped cold feed-water, while the ordinary engine pumped feed-water at 150 deg. The compound engine weighs 30 cwt. less than the ordinary 10-horse power engine. Messrs. Burrell have adopted a new bracket for portable engines, which is worth notice. A A in the sketch are two wrought iron plates rivetted to the boiler; C is a flat transverse plate, also rivetted to the boiler as shown; and B B are the two cast iron plummer blocks let into A A, and secured as shown. The exhaust pipe comes through one of the spandrils at D. This is a very excellent saddle, one of the best, perhaps, yet made.





DIAGRAMS FROM BURRELL'S ENGINES.

Messrs. Hornsby, of Grantham, have a new semi-portable compound engine. As we shall probably illustrate this engine in an early impression, we shall say nothing more concerning it now than that it is well designed and well made. It has a wrought iron frame, and the cylinders are under the boiler, the guide-bars being tubular. In many respects it is very like Messrs. Marshall's compound engine illustrated in our impression for June 30.

Messrs. Ruston, Proctor, and Co. show a compound portable engine. This will be found worth examination, for the workmanship is of a very high type indeed, and the firm inform us that careful experiments have shown a consumption of water of but 20·46 lb. per effective horse-power per hour. We believe that is the lowest recorded consumption with a small non-condensing engine. The engine is very similar in type to the ordinary double-cylinder engines made by the firm, and has the usual link adjustable expansion gear. The engine is 12-horse power nominal, with two cylinders of 7in. and 11in. diameter respectively, to use steam of 120 lb. per square inch, which is admitted first into the smaller cylinder and expanded to twice its original volume, and then passing to the larger cylinder is again expanded, escaping into the air with a final pressure of under 10 lb., or less than in an ordinary engine. In one of the trials alluded to above, this engine, with a load of 30·26-horse power on the brake, ran for 3 hours 45½ minutes with only 300 lb. of Welsh coal, equivalent to 2·63 lb. per effective horse-power per hour, or about 2·4 lb. per indicated horse-power. In construction there are several novel points. The cylinders are both jacketted and cast in one piece, with a flange all round, which is bolted to the boiler, every bolt being in sight. Steam is admitted at the back from a separate casting containing an improved balanced stop valve and the two safety valves, so that only one connection to the boiler is required for these three fittings. The crank shaft is of steel, supported by brackets, which are connected to the cylinders by steam expanding stays. One of these brackets has a facing for receiving the pump, so that the latter can be removed on disconnecting the flange of the delivery pipe without breaking any other joint. The boiler is of steel, and the fire-box of Lowmoor iron, very strongly made and of full proportion, provided with a flanged wrought iron manhole and mud collector, and the usual fittings.

Messrs. Marshall, Sons, and Co. exhibit a fine 20-H.P. semi-portable compound engine, but we have so recently illustrated the compound engines of this firm that we need not describe it.

The only stationary compound engine which is exhibited is that by the Reading Ironworks Company, which we illustrate on another page. This is in all respects a well-designed, well-made, substantial engine, which will more than maintain the excellent reputation long enjoyed by the firm. There is not, we may add, a stand in the yard which will better repay inspection. The firm is at home, and consequently was bound in some sense to make a good display. We may call particular attention to a wrought iron Jackson's split pulley with a double row of spokes, and 8ft. in diameter by 20in. wide, weighing only 12 cwt. 2 qr There is also to be seen a split pulley 4ft. long and 2ft. in diameter, which ran at the Crystal Palace during the whole time of the Electrical Exhibition, carrying eight driving bands. It may be said that to allude to pulleys here is a digression. We admit as much, but pulleys and engines have after all a good deal to do with each other.

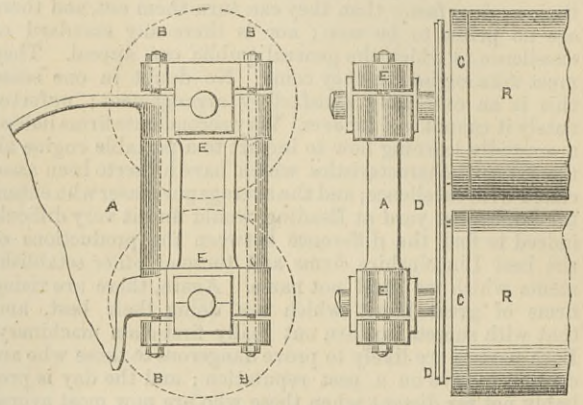
The greatest novelty in engines in the show was a 3-horse portable engine shown by the inventor and maker, Mr. G. Radford Mather, of Wellingborough. We shall illustrate this engine as soon as we receive drawings from Mr. Mather. Meanwhile it must suffice to say that it is a most ingenious and entirely new arrangement for small powers. The engine has a vertical boiler, to which are fitted a pair of shafts. The engine is single-acting, and is entirely without slide valves, excentrics, or piston rod. It has two fly-wheels, and on these it travels about, the boiler resting in an inclined position, and the connecting rod being detached from the crank shaft, which then becomes a carrying axle. We saw the whole engine taken to pieces while steam was up and put together again in less than ten minutes. The inventor is modest, and does not claim too much for it, but he has succeeded in accomplishing a very difficult task; he has managed to invent a steam engine which is, to all intents and purposes, entirely new, and at the same time good. Mr. Hindley, of Bourton, Dorset, also exhibits a little portable engine on one pair of wheels. The boiler is inclined and the engine lies on top of it. This is a handy little engine. At the same stand will be found a very well designed vertical engine with an enormous slipper guide. This engine deserves attention.

Messrs. Cochran and Co., Birkenhead, exhibit one of their well-known patent vertical multitubular boilers with horizontal flue tubes. These boilers are now so well known by steam users that further comment is unnecessary. The vertical engine and boiler combined which is exhibited presents several features which are not to be found in the ordinary engines of this class, and if it lacks some of the elegance of design offered in competing engines, it certainly excels most of them in great strength of construction and in large wearing surfaces—which in all important parts are adjustable—and is likely to meet the wants of those who require an engine for really hard work. The other exhibit is a two-wheel portable, a design of engine first exhibited at any Royal Show by Messrs. Cochran and Co. at the Carlisle meeting, and is intended for easy transit in mountainous districts. A specimen flange plate shows the high-class work this firm are now regularly doing by the aid of the most approved hydraulic machinery.

MISCELLANEOUS MACHINERY.

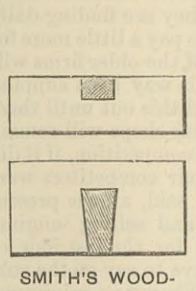
THE Reading Ironworks Company show a brick-making machine which has several points worthy of remark. The machine is one of the class having a vertical pug mill, and a pair of smooth horizontal feeding rolls, through which the clay from the pug mill passes, and is pressed and forced through a die of the area of the brick on its widest face, both these parts being on one frame, mounted on wheels to run on rails laid at a narrow gauge. A somewhat improved cutting table is placed in front of the rolls, and a vertical engine on wheels running on the same rails, and of 8 or 10-horse power, is placed at the pug mill end of the machine, and kept at the proper distance therefrom by a pair of removable struts, which drop into sockets provided on the bed-plate of the machine and of the engine for that purpose. The pug mill is driven by a strap from the engine, but the rolls are driven by a strong Ewart's driving chain from the slow-motion shaft under the pug mill, the chain wheel on the roll spindle being connected thereto through the medium of a friction brake clutch, so as to prevent breakage when hard substances get between the rolls. The machine, see page 21, and engine being thus arranged to run together on a narrow-gauge railway, they occupy little width between the clay heaps and the drying ground, and so minimise the carrying labour.

The top and bottom bearings E E, as in annexed sketch, of the feeding rolls are overhung, so that both rolls are easily removed, and they are connected by means of through bolts B B. These are proportioned so that they will break more easily than any part of the frame A of the machine should the friction brake seize when a stone or other hard substance gets between the rolls. The bearings are, as will be seen from the sketch, considerably outside the faces of the rolls themselves, intervening cheeks D with inlet fitting pieces being provided, so as to clear the falling clay, which is ordinarily the cause of excessive wear. The rolls are bonded at each end by a wrought iron ring C C, easily renewed when worn. This is rendered desirable as the ends of the rolls, being the parts subject to the greatest wear, rapidly round off with a small radius, so that putting on new rings will practically renew the rolls, save re-turning, and allow them to be used effectively for a longer period than with rolls not so fitted. The die is of the self-lubricative form, and the pug mill is so arranged

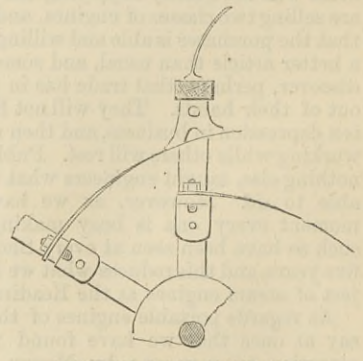


DETAILS, READING BRICK MACHINE.

that by removing a few bolts and nuts one-half can be swung back on hinges, rendering examination of knives and cleaning an easy matter. This also enables the workmen to clean out the mill, so that after standing it has not to be started partly full of dried and hardened clay, which is a frequent source of breakage. The main bevel wheel on the pug mill shaft is made in halves, so that it can be easily removed, and the shaft and knives lifted out without disturbing any of the other parts. The machine will make from 16,000 to 18,000 bricks per day, and amongst other bricks made by it, is one which is afterwards put into a press to receive an impression, which is afterwards filled with a plug of wood, as shown in the annexed sketch.



SMITH'S WOOD-PLUGGED BRI KS.

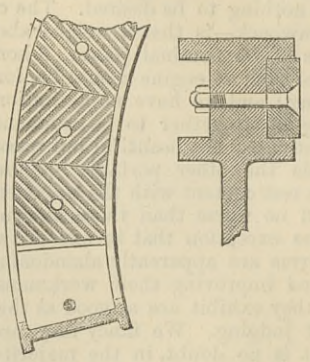


MALDON CO.'S HAYMAKER.

This is the invention of Mr. Smith, manager of Messrs Wheeler's Reading Brickworks, the object being to provide a ready means of attaching splines and panel work, and for pictures, &c.

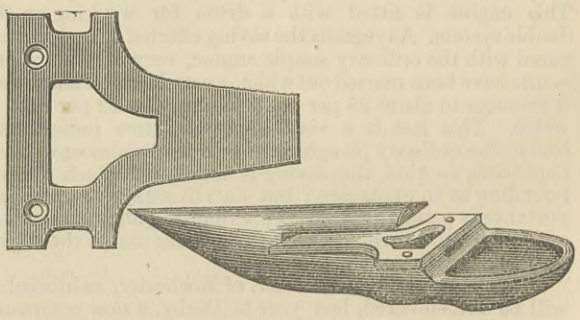
The Maldon Ironworks Company shows a haymaker in which the fork heads and their springs are arranged as in the above sketch.

Messrs. Murton and Turner, of Thetford, show a combined chaff-cutter, bruising mill, and kibbler, in which the turned periphery of the chaff-cutter knife wheel runs against a small smooth roller in a small case on the chaff-cutter frame, and constitutes the bruising mill, while the side recess in the rim of the wheel is fitted with a number



MURTON AND TURNER'S CHAFF CUTTER AND DRILL.

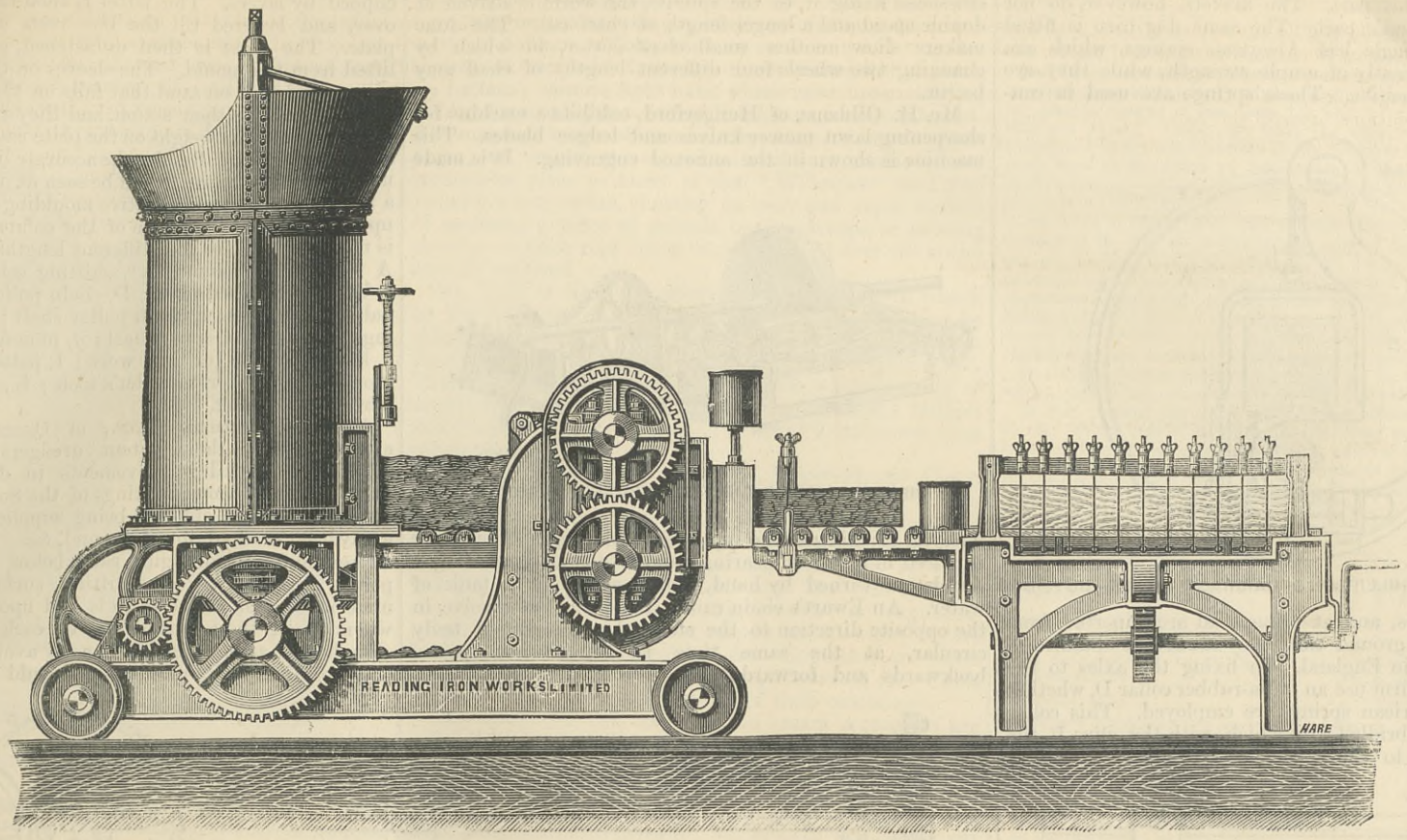
of grooved chilled segments, as shown in the annexed diagram, and these run against a small plate in the same case and constitute the kibbling mill. Machines of this kind are very useful where keepers of two or three horses



WILLIAMS AND SON'S MOWER FINGER.

have not room enough for three separate machines, and

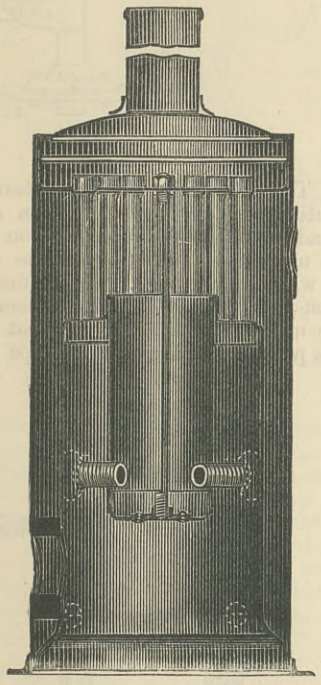
THE READING IRONWORKS COMPANY'S BRICK MACHINE.



the one combined machine does not cost so much as three for the separate purposes.

Messrs. J. Williams and Son, of Rhuddlan, near Rhyl, exhibit a mowing machine with fingers made as shown by the engraving, next page. This finger is made of malleable iron, with an open space at the shoulder of the part that fits against the bar. It is covered with a steel lining of the form shown, and with an opening corresponding to that in the finger. Its edges are bevelled, so that knife and finger act as shears. The advantages gained by the use of this finger are that it allows all soil and other matter to escape, so that choking is much less frequent, and the opening in the finger casting allows the iron to become more thoroughly annealed than if solid, so that greater strength and toughness are obtained.

Messrs. Penney and Co., of Lincoln, enter the list of boiler makers with what they call the Triplex boiler. It

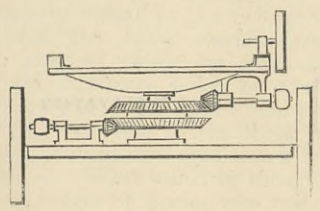


PENNY'S TRIPLEX BOILER.

is shown in the accompanying engraving, and consists of a pot boiler with four cross or radial water tubes between the pot and the fire-box, and a number of vertical fire tubes from the top of the fire-box in the ordinary way. There is a hand-hole cover opposite the end of each cross tube, as well as mud-hole covers at the bottom. The following are the dimensions of these boilers :—

Horse-power.	Height.	Diameter.	Heating surface in square feet.	Grate surface.
	ft. in.	ft. in.		
2	4 6	2 0	31	2
3	5 0	2 3	42	2¾
4	5 6	2 6	54	3¼
5	6 0	2 9	65	4½
6	6 9	3 0	78	5
8	7 4	3 4	95	6

Messrs. R. J. and H. Wilder, of Wallingford, show a straw elevator with a new arrangement of gear for driving it from the thrashing machine at any angle. It is shown by the above diagram of the fore carriage of the machine to which it is attached. The ordinary locking plate is replaced by a pillar carrying a double crown wheel, into the lower part of which gears a pinion on a shaft in bearings attached to the axletree. On the end of the same shaft is a pulley to receive the driving strap. Into the upper part of the double crown wheel gears



WILDER'S ELEVATOR DRIVING GEAR.

a similar pinion on a shaft in bearings attached to the frame of the elevator, this shaft carrying a pulley on which runs a strap for driving the elevator. It will thus be seen that the machine may be set at any angle so long as the front axle of the elevator is parallel with the shaft of the thrashing machine, from which it receives its motion. The machine exhibited is the first, and is roughly made ; but this is a fault that can be avoided in the subsequent machines, and it may be suggested that a single crown wheel may be made to do the work of both those now used by lengthening the bearing pedestals of both short shafts and slightly raising the lower part of the wheel. It is, however, difficult to see in what respect this arrangement is better than the half crossed strap on a vertical shaft gearing direct on to the elevator spindle by one bevel wheel and pinion as first used in Ransome's machines.

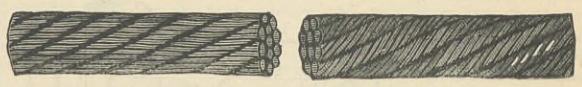
Messrs. C. Kite and Co., of London, exhibit some of their exhaust ventilators as applied to ricks instead of the fans employed by other makers. This is a powerful ventilator of the kind, and is to be put to work in the trial grounds next Tuesday if the weather is fine enough ; but it must be noted that a considerable wind is necessary to drive this ventilator in such a way that it would do any really useful work in drying and cooling a rick of damp hay. A slow combustion stove is shown in connection with the ventilator for passing heated air into the rick.

Messrs. King and Bomford, of Newmarket, Stroud, Gloucester, exhibit their string sheaf-binding reaping machine, with considerable improvements since the trials of last year. In the machine then exhibited the binding apparatus was below the binding platform and the needle had a descending movement. The binder is now above the sheaf to be tied ; the binding arm has an ascending movement, and the size of the sheaf determines the time at which the binding mechanism is thrown into gear. Any size of sheaf may be made, but the machine must be set for the size determined upon, and this takes a little time. In the machine tried last year the weight of the sheaf and not the size determined the period at which the binding gear was set at work ; but the failure we anticipated, as mentioned before the trials, took place. The weighing apparatus was too much affected by the movements of the machine on the rough field to permit uniform working, the inertia at one time and the momentum at another preventing the steady operation of the weighing apparatus. The machine exhibited will be shown at work next month during harvest, by those who wish to see it, by application to the makers. This is one of the very few English binding reaping machines now left which are not an imitation or an application of the American arrangement, and the inventors deserve the success which the machine now promises.

Messrs Hunt and Tawell show a number of small food-preparing machines, with wood legs simply fastened in a cap frame of iron, and made specially for export, which they exhibit for the first time.

Messrs. Ransomes, Sims, and Head show a thrashing machine of their new design with reciprocating shakers, and in which a strong iron panel with drum bearing rail forms a feature useful and new in this machine. To the overflow from the feed pump of their portable engine they have added a pipe from the exhaust, so as to provide a simple and effective feed-water heater.

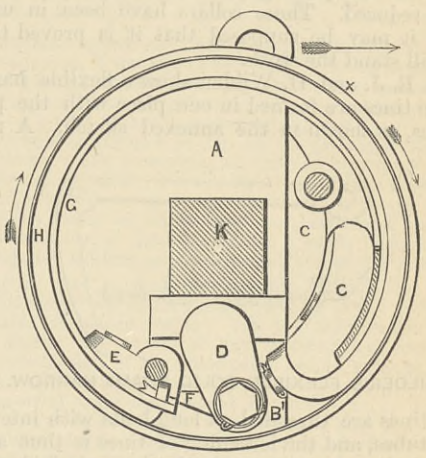
Messrs. G. Cradock and Co., Wakefield, show some of their steel wire ropes, to which we referred in our account of the Naval and Submarine Exhibition. The feature in these ropes is that instead of the strands being spun in one direction and laid in the other, they are both spun and laid in one direction, *i.e.*, twisted to the left or to the right. In the annexed woodcut the left figure shows a piece of rope twisted in the ordinary way, while



COMMON ROPE. LANG'S ROPE.

the right figure shows a wire made under Lang's patent by the exhibitors. In a rope as shown in the upper figure each exposed part of the wire in the strand is short and is held between the two adjoining strands. These exposed parts being short, break more easily when the rope is bent and when worn than do those made as in the lower figure, which have more freedom. The exhibitors show a coil of rope of about 500 yards in length which had been in work some time in an underground incline in a colliery of the Bedworth Coal and Iron Company. This was ¾ diameter when new, and has worn uniformly down to $\frac{9}{16}$, and in the lower end it is, according to Mr. Geo. Barker of the above company, worn down to ½in., and is not broken anywhere.

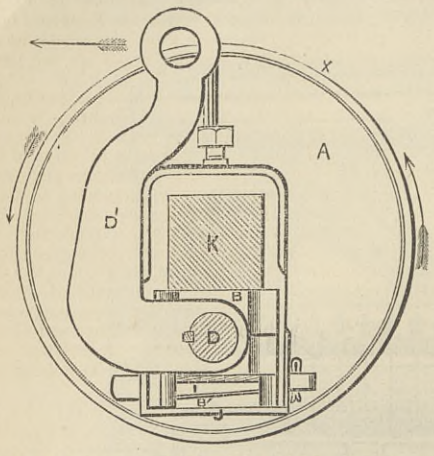
Messrs. Atkinson and Phillipson, of Newcastle-on-Tyne, exhibit what they call an agricultural dog-cart fitted with a brake constructed as shown in the annexed sketch.



ATKINSON AND PHILLIPSON'S CARRIAGE BRAKE—INSIDE.

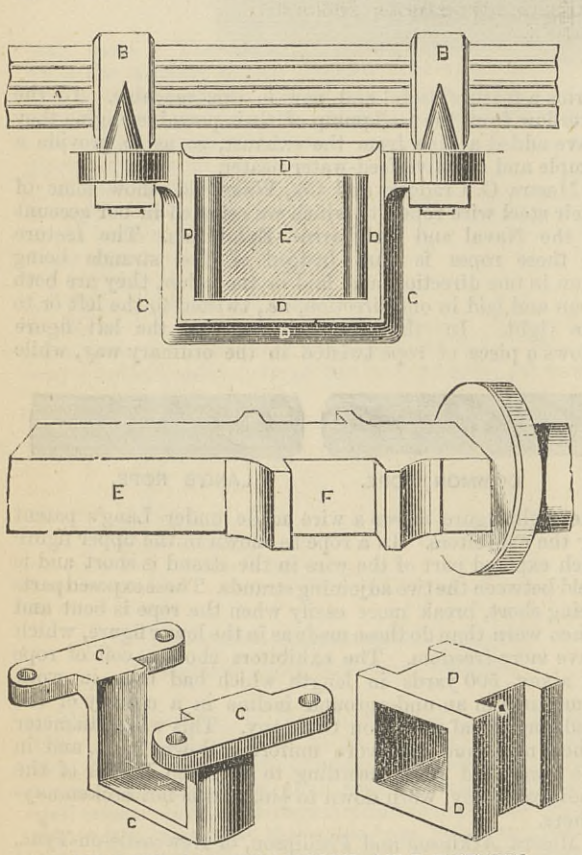
On the square part of the axle K, behind the collar, the disc A is fitted, having a slot at one side, and after being passed over the axle the slot is filled up by B B′, slid into the slot and secured by a key J. Passing through B B′ is a spindle D, having a crank at one end and a lever D′ keyed on to it at the other; from this lever D′ is attached the rod to work brake. The crank D is connected by a link F to one end of the divided circular spring G by E, the other end of the spring is fastened to C, C being made fast to the disc A as shown. The outer surface of the spring G is covered with leather H. The spring and its covering are of such a size that the periphery of the latter is clear within the ring X, which is a fixture on the nave of the wheel. On the rod attached to D′ being drawn, the spring G is expanded, forcing out the leather in contact with the inner surface of the ring X, and thus retards the wheel. The objection may have no weight ; but it will be seen

that the tendency is to twist the axle in its bridle, and the brake power throws a great strain on the nave hoop which has to be withstood by the wood, which is not very great in quantity in this part. The makers, however, do not consider this a weak part. The same dog cart is fitted with the light single leaf American springs, which are elegant and apparently of ample strength, while they are certainly very sensitive. These springs are used in con-



ATKINSON AND PHILLIPSON'S CARRIAGE BRAKE—OUTSIDE.

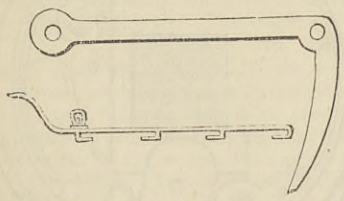
siderable numbers, and at present all are imported from America on the ground that they cannot be obtained of the same quality in England. In fixing the axles to the springs the same firm use an india-rubber collar D, whether ordinary or American springs are employed. This collar is placed in the bridle C, by which, with the clips B, the axle is fastened to the spring, and it allows a certain



ATKINSON AND PHILLIPSON'S AXLE FIXTURES.

amount of freedom, relieving the springs and axles of some strains, while side jerking is avoided and impact strains on the axle reduced. These collars have been in use four years, so it may be supposed that it is proved that the rubber will stand the work.

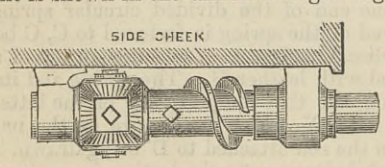
Messrs. R. J. and H. Wilder show a flexible harrow in which the tines are formed in one piece with the parts of the frames, as shown in the annexed sketch. A number



WILDER'S FLEXIBLE SOLID FRAME HARROW.

of these tines are threaded on long bolts with intervening distance tubes, and the loosening of tines is thus avoided. When it is necessary to make the harrow rigid the bar, also shown, is hooked on the harrow frame and the hook bolt screwed up. The bar forms a handle also. When working in dirty and stiff lands part of the harrow may be turned up and one-half or three-fourths of the width of the harrow only used.

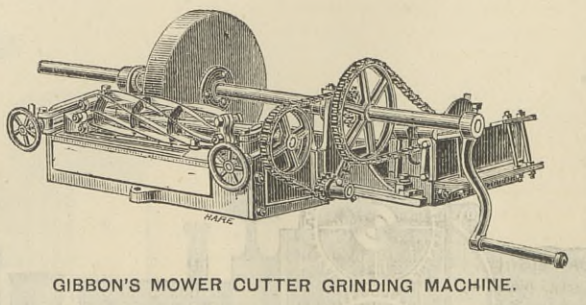
Messrs. Harrison and McGregor show a small chaff-cutter to cut two lengths by removing a set screw. The arrangement is shown in the annexed engraving. On the



HARRISON AND McGREGOR'S CHAFF-CUTTER.

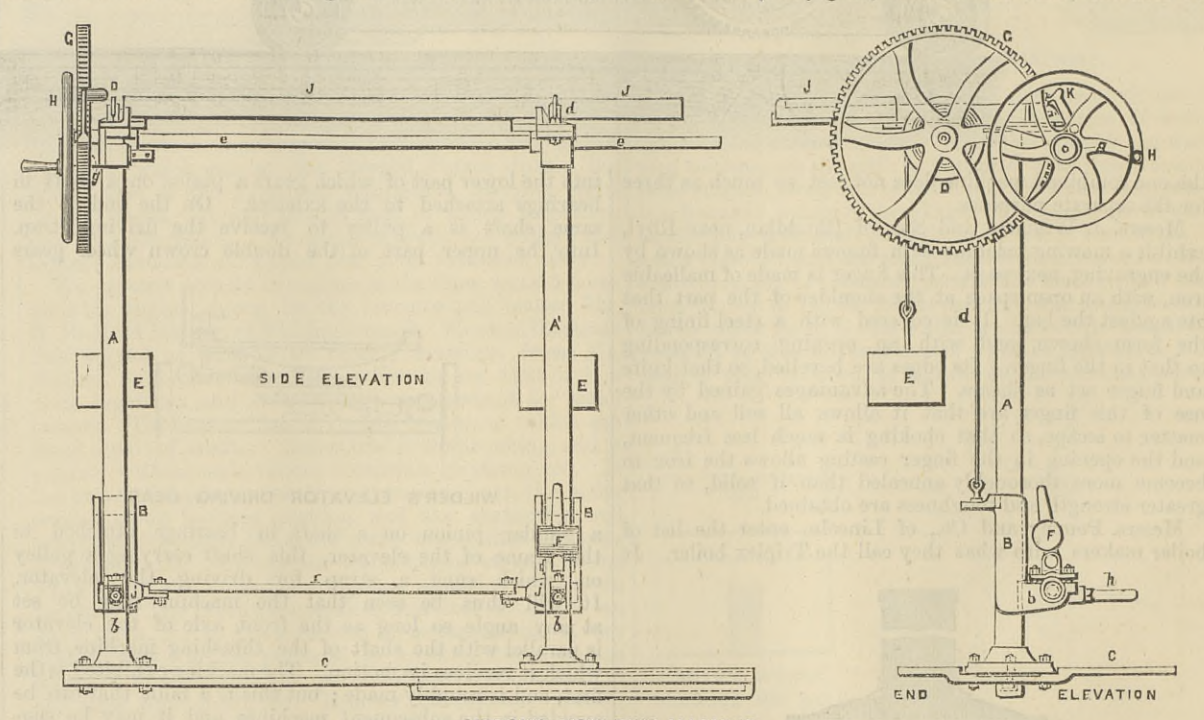
worm is a bevel pinion, and a similar one is cast on the end spindle bearing. On a small crosshead is a similar pair of pinions. When the set screw is fixed in the worm boss, and the crosshead carrying the two pinions left free to revolve, a short length is cut. When the screw is put into the crosshead fixing it to the spindle, the worm is driven at double speed and a longer length of chaff cut. The same makers show another small chaff cutter, in which by changing two wheels four different lengths of chaff may be cut.

Mr. H. Gibbons, of Hungerford, exhibits a machine for sharpening lawn mower knives and ledger blades. This machine is shown in the annexed engraving. It is made



GIBBON'S MOWER CUTTER GRINDING MACHINE.

for local machinists who repair lawn mowers. The cutter is placed in a pair of bearings, and is operated upon by a grindstone turned by hand, and working in a tank of water. An Ewart's chain causes the cutter to revolve in the opposite direction to the stone, thus keeping it truly circular, at the same time the grindstone passes backwards and forwards along the face of the cutter,

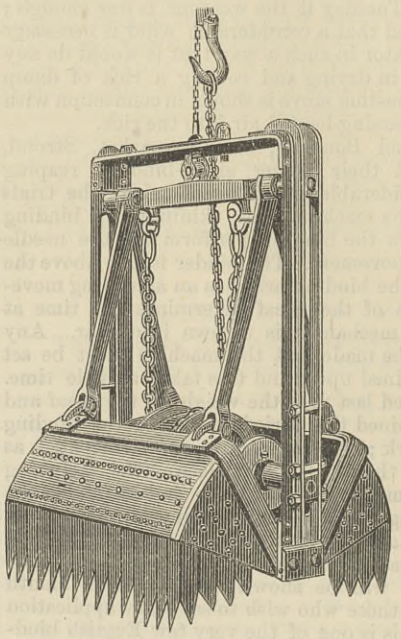


GIBBON'S MOULDING MACHINE.

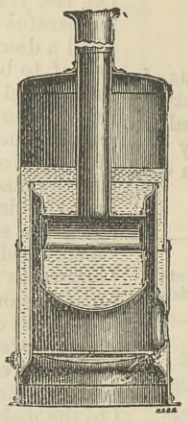
by means of a screw on its shaft. The cutter is thus ground perfectly true both ways, and the edge obtained is much better than when the cutter and blade is sharpened as they generally are in repairing shops by means of emery powder and oil worked in while the cutters are turned in the direction opposite to that in which they work. A boy can work the machine. Attached to the machine is a rest and disc grinder for sharpening the ledger blades.

over on its trunnions or fixed in position. In moulding with these machines the plate is run up to a convenient height on the columns, the moulding box placed on it, and clipped by levers. The latter is then rammed up, turned over, and lowered till the box rests on the foundation plate. The plate is then unfastened, gently rapped, and lifted from the mould. The sleeves on the columns are so constructed that no sand that falls on them can jam them or interfere with their action, and they are also self-adjusting for wear, as the weight on the plate causes them to touch at two parts only. Besides the accurate lift obtained by the use of these machines, it will be seen at once that they form a most convenient and effective moulding stage for ramming up and turning over. One of the columns of the machine is made movable to suit different lengths of pattern plate. A is the fixed column, A^1, shifting column; B, sleeves *b*, bearings; C, bed-plate; D, chain pulleys; *d*, chains; E balanced weights; *e*, chain pulley shaft; F, lever for locking trunnions; G, spur wheel; *g*, pinion; H, hand wheel; *h*, lifting handles for light work; I, pattern plate; *i*, trunnions; J, shelf for moulder's tools; K, pawl to lock spur wheel in ramming.

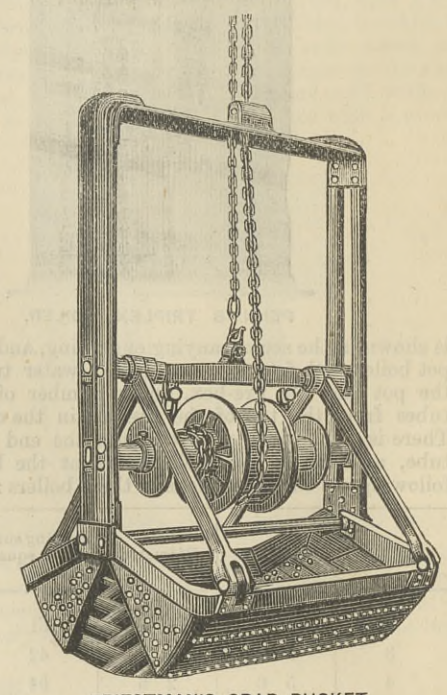
Messrs. Priestman Bros., of Queen Victoria-street, exhibit one of their patent dredgers and excavators. There are several improvements in details over those exhibited at previous meetings of the Society, but in other respects it is very similar, being supplied with grabs for excavating or dredging clay, mud, &c. A special grab is also exhibited for dredging sand below water. The steel points, forming a sharp cutting surface, penetrate the material as soon as the grab is laid upon the surface, but when closed they interlock with each other, forming a close bucket as it were, and thereby avoid the open spaces of the ordinary clay grab, which would allow the sand to pass through. The machine is fitted with steam propelling gear for excavating proper, or working from a quay, provision being made for bolts to secure it upon the deck of a barge. The machine is fitted with one of Keable's patent boilers, which was exhibited for the first time at the Derby show last year. Many of these boilers are now at work, and we understand are giving great satisfaction. Experience has proved that the internal pipe for cleaning



PRIESTMAN'S GRAB BUCKET.



KEABLE'S BOILER.



PRIESTMAN'S GRAB BUCKET.

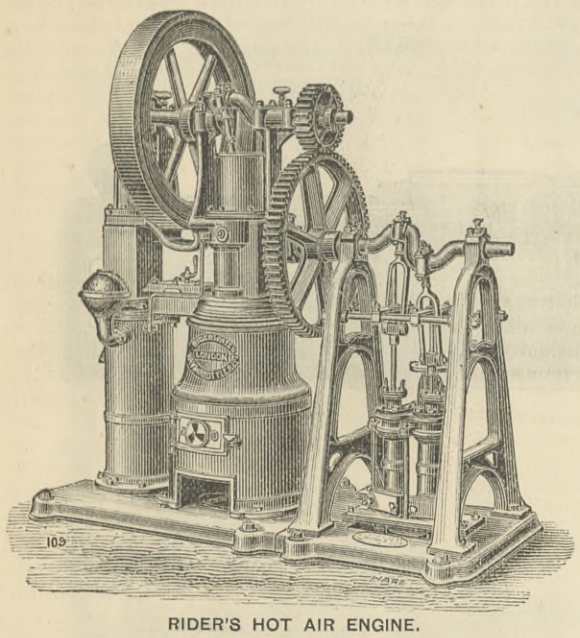
The same maker exhibits a moulding machine, which in price is within the means of the smallest founder. It consists of two upright turned columns, bolted to a foundation plate. On these columns work sleeves which carry the pattern plate, slung on trunnions. The whole is balanced by weights and chains passing over pulleys at the top of the columns. The plate can thus be moved up or down the columns with great ease and smoothness, the lift being perfectly accurate. The plate can be fixed at any height on the columns, and can be turned

out the centre pot is not necessary, the circulation being very great. These excavators, owing to the simple means adopted for lifting and lowering the grabs, &c., are now coming largely into use as ordinary cranes for lifting purposes, the system of lifting and braking the load by means of one lever only enabling them to work at a great speed.

Messrs. Batho also exhibited an excavating machine, with their well-known four segment bucket. This machine was smaller and lighter and of less power than Messrs. Priestman's, but it is capable of doing good work. It is a

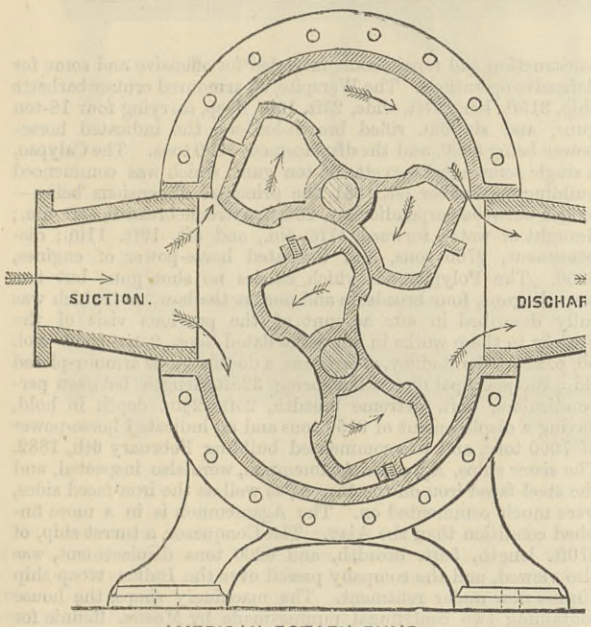
well-designed and ingenious machine, of which considerable numbers are now in use.

Messrs. Hayward Tyler and Co., of London, exhibited a modification of the now well-known Rider's hot air engine, which we illustrate. It will be understood that by introducing a toothed wheel and pinion, and increasing the weight of the fly-wheel, a lift pump may be fixed down a well, and the engine thus becomes capable of drawing from considerable depths, which it could not do before. When the well is of



RIDER'S HOT AIR ENGINE.

moderate depth two pumps instead of one may be used and the quantity of water doubled. This modification is shown at work at Reading, and is illustrated in the accompanying engraving which shows the pumps on the surface. It is only necessary to prolong the rods when the pumps are to be put down the well. The engine indicates less than 1-horse power, and will pump 600 gallons an hour 80ft. high with great ease. These Rider engines are very durable when worked with reasonable care; one of them



AMERICAN ROTARY PUMP.

has been at work at the office of Mr. Okes in Cannon-street for four years almost without repairs. At the same stand will be found an American pump—a modification of the well-known Root's blower. This pump we illustrate in section. It will easily deal with 20,000 gallons per hour, and the principle on which it works is too well understood to need explanation. In the construction of the pump, however, several details have been introduced which, while adding to the efficiency of the machine, can hardly be made intelligible by any description. There are also not a few curiosities of American engineering practice about the machine which will not commend themselves to engineers in this country, such as using three bolts where one would suffice, and employing two castings where one would do; but in the hands of Mr. Benson and Mesrs. Hayward Tyler and Co., all this will be changed, and an admirable pump for large quantities and heights beyond the proper scope of the centrifugal pump will remain.

Messrs. Bailey, of Manchester, also exhibited a hot air engine, but we must reserve our notice of it until next week.

The Patent Waterproof Paper and Canvas Company, Canal Works, Willesden, makes a very effective display of its products. If copper be placed in a strong aqueous solution of ammonia it will be dissolved, the result being a green liquid. If paper be steeped in this, and then dried, it will be found that it has become not only waterproof, but almost indestructible by any ordinary vicissitudes of weather. It cannot be rotted, and we have seen paper thus treated boiled for a considerable time in water, without showing the least symptoms of dissolving. The company has designed special modes of utilising this paper and canvas for roofing and building purposes, and at Reading will be found a portable shed, 40ft. by 12ft., made of nine panels or sheets of the "Willesden" roofing, thrown over light, well-braced frames, the sides and ends being also panelled with the card. The shed has been, we understand, exposed to all weathers for two years, and resisted the great snowstorm of January, 1881, and the gales of last autumn unharmed. A span roof, 15ft. by 12ft., which was exhibited at the Royal Agricultural Society's Show, Kilburn, 1879, since when it has been exposed to all weathers unhurt, is also at Reading. The card has withstood the unfixing and refitting six times without harm. A farm shed is exhibited, showing the permanent mode of fastening the "Willesden" sheeting by battens; several light huts, which have been standing unhurt for several years during all weathers, are also to be seen. The material is also shown in the shape of water pipes, tanks, and wagon covers, and an enclosure, made by one continuous piece or sheet of the "Willesden" card run round posts or stakes, showing an easy and rapid method of enclosing a piece of ground, hutting troops, or housing navvies—a pitch roof being readily erected over the enclosure, if required.

Mr. Hall, of Sheffield, shows a new bone mill, in which, by the addition of a third roller, a fine sample can be obtained at pleasure. This third roller is placed between the two upper rolls, and is driven at a much higher speed. This seems to be a very simple and inexpensive way of supplying a want. Mr. Hall also shows Jacob's ladders and other appliances for dealing with small coal, concerning which we shall have more to say.

The stand of Messrs. Wilkinson, Heywood, and Clark, Caledonian-road, will be found worth inspection. It contains a large case, in which are most tastefully arranged specimens of paints of almost every conceivable colour, some of them of extreme beauty, and most of them specially adapted for engineers' use. The firm shows a clear anti-rusting varnish for bright work; an engineers' patent bronze composition for reapers and mowers; engine furnace heat-resisting varnishes, &c. Engineers are not a little indebted to Messrs. Wilkinson, Heywood, and Clark for some of the attractive features of their machinery.

The results of the trials of the cream separators are sufficiently remarkable. It will be remembered that the Hamburg Company claimed that its double machines would each get through 300 gallons of milk per hour. As a matter of fact the double machine tried required 9 indicated horse-power to drive it; ran at 1312 revolutions per minute, and dealt with only 140 gallons of milk per hour. The Laval machine, made by Lamm, ran at 6000 revolutions per minute, and not at 8000 as stated by the exhibitors. It required about 0·15-horse power to work it, and separated 56 gallons of milk per hour, which is very nearly the quantity stated by the exhibitors. The first run showed that the Laval machine separated fully to the point required, while its rival did not even get down to the minimum fixed by the judges. We have not yet heard the results of the final two hours' run. It is a noteworthy fact that of the three judges in this department, only one had ever even seen a cream separating machine before. What would be thought of appointing a couple of judges of horses who had never seen a horse until they entered the showyard, and pronounced an opinion on his merits by making him work for a couple of hours? The whole value of the cream separating trials depends on the figures obtained by Dr. Voelcker and by Mr. Anderson. The judges were entirely superfluous, two of them who knew nothing about the machines tested being able to overrule the one gentleman who had at least seen a separator at work before.

So little has been done in the haymaking trials since we last wrote, the weather having been so catchy, that we leave our further remarks on these trials until another impression.

The awards of the judges of miscellaneous implements and cream separators were announced on Wednesday. In the class for separators driven by mechanical power no award is made; but in that for separators driven by manual or horse-power the gold medal is given to D. Hald and Co., 24, Great Winchester-street, London, E.C., for a cream separator manufactured by Mr. Oscar Lamm, jun., Stockholm, Sweden. The price is £32, and £5 extra for intermediate motion, and the machine is capable of separating from 60 to 80 gallons of milk per hour. The power required is one horse. Of the ten silver medals offered for implements, which are new either in principle or improvements, three medals are awarded as under:—Reading Ironworks Company, Limited, Reading, for their machine for washing railway milk cans; price £38. Nalder and Nalder, Limited, Wantage, for their improved method of driving shakers and riddles in thrashing machines. George Hathaway, Chippenham, for his double oscillating churn; price £3. It churns up to four gallons, and produces butter by concussion, and not by friction. Messrs. Nalder and Nalder drive shakers, jogboard and ridddles, and sieves, by means of one crank, which reduces the number of bearings to a remarkable extent. We shall describe it in another impression.

LETTERS TO THE EDITOR.

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

ELECTRICAL ACCUMULATORS.

SIR,—I have only just received my copy of THE ENGINEER, but I hope my reply to Mr. Howard's letter will be in time for your next issue. He will find, on referring again to my articles—say Art. IV.—that I am careful to say that e is the *maximum* E M F, namely, that which is active in opposing the *charging* of the cells, but that if the cells are allowed to stand for any time, however short, their E M F will have fallen off. It is the *maximum* E M F that we are concerned with in charging, and I repeat that this is very nearly indeed 2½ volts for a Faure cell. I am not prepared to deny that it is not still higher for an unformed Planté or for a full Faure—in fact, I may say that it is nearer three in certain cases. I have not said anything about the E M F of the discharge yet, which I presume Mr. Howard is referring to.

I may take this opportunity of noting that there is an error at the very end of Art. IV., where 100 is misprinted for 1000.

OLIVER J. LODGE.

University College, Liverpool, July 11th.

GAS *v.* ELECTRIC LIGHTING.

SIR,—Many hundreds of thousands of pounds have lately been invested in electric light companies upon the faith of statements made in the prospectus that the mode of lighting is as cheap, if not cheaper, than that by gas. As to public buildings, we are told that "the difference between the cost of gas and electricity, light for light, is largely in favour of electric light, as proved by the Brush arc system at South Kensington—a saving of £325 16s. 4d. having been effected during nine months as compared with the cost of gas." Then, Sir William Thompson is stated to have "had his house fitted with incandescent lamps from cellar to attic, to the entire banishment of gas, and the cost of internal wires for electric lamps is less than the cost of fittings in connection with gas pipes." Lastly, we have the statement of Mr. William Crookes, F.R.S., and director of the Gulcher Electric Light Company, that he has fitted up two rooms in his private house with electric lamps, and has effected a saving of £4 17s. 6d. per annum as compared with gas-lights.

No wonder, then, that one of my clients—a public Board—deemed it its duty to ascertain the cost of lighting by electricity one of the large institutions under its control. It instructed me to obtain estimates, and accordingly I applied to three of the most important electric light companies for specifications and tenders for lighting the building in question, merely stipulating that the work should be executed under the same general conditions as those employed in the contract for the supply of gas pipes and fittings.

In the result three tenders were received for the execution of the works, amounting, respectively, to £5500, £4345, and £3143.

It then became my duty to make an estimate of what would be the annual cost of lighting the building supposing one or the other of these tenders to be accepted, and I did so as follows, from one furnished me by one of the companies in question, though I thought it my duty to inform my client that I considered many of these items to be considerably under rated:—

	No. 1	No. 2	No. 3
	£ s. d.	£ s. d.	£ s. d.
Interest on first outlay at 5°/₀	275 0 0	217 5 0	157 3 0
Depreciation of plant and general repairs at 10°/₀	550 0 0	434 10 0	314 6 0
Coals, say 2 tons per day at 20s. per ton delivered	730 0 0	730 0 0	730 0 0
Oil, waste, &c.	52 0 0	52 0 0	52 0 0
Wages two engineers at £2 per week	208 0 0	208 0 0	208 0 0
Wages two stokers or attendants at 30s.	156 0 0	156 0 0	156 0 0
Renewal of lamps after first year, not including accidental breakage, but assuming the average life of a lamp to be 1000 hours and that the average time of lighting would be 5½ hours daily	475 0 0	475 0 0	475 0 0
Total	2446 0 0	2272 15 0	2092 9 0

As I was anxious that my report should, as far as possible, be incapable of question, I sent a copy of each of these estimates to the respective companies, with a request that they would point out any errors they might conceive to exist, and in reply they sent me their revisals, which resulted in the following estimates for the annual expense, viz.:—£2394, £1905, and £2000, as against my own of £2446, £2272, and £2092 respectively. These reductions were made in various ways, some conceiving 4 per cent. for interest on outlay, and an average of 5 per cent. only for depreciation and repairs, to be a sufficient allowance.

It now became necessary to calculate the corresponding cost of gas lighting. The total outlay for fitting up the building in question with gas pipes, burners, meters, and all other appliances had been £906. The annual cost of gas consumed, exclusive of that used in a cooking apparatus, was £738; but more than one manufacturer has offered to supply regulators—there are none at present—and to guarantee a reduction in the consumption of 20 per cent., failing which no claim would be made for payment. Moreover I have lately had the meters, from the records of which the above amount is computed, tested by a Government official, and he reports as to three out of four of them that they register 3 and 4 per cent. more than the actual consumption. But neglecting these important considerations, and assuming the consumption to continue now as in the past, we find the annual cost of the gas lighting to be as follows:—

	£ s. d.
Interest as before on first outlay, (£906) at 5°/₀	45 6 0
Depreciation of plant and general repairs as before at 10°/₀	90 12 0
Annual cost of gas actually used in the past	738 0 0
Total	£873 18 0

Now observe how the matter would stand supposing that the lowest tender, No. 3—£3143—for the electric lighting appliances were accepted, and that in the execution of the works no extra expenses were found to be necessary; assume also that the corresponding estimate, £2000, made by the company itself for the annual cost of lighting to be the right one, and we have:—

	Gas lighting.	Electric lighting.
	£	£
Cost of all apliances	906	3143
Annual cost of lighting	874	2000

These estimates ignore the fact that even though the electric light were adopted, it would still be necessary to retain and use the present gas fittings, because the majority of the rooms and corridors of the institution in question from the nature of their use require to be lighted with a subdued light during the whole of the night. It would clearly not be fair to calculate that the electric light machinery would be working all the time to supply this comparatively small demand. Neither does it take into consideration the very important fact that the gas-burners give greatly increased warmth to the rooms in which they are placed, and that, therefore, in the absence of these appliances a much larger consumption of coals for heating purposes would necessarily result.

This inquiry was entered into by me without the slightest prejudice in favour of either system, and in entire ignorance of their relative monetary values, but the information I have gathered during the course of my investigation results in a strong conviction that if the statements before referred to as to the economy of electric lighting in private houses were submitted to similar impartial tests they would be shown to be fallacious. Further I have no hesitation in saying that if only a tithe of the scientific labour now devoted to the improvement of electric lighting apparatus were expended upon discovering methods for improving the construction of gas lamps in closed rooms, the superiority of gas as a lighting agent in such situations would soon be shown to be paramount. I do not hazard an opinion as to the relative advantages of the two systems when employed to light railway stations or other such-like open spaces.

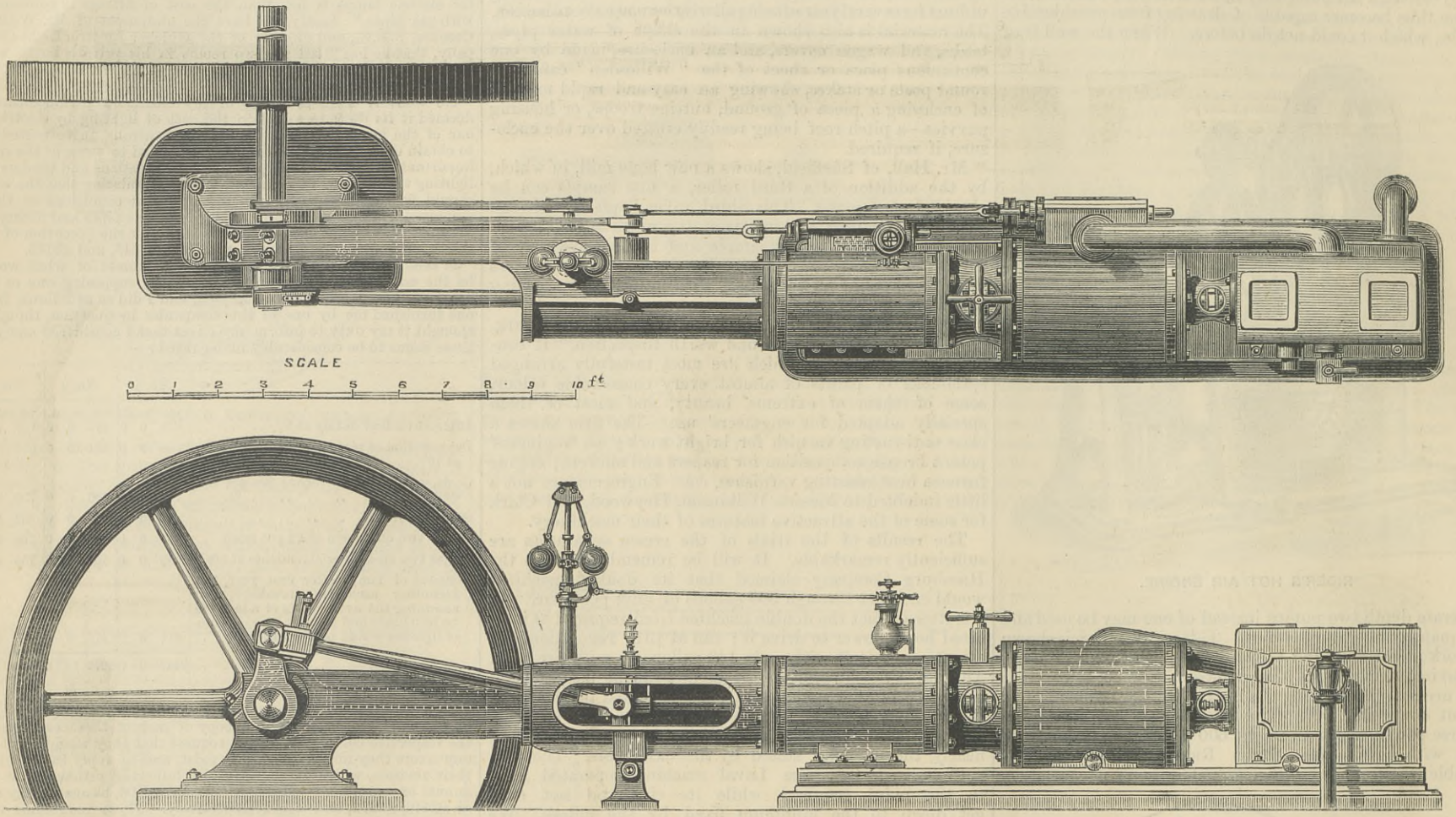
Mr. Crookes says that with the use of gas "the ceilings get blackened, the curtains are soiled with soot and smoke, the decorative paintwork is destroyed, the gilding tarnished, the bindings of the books rotted, and the air of the room is not cool and fresh, but vitiated by the hot fumes from burnt or semi-burnt gas;" but surely he must be aware that these ills do not attain where proper apparatus, such as Rickett's ventilating gas globe lights, Siemens' regenerative gas burners, or the ordinary sunlights are employed for lighting up rooms. These appliances when in use carry off into the outer air not only the products of combustion, but they also act as powerful ventilators by drawing away foul air from the upper parts of the rooms in which they are placed—air which would stagnate were these lamps to be replaced by electric lights, and it is therefore to the improvement of this class of apparatus, so as to moderate their present prices, that I would, as a corollary to my investigation, commend the attention of our scientists and mechanicians.

H. SAXON SNELL, F.R.I.B.A.

22, Southampton-buildings, W.C.

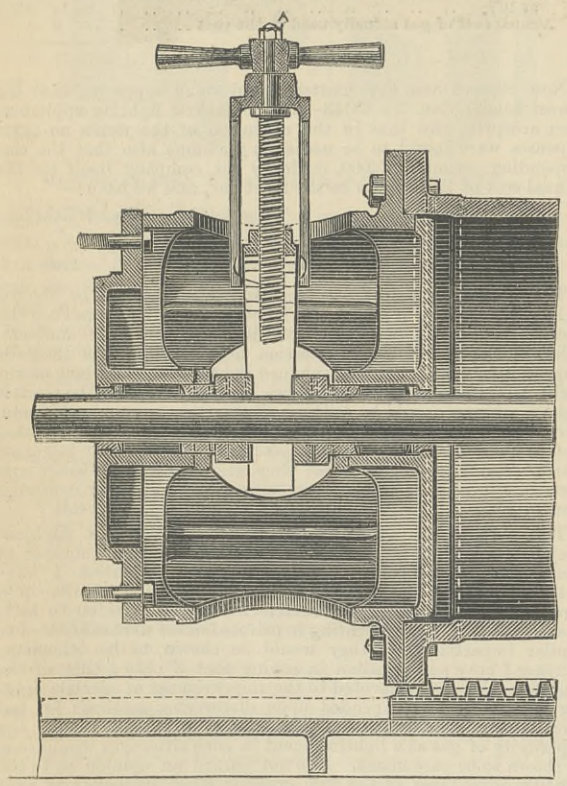
GILLETT'S COMPOUND TANDEM ENGINE.

MESSRS. SPENCER AND GILLETT, MELKSHAM, WILTS, ENGINEERS



We illustrate above a modification of the well-known tandem horizontal engine, with certain improvements, which have been patented by Mr. John Gillett, of Melksham. The advantages claimed for this engine are :—(1) It is considerably shorter, and consequently stronger, with the same section of piston rod than other similar engines. (2) Special facility is given for examination or repairs to pistons, &c. (3) The glands between the cylinders and condenser are tightened simultaneously by one screw operating on two keys, and are consequently at all times parallel with the piston rods.

The detail views show the method by which examination is effected. A short circular distance piece connects the two cylinders, being cast in one with the adjacent covers, and containing the stuffing-boxes and glands above referred to. The low-pressure cylinder and condenser are connected in the same way and secured to a cast iron bed-plate with bolts, the heads of

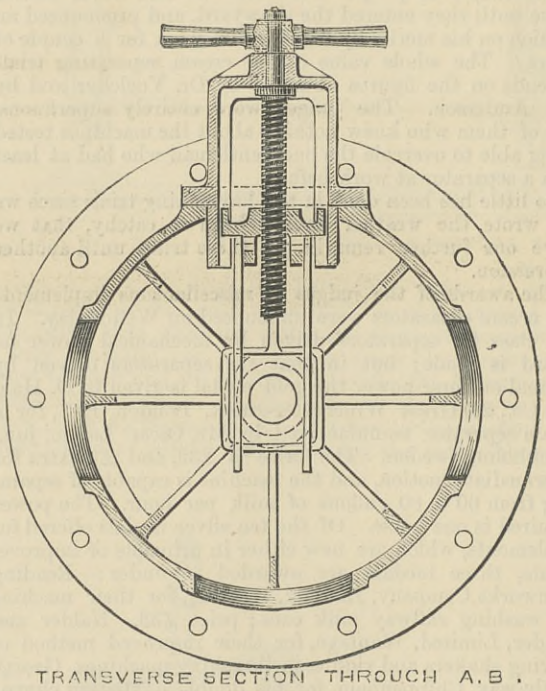


B

PART LONGITUDINAL SECTION

which run in planed grooves in it, and they are each provided with a spur pinion, which gears into a rack into the said bed-plate. Thus when the nuts of either cover are taken off and the sliding bolts slackened, the low-pressure cylinder or condenser, or both, can be racked back to any desired distance, and the pistons withdrawn. It thus becomes possible to attach a condenser on this plan to a horizontal engine in a confined place where there would not be length for one in the ordinary way. The two cylinders and the condenser, after being bored and fitted with their respective distance pieces, are planed at one setting. The base of the high-pressure cylinder is bolted to the crank end of the bed-plate, and its end bolted to the crank girder in the usual way. The cross A and screw are used for tightening the glands by wedges.

The disposition of the material relative to the strains, which is seen in this design, and the possibility of keeping this favourite class of engine within reasonable limits of length, must commend it to steam users, and the orders the makers have already received for them show that their efforts are appreciated. The engine from which our illustration is taken was erected in April,



TRANSVERSE SECTION THROUGH A.B.

1881, by Messrs. Spencer and Gillett, in Mr. Tucker's cloth mills, at Frome, and is designed to indicate 150-horse power when fully loaded.

THE SOCIETY OF ENGINEERS.

VISIT TO CHATHAM DOCKYARD.

On Wednesday, July 5th, about one hundred and forty members of the Society of Engineers and their friends paid a visit to the Chatham Dockyard and the new extension works now rapidly approaching completion. Upon the last occasion of a visit to these works the Society proceeded to Chatham by rail, as it was then considered advisable to spend as long a time as possible in the dockyard to inspect the extension work while open in course of construction; but the works now being sufficiently advanced to let the water in at any time, it was not so necessary to make such a long visit, and the company availed themselves of the inviting season of the year to make the journey to and fro by water, leaving London Bridge by the ss. Duke of Edinburgh at 9.30, and arriving at Chatham at 3 o'clock, luncheon being served on board by the way.

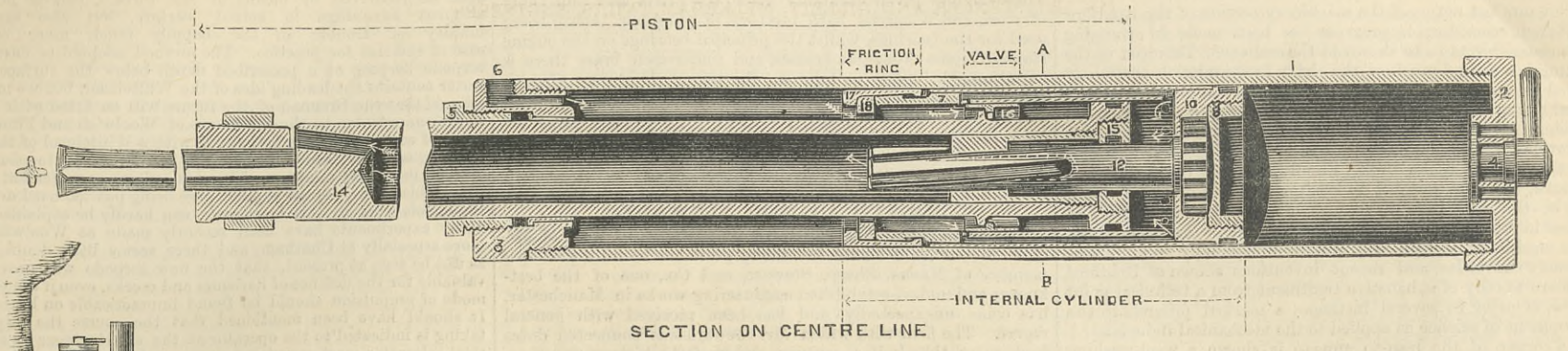
Landing at a pier adjoining No. 2 Slip, they were met by Mr. Edwin A. Bernays, the superintending civil engineer of the dockyard, under whose able guidance the company were, at the request of Admiral-Superintendent Watson, conducted through the works. To save time in travelling from one object of interest to another, the company were conveyed by open cars drawn by a locomotive over ground which would otherwise have caused much loss of time in walking. Mr. Bernays, Mr. Penny, the master shipwright, Mr. Newton, and others, explained what was to be seen. So extensive is the dockyard, that although many additional hands were employed, it appeared to those most familiar with our crowded workshops as if very few were engaged when we hear so much of warlike preparation. Several typical ships under various slip roofs were inspected in course of construction and repair, some intended for offensive and some for defensive operations. The Warspite, an armoured cruiser barbette ship, 315ft. long, 61ft. wide, 23ft. 10in. deep, carrying four 18-ton guns, and six 6in. rifled breech-loaders, the indicated horse-power being 8000, and the displacement 7390 tons. The Calypso, a single screw steel corvette of ten guns, which was commenced building September 1st, 1881, the principal dimensions being—length between perpendiculars, 235ft.; extreme breadth, 44ft. 6in.; draught of water forward, 17ft. 5in., and aft, 19ft. 11in.; displacement, 2765 tons, and indicated horse-power of engines, 3000. The Polyphemus, which carries no shot guns but five torpedo guns, four broadside and one at the bow, and which was fully described in our account of the previous visit of the Society to these works in our issue dated Sept. 24th, 1880—vol. 50, p. 225. The Rodney, of ten guns, a double screw armour-plated ship, the principal dimensions being 325ft. length between perpendiculars, 68ft. extreme breadth, 25ft. 2⅛in. depth in hold, having a displacement of 9150 tons and an indicated horse-power of 7000 tons, and was commenced building February 6th, 1882. The sister ships, Ajax and Agamemnon, were also inspected, and the steel-faced iron on the turrets, as well as the iron-faced sides, were much commented on. The Agamemnon is in a more finished condition than the Ajax. The Conqueror, a turret ship, of 270ft. length, 58ft. breadth, and 6200 tons displacement, was also viewed, and the company passed over the Indian troop ship Jumna now under refitment. The machinery shops, the house containing two centrifugal pumps made by Messrs. Rennie for pumping the water out of the lock, the dock-gates and caissons, and the concrete work of the new dock walls, all were examined by the party. Great credit is due to Mr. Bernays for his successful concrete work. He has no objection to machinery mixing or throwing concrete from a height, but considers that no ramming in a trench is so good as men with boots. The great secret in concrete mixture is to have plenty of water. The backing of the dock walls consists of concrete in the proportion of 12 to 1 faced with concrete 6 to 1. Some of the walls are over 60ft. high, and the docks will be capable of accommodating any vessel likely to be built, while the connection with railway communication will render them of special value.

Leaving Chatham at about half-past five, the company returned by water after a vote of thanks had been proposed by the president to the Lords of the Admiralty, Mr. Bernays, and others, who, by their attendance and courtesy, had tended to make the visit to these works both instructive and pleasing. Dinner was served on deck during the return journey, and the boat stopped at Gravesend and Blackwall piers for the convenience of those who wished to land there.

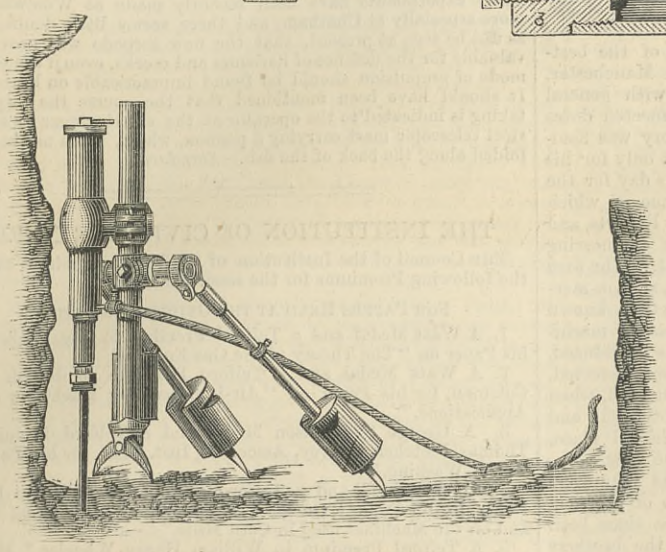
Among those present were Mr. Jabez Church, president; Messrs. Baldwin Latham and R. P. Spice, past presidents; Messrs. Rigg, Gandon, Barridge, Catler, and Walmisley, members of Council; Mr. Alfred Williams, honorary secretary and treasurer; Mr. Bartholomew Reed, secretary; Messrs. R. Meyer, J. Glaishier, R. W. Peregrine Birch, R. Masefield, H. Adams, and others.

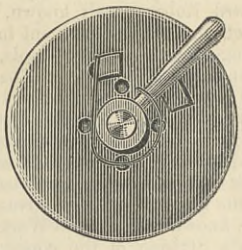
Smallest Locomotive in the World.—Henry Case, of Jamestown, has constructed a perfect locomotive that is the smallest of any in the world. He spent the best part of eight years in its construction. Following is a description of the miniature engine: —The engine measures in length, 8½in.; with tender 12in.; its height, 3½in.; gauge, 1⅜in.; length of boiler, 4⅝in.; diameter of boiler, 1⅛in.; fire-box, ⅞in. square, 1in. deep, with heating surface all round; diameter of drivers, 1⅜in.; diameter of truck wheels, ½in.; stroke of piston, ½in.; diameter of cylinder, $\frac{1}{16}$in.; stroke of valve, $\frac{1}{32}$in.; excentric, ¼in. in diameter; length of links, ½in.; width of links, ⅛in.; link blocks, $\frac{3}{16}$in. square; length of main and parallel rods, 1⅝in.; put together with straps, gibs, keys, set-screws, bolts and half boxes, with oil cups. Whistle, $\frac{5}{32}$in. in diameter; steam gauge, ¼in. in diameter; diameter of gong, ¼in.; glass water gauge in cab; lamp in cab burns one hour; heater pipes and blower pipes, $\frac{1}{32}$in. in diameter; head-light, $\frac{7}{16}$in. square, and burns 20 minutes; safety and pop valves in dome. The pumps throw one drop of water per stroke. This engine has 585 screws to hold its parts together. It weighs 1½ pounds; with tender, 2 pounds 2½ ounces.—*Rochester (N. Y.) Democrat and Chronicle.*

THE "DUNCAN" ROCK DRILL.

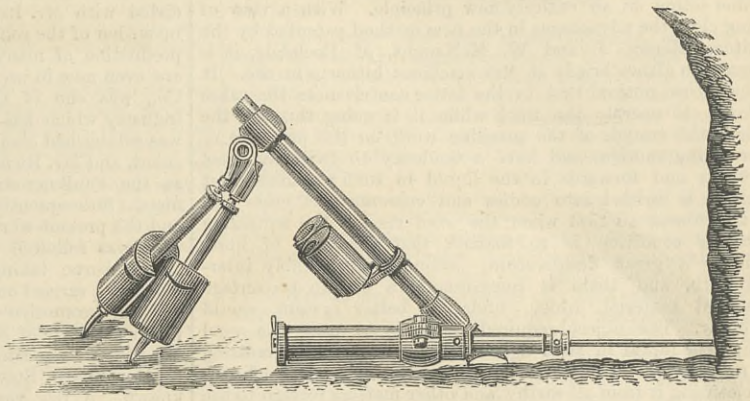


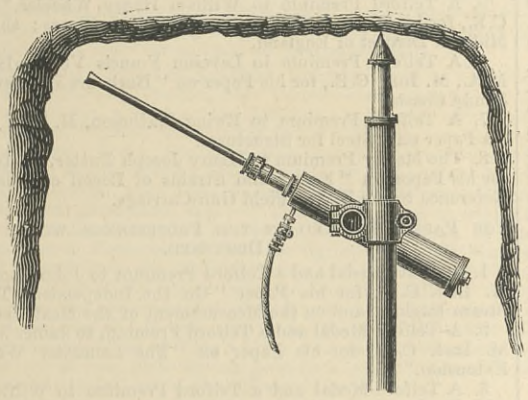
SECTION ON CENTRE LINE

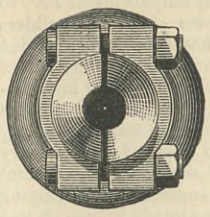




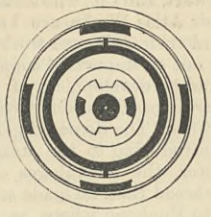
END VIEW



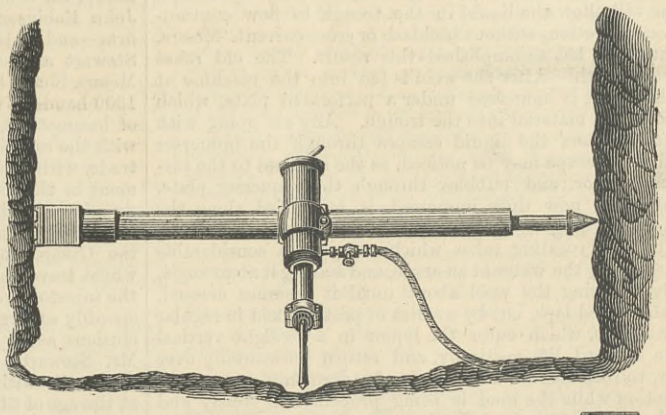


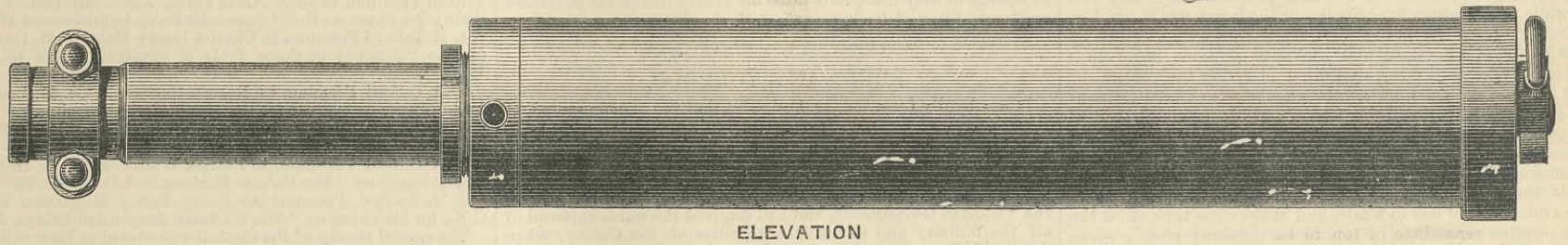


FRONT VIEW



SECTION AT A B





ELEVATION

THIS machine is being newly introduced into this country by Mr. J. D. Whidden, of 110, Belgrave-road, Birmingham, but which has been at work in the United States for upwards of two years. In the very many percussive rock-boring machines which have been invented and introduced with more or less success in working, the original principle of a reciprocating piston, armed at its forward end with a clamp to hold a steel drill-bit, and provided with an arrangement for mechanically rotating the piston and bit for a portion of a circle during each stroke, has not been departed from, having been found the exact counterpart of the motions performed in boring by hand.

In the Duncan drill this principle has been retained, but the piston is made heavy, gaining advantage at each blow from its increased momentum, while the same means result in economy of steam or air, as it is not necessary to keep full pressure on to the end of the stroke. The consumption of steam by the 3in. Duncan is, we are informed, 42 cubic inches per reciprocation. The feed-motion is complete and sensitive. The piston rod in its forward blow against the rock may, if the rock be cut or removed, strike against a split collar of steel, which is also an internal spring, bearing against the interior of the outer cylinder and driving it forward, carrying with it the whole interior cylinder in which the piston is reciprocating. This blow is not productive of wear and tear, as the pressure of live steam is against the collar on the other side, and the blow is taken up by the elastic cushion thus formed. The feed motion is thus sensitive and adjustable from the shortest possible stroke to 2in. at one stroke, if the rock were removed or cut to that depth. As a means by which, when the *débris* from the hole clogs the drill-bit, as is so often the case in soft materials, the bit can be expeditiously withdrawn from the hole, dragging the *débris* with it, a simple opening is provided with a little valve at the back end of the drill casing 1. When this valve is opened the piston, bit, and interior cylinder 7 alike are powerfully dragged backward from the hole to the point they occupied before commencing the perforation of the rock. At each successive feed forward of the interior cylinder 7 a vacuum would be formed in the rear of it, but that a little steam is permitted to leak between the inner and outer casings 7 and 1, and fill the space as it gradually increases; but on the opening of the little valve 4 at the rear end of the outer case 1 the steam so collected is allowed to escape into the atmosphere, and the live steam at the bottom end pushes the whole interior cylinder back till stopped by the cushion against the top head 2.

There is thus in this drill an entirely new feature, namely, the drawback motion doing with facility what in most other machines can only be done by stopping the steam supply, unscrewing a checknut, and slowly winding back the machine by the feed-screw, and then screwing it in again—an operation of several minutes. After thus being drawn back the drill again advances automatically to the rock in a succession of quick jumps requiring no attention, and going the full extent allowed by the feed collar at each stroke—probably 2in. at a blow—so that in a few seconds it is again on the rock, when it again commences its work.

The absence of outside gear in the Duncan drill is of much importance. In appearance the drill is a simple wrought iron tube, closed at one end by an internal cap, and at the other by an external or projecting cap. Out of the front end protrudes the piston rod, with clamp for the drill bit, and a single hole in the side is tapped for the steam supply pipe. A little handle on the top opens the drawback valve, and it closes automatically with a spring. Being without exposed tappets, ratchet wheels, pawls, glands, spindles, nuts, and feed screws, and with a smooth round wrought iron skin, the machine ought to be free from breakage. There are no delicate parts, and dirt cannot get inside, so that the wear is reduced to that which is inseparable from the working of the piston to and fro in its cylinder.

The weight of the 3in. machine is 127 lb., with its body clamp to hold it in position, while of this the piston is 52 lb. The cost of manufacture of such an apparatus is determined chiefly by (1) the number of parts, (2) amount of work of each part, (3) description of labour required, (4) number of special tools required. The parts number twenty-three altogether. These are of simple description; the outside cover is a piece of wrought iron pipe bored out and cleaned outside. The patterns needed are seven in number, and no core-boxes are required. With the exception of milling out the rifle grooves on the exhaust pin 12, the whole of the work is done in the lathe, and no special tools are necessary but some "arbors" and a boring bar to expedite work in the lathe. It will be noticed that all movements are by power, none by hand, and that the drill is easily taken to pieces and cleaned. Thirty inches can be drilled at one setting up, if the drill wears so long, and owing to its smooth exterior it can be worked nearer floor or wall than any other quarrying or mining machine.

The tripod used is one in which the machine is mounted wholly on one leg of the tripod, and that leg is fitted to carry a large proportion of the portable weights, which are arranged to be placed where they may be of most effective use, in line with the movement of the piston and drill-bit and firmly retained there. Around this one leg the machine can be revolved, and also slide up and down, covering a space of 2ft. diameter, on either a horizontal or vertical surface, whereby two or more holes can be bored at one "setting up" of the tripod in sinking or tunnelling. If placed in a line with this leg, sliding the machine up or down adds to the length of feed for the drill-bits as if it had a feed-screw or longer piston-rod, while sliding it through the pivot-clamp also adds to the feed.

THE LATE MR. JOHN BONNELL.—We regret to have to record the death of Mr. John Bonnell, for many years the leading engineer and designer of successful engines and thrashing machines for Messrs. Hornsby and Sons, Grantham.

COMPOUND CONDENSING ENGINE.

THE engine illustrated on page 28 and exhibited at Reading, has been designed with a view to compactness and at the same time the easy removal of its various parts for examination, as well as the development of the highest economy in fuel consumption to be attained by the system of compounding. The cylinders are placed one behind the other, the high-pressure cylinder being nearest the crank shaft. They are placed as closely together as is consistent with room to pack the glands. The condenser, instead of being placed behind the low-pressure cylinder or under the engine, is sunk a short distance below ground line at the fly-wheel end of engine clear of the engine foundation, and occupying the waste space which the overhang—projection—of the fly-wheel past the end of the bed-plate necessitates. The front cover of the low-pressure cylinder is made in halves so that it may be removed, and the back cover of the high-pressure cylinder and the high-pressure piston can be passed out through the large cylinder. The condenser has an ample capacity, and the air-pump, which is single-acting, is driven by means of a connecting-rod carried by a strong return crank from the main disc. The steam ports to the cylinders are kept very short, and this is accomplished by placing the expansion or outer valve excentric close up to the main shaft bearing and carrying the connection straight through to the valve. The exhaust valve excentric is outside that working the expansion valves, and its rod is connected to a pin on one side of a hollow wrought iron sleeve carried in double guides. On the opposite side of this sleeve another pin connects to the exhaust valve rod, so transferring the motion of the exhaust excentric from the centre line of the latter to that of the valve rod, which is situated much nearer the centre of the cylinders. The expansion valve rod is guided by passing through the before-mentioned sleeve, the ends of which are bushed with gun-metal. The governors are of the Porter type, and determine the partial revolution of the cylindrical expansion slide valve, having ports shaped so as to alter automatically the point of cut-off. Variable expansion is applied only to the high-pressure cylinder, the low-pressure cylinder being provided with a fixed cut-off slide. The bearing surfaces throughout are very ample, securing smoothness of working and absence of undue wear under high-pressure and quick piston speed. The engine is altogether of massive construction; the centres of the cylinders and main bearing are kept low to secure rigidity, and the various parts are strongly and well-proportioned, points which, combined with good workmanship and neat finish, make it in every respect worthy to be considered a high-class engine of the best modern construction.

ASSOCIATION OF MUNICIPAL AND SANITARY ENGINEERS.—At the Criterion on Thursday, the 29th June, the Association of Municipal and Sanitary Engineers held their annual dinner, which was attended by a large number of the leading municipal and sanitary engineers of the United Kingdom.

THE ART AND INDUSTRIAL EXHIBITION AT BRADFORD.

No. II.

SINCE our last notice of the machinery section of the Bradford Exhibition, considerable progress has been made in arranging the various objects to be shown in the annexe. This part of the building has caused much of the delay in completion previously alluded to, and even at the present advanced stage of proceedings several of the exhibits are yet in an unfinished state. The Exhibition, however, taken as a whole, is assuming formidable proportions, and public interest, which during the first fortnight after the opening began to flag rapidly, has now taken a favourable turn, and the number of visitors is daily on the increase. Some of the exhibitors have been at considerable pains and expense in order to make effective displays of their goods, and in the machinery section this remark is especially true. There are many novelties and recent inventions shown at Bradford which are worthy of exhaustive treatment from a technical point of view, evincing in several instances a marked progress in the development of science as applied to the mechanical industries.

In a corner of the lean-to annexe is shown a wool-washing machine acting on an entirely new principle. With a view of making clear the advantages in the new method patented by the inventors, Messrs. J. and W. McNaught, of Rochdale, it is necessary to glance briefly at the machines hitherto in use. It will have been noticed that in the latter contrivances the rakes employed to operate the wool while it is going through the liquor in the trough of the machine work on the principle of reciprocating motion, and have a tendency to twirl the wool backwards and forwards in the liquid in such a manner that the latter is swirled into eddies and currents that cross and felt the fibres, so that when the wool reaches the squeezing rollers its condition is so matted that openness of fibre, which is a great desideratum, becomes considerably interfered with, and there is consequently a certain percentage of wasted material, which, under a better system, would not occur. The object required, then, is to pass the wool through the liquid in such a manner as to avoid the crossing and matting of the fibres, while at the same time effectually cleansing it from all earthy and other matters foreign to the substance itself. This end is to be achieved only by such a method as will allow the liquid in the trough to flow continuously in one direction, without backlash or cross-current. Messrs. McNaught's plan has accomplished this result. The old rakes are dispensed with. After the wool is fed into the machine at the feed-lattice, it is immersed under a perforated plate, which presses down the material into the trough. Any air going with the wool as it enters the liquid escapes through the immerser plate, and such escape may be noticed, as the air rises to the surface of the liquor, and bubbles through the immerser plate. The wool being now duly immersed, it is carried along the trough, not according to the old system previously alluded to, namely, by reciprocating rakes which move at a considerable velocity, entering the water at an angle, and leaving it at an angle, and finally knocking the wool about until it assumes crossed, twisted, and felted laps, but by a series of prongs fixed in regular order to a frame, which enter the liquor in a straight vertical line, move forward, lift vertically, and return horizontally over the liquor, to recommence a like cycle of movements.

The motion while the wool is being propelled is steady and slow, while on its return over the liquor the frame moves quickly. The frame bearing the prongs is worked by a crank driven by eccentric wheels. Forward and backward motions being thus explained, the vertical motion required in lifting the prongs out of the liquid is obtained by a cam on the crank shaft, chains being employed to suspend the frame, and lift it and drop it at the proper moment. The machine, as seen in motion, operates the wool in a manner which guarantees openness of fibre and freedom from the cotting action noticed in the old machines. Wool of the shortest and finest descriptions is operated, so as to insure a minimum of loss in waste, and at the same time allow the largest possible percentage of top to be obtained from a given quantity of material.

The frame which propels the wool is jointed at the delivery end, which allows the wool to be delivered over the end of the trough, at the level of the liquor, directly to the squeezers. The material then goes forward through the squeezing rollers, and on its delivery therefrom shows considerable advantages over wool operated on according to the old method in the way of openness of fibre. On examination the wool coming off McNaught's machine is found to hang in locks, just as one might suppose it had come off the sheep's back. The direct delivery to the squeezers is obtained by their being placed close to the end of the trough, the bottom roller being below the level of the liquor in the trough. This roller does not, however, work in the liquor. At the side of the machine is an elevator consisting of a simple arrangement of revolving buckets, which lift the liquor which has been pressed out of the wool by the squeezing rollers back again into the trough. A balance apparatus facilitates easy and light working, and by overbalancing the counterpoise in this latter arrangement the frame can be lifted entirely out of the liquor, and the trough may be readily cleansed. As in the case of every useful invention made on the simplest principles, and on lines of discovery most natural of adoption, one is apt to ask why this new method has never been thought of or carried out before. There is no question that the step is one in the right direction, as an examination of the machine at the Bradford Exhibition will show.

Messrs. Thwaites and Carbutt make an excellent display of steam hammers. They also exhibit Mr. G. W. Tomlinson's patent damping machine. This machine is rapidly becoming a necessary adjunct to a finishing plant, and is generally made 7ft. 2in. wide, but may be varied. It will damp from 15 to 20 ends of cloth per hour, and can be regulated to throw from ¼ lb. to 6 lb. of water on each piece. The lower pipe is charged with water from the cistern, and a blast of air from the horizontal nozzle, blowing over the top of the vertical one, causes a vacuum. The water rises in consequence, and is blown on to the piece in the form of spray. The vertical nozzles are supplied with taps, allowing broads or narrows to be treated on the same machine. The goods operated upon by these machines are very much improved by this process. They are firmer, yet feel soft to the hand, and present more of the appearance of goods damped by London clothworkers. This firm are now making specially powerful blowers in twenty different sizes, capable of delivering from 600 up to 200,000 cubic feet of blast per minute, and for which they have invented the direct-acting duplex engine. One of these—a No. 1—is now running at the Exhibition. This one, running at a maximum speed of 400 revolutions per minute, will melt one ton of metal per hour, or supply a powerful blast to ten smiths' fires. The volume of blast delivered by this small machine is 1300 cubic feet per minute. There is also a smaller size of blower and engine on view—the No. 2a. This machine will melt ½ a ton of metal per hour, or supply blast for four smiths' fires, and gives 600 cubic feet of blast per minute. This invention obviates the necessity for driving belts. The gearing is protected by cast iron boxes fitted on the ends of the blower, and upon these boxes end plates are fitted which have extra bearings. These engines are substantially made, the shafts and pins being of steel, and a special hard mixture of phosphor bronze being used for the bearings, whilst the principal bearings on the engine standard have adjustable brasses, and under each brass there is an adjustable screw to take up the wear. If at any time it should be necessary to set up the shafts a little, the makers send out with the engine a gauge which indicates the exact height the centre of the shaft should be from a planed piece on the blower bed.

DEATH OF MR. STEWART.

THE announcement of the death during the past week of Mr. C. P. Stewart, who for the last thirty years has been the principal member of Messrs. Sharp, Stewart, and Co., one of the best-known and oldest-established engineering works in Manchester, has come unexpectedly, and has been received with general regret. The firm with which Mr. Stewart was connected dates back more than half a century, and its early history was associated with Mr. Richard Roberts, well known, not only for his invention of the self-acting mule, but eminent in his day for the production of many ingenious self-acting tools, some of which are even now in use, and under the style of Sharp, Roberts, and Co., was one of the pioneers of the important engineering industry which has since sprung up in the district. The firm was established about the year 1822 by Mr. T. Sharp, an iron merchant, and Mr. Richard Roberts, who, at what were then known as the Faulkner-street Works, carried on business of machinists. Subsequently the building of locomotives was introduced, and the present works, known as the Atlas Works, were erected. This was followed by a division of the concern in 1843, when Mr. Roberts, taking into partnership Messrs. Fothergill and Dobinson, carried on the machine-making trade at the old place, and the locomotive building was carried on at the new works under the style of Sharp Bros. and Co. About the year 1852 Mr. Stewart was admitted a partner, when the style of the firm became Sharp, Stewart, and Co., by which it has since been known. A few years later, by the retirement of the brothers Sharp, the concern came into the hands of Mr. Stewart and Mr. John Robinson—who had previously been associated with the firm—and in 1864 was formed into a limited company with Mr. Stewart as chairman, which position he held until his death. Messrs. Sharp, Stewart, and Co., who usually employ about 1200 to 1300 hands at their Atlas Works, are known chiefly as builders of locomotives, and their principal work has been in connection with the carrying out of important contracts in this branch of trade, with the gradual development of which, and the improvement in the construction of locomotives, Mr. Stewart has been prominently identified. The deceased gentlemen was also mainly instrumental in introducing to the steam users of this country the Giffard injector, the advantages of which so struck him whilst travelling abroad that he made arrangements for bringing the injector over to England, where, as is already known, it was speedily so largely adopted as to fully justify Mr. Stewart's conclusions as to the value of the discovery. The early years of Mr. Stewart's life were, we believe, spent in London as an apprentice with a metropolitan firm of engineers, and his death, at the age of fifty-nine, took place on Friday last at his Berkshire residence, Lilwood Park, Sunninghill.

BRENNAN'S TORPEDO.

IT was hardly from the far Antipodes that the announcement of the invention of a new fish torpedo of any practical value was to be expected, but this latest offspring of Australian destructive ingenuity promises to be a distinct success. It had been in process of manufacture and improvement for some considerable time at Melbourne, partly under the auspices and with the assistance of the Victorian Government, and had received the warm approval of all the military and scientific authorities of the Colony, when Admiral Wilson, then Commodore in the Australian waters, ordered a committee of four naval officers to examine the torpedo and report on its merits. This report was eminently favourable, although, as no opportunity could be given of seeing the torpedo actually at work, it could not be considered exhaustive. The results previously obtained, however, were most remarkable, and, combined with what the committee was able to see of the principle and construction of the weapon, abundantly justified the recommendation that a series of trials by experts in England should be undertaken. The invention has been patented in England and the Colonies, but it was not considered politic to exhibit it at the late Melbourne Exhibition, pending the negotiations with the British Government. It is difficult to convey a clear idea of such a machine as a locomotive torpedo to the general reader without the aid of sketches, but compared with the Whitehead, Fiume, or the Woolwich Royal Laboratory patterns, the Brennan is simplicity itself. Its motive power is not compressed air, neither is it contained in the body of the torpedo. To propel the weapon through the water at a speed of from 15 knots to 20 knots an hour for 1000 yards, a separate engine, or at least a special connection with an existing one, is necessary. This engine drives two drums, about 3ft. in diameter, with a velocity at their peripheries of 100ft. per second. Their duty is to wind in two fine steel wires No. 18 gauge, of the same sort as that used in the deep sea sounding apparatus of Sir William Thomson. The rapid uncoiling of these wires from two small corresponding reels in the belly of the fish imparts to them, as may readily be conceived, an extremely high velocity. The reels are connected with the shafts of the two propellers which drive the torpedo through the water. The propellers work, as has long been known to be necessary to ensure straight running, in opposite directions and both in one line, the shaft of one being hollow and containing the shaft of the other. Now, at first sight it would seem as if hauling a torpedo backward by two wires was a sufficiently curious way of speeding it "full speed a-head," but it is found in practice that the amount of "drag" is so small, as compared with the power utilised in spinning the reels that give motion to the propellers, that it may be left out of calculation altogether. Of course it is at once seen that this method of propulsion does away with the necessity for air-compressing engines and reservoirs pressed to 1500 lb. on the square inch, which, however carefully constructed, must always involve a certain element of danger, however small. Neither are any delicate little engines, controlled and stopped by complicated, though exquisite, mechanism required. But these advantages, great as they may be, are as naught compared with the power possessed by the user of the Brennan torpedo to guide and govern its course and movements.

A Whitehead, once launched, pursues its way at its own sweet will and pleasure, subject only to the skill and judgment with which its rudders and the rest of its machinery have been adjusted before starting; but a Brennan can be steered throughout its course with more accuracy than a steam pinnace. How this is accomplished is the very crown of the invention. What the mysterious "balance chamber"—that secret that has been so well kept, of which neither Lieutenant Sleeman's nor Sir Thomas Brassey's hints give any definite idea to the outsider—is to the Fiume and the R.L., that in its paramount importance is its steering gear to the Brennan. This is a most ingenious contrivance, whereby the relative velocities of the two driving drums, and consequently of the two propellers, can be varied at any moment. The perpendicular rudder, which is marvellously sensitive, is reacted on by the screws, and in this way the torpedo may be made to follow as tortuous a path as a figure-skater. It is hardly necessary to point out that should the torpedo miss its object it can at once be recovered by means of the wires. This is not only a great advantage in actual warfare, but also saves an infinity of trouble in the happily much more common case of exercise for practice. The method adopted to ensure the torpedo keeping at a prescribed depth below the surface of the water contains the leading idea of the Whitehead, but we may rest assured that the Brennan of the future will be fitted with all the improvements due to the experience of Woolwich and Fiume. In point of cost it compares favourably with a Whitehead of the same carrying capacity, and its mechanism can be taken to pieces and cleaned in twenty minutes. There is a clever arrangement, moreover, which prevents the rudders ever being put too hard over, but the means whereby this is effected can hardly be explained here. Many experiments have been recently made at Woolwich, and more especially at Chatham, and there seems little doubt, as far as can be seen at present, that the new torpedo will prove most valuable for the defence of harbours and creeks, even if the peculiar mode of propulsion should be found impracticable on board ship. It should have been mentioned that the course the torpedo is taking is indicated to the operator at the steering-gear by a slight steel telescopic mast carrying a pennon, which, when not in use, is folded along the back of the fish.—*Standard*.

THE INSTITUTION OF CIVIL ENGINEERS.

THE Council of the Institution of Civil Engineers have awarded the following Premiums for the session 1881-82.

FOR PAPERS READ AT THE ORDINARY MEETINGS.

1. A Watt Medal and a Telford Premium to Dugald Clerk, for his Paper on "The Theory of the Gas Engine."
2. A Watt Medal and a Telford Premium to Joseph James Coleman, for his Paper on "Air-Refrigerating Machinery and its Applications."
3. A George Stephenson Medal and a Telford Premium to Thomas Fletcher Harvey, Assoc. M. Inst. C.E., for his Paper on "Coal-Washing."
4. A Watt Medal and a Telford Premium to William Proctor Baker, for his Paper "On the Various Systems of Grinding Wheat, and on the Machines used in Corn Mills."
5. A Telford Premium to William Henry Wheeler,* M. Inst. C.E., for his Paper on "The Conservancy of Rivers; the Eastern Midland District of England."
6. A Telford Premium to Leveson Francis Vernon-Harcourt,† M.A., M. Inst. C.E., for his Paper on "Harbours and Estuaries on Sandy Coasts."
7. A Telford Premium to Ewing Matheson, M. Inst. C.E., for his Paper on "Steel for Structures."
8. The Manby Premium to Henry Joseph Butter, M. Inst. C.E., for his Paper on "Forces and Strains of Recoil considered with Reference to the Elastic Field Gun-Carriage."

FOR PAPERS PRINTED IN THE PROCEEDINGS WITHOUT BEING DISCUSSED.

1. A Watt Medal and a Telford Premium to John George Mair, M. Inst. C.E., for his Paper "On the Independent Testing of Steam Engines, and on the Measurement of the Heat Used."
2. A Telford Medal and a Telford Premium to James Mansergh, M. Inst. C.E., for his Paper on "The Lancaster Waterworks Extension."
3. A Telford Medal and a Telford Premium to Wilfrid Swanwick Boult, Assoc. M. Inst. C.E., and a Telford Medal and a Telford Premium to John James Potts, Assoc. M. Inst. C.E., for their joint Paper on the "Seacombe Ferry Improvement Works."
4. A Telford Premium to Charles Henry Moberly, M. Inst. C.E., for his "Account of Some Tests of Rivetted Joints for Boiler Work."
5. A Telford Premium to Robert Harvey, Assoc. M. Inst. C.E., for his Paper on "Plant for the Manufacture of Iodine."
6. A Telford Premium to James Barron, Assoc. M. Inst. C.E., for his Paper on "Buckie Harbour."
7. A Telford Premium, to Patrick Walter Meik, M. Inst. C.E., for his Paper on "The Bo'ness Harbour and Dock Works."
8. A Telford Premium to Harry Pasley Higginson, M. Inst. C.E., for his Paper on "The Kawarau Suspension Bridge, N.Z."

The special thanks of the Council were voted to their colleagues, Dr. William Pole, F.R.S., and Mr. B. Baker, for their contributions on "Aërial Navigation," and on "Steel for Tires and Axles."

FOR PAPERS READ AT THE SUPPLEMENTAL MEETINGS OF STUDENTS.

1. The Miller Scholarship to Alan Brebner, jun. B.Sc., Stud. Inst. C.E., for his Paper on "Dioptric Apparatus in Lighthouses."
2. A Miller Prize to John Augustus Thompson,‡ Stud. Inst. C.E., for his "Description of a Composite Screw Tug Boat."
3. A Miller Prize to Albert Havelock Case, Stud. Inst. C.E., for his Paper on "Cranes and Lifting Apparatus."
4. A Miller Prize to William Townshend Batten, Stud. Inst. C.E., for his Paper on "Modern Apparatus for the Manufacture and Purification of Coal Gas."
5. A Miller Prize to William Bashall, Stud. Inst. C.E., for his Paper on "Laboratory Work; Iron and Steel in Compression, Hardened Iron in Tension and Deflection."
6. A Miller Prize to Richard Marion Parkinson, Stud. Inst. C.E., for his Paper on "The Swindon, Marlborough, and Andover Railway."
7. A Miller Prize to Louis Samuel, Stud. Inst. C.E., for his Paper on "Excavating and Dredging Plant."
8. A Miller Prize to Urban Hanlon Broughton, Stud. Inst. C.E., for his Paper on the "Narrow-Gauge Railways of Ireland."

*** Of the eight Students' Papers, those by Mr. Brebner and Mr. Thompson, being 1 and 2 in the above list, are to be printed in vol. lxx. of the "Minutes of Proceedings."

HIGH SPEED TEA STEAMERS.—The following appears under the heading "Random Notes" in the *Straits Times*:—"There has been a great deal of 'hi-falutin' in your columns of late respecting steamers going at prodigious rates, and the marvels they are to perform in the tea race. One of these ocean clippers went from this to Hongkong in five days and one hour, another in four days and half-an-hour, and another mysterious craft is to perform the same trip in three days, nineteen hours, fifty-nine minutes, and forty-five seconds! Now, what is the use of all this haste? Why this vast expenditure of coal and fuel? The Stirling Castle is reported to have burnt two thousand tons of coal between Suez and Singapore, or say from London to China five thousand tons. She will possibly burn six thousand tons going back. Among her crew are a hundred stokers, pokers, and engineers!! Will the tea speculators care to pay a high freight to get their merchandise to an early and generally bad market? Who, then, is to pay the piper? To build a fast steamer and a coal glutton is not difficult, but it is expensive. The point to attain is the greatest quantity of speed with a minimum consumption of fuel. This is the true test of mechanical skill. A race-horse is a nice thing to have, but it is an expensive article in the long run, especially if it does not win; and a steamer burning from 150 tons to 175 tons of coal a day, tearing through the ocean, blow high, blow low, is likely to prove very serious with Jumbo! In these days, economy of fuel must be studied. Every day discoveries tending to that end are being made, and then what will the wonderful coal-devouring 'Castles' and 'Glens' do?"

* Has previously received a Telford Premium.
† Has previously received the Manby Premium.
‡ Has previously received a Miller Prize.

RAILWAY MATTERS.

THE *Buenos Ayres Standard* says:—"The magnificence of this year's maize crop is proving too much for our railways. This is the first year that the River Plate could boast of what may be termed a decent crop of maize, and it is estimated that the crop available for export will reach 200,000 tons. Every steamer leaving port takes thousands of bags of this new staple, and to new European markets."

THE inhabitants of Maryport, Silloth, Allonby, and other towns have forwarded petitions to the North British Railway Company, asking it to construct a railway from Maryport to Silloth, on the coast, *viâ* Allonby. A reply has been received that the directors will consider the proposal at their next general meeting. A Bill will be presented to Parliament next session by the promoters of the Mid-Cumberland Railway Scheme, seeking powers to construct the line.

IN his report on the accident which occurred on the 17th May, between Bow signal-cabin and Coborn-road station, on the Great Eastern Railway, Major-General C. S. Hutchinson, says:—"The make-up of the train in this case was by no means a proper one, there having been nine vehicles with the only available brake power in the vehicle next the engine. As it was, no serious results ensued from the absence of brake power at the tail of the train, though it might well have been otherwise. Had the brake with which the vehicles of the train were fitted been in operation, and had there been—as there should have been—a guard in a rear brake compartment having the power of applying the brakes, the perilous journey of 700 yards, which was run by the last vehicle with its wheels off the rails, might have been considerably reduced."

A TRAM-CAR axle has been recently patented by a Dane, the object of which is to allow the wheels to pass round sharp curves without grinding. For this purpose the axle is divided in the centre, the end of one half having a hollow, and that of the other a corresponding projection, somewhat similar to a ball-and-socket joint, the necessary stiffness being given to the axle by a tube which surrounds the axle and extends between the naves of the wheel, against which it bears by gun-metal collars. At the centre, between the tube and the axle, is a gun-metal bearing, in which the axle can revolve. The wheels act in such a manner that in running along a straight line the wheels and axle turn together, as in an ordinary pair of wheels, but on passing round a curve the axle slips round in its joint, so that the wheel on the inner radius of the curve is retarded and the outer wheel accelerated in proportion to the sharpness of the curve, greater smoothness being obtained in the vehicle, and less wear and tear of the tire and rail.

IN concluding a report on a collision which occurred on the 18th April, at Paul's-road junction, near Camden-road station, on the Midland Railway, where, as the 7.45 a.m. passenger train from Bedford to St. Pancras, where it was due at 9.35 a.m., was crossing St. Paul's-road junction, the last vehicle was struck, and its front and middle wheels thrown off the rails, by the engine of the 9.20 a.m. passenger train from Moorgate-street to Kentish Town, Major-General Hutchinson says:—"This collision had its origin in a very unusual cause, viz., in the driver and fireman of the 9.20 a.m. down Metropolitan train having been partially blinded as they started from King's Cross station by a fall of limewash on to the foot-plate of the engine from the floor of a building under construction just above the spot at which the down line enters the King's Cross tunnel. It was a very careless act of the contractor erecting the buildings at King's Cross to have allowed mortar to be mixed on an iron plate having holes in it, which holes allowed the limewash to fall on to the railway below."

ON the 10th inst. the tramways constructed in Stanley-road by the Corporation of Bootle were inspected by Major-General Hutchinson, R.E., one of the inspectors of the Board of Trade, who was met at the boundary of the borough by the Mayor of Bootle, Mr. W. Poulsom, Mr. Alderman Leslie, the chairman of the General Purposes Committee; several other members of the council; Mr. T. D. Pierce, town clerk; and Mr. C. H. Beloe, C.E., the engineer of the tramways. The inspector made a careful examination of the route, walking over the road from the boundary of the borough to Marsh-lane, to which point the tramways are now completed, and returning in the car to the borough boundary. The tramways have been constructed on Mackison's patent system, with steel rails, weighing 40 lb. per yard, laid on cast iron sleepers, weighing 103 lb. per yard, the whole resting on a bed of concrete 6in. thick, the entire width of Stanley-road having been repaved by the corporation. The whole of the work has been executed from the designs, and under the superintendence of Mr. Charles H. Beloe, M. Inst. C.E.

THE extent to which the manufacture of locomotives is now carried on in the United States may be gathered from the figures given below, which we take from Mr. Drummond's report. There are now 15 locomotive works in the United States, with a capacity of from 8 to 50 engines per month. In 1881 they turned out in round numbers 2700 locomotives. Add to this 300 built by railway companies, and we have at least 3000 new engines constructed during the year, besides those rebuilt. At the commencement of last year there were, speaking roughly, 18,000 locomotives running on the 94,000 miles of railway in the Union, or an average of about one engine to every five miles. If, as is probable, the new railway construction this year reaches 10,000 miles, this average would call for 2000 new engines. The life of a locomotive is estimated by manufacturers to average from fifteen to twenty years. The latter figure is probably more nearly correct, as the improved condition of American railways has prolonged the existence of engines considerably. At this rate about 1000 new engines per year would be required to keep good the reduction by decay. Adding this to the 2000 presumably required this year for the increased mileage, we find that about 3000 new engines will be demanded. The great Boston statistician, Mr. Atkinson, believes that in the next sixteen years there will be added 100,000 miles of rail. They deal in big figures over the water.

A CIRCULAR, giving the following rules for shipping high-power explosives, has been issued by Mr. H. H. Courtright, general freight agent of the Chicago and Alton Railroad:—"This company will receive for shipment the high explosives, as Atlas, Hercules, Giant, and Dittmar powder, in car-loads only when shipped under the following conditions: First, shipment to be in strong boxes not too large to be readily handled by one person; second, each package to be plainly marked 'explosive,' 'dangerous;' third, it is understood that these nitrate preparations are thoroughly absorbed in charcoal, saw-dust, magnesia, wood fibre, or other similar substance, and that no natural heat will cause them to liquefy. Should any packages show outward signs of oily stain or other indications that absorption is not perfect, they will be refused in every instance; fourth, any and all nitrates or other explosive preparations not in accordance with above specifications —excepting ordinary black powder—will in no case be received for shipment by this company; fifth, these articles, which include 'mining cartridges,' as well as every other form of explosive—not excluded from shipment—except common black powder, will be rated at one and a-half first-class rate, in car-loads only, to all points; sixth, in no case must the cap used for exploding these powders be loaded in the same car with the explosives, and under no circumstances will cars be received if so loaded; seventh, shipments of these articles in less than car-loads will in no case be received; neither will they be allowed to be mixed with other freight. Our laws provide heavy penalties, both to shippers and common carriers, for a violation of these rules, and it is to be hoped that the common welfare of the people, if not this circular, will induce shippers and common carriers alike to know that such shipments are put up, marked, and forwarded only under their proper names and in accordance with these provisions. Shipments of common black powder may be shipped in any quantity if packed in good, substantial magazines or put up in iron kegs."

NOTES AND MEMORANDA.

THE Eastern Telegraph Company connected a telephone to their cables on board their cable ship Chiltern, lying off Alexandria, on Monday, and by this means the bombardment was heard at Malta, about a thousand miles from the scene of action.

THE fire department of Marshall, Michigan, has twenty-three tube wells ranging from 65ft. to 110ft. in depth. The piping is of wrought iron ¼in. thick and 6in. bore. Their average cost was 325 dols., and they have been in use 12 years without any expense.

THE Commission appointed by M. Ferry to report on the construction of the rotating dome for the large refractor of the Paris Observatory has held numerous meetings at the Conservatoire des Arts et Métiers, Colonel Laussedat, director of the establishment, being in the chair. Only two projects have been reserved for final choice. M. Eiffel proposes to use a saline solution in a horizontal circular channel placed on the wall to diminish the weight of the rotary roof.

THE preliminary surveys for the proposed reclamation of the Zuyder Zee have been finished, and the work of building the walls will soon begin. A dike about 24½ miles in length will be constructed of sand and faced with clay, reaching 16ft. above the level of the sea, which will make it about 6½ft. above the highest tide. The thickness of the dike will be such as will enable it to resist the heaviest seas. Operations will begin at four different points, and the calculation is to have it completed in from seven to ten years, at a cost of 46,000,000 dols.

DR. HERTZ has recently made experiments on the vapour-tension of mercury. The vapour-tension was measured at high temperatures, and values were obtained which likewise were smaller than Regnault's, but greater than those found by Dr. Hagen. From his values, Dr. Hertz calculated a formula, according to which he produced a curve of the vapour tension of mercury with varying temperature; its zero point being at absolute zero—273 deg. C.—For low temperatures, 0 deg. C., 10 deg., and 20 deg., the values he deduces from his formula are under those obtained experimentally by Dr. Hagen for the same temperatures.

WE are glad to learn, says *Nature*, that owing to the exertions of Admiral Mouchez, magnetical observations will soon be resumed at the Paris Observatory, in subterranean chambers which have been excavated in the newly annexed grounds. These observations will be self-registering by photography, in conformity with the instruments established by M. Mascart at the Collège de France. Direct observations will also be conducted with the old instruments which were used by Arago, which were famous for his prognostications of Auroræ, at a period when, the electric telegraph not having been invented, many days must elapse before the arrival in Paris of news from the northern parts of Europe.

AFTER a protracted microscopic study of coal, Prof. Reinsch has come to the conclusion that coal was not derived from land plants, but chiefly from microscopic forms of "a lower order of protoplasm." He holds that plants of a higher order have contributed but a fraction of the mass of coal veins, however numerous they may have been in some instances. In a recent lecture, stating his conclusions, Prof. Reinsch referred to the fact that Dr. Muck, of Bochum, held that algæ have mainly contributed to the formation of coal, and that marine plants were rarely found in coal because of their tendency to decompose, and that calcareous remains of molluscs disappeared on account of the rapid formation of carbonic acid during the process of carbonisation.

AT a recent meeting of the Paris Academy of Sciences a paper was read:—"On the Reaction-current of the Electric Arc," by MM. Jamin and Maneuvrier. With a Gramme machine and an arc between unequal carbons, or between some metal and carbon, there is a differential current by which a galvanometer is affected—largely when copper, zinc, or mercury is used; little—and about equally—with lead, iron, and carbon; these latter show the greatest resistance. The current is explained, not by the difference of resistance, but by an inequality in the inverse reactions of the arc in the two directions. With a mercury arc, the differential current wholly changes the working of the machines, one system of currents being greatly weakened, while the other grows in strength.

THE pigments employed to colour hydraulic and other cements, and obtain the shades common in trade, are, according to the *Bauzeitung*, the following, the proportions used being those used by R. Dyckerhoff, of Amoeneburg:—For black, pyrolusite, 12 per cent.; for red, caput mortuum, 6 per cent.; for green, ultramarine green, 6 per cent.; for blue, ultramarine blue, 5 per cent.; for yellow and brown ochre, 6 per cent. The strength of the cement is rather increased by the addition of ultramarine pigments, but somewhat diminished by the others. The ill effects of the latter may be somewhat removed by grinding the cement again after the pigment has been added, whereby it gains in fineness, and the strength is so much increased that no difference is observable between this and the ordinary cement. The black and red cements made in Dyckerhoff's works for making tiles and artificial stone show a strength by normal tests after twenty-four hours' drying of 20 kilos. per square centimetre, or about 275 lb. per square inch —a very respectable strain for such work.

THE utilisation of the earth's internal heat is a subject which, *Nature* says, is attracting the attention of scientific men in Japan just now. At a recent meeting of the Seismological Society, Mr. Milne introduced the subject for the consideration of the members. He first drew attention to the fact that philosophers have told us the whole available energy upon the surface of the earth had in some way or other its action and its existence traceable to the sun. That there was an unlimited supply of energy in the interior of the earth was a circumstance which had, he said, been overlooked. In speaking of this energy, Mr. Milne first referred to that portion of it which crops out upon the surface in countries like Japan, Iceland, and New Zealand, in the form of hot springs solfataras, volcanoes, &c. He stated that there was an unlimited supply of water in hot springs within a radius of 100 miles around Tokio, and that the heat of these springs could be converted into an electric current, and the energy transmitted to the town. The second part of the paper referred to the possibility of obtaining access to the heat which did not crop out in the surface.

AT a recent meeting of the Berlin Physical Society, Professor Neesen described experiments on the relation between specific heat and temperature; and first, in the case of distilled water. In these he used the method of cooling, and the ice-calorimeter, the manipulation of which he indicated. Each time, after filling the calorimeter, and before the heated substance was introduced, the mercury-column, whose displacement, due to the melting ice, was to be observed, showed spontaneous movements, first back and then forwards; which source of error could be partly avoided by using glass for the external envelope of the calorimeter, instead of the zinc-vessel. It further appeared, that the first two measurements always gave too small values, and were useless, probably because the ice, which was to be melted by the cooling body, was not at 0 deg. C. at the beginning of the experiment, but at a lower temperature, and therefore a part of the communicated heat was used in heating to 0 deg. C. The purified distilled water, whose specific heat was to be ascertained, was in a platinum or glass capsule; in the former the soldering occasioned great difficulties, so that most experiments were made with glass. The measurements already made range in temperature from 2 deg. to 30 deg. C. If the directly observed changes of volume be taken as ordinates, and the temperatures as abscissæ, a curve is obtained, differing little from a straight line. A close examination of the numerical values shows that the mean specific heat of distilled water from 2 deg. C. slowly increases to a maximum between 20 deg. and 21 deg., beyond which, to 30 deg., it slowly decreases; but the divergences from the mean value are always very slight. According to the mercury-thermometer, the maximum of the specific heat is about 12 deg. C., instead of 20 deg.

MISCELLANEA.

MESSRS. DEFRIES AND SONS, of Houndsditch, have secured the contract for lighting the Camp at the Wimbledon meeting.

MESSRS. LIVET AND CO., were awarded the highest prize—a silver medal—at the recent Smoke Abatement Exhibition at Kensington, for perfect combusion of any fuel by means of Messrs. Livet's furnaces and flues.

THE annual National Exhibition and Market of brewers' machinery and requisites will open on the 16th and close on the 21st October next. So far the applications for space in Exhibition are in excess of those of last year.

AT a monthly Council meeting of the Royal Agricultural Society, held in the Reading Showyard on Wednesday, Mr. John Coxon, of Freeford Farm, Lichfield, was, on the recommendation of the Committee of Selection, elected a member of the Council, in the room of the late Mr. Aveling.

IN this column in our last impression, in a description of the Tipton Gasworks, we mentioned the exhauster was supplied by Messrs. Walker and Co. This should have been Messrs. Waller and Co., as this firm of Holland-street, S.E., supplied the combined engine and exhauster, an extra 6-horse engine, 10-horse boiler, two special steam pumps, one for water and one for tar and liquor.

TWO duplicate new iron screw steamers, each of 500 tons capacity, built and engined by Messrs. W. Simons and Co., were on Tuesday launched complete from their works at Renfrew. They are fitted with compound engines of 100-horse power, and are named respectively Cumbrae and Cloch. These steamers are the property of the Clyde Lighthouse Trust, and are intended for the deepening operations on the Clyde, under the supervision of their engineers, Messrs. D. and J. Stephenson.

AN exhibition of life-saving apparatus of all kinds has been opened in the Alexandra Palace. The exhibition is divided into the following six classes or sections:—(1) Railway safety appliances, including continuous brakes, signalling, and point-locking apparatus, switches, &c. &c., this being the leading feature; (2) means for extinguishing fires and the rescue of people therefrom; (3) mining safety appliances; (4) apparatus for all marine and inland water emergencies; (5) surgical and sanitary; and (6) engineering and miscellaneous safety appliances.

OUR Birmingham correspondent writes:—"Some interest was taken on 'Change to day in Mr. Hy. Bennet's machine for washing mill scale, which the inventor had on view. It is a machine for cleaning scale from the sand before it is used for fettling in the puddling furnace. A thorough washing is given by means of a square barrel revolving in a tank of water. The motive power may be either manual or mechanical, and the cleansing process progresses about as fast as a man can shovel the scale in. Several of the machines are in use and are said to work satisfactorily."

A FULLY attended meeting of the Provisional Committee for the promotion of the Manchester Tidal Navigation was held at the temporary offices, St. Ann's-square, Manchester, on the 7th inst., when important steps in advancement of the undertaking were taken. Messrs. Hamilton Fulton, C.E., of London, and E. Leader Williams, C.E., of Manchester, were appointed engineers, and instructed to make the necessary survey, to prepare a joint report and estimate, and to submit the same to a future meeting with the least possible delay. Mr. Henry Whitworth, of King-street, Manchester, was appointed secretary. A guarantee fund to meet the preliminary expenses was opened, and several important adhesions were announced.

THE trial trip of the steamer Admiral Rooke took place on the 10th inst., from Middlesbrough to the Tyne, with a very satisfactory result. This steamer is the first of two built by Messrs. Raylton, Dixon, and Co. for Messrs. Smith, Imossi, and Co., of Gibraltar, and to be principally employed in the coal trade of that port, being also notable as the first steamship owned in Gibraltar. Her dimensions are, length over all 250ft., breadth 34ft., depth of hold to floors 17ft., and she will carry over 1800 tons dead weight. She is fitted with engines of 130-horse power nominal, by Messrs. Blair and Co., Limited, of Stockton, having cylinders 31in. and 58in. diameter and 36in. stroke, large boiler with 80 lb. pressure, which gave a result of over 11 knots speed on trial trip, on her run from Middlesbrough to the Tyne, where she will load in the Tyne dock her first cargo for Huelva.

A TRUE overflowing artesian well, tapping the chalk formation, has just been carried out in the neighbourhood of Woking. The waterworks' company established for the supply of that district has, for the last six months, been sinking a large shaft at West Clandon through the London and Plastic clays, and a few days ago the chalk water bed was touched by it at a depth of 310ft. below ground, when the water immediately rose in the shaft, finally overflowing the surface at a height of 200ft. over sea level. It is not often that a well sunk for over 300ft. in dry soil touches a spring strong enough to overflow the surface, and it must be a source of considerable gratification to those interested in the project to know that the anticipations of the engineers have been so completely realised. The works have been designed by Messrs. Quick and Son, C.E., of Westminster, and are being carried out under a general contract with the Woking Water and Gas Company by Mr. R. A. Meyer, of Westminster.

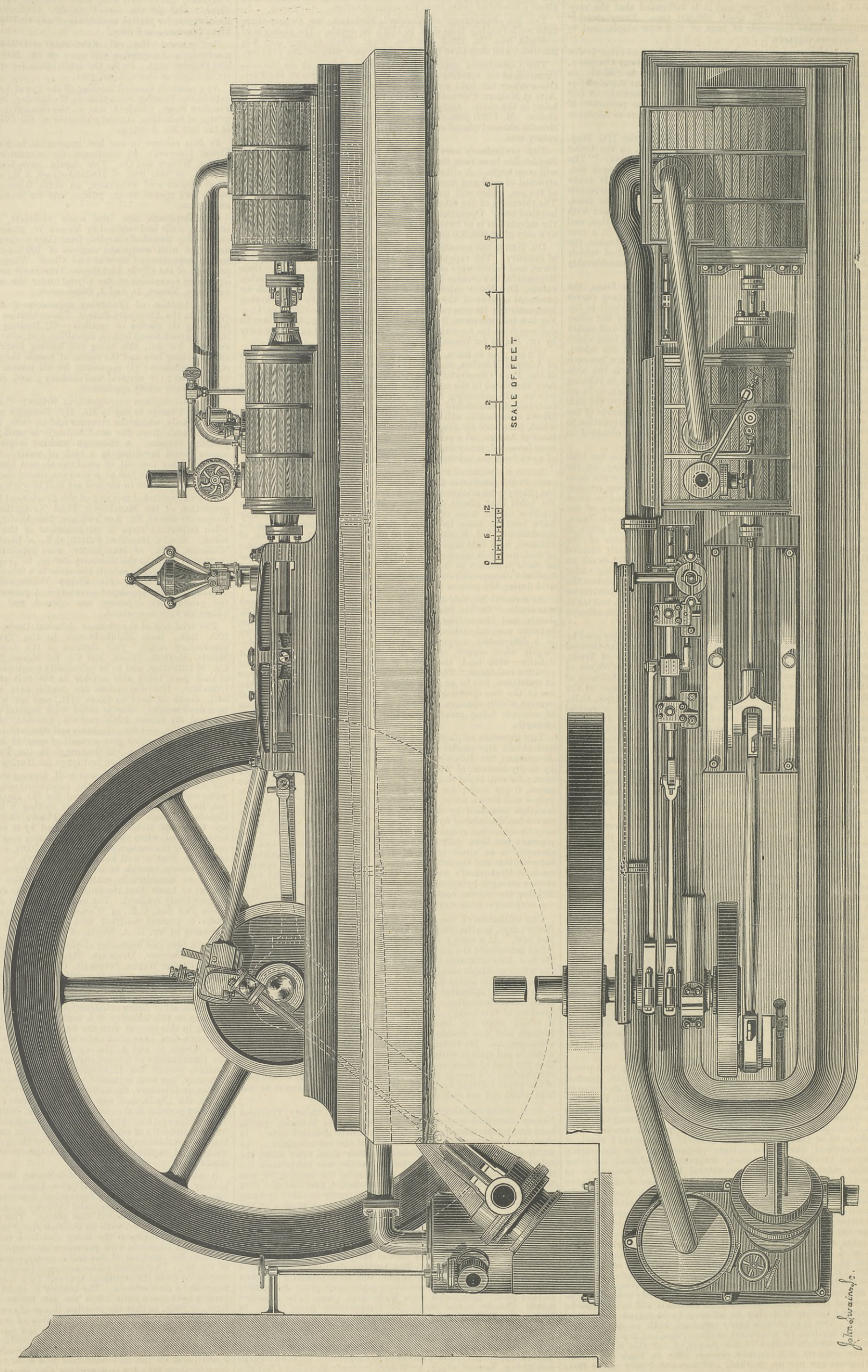
FOR a firm just beginning shipbuilding and engineering on a large scale at Elsinore, Denmark, Messrs. James Bennie and Co., of Clyde Engine Works, Polmadie, Glasgow, are sending off in the course of the present month a full equipment of machine tools for shipbuilding. The machinery comprises the usual punching and shearing, plate-bending, planing, beam-bending, and keel-plate machines, all of heavy construction and most modern design, for carrying on this industry in a manner which will place them on a footing in this respect with the best-appointed establishment here. The same firm have also ordered all the necessary machine tools from Messrs. G. and A. Harvey and other well-known makers for the manufacture of marine engines of the largest class. This new concern, named the Helsingfors Jernskibs, and Maskinbygnings Company, has been organised by men of considerable experience in marine architecture, the active manager having received his training on the Clyde, and who for a considerable period occupied a foremost position in the marine engineering department of Messrs. John Elder and Co. The new firm is already entrusted with orders for four steamers of considerable dimensions, and it is anticipated that the establishment will be in full working condition in a few weeks, and capable of turning out steamers of great power and capacity.

A NEW arrangement of the well-known bichromate of potash battery is made by Mr. F. Higgins, London. It yields powerful currents, and is exceedingly economical, inasmuch as it utilises the waste liquor of other bichromatic batteries, and the residual scraps of zinc left by the wasted zinc plates. The cell consists of an earthenware jar fitted with an overflow spout near the mouth, and on the bottom is placed the scrap zinc in a pool of mercury. A copper wire insulated with gutta-percha except at the foot, where it enters the amalgam of zinc and mercury, passes down the middle of the jar. Two carbon plates arranged parallel to each other are suspended from the mouth of the cell by a frame, and connected together by an electrode. The battery of these cells is built up by placing each one a little below the one before it on a step, platform, or stair, so that the overflow liquor of one cell may run into the next, and thus a continual circulation of waste liquor may be going on from the high reservoir to the low one. The circulation prevents polarisation of the plates, and produces a powerful and steady current. The electromotive force of each cell is from 1·9 to 2 volts, and its internal resistance is a mere fraction of an ohm. Nine of these cells are now working nine Morse circuits in place of a battery of 250 Daniell cells. Mr. Higgins estimates that 7000 to 8000-foot pounds of current energy can be supplied by them at a cost of about 6d.

COMPOUND CONDENSING ENGINE.

THE READING IRONWORKS COMPANY, READING, ENGINEERS.

(For description see page 25.)



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*** *Owing to the pressure of other matter on our space we are compelled to hold over until next week a number of letters which we have in type.*

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THE DAVIES DISC ENGINE.

(To the Editor of The Engineer.)

SIR,—I shall be glad if some of your readers will kindly give me particulars of this engine, and also tell me if it is still in use? F. W.
July 11th.

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THE ENGINEER.

JULY 14, 1882.

POSSIBLE OPERATIONS IN EGYPT.

WE hardly think that previous to last week an instance could be found on record when an enormously powerful fleet destroyed the forts of the principal port of a country against the consent of her rulers, not only without war being declared, but without any nation considering that the conditions of peace have been violated. Arabi Pasha, then, furnishes an exception to all rules, being a rebel under unprecedented conditions. We are not quarrelling with the conclusion, which we hope is as just as it is convenient; we are rather at this moment wondering whether the same conditions of peace will by-and-bye adjust themselves to lead to our landing troops engaged in an expedition organised to protect our interests in the Suez Canal. We have a force of 10,000 men, with guns, provisions, and transport, ready in India, and a force of about 18,000 prepared in this country, while our Royal Laboratory is beginning to make small-arm ammunition at a rate of a million rounds per week. Under these circumstances it is a matter of some interest to consider what we might expect to see undertaken. On pages 32 and 31 will be found two maps—one of the whole country between Alexandria and Suez, and the other of the Canal itself, to which we propose to refer briefly in this article.

It may be seen that the whole country is furrowed with channels of water. On a portion of these depends its fertility in the almost entire absence of rainfall. Of these we must, of course, primarily distinguish between the salt water or, as it is termed, the "bitter" water canal, with the lakes through which it passes connecting the Mediterranean and Red Sea, and the fresh or "sweet" water canals employed for irrigation. The former is all-important to us as a nation; the latter are necessary to the existence of Egypt as a cultivated country. Both could be destroyed in a great measure without much difficulty if left unprotected. The sweet-water question must be a very serious one at the present moment. To commence with Alexandria. The level of the country not being such as brings a sweet water supply into Alexandria, a large pumping station is maintained at Afteh, where the water is raised to such a level as to flow along the canal extending from this point to the town. Europeans have hitherto been employed at the pumping station, which they have recently been compelled to leave. It is very doubtful whether the natives could work the station alone, or whether they have attempted to do so; if not, the water supply of Alexandria must fail. Another pumping station may be seen commencing at the barrage. This is for the irrigation canal running up from it north-west, in a direction more or less parallel to the Nile. This station would not have been necessary had the magnificent dam—barrage—made by the French across the branches of the Nile been found solid and strong enough to hold in the water until it reached the necessary level for the canal. The water, however, found its way beneath the work, and it failed in its object. This canal is important for its own district, and the Europeans having left its pumping station, it, like the first-mentioned canal, is dependent on native industry and science for the supply of water at the present moment. Thirdly, we would call attention to the sweet water canal running from the Nile past Ismalia, and then along near the great canal until it reaches Suez. This canal has supplied all the dwellers in the immediate vicinity of Ismalia and the lower portion of the great canal.

This third sweet water canal is very easily blocked; its fall being very slight, its waters are easily diverted in another direction. We have yet to learn exactly in what state these canals are. The first would concern us seriously if we occupied Alexandria. The third would cause great inconvenience to all on the southern end of the great canal; but they primarily concern the natives of Egypt, now left almost without any European population among them. Our chief question is simply the protection of the great Port Said and Suez Canal. Let us see to what casualties it is liable now, and how would the matter be affected by an occupation by our troops. The Admiral recently advised English ships not to attempt to pass through the canal. We presume that this was on the score of danger. It is clearly possible for a comparatively small party of lawless Egyptians to drop mines in the canal, or simply to impede the passage of a vessel and then to attack it. A vessel when checked is apt to turn diagonally across the canal and block everything. This can hardly be difficult for natives to effect now, but it would not, of course, stop the canal for long. The question of blowing in the side by dynamite or cotton suggests itself. The banks of the canal, however, are too sandy to allow of large quantities being detached by means of an explosive. Suppose, however, boats full of stones were allowed to enter the canal and were then sunk, an obstruction of a far more permanent character would be the result. We may hope, however, that we already have a sufficient hold on the extremities of the canal to prevent such an action being feasible. It is only the threatening of an organised attack in force which should call for the dispatch of expeditions from India and England.

We presume that the object of such an expedition would be to secure the canal, and keep it open with the consent of the European Powers. To this end we should doubtless have to station troops at different points, Suez, Ismalia, and Port Said are the most natural stations to select; but in reality those localities offer little accommodation to troops in any number. The houses or huts in these towns are abominable, the natives of the worst character, and the water supply very precarious; ships bringing troops there would have to supply them with water, provisions, and probably with tents also, and the troops would suffer much from the intense heat. A more miserably hot and sandy locality is hardly to be found. We have heard the suggestion that the best way to protect the Canal would be to follow and crush the Egyptian troops and Arabi, and this is undoubtedly true. The question is whether the Sultan would consent to it, and if his consent should be refused, would the European Powers consider that the act also was strictly consistent with a state of peace. We presume that there must be a limit to "strictly defensive" operations. We have destroyed forts and landed temporarily, and incidentally burnt the poor Khedive out of his palace; but it may be well to inquire whether we can also traverse the whole country and destroy the army without the consent of the Sultan. If so, the sooner it is done the better for Egypt.

TORPEDO BOAT BOILERS.

IN a recent impression we published an article on "Fire-boxes for High Temperatures," in which we explained some of the difficulties involved in working with a very intense draught. One of our contemporaries writing last week on the same subject, makes certain suggestions which deserve attention, for improving the boilers of torpedo boats. He points out that a very high air pressure is expended merely in overcoming the friction of the flue tubes; and he suggests that the grate area might be reduced, the reduction of grate area being, of course, intended to give more room for water and steam in a boiler occupying a given space. He also points out that Mr. Thorneycroft's experiments show that the greater the draught the less is the evaporation per pound of coal, because so much more is wasted, as we have already explained.

Now, it is not to be disputed that it is altogether desirable that the intensity of the draught should be reduced; but to assume that when Messrs. Yarrow, for example, work with a water pressure draught of 6in. they are using more than is essential is altogether a mistake. In fact, the matter admits of being determined by actual experiment at any time. It is only necessary to run the stokehole fan at various velocities, equivalent to 1in., 2in., 3in., 4in., 5in., and 6in. of water, and to take the corresponding power exerted by the engines. In this way can be determined, in less than half an hour, whether a velocity of 20 knots, say, can be maintained with an air pressure in the stokehole of less than 5in. or 6in. As a matter of fact we may state that the experiment will prove that a very sharp draught indeed is required for high velocities; a draught of an inch will not keep more than 50 lb. pressure in any torpedo boat with which we are acquainted when the engines are working at the most economical point of cut-off. Our contemporary, however, may perhaps assume that such a test would not be fair because the boiler is not properly proportioned to work with a small draught; but, curiously enough, he suggests that the grates are too large now, and that better results would be got with grates of less area. He goes so far as to say that by carrying a very heavy fire as much as 120 lb. of coal might be burnt per hour per square foot of grate, by augmenting the air pressure by only 0·6in. of water more than is needed to burn 96 lb.; while to increase the rate of combustion from 49 lb. to 96 lb. would require the pressure to be raised from 2in. to 2·7in. only, the grate area in the first case being reduced 20 per cent. and in the second halved in area. But in practice it has been found that to burn 120 lb. requires 5in. to 6in. of water pressure on the largest grate that can be got in; and it is difficult to see how halving the grate area and augmenting the friction through the fire can help us. Let us suppose that a given boiler has 20 square feet of grate, and that the consumption is at the rate of 56 lb. per square foot per hour. Then $20 \times 56 = 1120$ lb. per hour, and $\frac{1120}{96} = 11{\cdot}66$. It may be contended that the resistance to the passage of air through the fuel is comparatively small as compared with the resistance offered by the tubes. If this were the only factor to be considered, then it would be possible by carrying a sufficiently heavy fire to burn 1120 lb. of coal per hour on a grate 11·66 square feet in area as well as on one of 20 square feet in area. Unfortunately, however, whatever theory may say, it appears to be impossible to do anything of the kind in practice; and the reduction of the grate area would of a certainty be attended by a necessity for augmenting a draught already mischievously intense. If any proof of this were needed, we have only to turn to old locomotive practice. Until grates were made large, very heavy fires were carried, and the blast pipes had of necessity to be contracted in order that steam might be kept up. With each increase in the size of the grate came a more than corresponding enlargement in the size of the exhaust nozzle. We have no reason whatever to assume that a reduction of grate area could be accompanied by a reduction in draught.

But the assumption that by burning coal at the rate of 56 lb. per foot of grate, steam can be kept up for a large torpedo boat, is quite erroneous. The consumption is more than double this. It reaches, indeed, as much as 125 lb. per square foot of grate; and although much of this is not fully consumed, we never saw anything but cinders from which all the gases at all events had been liberated, come from either funnel or smoke-box. We shall not be far wrong if we assume that the actual consumption for such a boat is that which we recently described in our pages as the largest of the kind yet built, would reach 1 ton an hour. As she indicated about 640-horse power, this would correspond to a consumption of 3·5 lb. per I.H.P. per hour. The engines are economical; but considering that they were not linked up, and were driven as hard as they could go, and making a deduction for the steam required to work the air and circulating pumps, &c., we cannot possibly arrive at any other conclusion than that the boiler evaporated about 7 lb. of water per pound of coal burned. This gives but 24·5 lb. of feed-water per horse-power indicated of the main engines; but the total horse-power, including fan and pump, cannot have been much less than 700. This would represent a consumption of feed-water of 22·4 lb., and we think it altogether unlikely that less could have been used. Indeed, the result would, under the conditions, be very excellent. We thus have a boiler evaporating 7 lb. of water per pound of coal actually consumed. The grate had an area of 25 square feet, and 1 ton an hour burned on this grate is very nearly 90 lb. per foot. Adding the other quarter of a ton, we have 5·6 lb. per lb. of coal as the evaporation. Neither figure can be regarded as unsatisfactory. Of course if it were possible so far to mitigate the draught that 20 per cent. of all the coal charged on the grate would not be sent almost unburned through the tubes it would be a very good thing; but to fancy that this can be done by reducing grate area appears to us to be a complete mistake. If only a good bridge such as that used in locomotives could be adopted, the advantages gained would be very great. In the first place, the clinkering up of the tube ends would be perhaps avoided; in the second, the coal would be much better burned, more time being allowed for its combustion; and last, but by no means the least, the tube ends being protected from the impingement of cold air would keep tight It is very difficult, however, to see how this can be attained. Even in the largest torpedo boats, with boilers about 4ft. 9in. in diameter, there is not more than 18in. of steam and water space above the crown of the fire-box, which is made flat, as in the case of Belgian locomotives. Less than this cannot possibly be allowed. But the vessels are so shallow that while the roof of the fire-box comes within a few inches of the deck, the grate cannot be kept a foot below the lowest row of tubes. There must be a tolerably large ash-pan filled with water, and this takes the boiler very near the bottom of the boat. Under the circumstances the fire-box is as deep as it can be made, and there is really no room in it for a fire-brick arch. There is a wall or vertical bridge built up a certain height to keep the coal from getting into the lower row of tubes, but as much as 5 cwt. of cinders have been taken out of the space between this bridge and the tube plate after a run of a few hours, full speed being only made for part of the time; and it is indeed open to question whether even if a hanging bridge were fitted, cinders would not settle on the back of it and choke the tubes even more than they do now. We do not know that they would, but we are by no means certain. Our contemporary holds that the grate could be placed lower than is now the case, so as to give room for an arch, but as he also holds that the grate should be smaller and the fire thicker, it would appear that no additional room would be obtained in which to build a fire-brick arch, and serious practical difficulties in firing would be introduced

if the door were brought down to the level of the grate-bars as he proposes. The great desideratum in a torpedo-boat boiler is the protection of the tube plate from the direct impingement of the flame and sparks, and we fancy that the best result would probably be obtained by using a fireclay guard-plate about 2in. thick and resting directly against the tube-plate. This guard could be built up from the bottom and could have a hole in it opposite to the mouth of each tube. Such plates have been tried in portable engines, but the heat there was too small to make them of any use. But in torpedo boat boilers it appears that they might be made to serve an excellent purpose, and a few experiments might be tried with them for a very small sum. The brick bridge or wall now used could, of course, be retained, and no change of any kind need be made in the boiler. Clinkering would be quite prevented, because the guard-plate would very quickly become brilliantly white hot, and the small particles of coal dashed against it would be at once burned up, leaving nothing but a fluid cinder, which would run down at once. The clinkering takes place now on the tube-plate only because it is cool, and will not let the silicate of alumina and iron run away.

MADRAS AND COLOMBO HARBOUR WORKS.

After a somewhat long interval, considering the importance of the subject to be dealt with, we have learned briefly the result of Mr. Parkes' inspection of the harbour works at Madras, which, as our readers will recollect, were almost completely wrecked during a cyclonic storm which occurred off that coast a few months back. We are glad to learn that Mr. Parkes considers that these works, upon which so large a sum of money has been spent, are not entirely destroyed; and that, as their designer, he has expressed his conviction that they can be restored and completed upon his original plan for an outlay beyond the amount of the first estimate of £190,000. Certainly such a sum is no trifle, and its expenditure may mean all the difference between a paying and losing investment; but doubtless the amount will not be regarded as serious by the Government of India in comparison with the necessity for total abandonment which it was feared would be involved by the catastrophe we have referred to. The time believed by Mr. Parkes to be required for the full completion of the breakwater is said to be three years from the date when the repairs may be commenced. We confess ourselves extremely surprised to learn that "Mr. Parkes does not attribute the disaster to want of bond, quantity of material in masonry or foundation mound, but to the extraordinary and unforeseen force caused by an unusual cyclone, especially shown in the fact that the sea reached the foundation 22ft. below low water, and scooped out the materials."

To what shortcoming, therefore, we may naturally ask, does Mr. Parkes consider the failure of his work to be due? It is manifest there must have been defective provision somewhere, and we have before pointed out in our pages how very inadequate the system of bonding adopted appeared to be. Then, again, the engineer's contention that the cyclone was of an "unusual" character appears to be altogether negatived by the information which at first reached us, that the cyclone in question was very considerably below the strength of forerunners previously observed, and upon the data afforded by which it must be presumed Mr. Parkes based the design of his breakwater. If the sea has had the effect of scooping out material from the foundations 22ft. below low water, it is evident that these were laid in at an insufficient depth. It is, of course, impossible to say that such an effect could have been foreseen, and that Mr. Parkes is therefore chargeable with want of foresight in not making provision against such action; but we much fear that, in his anxiety to take a fresh departure, insufficient solidity was provided throughout every part of the work. We have shown before how slight that solidity was as compared with what Sir John Coode has considered to be necessary at Colombo, the provisions for which was based upon the result of many years' experience. Apart from this source of weakness, the engineer also appears to have entirely overlooked the fact that to resist wave force the compactness of the mass, so as to distribute the force of wave impact, is one of the foremost considerations affecting the design of a breakwater, for the slight and very incomplete method of bonding adopted nearly altogether deprived the breakwater of that very necessary quality.

Leaving here our consideration of the causes which led to the disaster, it is satisfactory to learn that Mr. Parkes's view as to the possibility of restoring the damage done is supported by so high an authority as Mr. Guildford Lindsay Molesworth, the consulting engineer for State railways in India. Mr. Molesworth is a man who does everything he undertakes thoroughly, and we are not therefore surprised to learn that he donned one of the diver's dresses and went below himself to make the required examination. We therefore feel inclined to place great reliance upon his opinion, which, according to the *Madras Mail*, confirms that of Mr. Parkes's, that the works can be restored. On the receipt of his report, the journal quoted states that the Government considered it so encouraging as to justify the sanctioning of a further expenditure upon them of £150,000, bringing the total up to £700,000. It will be observed that there is a difference between the estimates for repairs named of £40,000. This is a considerable percentage of difference, and the authorities will find themselves disagreeably situated if, when their work again approaches completion, it be discovered that the larger sum named by the designing engineer is really required.

Leaving Madras, and passing to the second part of our subject, the harbour works at Colombo on the opposite coast of Ceylon, it is pleasant to be able to turn from the record of failure to one of hitherto complete success. The work of the season on the breakwater of Colombo must now be considered to have closed, as the advent of the south-west monsoon compels the stoppage of all constructive work upon it. We have before us the report of Mr. Kyle, the resident engineer, for March last, which states that on the closing day of that month the total length of the breakwater pier from the junction line to the scar end was 3349½ft. An additional 12ft. were added early in April, so that the final length completed at the close of the season stands at 3361½ft. The design of Sir John Coode provides for carrying out this breakwater for 4200ft., and thus only 838½ft. are required to be added for its full completion. Mr. Kyle believes, therefore, that this work will be out of hand some time during February next. By that date Sir John Coode will doubtless have secured the assent of the Ceylon Government to the construction of the northern breakwater proposed by him as necessary to protect the anchorage from the sea due to northerly long-shore winds. If this be undertaken, the harbour will afford perfectly still water in all conditions of weather. Mr. Kyle reports the output of the Mahara quarries to be a steady 600 tons of stone daily, but this has not proved to be more than sufficient to furnish the supply considered requisite for the completion of the sea-berm destined for the protection of the face of the completed breakwater during the south-west monsoon, and blockmaking has therefore had to be entirely suspended. During the cessation of work on the breakwater, a sufficient supply of blocks can, however, be provided to guard against any delay arising when the quieting of the sea after the south-west monsoon admits of the resumption of block-setting.

The steam dredger engaged in deepening the anchorage ground within the breakwater has, since the supply of fresh gear from England arrived, been doing good work. There have been numerous stoppages of a minor character, arising from the replacement of worn-out pins and buckets so usual in machines of this class, but nevertheless the deepening had been effectively done over an area of 20,000 square yards during the month. The stuff raised amounted to 23,905 cubic yards, and this has been devoted to a considerable extent to reclamation of the foreshore, on the space gained by which the representatives of the Peninsular and Oriental Company, the Messageries Maritimes, and the British India steamer line are busy erecting coal stores, and require offices for their approaching transfer from Galle to Colombo during June. Twenty-five thousand tons of coal, we learn from the *Ceylon Observer*, have already been deposited in these stores. The total requirements of the port to meet the demands for coaling steamers will be about 100,000 tons per annum. The moorings at first laid down appear to have been in some particulars insufficiently strong to bear the strain imposed upon them by the steamers of large size resorting to the harbour, and these defects have, Mr. Kyle informs us, been remedied by the receipt of new and stronger links and pins from England. The total expenditure on all the works to the end of March had been £611,928. The merchants of Colombo are most anxious to secure the necessary advantage of a dry dock for their port, for the making of which, it is said, the old tank known as the Lotus Pond offers great facilities.

RELATIVE WAGES OF SHIPBUILDERS.

There is some controversy in progress as to the sufficiency of the wages and the fulness of the labour of the workmen in the shipbuilding yards on the Clyde; and in that controversy some interesting facts have been brought to light in relation to the wages of the shipbuilders in different districts. It is stated that the Clyde rates are over 10 per cent. below those of the English ports, and a series of figures are quoted in support of the contention. Platers are paid on an average in Scotland, £1 14s. 6½d. per week, and in England £1 18s. 6¾d. per week, whilst there is a similar discrepancy in the relative wages of rivetters, caulkers, and holders-up in the two districts, the Scottish builders having the advantage of the cheaper labour all through. The Scottish week is fifty-four hours all the year round; the English week is longer in summer than in winter, and averages, it is stated, fifty-two and a-half hours throughout the year. Against this dearer cost of labour in England is to be set the fact that it has usually at the north-east ports the advantage of cheaper iron plates, often averaging 10s. per ton cheaper in the Durham district than in Scotland, when iron plates are used—steel plates being on the other hand cheaper on the Clyde. Still the advantage must be held to be possessed by the Clyde builders, in having cheaper labour, and in having cheaper material when steel is used. The growth under these circumstances of the trade at the north-eastern ports must be held to be most surprising—the tonnage launched between the Tyne and Hull during the first half of the present year approaching 300,000 tons register. And although the labour difficulty presents itself at the moment, yet there is a decided tendency on the part of the shipbuilding industry to grow in those ports. There is not that building of magnificent "liners" that there is on the Clyde, but the construction of cargo-carrying vessels has been successfully cultivated, and that to some extent for local owners, who show strong desires to swell their fleets, and thus give a solid foundation to the shipbuilding industry of the north-east.

THE MANCHESTER SHIP CANAL.

The preliminary steps for ascertaining the practicability of the projected ship canal to Manchester have now been fairly commenced, and Messrs. Hamilton Fulton, C.E., of London, and E. Leader Williams, C.E., of Manchester, who have been appointed by the Provisional Committee having in hand the promotion of the scheme, to make the necessary survey, and prepare a joint report, have begun their work during the past week. Of course nothing definite can be said as yet as to how the project, if taken in hand, is likely to be carried out, but from what we can hear the general feeling is to avoid all locks, and to provide an unencumbered waterway throughout. To provide for the preliminary expenses of the survey a guarantee fund has been raised, and with the influential support which the proposal has already received, no doubts are entertained by the promoters as to the possibility of forming a strong company to carry out the project. An incident has already occurred in connection with the scheme, which, whilst it serves to show the support it will receive at important centres along the route, is also an indication of the varied obstacles which may have to be overcome. It appears that by the Liverpool Water Act of 1880 the Board of Trade is empowered to determine at what depth the aqueduct from the Vyrnwy to Liverpool shall pass beneath the Mersey, and the Warrington Chamber of Commerce, who strongly approve of the proposed improved navigation, have memorialised Mr. Chamberlain, asking him to require that such aqueduct shall be at such a depth and such a place as will not cause any obstruction to the proposed canal. It may, however, be anticipated that the Liverpool Corporation, who of course cannot be expected to take a very favourable view of the navigation project, will strongly object to being saddled with any large additional outlay in view of the possible construction of the canal.

ELECTRICAL ACCUMULATORS OR SECONDARY BATTERIES.

By Professor Oliver J. Lodge, D.Sc.

No. VI.

So far we have only considered in the roughest and broadest manner the chemical action going on in a Planté or Faure cell, but to understand all the details of their behaviour it is necessary to investigate these actions very closely. In this study we shall be greatly assisted by an excellent memoir of Messrs. Gladstone and Tribe, which is to be found in *Nature*, January 5th and March 16th, in the *Electrician*, March 25th, and doubtless also in other places. A letter of Professor A. S. Herschel, in *Nature*, February 16th, is also of great interest.

As a preliminary the reader is recommended to try a few experiments with two simple lead plates, say about the size of a finger. Scrape them both bright, and immerse them in ordinary dilute sulphuric acid as mixed for charging batteries, supporting them by some convenient arrangement which will hold them steady and vertical, and permit either of them to be withdrawn and re-inserted easily without disarranging the wires.

First connect them with a single Grove cell, and you will see a few minute bubbles of hydrogen rise from the plate connected with the zinc, while that connected with the platinum is slowly coated with a white crust of $PbSO_4$. In about a minute the current will be very much weaker, and no bubbles will be noticed, and presently all action nearly ceases. The discharge current which can be obtained is exceedingly weak and practically *nil*. No peroxide is formed with the EMF of one Grove, which, as is well known, is unable to decompose water.

Now put on two Grove cells instead of one. Immediately bubbles of gas rise from both plates. The darkening of the + plate shows that some peroxide is being formed, and in a few seconds a discharge current can be obtained from the two little plates sufficient to ring a bell. It dies away very rapidly, however, and requires a fresh application of the current to resuscitate it.

One may note in passing that it was by no means essential, or even helpful, to the success of this second experiment that the first should have preceded it. If two cells are joined up at once to the clean plates, without first clogging one of them up with $PbSO_4$, the same things go on and perhaps rather more easily. If a preliminary coat of sulphate has been allowed to form for a long time it exerts quite a serious clogging action, by reason of its want of conducting power.

Another experiment of Gladstone and Tribe's is this: Immerse the plates in plain water—or salt and water—and act upon them with twenty Groves if you like; no peroxide will be formed, but only hydrated protoxide, which refuses to give an appreciable counter current.

One more experiment—this time Professor Herschel's. Having charged the two lead plates with a couple of Groves properly, remove the hydrogenised plate, insert in its place a bit of clean lead, and try for the discharge current. It is very weak, and can scarcely ring a bell. Remove the clean and replace the hydrogenised lead, and a strong bell-ringing current is obtained for a few seconds; but it stops suddenly. Why does it stop suddenly? Modify the experiment by immersing only half the charged surface of the plates when you are going to discharge, and as soon as the bell stops depress one of the plates more so as to bring a fresh surface into action. It will be found on depressing the + plate that a fresh surface of peroxide does no good, showing that that is not what is exhausted; but a fresh surface of hydrogenised lead (*i.e.*, depressing the — plate) rings the bell again instantly. The current stops, therefore, as soon as the hydrogen is exhausted. It is not correct to say the current stops though, but it is suddenly and seriously weakened; clean lead and peroxide do not give a powerful EMF; the current from clean lead and hydrogenised lead is nearly as strong in the opposite direction.

A further experiment is instructive. Having peroxidised a lead plate, insert it in a beaker of acid in opposition to a plate of platinum, and connect them both with a galvanometer. It will be found that the current sets out from the lead, showing that even platinum is electro-positive to peroxide of lead. If the platinum has been alloyed with hydrogen the current is strong, but if it is clean the current is still perceptible without a very delicate galvanometer.

If instead of hydrogenised lead we try zinc, we shall find a strong current; and it appears that hydrogenised lead and zinc are almost equal to one another at first, though the hydrogen gets exhausted, while the zinc does not. Doubtless amalgamated zinc keeps itself permanently coated with a layer of hydrogen. Amalgamating metals seems to make the layer of hydrogen adhere better, and even amalgamated copper acts extremely well if it has been charged with hydrogen. Indeed, as long as the hydrogen lasts, it is scarcely inferior to zinc or hydrogenised lead. A curious thing, however, is that clean copper opposed to peroxide of lead gives a bell-ringing current much stronger than clean lead, and nearly as strong as hydrogenised lead does. This of course is the foundation of Sutton's cell.

All these experiments show the high value of peroxide of lead as the electro-negative element of a cell. Peroxide of manganese is very good, but peroxide of lead beats everything with which I am acquainted. In order that any of these oxides may act in this way, it is of course necessary for them to be in good metallic contact with the electrode, so as to form its real surface.

We can further learn from the first three experiments that peroxide is not formed on the + plate until there is a

visible evolution of oxygen gas; and one becomes convinced that its formation is due to some secondary action.

The action is probably this: Of the SO_4 liberated against the + plate, some combines with it, forming $PbSO_4$; but the whole is not thus consumed, if it is liberated sufficiently fast, and the rest decomposes the water, liberating oxygen, and forming free sulphuric acid. Of the oxygen atoms so liberated, some unite into molecules of oxygen, others into molecules of ozone; and perhaps all this escapes as gas. But another portion liberated in contact with $PbSO_4$ acts upon it thus: $O + PbSO_4 + H_2O = PbO_2 + H_2SO_4$, making some more sulphuric acid and also peroxide of lead. Another portion of oxygen may very likely attack the lead itself in its nascent state, peroxidising it directly; and perhaps it is the ozone which is active in this manner.

It is therefore not easy to say exactly what goes on at the + plate, though the broad facts are these—that some sulphate of lead is certainly formed, being visibly white; that as soon as oxygen gas is liberated some peroxide is formed; that some of this peroxide is in such close conducting contact with the lead plate—see above—as to justify the belief that it is formed by direct oxidation; that the sulphate of lead itself gets ultimately, though slowly, peroxidised; and as sulphate of lead is a non-conductor it can only be acted on by secondary action, as explained.

At the — plate nothing particular goes on. Hydrogen is liberated against it, and partly clings to it, but mostly escapes as gas. If the clean lead surface has stood in the acid a short time before charging, it will load itself very slightly with $PbSO_4$; but this substance does not appear to be easily reduced by the hydrogen, and it is seen to fall off as a faint white filmy descending current.

Liverpool. O. J. L.

THE NAVAL ATTACK ON THE ALEXANDRIA FORTS.

WHEN we spoke of the relative powers of our fleet and the Alexandria forts last week, we hardly expected that the question would be so immediately tried. How completely our ships have done their work has been abundantly recorded in our daily papers. Our present object, then, is to trace as concisely as materials admit what took place, reviewing it from an artillery point of view. Admiral Sir Beauchamp Seymour had the following ironclad ships at his disposal:—

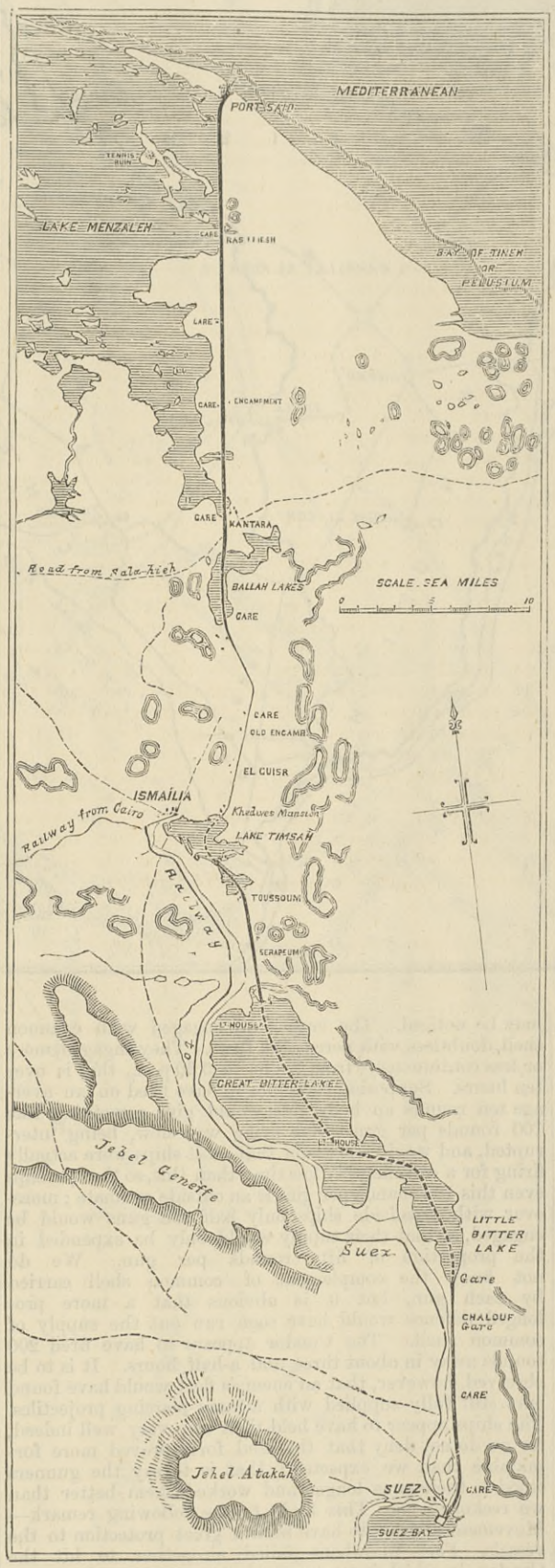
Ships' Names.	Guns. 80-ton. 16in.	25-ton. 12in.	25-ton. 11in.	18-ton. 10in.	12-ton. 9in.	9-ton. 8in.	6½-ton. 7in.	Armour. Max. in inches on sides.	Draught of water. Feet.
Inflexible (Turret)	4	—	—	—	—	—	—	24 to 16	25½
Monarch (Turret)	—	4	—	—	—	—	2	10 to 8	26½
Téméraire (Barbette) ..	—	—	4	4	—	—	—	11 to 8	27
Alexandra	—	—	2	10	—	—	—	12 to 8	26½
Sultan	—	—	—	8	4	12	—	9 to 6	27½
Invincible	—	—	—	—	10	—	—	8 to 6	23
Superb	—	—	—	16	—	—	—	12	25½
Penelope	—	—	—	—	10	—	—	6 to 5	17½
Total guns	4	4	6	38	24	12	2	—	—

In addition to these were the gunboats Condor, Cygnet, Bittern, Beacon, Decoy, and others, carrying 7in., 64-pounders, and lighter guns, eleven in all we believe. The above table gives us the principal features of the ships which we have to consider.

We are only able to state with regard to the Alexandria forts that they possessed a limited number of heavy rifled guns and a large armament of smooth bores. The rifled guns were the same as the 10in. 18-ton guns and the 9in. 12-ton guns mentioned in the preceding columns. In fact, they corresponded exactly with the guns carried on board our ships, having been purchased from Sir W. Armstrong and Co., and passed subject to the usual tests by our officers, whose services were lent to the Egyptian Government for this purpose. The ammunition also exactly corresponded with our own—except in insignificant details—and would, by the way, at this day be available for our own ships if necessary. It has been stated in the accounts that the Egyptians fired no shells. This needs explanation. Their Elswick ammunition consisted chiefly of shell. Common shell may have been fired blind, or such Palliser shells as were fired with bursting charges may have failed to strike. As they were dealing with thick armour they may have preferred to fire Palliser shot. However this may be, it must be understood that credit had to be given them by us for the proper complement of ammunition.

The forts may be said to be of a character extremely formidable for unarmoured ships if manned by good gunners, but as we stated last week, although the thinner parts of our armoured ships might be penetrated, we did not expect any serious case of penetration. As we then said, the 18-ton guns might get through a little over 14½in. of iron at the muzzle. It will be seen by the table above that this means the possibility of penetrating the thickest armour of our fleet, always excepting that of the Inflexible. The 10in. guns, however, were few, and the ships not likely to engage closer than 1000 yards. The shots were unlikely to strike quite direct, and therefore there would be a good chance of even the 10in. projectiles not penetrating the heavier armour. Supposing it to penetrate, the evil would be confined to a certain quantity of langridge entering the ship in the form of dead metal. The 9in. guns were hardly likely to penetrate any except the Sultan, Invincible, and Penelope, and the damage done by smooth bores and lighter rifled guns might be limited to unprotected and secondary parts of the ships. The forts had one battery of Moncrieff guns near Fort Ada—see page 33. The other guns would doubtless admit of being dismounted by good shooting, there being no great advantage in command, and Turkish parapets being apt to be badly made. The strength of the land batteries then, while to a certain extent unknown, was unlikely to be sufficient to contend with the ships. The two most important elements telling against the full use of their guns were the probable absence of artillery science, and the command of the ground not being sufficient to enable our decks to be struck.

The Admiral's plan of destroying the forts appears to have been, to commence with all those which bore on the outside of the harbour and on the entrances. Herewith are the orders. "The Admiral's instructions are that there will be two attacks. The Invincible,



THE SUEZ CANAL.

Monarch, and Penelope will attack from the inside of the harbour, and the other ships will operate from the outside. The action will commence by signal. The ship nearest the Fort Ada, to the north-east, will fire a shell into the earthwork. Upon the fort making any reply the outside squadron must destroy the Ras-el-Tin batteries, afterwards moving eastward and destroying Forts Pharos and Silside. The Inflexible will engage the Mex forts; the Superb, Sultan, and Alexandra will flank the works on Ras-el-Tin. The gun vessels and gunboats will remain outside and keep out of fire until a favourable opportunity offers itself for making an attack."

Looking at the map—page 33—there will be seen to be the masonry and earthworks, extending from fort Pharos along by fort Ada and Ras-el-Tin up to Eunostos Point and lighthouse, and the earthworks commencing near Fort Mex, opposite the breakwater and Mars-el-Kanat. Fort Marabout was not at first attacked, being probably regarded as too remote to be of primary importance. We have now to see how this plan was carried out, following the operations as far as possible by means of the map, which is taken from the Admiralty chart and the official and excellent private accounts in the *Times*, *Standard*, and *Telegraph*. Until the night of Monday, July 10th, the Monarch and Invincible lay in the inner harbour, and none of the ships indicated the stations from which they would open fire. During the night each vessel quietly took up the station at which action commenced in the morning at seven o'clock. The Invincible, with the Admiral on board, and the Penelope had then moved into position to bombard Fort Mex, in about the spot shown on plan, 1000 to 1500 yards W. by N. of "Masse"—properly Mex—the Penelope and Invincible, broadside vessels, being at anchor and the Monarch under steam. The Alexandra, Superb, and Sultan commenced under steam on a north-east line from 1500 to 1900 yards W. half N. Eunostos Lighthouse—*vide* map. The Inflexible in Corvette Pass, 3700 yards from Fort "Masse"—properly Fort Mex, as shown on map—Téméraire in Central pass 3500 yards N.N.W. from Fort Mex. This was the position of the armour-clads on commencing the action, the gunboats watching for any opportunity to engage—which, we may add, they apparently had made up their minds should happen very quickly. Indeed they were not long in finding just what they wanted. What reasons can we see for this disposition of the ships.

The first feature that strikes us is peculiar, namely, that the three lightest clad ships are thrust furthest into the harbour. Our readers may be almost inclined to think that the heaviest guns were known to be mounted on the Pharos and Ada face, as we have heard of two heavy rifled guns being recently mounted there with the Moncrieff guns and others, the natural supposition of the vessels' draught having been the ruling feature having been apparently negatived by the fact that the Monarch draws one foot more water than the Inflexible—*vide* table. It happens, however, that the former ship had been specially lightened to enable her to enter the harbour where she has been now lying so long. It will be seen that the Penelope and Invincible have considerably less draught than the other ships, so that no doubt this was the factor which decided their position. We may, however, here notice that coast defenders, which we do not send to the Mediterranean generally, would be the vessels best suited for this work, for which their flat-bottoms and small draught of water on the one hand, and their heavily-plated decks and sides on the other, admirably qualify them.

The two broadside ships Invincible and Penelope, then at anchor, and the Monarch, under steam, took the brunt of the battle against the earthworks at fort Mex and Mars-el-Kanat, supported at longer ranges by the Téméraire in the Central pass, who played on the Windmill battery, and two guns of the Inflexible, which divided her fire between Fort Mex and Ras-el-Tin. The Téméraire so far ventured into the Central pass as take ground at 6 a.m., and she opened fire at 7 in this condition, the gunboat Condor having at 6.20 been sent to her assistance.

The three remaining ships, Alexandra, Superb, and Sultan, had abundance of work on the Pharos Ada line of permanent works, which they engaged at first under steam, moving alternately N.E. by E., and then putting about and coming S.W. by W. The first shot was fired by the Alexandra either at Fort Ada or Ras-el-Tin, probably the latter, at 7.4 a.m. The Egyptian gunners then stood to their guns all along the works and accepted the challenge, and the fire commenced generally from both ships and forts. At 7.10 all the armour-clad ships were firing, the Invincible, Penelope, and Monarch employing their Gatling as well as their heavy guns.

For about an hour the attack continued without any very marked change in our disposition. The sun was rather in the eyes of our gunners, especially those firing so nearly S.E. by E. as the flagship, while the wind rather carried the smoke in the way, so that the guns had continually to wait for it to clear. The Egyptian gunners at Mex fired manfully, in spite of the heavy losses caused by our guns and Gatlings. We are best informed about the Invincible by the *Standard*. Round shot struck her, we are told, occasionally, and the whirr and shriek of missiles between and over the masts was continual. The armour of the Invincible was repeatedly struck, sometimes close to the water-line, but by shot incapable of penetrating it. The direction of fire of this ship was well aided by Mr. Hardy, a midshipman, posted in the maintop. The forts on the Pharos face also answered well. The Marabout fort, which had not yet been attacked, fired at the flagship and her consorts.

At 8 the Téméraire gets afloat, and the Condor leaves her. The Cygnet gunboat has got into action, and Lord Charles Beresford in ten minutes' time runs the Condor up to the Marabout Fort, which at first disregards her fire, but gradually suffers severely from it, her guns being one 7in. and two 64-pounders. It then turns its guns on the Condor, but fails to strike her. The Condor moves continually, and at length closes to get her Gatlings to bear. The other gunboats—ten, making eleven in all—support the attack, and at 11 a.m., on the Admiral's signal to cease fire, Fort Marabout is left by the Condor with only one gun firing.

In the meantime, at 8.30, a magazine in Mars-el-Kanat has been blown up by the fire of the Invincible and Monarch. At 9 o'clock the Alexandra, Superb, and Sultan come to anchor in a line at about 800 yards from Fort Ada, and pour in a steady fire all along that line of works extending from Pharos to Ras-el-Tin. From 9 to 10 the Téméraire is signalled to play on Fort Mex; all the guns in that fort having been silenced except four, which are well worked and well under cover. These four guns strike the Invincible all along her water line, and penetrate unarmoured parts, wounding six men on board. By 10.30 one of these Mex guns is dismounted, but their position is difficult to see. At 10.30 the Khedive's palace, unfortunately situated behind Ras-el-Tin, takes fire. At 11.40 Fort Marabout is silenced completely. At 12 o'clock the great body of the guns all along the forts is silenced; a powder magazine in Fort Mex has been blown up by a shell, it is thought, from the Monarch. At 1 o'clock volunteers are called for by the Admiral to land at Fort Mex, and destroy the guns now silenced, and a party of twelve men, with Lieuts. Bradford, Lambton, and Poore, Midshipman Hardy, and Major Tulloch row in to shore, swim through the surf, and destroy the guns, spiking six and destroying two by bursting them with gun-cotton. Meeting

THE DELTA OF THE NILE.

with no opposition, they all return safely to the flagship. At either 12.15 or 1.30—the accounts are contradictory—the Inflexible moves round and takes up a position N.E. of the Alexandra squadron, the Téméraire now joining her, both firing into Fort Pharos and Ada; the shells of the Inflexible 80-ton guns, which had not exhibited their powers to the full advantage against earthworks, now tell with tremendous effect on the masonry. About this time a large magazine in Fort Ada is blown up. At 2.30 the Inflexible and Téméraire are both firing at the Pharos Fort and the Moncrieff battery, which holds on gallantly till about 4 p.m., when both are silent. At 5 p.m. the inner squadron —Monarch, &c.—commences firing on the harbour works further east, but soon ceases firing by order of the Admiral about 5.30 p.m.

The following casualties were found to have occurred in the fleet :—Invincible—flagship. Wounded severely, Redmond M'Guire, boy. Slightly, Mr. Wm. Lumsden, midshipman, Chasiera, stoker, John Yolland, A.B., John Gill, seaman, J. W. Moore, private R.M. Penelope. Wounded severely, John Wheadon, leading seaman, W. Woon, captain of the mast. Wounded dangerously, H. Dawson, leading seaman; L. Holly, and A. Jackson, boys. Wounded slightly, Lieut. Davies, W. Lee and W. M'Canalley, A.B. Inflexible. Killed, W. Shannon, carpenter. Wounded severely, Lieut. Jackson. Slightly, W. Houghton, private R.M. Alexandra. Killed, W. Fisher, A.B. Wounded severely, J. Myers, A.B. Slightly, T. Palmer, capt. of forecastle, G. Talbot, private R.M. Sultan. Killed, C. Collins and R. Marshall, A.B.'s. Wounded severely, J. Dexter, boy. Wounded slightly, A. Jutson, J. McCarthy, R. Pacey, J. Tussell, and T. Poigndestre, A.B.'s; J. Gomes, boatswain's mate; S. Fuller, leading seaman. Superb. Killed, G. M'Claine, gunner R.M.A. Wounded slightly, G. Webb, ship's corporal. Details of injuries to ships are not given. Two 18-ton guns of the Alexandra are reported dismounted by a shot entering one of her ports; but apparently the effects generally are slight, and although the *Standard* correspondent speaks of one formidable-looking hole in the Superb's armour, we are inclined to think that it is not in her armour, which is 12in. thick, with backing and skin 1½in., and, therefore, not in an important place. Some damage was done to the boats of the Condor.

On the morning of Wednesday, July 12th, Sir Beauchamp Seymour again opened fire; but further operations were shortly stopped by a flag of truce.

To criticise this the first action between ironclads and forts is by no means easy, owing to the impossibility of obtaining full and accurate information concerning its results within a few hours of such an occurrence. We do not propose to criticise the attack, which appears to have been admirably carried out; but the following features may be noticed. The vessels all engaged with common shell, doubtless with percussion fuses. They engaged, more or less continuously, from 7 a.m. to 5.30 p.m., that is over ten hours. Supposing each gun to have fired on an average ten rounds an hour, this would give something like 100 rounds per gun. The firing was slow, being interrupted, and we do not doubt that most ships were actually firing for a considerably less time than this, so that perhaps even this 100 rounds per gun is an outside estimate; moreover with broadside ships only half the guns would be engaged, so that their supply would only be expended in the proportion of fifty rounds per gun. We do not know the complement of common shell carried by each gun, but it is obvious that a more prolonged defence would have soon run out the supply of common shell. The Condor appears to have fired 200 rounds away in about three and a-half hours. It is to be observed, however, that an enemy's fleet would have found ours still fully supplied with armour-piercing projectiles. The ships appear to have held their own very well indeed, for we do not deny that the land forts proved more formidable than we expected; that is to say the gunners stood to their guns longer and worked them better than we reckoned on. This leads to the following remark—Movement appears to have been a great protection to the vessels. Fort Marabout failed altogether to hit the Condor, on which it appears to have concentrated most of its available fire, and the casualties chiefly occur in the ships which engaged at anchor. The Monarch and the unarmoured ships escaped altogether, yet they engaged at close distances. This feature is specially important in its bearing on the instructions given, we believe, to our fleet destined for the Baltic when war was last threatened with Russia, which were to clear water of mines, anchor in cleared spaces, and destroy forts in succession. The great objection to anchoring appears to be not alone that horizontal fire is easily directed on a stationary object, but that vertical fire can with skill be brought to bear on decks. At Meppen, in 1879, Krupp at a range exceeding four miles struck a target made to represent H.M. Inflexible's deck five times out of ten rounds. In this engagement the decks do not appear to have been subjected to attack. While, then, the ships have stood admirably, we must not forget that forts manned by more scientific gunners, and especially if situated on higher ground, would have tried our fleet much more severely. Again, if the Egyptians did not fire common shells at all they made a great mistake in our judgment. We are inclined to think that gunners, too commonly, simply regard an armour-clad ship as an object to be attacked with armour-piercing projectiles, and thus fire at them with such only, taking their chance of penetration with what they regard as the hardest hitting projectiles, while they probably regard any further discrimination as impractical.

Now, we would point out that partial penetration into iron does not practically injure it at all. The shot even plug up the holes they make and the structure suffers very little. If complete penetration is impossible, it is better to discard the effort to fire at the armour and take to what has been called the "secondary attack," that is, fire common or even occasionally Shrapnel shell into the less protected parts. The effects of missiles thus caused to enter a ship are beyond comparison with those of armour-piercing projectiles.*

Discussing what the Egyptians might have done, the possibility occurs to us of their placing all their most powerful guns behind parapets with embrasures completely closed outside, until such time as their inferior guns had drawn the greater part of our ammunition, and our ships had confidently anchored at close distances. Of course, however, nothing could have very materially affected their powers of resistance with the guns at their disposal. The Moncrieff guns appear to have held out wonderfully well; indeed, they are reported to have been in action again on Wednesday morning. The earthworks stood far better than the masonry, judging by the accounts.

Lastly, we cannot close this very hasty review without offering a tribute to the cool courage exhibited both by our own men and the enemy. We refrain from commenting much on the conspicuous acts of individual daring which cannot fail to be noticed in what we have narrated, because they were the acts that specially fell under the eye of reporters who, however able, could not see all that was done in other quarters of the fleet. We shall have the Admiral's despatch by and bye. It is due to the poor Egyptians at all events to praise their gallantry. At the commencement it is probable that they were not aware of their great inferiority both in artillery power and protection, but this must have soon made itself apparent. Yet the officers exposed themselves conspicuously, and the men stood wonderfully to their guns, and whether it was due to ignorant fatalism or any other cause, we deeply regret

* The following is a simple rule for the limit of penetration of wrought iron :—Taking the calibre of the gun as the scale to measure by, no gun will penetrate armour with less than 1000ft. velocity for each calibre in the thickness of the armour. Thus, a 9in. gun cannot possibly penetrate 9in. of armour with less than 1000ft. striking velocity; for 13½in. it must have at least 1500ft., and so on. Speaking generally also, old type guns projectiles at the muzzle do not exceed 1500ft. velocity, and new type 2000ft., so that it would be useless under any circumstances to fire an old type gun at iron 1½ calibres thick, and a new type gun at iron 2 calibres thick. Indeed, while this is a safe limit, only a few guns get nearly up to it. Most fall decidedly below. It is, however, a good general rule, and with certain assumptions, admits of mathematical proof—*vide* Engineer, January, 1881. This rule does not apply to steel, which may gradually succumb to light guns.

THE BOMBARDMENT OF ALEXANDRIA.

(For description see page 31.)

hearing of numbers that were found dead by our own gallant spiking party when they landed. Let us hope that it will not be necessary to sacrifice many more lives in this way. The few rounds that were fired on Wednesday, and the burning of the town of Alexandria, call for no observations here.

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

(*From our own Correspondent.*)

The Ironmasters' quarterly meetings were held in Birmingham to-day—Thursday—and in Wolverhampton yesterday. Both were remarkably well attended, but speculation was checked by what is happening in Egypt and by the adverse weather. The crucial prices alike as to pig and rolled iron were re-declared upon the bases of the quarterly meetings three months ago.

The past quarter has not been marked by much variation in prices. During the first two months or so the tendency of the market was downwards, but since that time prices have rallied, and they close the quarter quite as strong as at the opening. Medium and common finished iron makers have upon the whole been more active than the makers of best qualities, since these last have only been partially employed. The sheet rollers have been more active than any other branch of the trade, orders from the galvanisers during the past month of the quarter having improved considerably. Prices of sheets have fluctuated very much according to the state of individual makers' order books. In the first part of the quarter they were very low, and an attempt to get them up by the formation of an association for restricting the output failed. Singles, ordered alone have occasionally been as low as £7 15s., and doubles £8 10s. Common plates have varied from £8 to £8 10s. Marked bars have remained at £7 10s.

Yesterday £7 10s. was announced to have been again determined upon by the leading firms as the price for marked bars, and £8 2s. 6d. became the quotation for Earl Dudley's common bars. Common Staffordshire bars were quoted at £6 10s., but a minimum quality was offered at 2s. 6d. under that figure. Medium bars ranged up to £7. A fairly good business was reported to be doing at the works in marked bars mainly for export. Angle bars were doing most on home account. Common angle bars were procurable up to 4in. at £6 10s., and up to 6in. at £7. Sheets were sought after, but buyers hesitated to give makers' prices. These were £9 for doubles, and £10 10s. for latens. Singles, also for galvanising, varied from £7 15s. to £8 and £8 5s., according to the proportion of singles in a mixed order embracing also doubles and trebles. Hoops met with inquiries in Wolverhampton on account of United States as well as Australia and India; but the merchants were not prompt to give the £7 upwards at which alone the general run of the specifications which they offered would be accepted. Bedstead strip was quoted £7 down to occasionally £6 15s., and gas strip was priced £6 10s. down to £6 7s. 6d.

To-day it was not easy for all finished iron to firmly hold its own on the Wolverhampton basis. The receding prices of galvanised sheets and of fencing wire in Australia, to the extent of 17s. 6d. per ton on the fortnight, weakened both these commodities, alike in a galvanised and also in a black state. There were bars which were to be had at £6 10s., and a minimum bar was procurable down to £6 5s.; but the smaller sections of rounds and squares were firm, at a rise upon last quarter of 2s. 6d. and 5s. respectively. Angle bars were fractionally improved upon the quarter, and there was a trifle more doing in hoops and strips. Medium boiler plates were procurable at £8 10s.—"Wright" brand—and a good quality —"Monmoor" brand—was to be had at £9. Some other makers quoted up to £10. Girder plates were occasionally to be had at £8, but the price was not low enough to keep out the northern brands when a cheap quality was imperative.

As 'Change closed in Birmingham to-day it became known that the Galvanised Association had met and reported themselves full of orders; they therefore resolved to advance prices 10s. per ton, making the Association quotation for 24 gauge delivered in Liverpool, £15. The quarterly meeting of the Welsh tin-plate makers was held here, and the mills reported themselves fully active; one maker, indeed, was said to have orders in hand for 40,000 boxes. The Association suggested that the price for Welsh coke plates in Liverpool should now be 17s., which is an advance of 1s. per box. It transpires that the Staffordshire Steel Syndicate would meet again in Birmingham to-morrow—Friday—to further promote the formation of a company. Mr. Percy C. Gilchrist, one of the inventors, was on 'Change. Representatives of Sheffield crucible and Bessemer steel houses reported a fairly brisk business.

Pig iron has been in demand sufficient almost to keep pace with production. The furnaces in blast on the last day of June out of 136 built, numbered forty-nine, and of these two have been restarted since the quarter opened. All-mine hot blast sorts have ranged from 65s. to 70s.; part-mines have been about 50s. to 57s. 6d.; and in actual sales cinder pigs have passed all from 37s. 6d. to 40s. Yesterday Lilleshall hot-blast pigs were quoted £3 5s., and cold-blast £4 5s. per ton; and Staffordshire all-mine were to be had from £3 7s. 6d. to £3 10s. Thorncliffe were strong at 60s., and Wellingborough at 50s. Barrow hematites were 67s. 6d., and the Tredegar brand 65s. for forge sorts. To-day pigs were not actively sought for, and there was less disinclination to book at prices which were not generally quoted yesterday in Wolverhampton. A few brands of all-mine pigs were to be had at from 2s. 6d. to 5s. under the quotations at Wolverhampton; and one or two hematites were a shade easier to buy. Nor did all the Derbyshire and Yorkshire brands manifest yesterday's firmness.

Oolitic ore was plentifully offered from Northamptom at within 6s. per ton delivered. Native "blue-flats" and "gubbin" were quoted up to 15s. and 15s. 6d. and 16s., mostly according to weight.

Coal was to be had to-day at as low as 5s. 6d. per ton for forge purposes, whilst some blast furnace proprietors were giving 10s. for picked furnace coal. North Staffordshire washed coke was 15s. per ton delivered.

Iron masters hereabouts note with satisfaction that the total exports of iron and steel during the past half year are officially returned as an increase of 15 per cent. in quantity and 16 per cent. in value over the first half of 1881. The total quantity has been 2,094,839 tons, an increase of 266,632 tons; and the total value £15,427,917, an increase of £2,821,646. The total quantity of pig iron is 802,983 tons, or an increase of 143,409 tons. Hoops, sheets, and plates have been shipped to the extent of 157,910 tons, an increase of 25,427 tons. The quantity of bar and angle is 149,205 tons, an increase of 15,867 tons. Old iron, 70,058 tons, an increase of 14,011 tons; cast and wrought, 160,731 tons, an increase of 21,771 tons. Tin-plates have been much more largely exported, 128,561 tons having been sent, against 111,286 tons last year.

Iron pipe founders in this district are tendering for a supply of 1200 tons of cast iron pipes varying from 30in. to 9in. diameter, required by the Cheltenham Corporation Waterworks; and it is very likely that they will be successful in securing the contract.

The prices of nuts and bolts are rising, and certain manufacturers in the Darlaston district are intimating that all new orders must be subject to special quotations until the issue of the new advanced price list which the trade are now compiling.

The war preparations have caused the War Office and the Admiralty to require urgent supplies. Firms here who are under contract to supply hardware stores are receiving telegrams desiring consignments of culinary utensils at the earliest possible date to Woolwich and to the various dockyards. And the Departments are supplementing contracts placed some little time ago with new orders, and to these also "urgency" applies. At numbers of works where Government contracts are in hand, overtime is being made to comply with the requests of the Departments.

The strike of the operative hammered-chain makers for a return in payment of wages to what is known as the "4s. list," drawn up last March, is likely soon to be concluded. Wages have been lowered from this standard by from 10 to 15 per cent., but on Monday, at a gathering of the men at Cradley Heath, it was announced that several employers in the Rowley, Cradley Heath, and Netherton districts were willing to return to it.

Most of the "cutters" in the Birmingham file trade are on strike for higher wages. They complain of the abolition of a discount which had been allowed by the chief employers for the past three years. Seven weeks' notice of the abolition was given on 13th May last, but the men refuse to allow it to be enforced. At some half-a-dozen shops wages are paid on what is known as "the full 1872 statement," and in these cases there is no disquiet.

The step taken by the local authorities of Oldbury at the beginning of the year, when they bought the gas undertaking in their town from the Corporation of Birmingham, has proved a wise one. The proceeds from the sale of gas and residuals combined during the past six months were £4440. The sale of the coke realised some £800, which was only £100 less than the actual cost of the coal. The total profit is £1710, and of this £1100 is available for the relief of the rates.

The North Staffordshire coalmasters have determined to give notice to the colliers on the 15th inst. for a drop of 5 per cent in wages, upon the ground that no improvement in trade has taken place to cover the advance of 5 per cent. which they conceded to the men last October.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—The iron market here, so far as actual business is concerned, continues dull, but prices generally are firm. The quarterly meetings this week have no doubt caused a little holding back on the part of buyers; certainly there is for the present a pause as regards anything like heavy buying, and the question is whether makers will be able to maintain their recent advance in prices. No indication of giving way has yet been apparent, and although large orders are not being booked at the extreme rates where buyers have to come into the market, full prices have to be paid.

Only a limited business was done on the Manchester Exchange on Tuesday. Lancashire pig iron was unaltered in price, local makers being from at 45s. to 46s., less 2½ for forge and foundry pig iron delivered equal to Manchester, and at these figures reported a moderate business having been done during the week. Outside brands of pig iron coming into this district were also without material change, the prices averaging about 47s. 6d. to 48s. for Lincolnshire, up to 48s. 6d. and 49s. for Derbyshire, less 2½ delivered equal to Manchester, and on the basis of these figures, at which makers were firm, small sales have been made. Middlesbrough iron continues practically out of this market at the prices quoted by north country makers, which ran from 51s. 4d. to 52s. per ton net cash for g.m.b.'s delivered equal to Manchester, and at these figures only a few occasional small sales for special purposes were made.

In the finished iron trade makers generally appear to be tolerably well supplied with work, and are not at all pressing for orders. Although there is no really big trade being done, there is a fair business stirring, with moderately good shipping inquiries in the market for bars and sheets, and for delivery in the Manchester district prices are firm at £6 2s. 6d. to £6 10s. for bars, £6 10s. to £6 12s. 6d. for hoops, and £8 5s. to £8 10s. for sheets. For engineering work new inquiries are reported to be coming in only to a limited extent, but the various shops generally throughout the district are still well employed.

The coal trade continues dull, but it can scarcely be said that the business doing is below the average for the season of the year, and although there is still a good deal of pressure to sell at low prices, there is a somewhat more hopeful tone in the market as regards the future. Prices are looked upon as having got to their lowest point, and it is thought that it would require only a very little improvement in the demand to give a stronger tone to the market. At the pit mouth prices average about 8s. to 8s. 6d. for best coals, 6s. to 6s. 6d. for seconds, 4s. 9d. to 5s. 6d. for common, 3s. 9d. to 4s. 6d. for burgy, and 3s. to 3s. 9d. for slack.

Shipping is quiet, and the scarcity of vessels still seriously interferes with trade. Steam coal delivered either at the high level, Liverpool, or at the Garston Docks can be bought at 6s. 6d. to 7s. per ton, and seconds house coal at 8s. 3d. to 8s. 6d.

Coke is in tolerably good demand at about 9s. for common up to 11s. and 12s. per ton for the best qualities at the ovens.

The strike in the St. Helens district against a reduction in wages has commenced, but for the present an informality in the notices of the men has prevented it extending beyond two pits. There is, however, every probability of the whole of the pits owned by Messrs. Richard, Evans, and Co., who employ about 4000 hands, being stopped, and a protracted struggle is expected.

Barrow.—During the past week the hematite pig iron market has shown considerable improvement. The demand continues strong, and is well maintained all round. American buyers are buying largely, and are feeling their way to placing orders of some magnitude in the hands of smelters before prices get much higher. The demand is very large, and the output at the furnaces is insufficient to meet it, but efforts are being put forth at some works to increase it. As a consequence of the brisk demand, stocks are being freely used up to meet present requirements. Prices have advanced sixpence per ton all round, and within the next few days another advance may be confidently looked for. No. 1 Bessemer is quoted at 57s. 6d. per ton; No. 2, 56s. 6d.; No. 3 forge, 55s. 6d.; net, f.o.b., West Coast ports delivery over the next three months. The gradual recovery of the iron trade from the somewhat stagnant position it occupied some little time ago has inspired confidence on the part of both buyers and sellers, and they regard the present position of the pig iron market as reassuring and satisfactory. Steel is in good request, and several large orders have lately been booked, principally in steel rails Other qualities, however, find a good market. Prices are unchanged, but it is quite evident that the present demand must be the means of bringing about an advance before very long. Iron shipbuilders are laying down one or two keels. Engineers, ironfounders, are in steady employment. Iron ore in firm request at late quotations—13s. 6d. to 14s. per ton on trucks at mines. Shipping steadily employed.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

The Board of Trade returns disclose some interesting facts in reference to Sheffield trading during the last six months. In hardware and cutlery, Russia, which fell away in 1881 to £26,220, is now up again to £36,210; Germany has advanced from £86,874 to £94,663; Holland from £37,342 to £40,759; Spain and Canaries from £65,879 to £71,641; United States, from £225,469 to £239,623; Brazil, from £128,133 to £134,028; British North America, from £90,350 to £114,199; British Possessions in South Africa, from £94,662 to £114,209; Australia, from £231,330 to £376,642; while "other countries," lumped together, show an increase of from £412,265 to £467,463. The total result comes out thus for the six months of the two years:—June, 1881, £1,788,896; June, 1882, £2,031,172.

France, British India, the Argentine Republic, and the foreign West Indies, are the only markets which show a falling-off. In France, the operation of the new tariff for the short time it has been the law is already telling severely, our exports of hardware and cutlery having diminished from £19,962 for June, 1881, to £14,942 last June—a falling-off equal to £5000 in a month. On the month, Germany, Spain and Canaries, United States, foreign West Indies, Brazil, Argentine Republic, British Possessions in South Africa, and British India all show a decline, but the gain in the gross is considerable—the value rising from £319,262 for June, 1881, to £352,831 last month.

The bombardment of the Alexandrian forts is being spoken of as a contest between land defences and the most powerful of floating war vessels. This is not quite correct. Not one of the British ships before Alexandria is coated with compound armour, the most powerful protection which any vessel can have. In one or two cases the turrets may have steel-faced plates; but with these exceptions, the ships are, literally, ironclads. The new ships which are being built for the British Navy are armoured with compound plates after the "Ellis" and "Wilson" type, and the real defensive strength of the British Navy is not, and cannot be reached, till the iron armour gives place to the steel faced plates. Messrs. John Brown and Co., of the Atlas Works, are at present exceptionally busy on work for her Majesty's Government and for other Powers. Among the orders at present on hand are the plates for the monitor Collingwood, one of which was tested at Portsmouth on Tuesday with the most satisfactory results.

The whole of the miners employed at the Manston Collieries, belonging to the Manston Coal Company, numbering about 500, have received a fortnight's notice to leave work. Owing to the depressed state of trade and the low price of coal, it is understood that the pits are to be closed for the present. A clause in the lease entitles the company to set down if the collieries cannot be worked at a profit.

The Yorkshire Engine Company, which has been doing some profitable work of late, will probably become merged in a new concern in a short time. The Agricultural and General Engineering Company, Limited, proposes to purchase the works, and the terms agreed upon seem very reasonable for the new comers. They are to have for £60,000 what cost the Yorkshire Engine Company's shareholders over £160,000. The works are mainly to be used for the production of Darby's broadside steam digger and for general engineering business. The company invite applications for 6000 £10 shares to effect this purchase, and intimate their intention of having their chief manufactory at Sheffield, using the London premises more as a depôt. I hear the proposal very favourably spoken of, and the success of Darby's digger is, of course, already assured.

An immense landslip near Crich, in Derbyshire, is at present exciting the attention of experts. A limestone cliff, in which rents and rifts had been observed for some time, gave way last Thursday, wrecking several houses, lifting the turnpike road out of its place, and carrying it several yards into the adjoining fields. Hundreds of thousands of tons of material have fallen. The Clay Cross Company, who have their limestone quarry near, have been excavating on the other side of the hill, but it is not believed that their operations have caused the land to slip, and the subject is now being carefully considered. Fortunately the people were got out of the houses without injury.

Major Marindin, of the Board of Trade, examined on Monday the works in connection with the extension of the Barnsley Coal Railway, some seven or eight miles long, which has been completed for the purpose of providing the Manchester, Sheffield, and Lincolnshire Railway Company with a more direct route from Manchester to Leeds. The company intends to run eight through trains daily, which will effect a saving of about twenty miles in distance. The extension is secured by means of a loop-line near Stairfoot with the Manchester, Sheffield, and Lincolnshire Railway, and by extending the coal railway from Lee-lane, in the parish of Royston, to Nostell, where it joins the West Riding and Grimsby line, and thence proceeds by way of Wakefield to Leeds.

The closing of Alexandria will limit the supplies of ivory, as a large quantity comes to the London and Liverpool sales by that port and the Suez Canal. A remarkable instance of advance in values is furnished by Manilla mother-o'-pearl shells. At Tuesday's London sales, average quality of pearl shells readily sold at £11 17s. 6d. per cwt. The same quality was sold at the May sales at £9 5s. per cwt., and in the beginning of the year at £8, showing an advance of close upon 50 per cent. in six months on this class of material, which is so largely used by the manufacturers of cutlery

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

The Scotch iron trade continues in a satisfactory condition, almost every branch of business exhibiting favourable results. In the warrant market a good business has been done, principally, however, between brokers. The fluctuations in prices have not been very large. The market was very little influenced by the Board of Trade returns, which, although favourable as regards the trade generally, did not show any marked increase in connection with the iron industry. On Tuesday forenoon when the news arrived of the bombardment of Alexandria, the market became somewhat easier in consequence of a number of holders thinking it safer to sell out their warrants. The feeling, however, improved in the afternoon, and as the holidays were just at hand the market assumed a quiet but steady aspect. Makers of pig iron have been doing a very good business, the home demand continuing on an extensive scale, notwithstanding that the arrivals of pig iron from Middlesbrough are increasing. The foreign department of the trade is considered good for the season, although the past week's shipments were considerably smaller than those of the preceding week. A further slight decrease has to be noted in the stock in Messrs. Connal and Co.'s stores.

Business was done in the warrant market on Friday forenoon at 49s. 4½d. to 49s. 3d. and 49s. 4d. cash, and 49s. 3d. to 49s. 5d. and again 49s. 6d. one month, the afternoon quotations being 49s. 4d. to 49s. 6d. cash, and 49s. 6d. to 49s. 7½d. one month. On Monday forenoon business was done at 49s. 4½d. to 49s. 6d. and back to 49s. 4½d. cash, and 49s. 6d. to 49s. 7d. one month; the afternoon's transactions were at 49s. 4½d. cash, and 49s. 6d. to 49s. 6½d. one month. On Tuesday forenoon business was done at 49s. 3½d. to 49s. 1½d. cash, and 49s. 5d. to 49s. 3d. one month, the afternoon's quotations being 49s. 2½d. to 49s. 3d. cash. The market was strong on Wednesday at 49s. 5½d. to 49s. 11½d. cash, 50s. eight days, and 50s. 1d. one month. Business was done to-day—Thursday—up to 50s. 2d. cash and 50s. 4d. one month.

The prices of makers' iron are very firm, and in some cases 6d. per ton higher than last week. The quotations are as follows:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 60s. 6d.; No. 3, 55s.; Coltness, 62s. and 55s. 6d.; Langloan, 60s. 6d. and 55s. 6d.; Summerlee, 58s. 6d. and 52s.; Calder, 59s. and 52s.; Carnbroe, 53s. 6d. and 50s. 6d.; Clyde, 53s. and 50s.; Monkland, 50s. 6d. and 49s.; Quarter, 50s. 6d. and 49s.; Govan, at Broomielaw, 50s. 6d. and 49s.; Shotts, at Leith, 60s. 6d. and 55s. 6d.; Carron, at Grangemouth, 50s.—specially selected 52s. 6d.—and 49s.; Kenneil, at Bo'ness, 49s. 9d. and 48s. 6d.; Glengarnock, at Ardrossan, 53s. and 50s.; Eglinton, 50s. 6d. and 49s. 6d.; Dalmellington, 50s. and 49s. 6d.

The manufactured iron trade is brisk, there being a satisfactory amount of activity at the malleable works, although ship-plates are reported to have been purchased at rather easier terms. Prices of bars are pretty well maintained, and there is a fair demand for boiler-plates at former prices. Founders are still very well employed, and there are one or two very good pipe founding contracts in the market. The various branches of the hardware trade, which have been busy since before the May term, have also been doing very good work this week, and there has been a pressure upon the works generally in order to complete orders before entering upon the summer holidays.

The War Department have forwarded to Glasgow a number of chests of specimen tools, such as are used in connection with the department, in order to give manufacturers in the West of Scotland an opportunity of examining the articles for which they are invited to compete. The tools sent comprise carpenters' tools,

heavy and light, for general army and field service; and plumbers', gasfitters', and tinsmiths' tools, for engineers' service; as also coopers' tools for general service

The principal engineering firms of Edinburgh have granted their men an increase of ½d. an hour, and it is thus expected that the threatened strike will be averted.

The coal trade has been fairly active during the week. At Glasgow the shipments have been above the average, although they do not show quite so well at some of the other Scotch ports, and are upon the whole some 3000 tons less than last week. At the collieries the men have been very busy preparing for the holidays, but the inland demand has not been quite so brisk. Prices are everywhere without alteration.

WALES & ADJOINING COUNTIES.

(From our own Correspondent.)

THE trading community of Cardiff are beginning to take a more lively interest in the Bute Dock question. It is now seen that the proposal of the opposing freighters to construct docks on the Ely or at Barry would naturally tend to divert business from Cardiff. I may add to this that if the Great Western Railway interest should be obtained to this end, this result would be very likely, as the Great Western Railway has more interest west of the Rhondda—the great feeder of Cardiff—than in the Rhondda. A third view of the matter is now under discussion: to form a trust, the same as governs the Swansea Docks; buy the interest of the Marquis of Bute; let the trust have the government, and the Marquis stand landlord's rights and privileges. The easiest solution of the case would be the support of the present Bill, which aims at sweeping away antiquated rights, and instituting rules and regulations which would ensure thorough government and equity.

Under the Rhymney Railway Bill, into which the Taff Vale Railway seek to place two clauses, the Brecon and Merthyr Railway would suffer considerably unless arrangements with Cyfarthfa are continued, or just allowance made. This is a matter which should be vigorously defended.

There has been an *emeute* at Tredegar Ironworks between the Welsh and the Irish. I note it briefly on account of its important bearing on the labour market. The Irish now abound thickly in all the iron districts, and as a rule they work far less than the Welshmen. This riot which arose out of ill-feeling engendered by the conduct of Irish assassins—the Cavendish and Burke tragedy—threatens to drive the Irish out of Wales. Thousands have left already, and only a spark is required to cause a similar riot and exodus from Dowlais.

It is much to be regretted that peaceful labour has had any intrusion of political feeling, or national antagonism, especially as the iron trade is looking up.

In the half-year ending June, Wales has exported a very large quantity of iron and steel. The following are the returns which have just been issued:—From Cardiff, 69,880 tons; from Newport, 93,027 tons; from Swansea, 4485 tons. This shows a gratifying state of trade, and one that should prompt Cyfarthfa and Plymouth to be active in getting in a state of forwardness for co-operation. I hear not only of the large French order noted last week as being in the market, but of an Austrian one for 30,000 tons, and an improvement setting in with regard to American demands. The orders now being placed warrant the belief that we are in for a busy autumn and winter trade.

There is a firm tone prevailing in the coal trade, though some degree of surprise has been expressed that a busier week has not been had. The total shipments from all the Welsh ports last week were 189,746 tons, a slight falling off, but not to an appreciable extent. The fact is, that the coaling ports have been well supplied of late, in expectation of the hostilities which have taken place in Egypt, and no great excess of export need be anticipated, only a steady continuance. Many of our large coalowners at Cardiff are vitally interested in the Egyptian question, Sir George Elliott and Mr. Cory in particular.

Patent fuel continues in good demand, both at Cardiff and Swansea. During the month of June Swansea shipped 22,000 tons. Last week the average was well maintained. The Prince of Wales Dock at Swansea is still in the background as regards anything like a general use. It is now stated that the Midland Railway Company propose to levy 1d. per ton on all coal coming over their system to be shipped at the new dock. If this intention, and a similar one on the part of the Great Western Railway, be carried out, lessened use may be expected.

Some notion of the extent of a Welsh colliery is given by the fact that in the Dinas Pit, where an explosion took place in January, 1879, the bodies of the sufferers are only now being found. Two were found this week.

With reference to the strike now on at Fernhill, the proprietors have proved conclusively that by abstaining from work without having given notice the men on strike are liable to a prosecution.

Small steam coal is in good demand, and large sales have been concluded at 5s. per ton.

The Llangammarch Railway Bill has passed standing orders. This line will open up a good field and develope various mineral and other industries.

THE *Chicago Railway Age* reports that 4990 miles of new American railways were laid during the first half of 1882, making the total mileage over 107,000. This construction is unequalled by that effected in the first half of any year.

THE IRON ORE TRADE IN CUMBERLAND.—Owing to the increased demand for pig iron raisers of iron ore are doing their utmost to increase the output. Around Frogington, Moor Row, and Cleator Moor, boring operations are being carried on with very fair success. The tramways which are being constructed from Lord Leconfield's, St. John's Pit, and for the Carron Company's mines at Jacktrees, in order to facilitate the transit of ore and lessen the cost of carriage, are expected to be ready for working in a short time.

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.

4th July, 1882.

3139. GUIDES, P. Sharp, Aberdeen.
3140. LADDER-TAPES, T. French & J. Monks, M'chester.
3141. FRAMES, M. M. Simmons, D. A. Lowthime, and J. H. Tree, London.
3142. SUBMARINE TELEGRAPH CABLES, G. E. Vaughan.—(*S. Trott and F. A. Hamilton, Nova Scotia.*)
3143. GRAPNELS, G. E. Vaughan.—(*S. Trott and H. Kingsford, Nova Scotia.*)
3144. BARBED WIRE, F. C. Glaser.—(*A. Schniewindt, Germany.*)
3145. RACK PULLEYS, C. Priestland, Birmingham.
3146. SEPARATING PRODUCTS from GASES, W. Ferrie, Calderbank, Lanark.
3147. GLASS GLOBES, R. W. Harris, Paris.
3148. WATERPROOF CLOTHES, A. Sachs, Berlin.
3149. PLOUGHS, T. T. Mallett, Street, Somerset.
3150. DYNAMO MACHINES, R. Werderman, London.
3151. SEWING-MACHINES, F. Wirth.—(*Junker and Ruh, Karlsruhe, Germany.*)
3152. BOOTS, &c., T. Morgan.—(*F. Schmider, Baden.*)
3153. GENERATING GAS, W. F. Browne, London.
3154. MANUFACTURING GAS, W. F. Browne, London.
3155. EVAPORATING LIQUIDS, W. F. Browne, London.
3156. ENGRAVING, H. J. Haddan.—(*J. Earle, U.S.*)
3157. HYDRAULIC MOTOR, G. W. von Nawrocki.—(*F. K. Theis, A Meckel, and L. A. Simons, Germany*)
3158. COOKING FOOD, G. W. von Nawrocki.—(*C. Becker and J. Reunert, Berlin.*)
3159. EXTRACTING GREASE, G. W. von Nawrocki.—(*J Wellstein, Germany.*)
3160. REGULATING DYNAMO-ELECTRIC MACHINES, W. R. Lake.—(*J. Carpentier, Paris.*)
3161. INCANDESCENT LAMPS, A. R. Leask, London.
3162. DRESSING, &c., ORES, F. Wirth.—(*H. Hochstrate, Germany.*)
3163. SPINNING FRAMES, A. Clark.—(*G. Jaquith, U.S.*)
3164. STILL, W. A. Barlow.—(*J. Gäreis, Prussia.*)
3165. EDUCATIONAL GAMES, A. Boult.—(*J. Froin, Paris.*)

5th July, 1882.

3166. HEM-STITCHING, A. Gass, Belfast.
3167. RAILWAY SIGNALLING, D. Knight, Cambridge.
3168. CUTTING STONE, M. Kellow, Penrhyndeudraeth.
3169. NECKTIES, I. Noar, Finsbury.
3170. PAVEMENT LIGHTS, T. G. Webb, Manchester.
3171. GOVERNING ENGINES, W. W. Girdwood, Poplar.
3172. VOLTAIC BATTERIES, J. Imray.—(*P. Joblochkoff, Paris.*)
3173. RECORDING SPEECH, J. Imray.—(*A Gentilli, Leipsic, and L. C. Alexander, Boulogne.*)
3174. HORSESHOES, M. Bauer.—(*J. R. Cancio, U.S.*)
3175. ELECTRICALLY INSULATING, W. F. Bottomley, J. H. Barry, and J. J. Lundy, London.
3176. INSULATING COMPOUNDS, M. Mackay, London.
3177. HORSESHOES, W. R. Lake.—(*F. A. Roe, U.S.*)
3178. BONE HANDLES, W. Lake.—(*A. Estabrook, U.S.*)
3179. SUGAR, E. T. Hughes.—(*E. Wernickenck, Moscow.*)
3180. PROPELLING SHIPS, A. Rickarby, Newcastle.
3181. DYNAMO-ELECTRIC MACHINES, A. Lévy.—(*D. Lachausée, Liege.*)
3182. SECURING MAIL-BAGS, A. M. Clark.—(*T. A. Platt and W. Man, New York, and W. Platt, New Jersey.*)
3183. PREPARING COTTON, A. M. Clark.—(*G. A. Risler, Cernay, Alsace.*)
3184. STEAM ENGINES, A. Clark.—(*W. Goodwin, U.S.*)
3185. VENTILATING ROOMS, J. G. Tongue.—(*H. Wattel, Tourcoing, France.*)

6th July, 1882.

3186. RECOVERING SULPHUR, W. Weldon.—(*M. Schaffner and W. Helbig, Austria.*)
3187. REGULATING SUPPLY of AIR, R. H. Brandon.—(*A. Howatson, Paris.*)
3188. DRIVING BELTS, J. K. Tullis, Glasgow.
3189. SEPARATING PRODUCTS from GASES, W. Ferrie, Calderbank, Lanark.
3190. TELL-TALES, A. Schweitzer & T. Lawrie, London.
3191. BRICKS, W. C. Gibson, Newcastle-on-Tyne.
3192. CUTTING CHEESE, R. Alexander, jun., Edinburgh.
3193. OPENING BOTTLES, J. Parton and D. G. Stansbie, Birmingham.
3194. WEIRS, F. Wiswall and W. Collier, Manchester.
3195. AIR PUMP, L. Bishop, and S. Girling, London.
3196. PLACING WOOL YARNS, W. Greenwood, Halifax.
3197. TENSION COUPLINGS, J. T. Mitchell, Mere.
3198. WALLS, T. N. Sully, Wellington.
3199. CARDBOARD, &c., J. H. Johnson.—(*J. Müller, Switzerland.*)
3200. WHEEL TIRES, A. C. Guerrier, Fulham.
3201. VELOCIPEDES, J. Walker, Coventry.
3202. COMBING WOOL, F. Fairbank and J. Robertshaw, Allerton.
3203. SCRUBBING SHIPS, R. C. A. Allen, Liverpool.
3204. GENERATING, &c., ELECTRIC CURRENTS, W. R. Lake.—(*E. Thomson, New Britain, U.S.*)
3205. MILLING MACHINERY, J. Cadogan, Wexford.
3206. DRYING CROPS, J. L. Norton, London.
3207. CULTIVATING, &c., OYSTERS, W. H. Thompson and C. W. Kitto, London.
3208. SEPARATING HAIR from SKINS, J. T. Tussaud, London.
3209. FANS, C. Clay, Wakefield.
3210. LOOMS, W. Buckley & J. Hollingworth, York.
3211. HEATING WATER, E. Brydges.—(*D. Grove, Berlin.*)

7th July, 1882.

3212. GAS, J. Thomas, Bodmin, and C. Ennor, Oporto.
3213. VALVES, J. Thomas, Bodmin, & C. Ennor, Oporto.
3214. SULPHATE of AMMONIA, J. Coates, London.
3215. SEAT-SHIFTER, W. H. Roberts, Bridgewater.
3216. ORTHO-NITRO-META-METHYL-BENZALDEHYDE, J. Erskine.—(*Farbwerke vorm: Meister, Lucius, and Brüning, Germany.*)
3217. APPLYING ANTI-INDUCTION COVERINGS, G. S. Page.—(*J. M. Stearns, jun., Brooklyn, U.S.*)
3218. CINNAMIC ACID, &c., J. Erskine.—(*Farbwerke vorm: Meister, Lucius, and Brüning, Germany.*)
3219. SUPPORTS for CONDUCTORS, G. S. Page.—(*J. M. Stearns, jun., Brooklyn, U.S.*)
3220. METALLIC WOOL, R H. Woodley, London.
3221. ACCUMULATORS, R. Woodley & H. Joel, London.
3222. OMNIBUSES, &c., H. W. Hart, London.
3223. FILTERING, J. H. Topham, Manchester.
3224. TACK-MAKING, R. Brandon.—(*F. Huré, Paris.*)
3225. CABS, J. Abbott, Bideford.
3226. ELECTRO-MAGNETIC MOTOR, E. Toynbee, Willesden.
3227. BEARINGS, J. V. Hope, Wednesbury, and J. Dickson, Seaforth.
3228. CARTRIDGES, F. Wirth.—(*Pulverfabrik Rottweil Hamburg, Germany.*)
3229. CISTERNS, U. Bromley, G. Crowe, and W. James, Chester.
3230. TRICYCLES, &c., W. T. Shaw, Surbiton, and W. Sydenham, London.
3231. BUNDLING LETTERS, F. A. R. Russell, London.
3232. STAND, J. F. Plücker, Antwerp.
3233. ELECTRIC CLOCKS, J. P. A. Schlaefli, London.
3234. BOTTLES, O. G. Abbott, Huddersfield.
3235. COLLECTORS, J. T. Mitchell, Mere.
3236. ARC LAMPS, F. M. Rogers, London.
3237. TIPPING CARTS, W. Vincent, Arborfield.
3238. TURRET CLOCKS, W. H. Bailey, Salford.

8th July, 1882.

3239. TREATING FABRICS, J. Ashworth, Rochdale.
3240. PLATES for ACCUMULATORS, T. S. Sarney and J. M. Alprovidge, London.
3241. RULING PAPER, E. Barnett, London.
3242. TAPE LADDERS, J. Carr, Manchester.
3243. PRINTING, J. Gibson, Manchester.
3244. INCANDESCENT ELECTRIC LAMPS, T. J. Handford.—(*C. A. Van Cleve, New Jersey, U.S.*)
3245. SEPARATING TAR from AMMONIACAL LIQUOR, J. and R., jun., Dempster, Elland.
3246. BRUSHES, W. H. Baynes, London.
3247. AXLES, H. J. Haddan.—(*E. Mers, Bruxelles.*)
3248. CRANES, M. Brooks and J. Spencer, Lancaster.
3249. LOOMS, C. Thompson, Halifax.
3250. WORKING FURNACES, J. Burch, Stockport, and R. Allen, Manchester.
3251. OVENS, A. M. Clark.—(*J. E. J. Mounié, Paris.*)
3252. BOTTLES, H. Codd, London, and D. Rylands, Barnsley.
3253. SMELTING, R. Parry, Hoole.
3254. KNIFE-CLEANING, G. Kent, London.
3255. INCANSDECENT ELECTRIC LAMPS, J. H. Gardiner, London.

10th July, 1882.

3256. ROLLING MILLS, C. A. Snow.—(*C. B. Sill, U.S.*)
3257. STOPPERS, A. T. King, Nottingham.
3258. HALF-CIRCLE GARTER, J. Parry, London.
3259. PICKERS, E. Booth, Manchester.
3260. STAIR-RODS, I. C. Morris, Manchester.
3261. SPINNING, &c., J. Myers and B. Berry, Bradford.
3262. DYEING, E. Heppenstall, Huddersfield.
3263. "BLOCKS," E. Davies, London.
3264. TRANSPORTING LIVE FISH, E. L. Sheldon, London.
3265. EMERY WHEELS, R. R. Gubbins, New Cross.
3266. PARING CURLS of HAT-BRIMS, J. Cree, Denton.
3267. HEELS, J. J. Gascoigne, Leicester.
3268. PHOTOGRAPHIC CAMERAS, W. F. Stanley, London.
3269. FILLET CARD SETTING, W. and E. Blackburn, Cleckheaton, York.
3270. ROTARY ENGINES, J., F. W., and W. W. Brierley, Kensal Green.
3271. ELECTRICAL METERS, T. J. Handford.—(*T. A. Edison, New Jersey, U.S.*)
3272. SHOOTING SEATS, H. F. Beaumont, Huddersfield.
3273. MAGNETS, J. S. Fairfax, London.

Inventions Protected for Six Months on Deposit of Complete Specifications.

3132. VALVES, A. M. Clark, London.—A communication from W. S. Phelps, U.S., and W. Hofford, Canada.—*3rd July*, 1882.
3133. MOTIVE POWER, J. Jeffs, Islington.—*3rd July*, 1882.
3153. USING GAS, W. F. Browne, London.—*4th July*, 1882.
3154. MANUFACTURING GAS, W. F. Browne, London.—*4th July*, 1882.
3155. EVAPORATING, W. F. Browne, London.—*4th July*, 1882.
3156. ENGRAVING, H. J. Haddan, Kensington. — A communication from J. Earle, Delaware, U.S.—*4th July*, 1882.
3178. BONE HANDLES, W. R. Lake, London.—A communication from A. C. Estabrook, Florence, U.S.—*5th July*, 1882.
3187. REGULATING SUPPLY of AIR, R. H. Brandon, Paris.—A communication from A. Howatson, Paris.—*6th July*, 1882.

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

2746. Looms, W. Morgan-Brown, London.—*5th July*, 1879.
2880. GENERATING STEAM, H. E. Newton, London.—*15th July*, 1879.
2636. DIES, J. Hamblet, West Bromwich.—*30th June*, 1879.
2759. SUPPORTING RAILS, C. Markham, Staveley.—*7th July*, 1879.
2851. PARALLEL VICES, &c., C. Neil, Sheffield.—*12th July*, 1879.
2886. SPRING TIP VANS, J. Watling, London.—*16th July*, 1879.
2792. PISTONS, &c., T. Melling, Liverpool.—*9th July*, 1879.
2883. MAKING ICE, F. N. Mackay, Liverpool.—*16th July*, 1879.
2939. PURIFYING ALKALINE SOLUTIONS, E. Carey, H. Gaskell, jun., & F. Hurter, Widnes.—*18th July*, 1879.
2785. RAILWAY CROSSINGS, J. S. Williams, Glasgow.—*8th July*, 1879.
2806. PERMANENT WAY, S. Nicholls, London.—*9th July*, 1879.
2845. SELF-ACTING MULES, J. Chisholm, Oldham.—*12th July*, 1879.
2848. BREECH-LOADING FIRE-ARMS, J. MacNaughton.—*12th July*, 1879.
2798. REFLECTORS, J. Westaway, Plymouth.—*9th July*, 1879.
2804. HAIR-CLIPPERS, L. Sharp, Providence, U.S.—*9th July*, 1879.

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

2405. PNEUMATIC BRAKE, G. Westinghouse, jun., London.—*3rd July*, 1875.
2434. SIGNALLING, W. Stroudley and S. Rusbridge, Brighton.—*6th July*, 1875.
2460. COMBINING METALLIC SULPHIDES, &c., T. Griffiths, London, and W. P. Thompson, Liverpool.—*8th July*, 1875.
2551. FILLING, &c., BOTTLES, A. Macdonell, Newry.—*16th July*, 1875.
2639. GAS METERS, G. Goldsmith, Leicester.—*24th July*, 1879.
2478. WINDING APPARATUS, A. M. Clark, London.—*9th July*, 1875.

Notices of Intention to Proceed with Applications.

Last day for filing opposition 28th July, 1882.

1008. LOOMS, T. Singleton, Darwen.—*2nd March*, 1882.
1020. TRANSMITTING SOUND, J. Rapieff, London.—*3rd March*, 1882.
1045. FOUNTAIN PENS, J. D. Carter, London.—*4th March*, 1882.
1049. UMBRELLA SLIDES, A. C. Henderson, London.—A communication from C. Grataloup and J. B. Leymarie.—*4th March*, 1882.
1053. DISENGAGING SHIPS' BOATS, M. E. T. Bulow, Hamburg.—*4th March*, 1882.
1059. KEYS of VIOLINS, &c., J. Stuttaford, New Barnet.—*4th March*, 1882.
1067. SIGNALLING, E. Callot, St. Denis.—*6th March*, 1882.
1068. COPYING PRESSES, W. J. Brewer and J. R. Meihé, London.—*6th March*, 1882.
1070. IMITATING NIELLO, F. Wirth, Frankfort-on-the-Main.—A com. from F. Beck.—*6th March*, 1882.
1071. FOLDING CHAIRS, C. D. Abel, London.—A communication from C. Timme.—*6th March*, 1882.
1076. SMITHS' HEARTHS, P. Everitt, London. — *6th March*, 1882.
1087. FELTING HATS, R. Wallwork, Manchester.—*7th March*, 1882.
1133. BOTTLE STOPPERS, A. Clark, London.—A communication from G. D. Dows.—*8th March*, 1882.
1151. CASH COUNTERS, C. D. Abel, London.—A communication from F. Witte.—*9th March*, 1882.
1156. SODA and POTASH, J. Mactear, Glasgow.—*10th March*, 1882.
1162. ELECTRIC CURRENTS, W. R. Lake, London.—A communication from H. Maxim.—*10th March*, 1882.
1163. ELECTRIC LIGHT, W. R. Lake, London.—A communication from E. Weston.—*10th March*, 1882.
1206. STRAINERS, R. Laurie, Darley Paper Mills.—*13th March*, 1882.
1320. SMALL-ARMS, W. M. Scott, Birmingham.—*18th March*, 1882.
1358. CUTTING MORTISE HOLES, J. and W. Hall, Nottingham.—*21st March*, 1882.
1550. FILTERING, A. Reddie, London.—A com. from L. Hélie and C. M. de la Vieuville.—*30th Mach*, 1882.
1586. BLEACHING JUTE, T. G. Young, Kelly.—*1st April*, 1882.
1745. STEAM BOILERS, R. Brandon, Paris.—A communication from C. Gamper.—*12th April*, 1882.
1816. VEGETABLE FABRICS, C. D. Abel, London.—A com. from E. Frémy & V. Urbain.—*17th April*, 1882.
2236. ALCOHOLIC BEVERAGE, J. H. Loder, Holland.—*11th May*, 1882.
2249. REELS, A. J. Boult, London.—A communication from A. Descamps.—*12th May*, 1882.
2304. WASHING DISHES, &c., R. Bramwell, Bayswater.—*16th May*, 1882.
2366. PREVENTING EXPLOSIONS, T. Sheehan, London.—*19th May*, 1882.
2511. CARRIAGES, &c., S. Andrews, Cardiff.—*26th May*, 1882.
2548. FURNACES, J. A. MacLellan, Glasgow.—*30th May*, 1882.
2562. ROTARY MOTION, R. F. Heney, London.—*31st May*, 1881.
2576. COMPRESSING AIR, W. Darling and R. Sellers, Keighley.—*31st May*, 1882.
2673. GAS, W. R. Lake, London.—A communication from A. Binnie.—*7th June*, 1882.
2728. WASHING HOUSES, M. Cockburn, Falkirk.—*10th June*, 1882.
2752. ELECTRIC LAMPS, J. Lane, Fulham.—*12th June*, 1882.
2767. GRINDING MILLS, P. M. Justice, London.—A communication from M. B. Church.—*13th June*, 1882.
2768. CARRIAGES, P. M. Justice, London.—A communication from M. B. Church.—*13th June*, 1882.
2772. SLABS, R. W. Hitchins, Stoke Newington.—*13th June*, 1882.
2794. BOILERS, C. Hulsberg, Finsbury.—*14th June*, 1882.
2815. COOLING, &c., AIR, A. B. Brown, Edinburgh.—*15th June*, 1882.
2838. RING SPINNING, G. Perkins, G. Wimpenny, and J. Evans, Manchester.—*16th June*, 1882.
2839. INFANTS' FEEDING BOTTLES, C. P. D. Chittenden, Lee.—*16th June*, 1882.
2848. ENGINES, &c., T. H. Ward, Tipton.—*16th June*, 1882.
3132. VALVES, A. M. Clark, London.—A communication from W. Phelps & W. Hofford.—*3rd July*, 1882.

Last day for filing opposition, 1st August, 1882.

1078. STEAM GENERATORS, C. Kingsford, London.—*6th March*, 1882.
1093. MARKING OUT LAWN TENNIS COURTS, R. W. Ralph and W. S. Underhill, Newport.—*7th March*, 1882.
1095. FILTER PRESSES, W. G. Strype, Wicklow.—*7th March*, 1882.
1096. ACTUATING CAPSTANS, W. L. Williams, London.—*7th March*, 1882.
1104. LASTING BOOTS, W. R. Lake, London.—A communication from G. W. Copeland.—*7th March*, 1882.
1109. FIXING SHEETS of ZINC, &c., T. W. Helliwell, Brighouse.—*7th March*, 1882.
1114. BICYCLE LAMPS, W. Skaife, Limehouse.—*8th March*, 1882.
1117. NAPPED HATS, G. Atherton, Stockport.—A communication from G. Yule.—*8th March*, 1882.
1146. PIANOFORTES, A. Squire, London.—*9th March*, 1882.
1170. FLOATING ANCHORS, W. M. Bullivant, London.—*10th March*, 1882.
1172. ELECTRIC LAMPS, J. Wauthier, London.—*10th March*, 1882.
1177. TELEPHONES, J. D. Husbands, London.—*10th March*, 1882.
1184. TREATING RICE, G. P. Witt, London. — *11th March*, 1882.
1186. HEELS, W. E. Gedge, London.—A communication from L. Dourdet.—*11th March*, 1882.
1215. LOOMS, J. and F. Leeming and R. Wilkinson, Bradford.—*13th March*, 1882.
1237. LIGHT and HEAT, A. Reckenzaun, Leytonstone, and J. H. Redfield, London.—*14th March*, 1882.
1349. RAILWAY SIGNALS, J. Livesey, Blackburn, and S. Whitehall and R. Becconsall, Summerseat.—*20th March*, 1882.
1422. UMBRELLAS, J. Minière, Paris.—*24th March*, 1882.
1574. ELECTRIC CURRENTS, W. R. Lake, London.—A communication from J. Moser.—*31st March*, 1882.
1696. FISHING BAIT, M. Carswell, Glasgow.—*8th April*, 1882.
1946. SECONDARY BATTERIES, C. V. Boys, Wing.—*25th April*, 1882.
2074. TRANSMITTING HEAT, W. and J. Beesley, Barrow-in-Furness.—*2nd May*, 1882.
2094. PREPARING PRESERVES, V. Manuel, Brixton.—*4th May*, 1882.
2116. VENTILATORS, A. W. Kershaw, Lancaster.—*5th May*, 1882.
2290. WINDING YARN, B. M. Knox, Kilbirnie.—*16th May*, 1882.
2435. SIGHTING ORDNANCE, J. H. Johnson, London.—A communication from A. Deport.—*23rd May*, 1882.
2566. WEAVING CLOTH, D. A. Guille, London.—*31st May*, 1882.
2641. FIRE ALARMS, A. W. Rose, London.—*5th June*, 1882.
2647. METAL TUBES, J. Robertson, Govan.—*6th June*, 1882.
2729. STEEL INGOTS, I. Beardmore, Glasgow.—*10th June*, 1882.
2730. TREATING WASTE LIME, G. R. Hislop, Paisley.—*10th June*, 1882.
2783. DRESSING STONE, H. J. Haddan, Kensington.—A communication from A. McDonald.—*13th June*, 1882.
2799. SPINNING FIBRES, S. Tweedale, Accrington.—*14th June*, 1882.
2851. FURNACES, J. Mason, Witney.—*16th June*, 1882.
2864. BLEACHING, E. de Pass, London.—A communication from G. D. Davis.—*17th June*, 1882.
2870. CALORIC ENGINE, A. M. Clark, London.—A communication from J. Schweizer.—*17th June*, 1882.
2898. ELECTRIC LAMPS, A. Swan, Gateshead.—*19th June*, 1882.
2907. ELECTRIC TELEPHONY, J. G. Lorrain, London.—A communication from A. Dunand.—*20th June*, 1882.
2988. HARNESS, W. Powell, Merthyr Tydvil.—*23rd June*, 1882.
2990. ELECTRIC CURRENTS, J. H. Johnson, London.—A com. from La Compagnie Electrique.—*23rd June*, 1882.
3002. DYNAMO-ELECTRIC MACHINES, P. Jensen, London.—A communication from D. A. Schuyler and F. Goodyear.—*24th June*, 1882.
3100. SEWING CARPETS, W. R. Lake, London.—A communication from A. Neustadt.—*30th June*, 1882.
3178. TOOTH-BRUSH HANDLES, W. R. Lake, London.—A communication from A. Estabrook.—*5th July*, 1882.

Patents Sealed.

(List of Letters Patent which passed the Great Seal on the 7th July, 1882.)

89. LOCKWASHER, T. H. Drew, Walsall.—*7th January*, 1882.
117. CAMBER, N. Ager, London.—*9th January*, 1882.
128. ARMY TRENCHING TOOL, A. H. Storey, Wandsworth.—*10th January*, 1882.
137. TIP WAGONS, J. W. Glover, Warwick.—*10th January*, 1882.
139. SIGNALLING, A. H. Perry, Croydon, and E. J. Houghton, Peckham.—*10th January*, 1882.
144. SECONDARY BATTERIES, H. J. Haddan, Kensington.—*11th January*, 1882.
146. PRINTING MACHINES, G. Newsum, Leeds.—*11th January*, 1882.
151. BRANDING CORKS, C. J. Leclere, Paris.—*11th January*, 1882.

222. TABLE FOUNTAIN, C. H. and C. Kessell, Southwark.—16*th January*, 1882.
224. ELECTRIC LIGHTING, W. R. Lake, London.—16*th January*, 1882.
234. DYNAMO-ELECTRIC MACHINES, W. R. Lake, London.—17*th January*, 1882.
254. OPERATING BRAKES, W. Wakefield, Dublin.—18*th January*, 1882.
339. ELECTRIC LAMPS, E. de Pass, London. — 23*rd January*, 1882.
346. ELECTRIC LAMPS, R. E. B. Crompton, London.—24*th January*, 1882.
357. FASTENINGS for NECKTIES, J. Hinks, T. Hooper, and F. R. Baker, Birmingham.—24*th January*, 1882.
415. VELOCIPEDES, W. Hillman, Coventry.—27*th January*, 1882.
417. GAS ENGINES, S. Withers, Torquay.—27*th January*, 1882.
418. LATHES, J. Dewrance, London.—27*th January*, 1882.
446. COFFERDAMS, C. J. Fox, Birkenhead. — 28*th January*, 1882.
539. METALLIC BEDSTEADS, J. Taunton and G. Aston, Birmingham.—3*rd February*, 1882.
544. CUTTING BRICKS, G. Otway, Brixton.—4*th February*, 1882.
574. PREVENTING INCRUSTATION, J. Pover, Liverpool. —6*th February*, 1882.
617. SMALL-ARMS, &c., W. M. Scott and T. Baker, Birmingham.—8*th February*, 1882.
736. PROPELLING TORPEDOES, J. H. Johnson, London. —15*th February*, 1882.
744. SOCKET BOLTS, W. Randle, Birmingham.—15*th February*, 1882.
780. ENGINE GOVERNORS, D. Greig and M. Eyth, Leeds.—17*th February*, 1882.
842. ASCERTAINING the VOLUME of GAS, A. G. V. Harcourt, Oxford.—21*st February*, 1882.
863. DRAWING in WARP THREADS, J. H. Johnson, London.—22*nd February*, 1882.
868. TELL-TALE, M. Levy, Knighton, and F. Lowe, Aylestone Park.—22*nd February*, 1882.
907. PENDULUM MOTOR, W. R. Lake, London.—24*th February*, 1882.
1518. PROJECTILES, W. Naylor, Penistone. — 29*th March*, 1882.
1637. BEARINGS, J. H. Johnson, London.—4*th April*, 1882.
1668. SUBMARINE TORPEDOES, W. N. Hutchinson, Wellesbourne.—6*th April*, 1882.
1815. AUTOMATIC OBTURATOR, L. A. Groth, London.—17*th April*, 1882.
1944. RAISING SHIPS, &c., W. L. Wise, Westminster.—24*th April*, 1882.
1966. PREVENTING SMOKE, W. Begg, Sale.—26*th April*, 1882.
2010. SHOES, D., P., and N. Fraser, Arbroath.—28*th April*, 1882.
2016. GLOVE FASTENERS, &c., W. J. Walden, Kingsland.—28*th April*, 1882.
2075. CALORIC ENGINES, J. Buckett, Southwark.—2*nd May*, 1882.

(*List of Letters Patent which passed the Great Seal on 11th July, the* 1882.)

5496. ROVING FRAMES, J. Cryer, Dukinfield. — 15*th December*, 1881.
77. MOULDING CEMENT, H. Reid, London.—6*th January*, 1882.
166. INDICATING SPEED, L. Smith, Westminster.—12*th January*, 1882.
168. LUBRICANT, T. G. Alcock, Manchester, and J. Johnson, Stretford.—12*th January*, 1882.
169. ELECTRO-MOTORS, &c., H. S. Raison, Bayswater.—12*th January*, 1882.
171. LOOMS, C. Turner, Colne.—12*th January*, 1882.
178. SIGNALLING, C. E. Spagnoletti, London.—12*th January*, 1882.
181. VELOCIPEDES, G. Moss, London.—13*th January*, 1882.
186. COKE, H. J. Haddan, Kensington.—13*th January*, 1882.
195. WORKING WIRE ROPES, G. Cradock and L. Gooder, Wakefield.—13*th January*, 1882.
198. ELECTRIC BLOCK SIGNALS, J. Radcliffe, Retford. —13*th January*, 1882.
206. WIRE NET, F. Wirth, Frankfort-on-the-Main.—14*th January*, 1882.
239. COMPOUND, F. Wirth, Frankfort-on-the-Main.—17*th January*, 1882.
240. CIGARETTES, W. H. Beck, London.—17*th January*, 1882.
246. PLOUGHS, J. Hornsby, Lincoln, and I. Trolley, Spittlegate.—17*th January*, 1882.
252. SECONDARY BATTERIES, H. H. Lake, London.—18*th January*, 1882.
263. THREE-LEGGED IRON POTS, D. Cowan, Stirling.—19*th January*, 1882.
264. ASCERTAINING DEPTH of LIQUIDS, T. Bassnett, Liverpool.—19*th January*, 1882.
285. CARRIAGE LAMPS, W. Howes and W. Burley, Birmingham.—19*th January*, 1882.
288. BLEACHING and DYEING, J. Auchinvole, Glasgow. —20*th January*, 1882.
309. BOXES, H. Stevenson, Manchester.—21*st January*, 1882.
312. SPINDLES, W. R. Lake, London.—21*st January*, 1882.
319. SECONDARY BATTERIES, J. S. Sellon, London.—21*st January*, 1882.
327. BREECH-LOADERS, S., R., and W. Trulock, Dublin. —23*rd January*, 1882.
411. SEWERAGE GULLIES, C. Pieper, Berlin.—27*th January*, 1882.
413. PROTECTING ROOFS, B. L. Thomson, London.—27*th January*, 1882.
435. GUN WADS, H. E. Newton, London.—28*th January*, 1882.
477. SPRINGS, H. J. Haddan, Kensington. — 31*st January*, 1882.
517. BICYCLE SADDLE, W. R. Lake, London.—2*nd February*, 1882.
559. PRINTING TELEGRAPH, W. R. Lake, London.—4*th February*, 1882.
598. BREAD, A. M. Clark, London.—7*th February*, 1882.
633. ANTI-CORROSIVE PAINT, A. Riegelmann, Prussia. —9*th February*, 1882.
665. INJECTING APPARATUS, H. A. Bonneville, London. —11*th February*, 1882.
696. TREATING METALS, A. M. Clark. London.—13*th February*, 1882.
740. ELECTRIC LAMPS, A. M. Clark, London.—15*th February*, 1882.
813. CONNECTING APPARATUS, E. J. Evans, Sudbury.—20*th February*, 1882.
1032. SWIMMING, C. D. Abel, London.—3*rd March*, 1882.
1100. PIANOFORTES, J. Ainsworth, Brinscall.—7*th March*, 1882.
1527. RAILWAY SIGNALLING, H. Morris, Manchester.—29*th March*, 1882.
1529. ATTACHING NON-CONDUCTORS, T. and J. Brooke, Sheffield.—29*th March*, 1882.
1633. DRIVING GEAR, H. Clegg, Accrington.—4*th April*, 1882.
1728. GLYCERINE, B. J. Young, Manchester.—12*th April*, 1882.
1988. VALVE, &c., E. H. Greeven, London.—27*th April*, 1882.
2223. CAR COUPLINGS, H. J. Haddan, Kensington.—11*th May*, 1882.
2325. BOOTS and SHOES, P. M. Justice, London.—17*th May*, 1882.

List of Specifications published during the week ending July 8th, 1882.

4377, 2d.; 4924, 1s. 2d.; 4977, 4d.; 5012, 6d.; 5063, 6d.; 5064, 6d.; 5170, 6d.; 5201, 1s.; 5260, 6d.; 5261, 6d.; 5295, 6d.; 5300, 2d.; 5301, 2d.; 5303, 2d.; 5304, 2d.; 5306, 2d.; 5308, 2d.; 5311, 6d.; 5313, 6d.; 5314, 2d.; 5319, 6d.; 5317, 6d.; 5318, 2d.; 5319, 2d.; 5322, 2d.; 5324, 2d.; 5325, 6d.; 5327, 4d.; 5329, 6d.; 5330, 6d.; 5331, 8d.; 5332, 6d.; 5333, 2d.; 5334, 6d.; 5335, 6d.; 5336, 2d.; 5338, 6d.; 5340, 6d.; 5341, 2d.; 5342, 6d.; 5345, 6d.; 5347, 8d.; 5349, 2d.; 5350, 8d.; 5352, 6d.; 5353, 6d.; 5354, 6d.; 5355, 6d.; 5356, 2d.; 5257, 6d.; 5359, 6d.; 5360, 2d.; 5361, 1s. 4d.; 5362, 2d.; 5363, 2d.; 5364, 2d.; 5365, 6d.; 5366, 4d.; 5368, 2d.; 5370, 2d.; 5372, 8d.; 5373, 6d.; 5374, 2d.; 5375, 10d.; 5376, 6d.; 5377, 8d.; 5378, 1s.; 5380, 6d.; 5381, 6d.; 5382, 6d.; 5383, 2d.; 5384, 2d.; 5385, 6d.; 5386, 6d.; 5388, 6d.; 5389, 4d.; 5390, 6d.; 5391, 6d.; 5392, 2d.; 5394, 2d.; 5395, 2d.; 5398, 4d.; 5399, 6d.; 5403, 2d.; 5405, 2d.; 5406, 2d.; 5407, 2d.; 5409, 6d.; 5410, 4d.; 5411, 6d.; 5412, 2d.; 5413, 2d.; 5414, 2d.; 5415, 2d.; 5416, 2d.; 5418, 6d.; 5421, 6d.; 5422, 2d.; 5427, 4d.; 5429, 4d.; 5439, 4d.; 5447, 6d.; 5468, 4d.; 5478, 6d.; 5523, 6d.; 5563, 8d.; 39, 2d.; 44, 2d.; 304, 4d.; 627, 2d.; 660, 4d.; 902, 4d.; 912, 6d.; 1264, 6d.; 1293, 4d.; 1708, 4d.; 1738, 6d.; 1840, 6d.

*** 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.*

4377. CLUTCH GRIPPING OR RATCHET MECHANISM FOR PORTABLE FORGES, &c., *J. Hardinge, Westminster.* —8*th October*, 1881.—(*Not proceeded with.*) 2*d.*

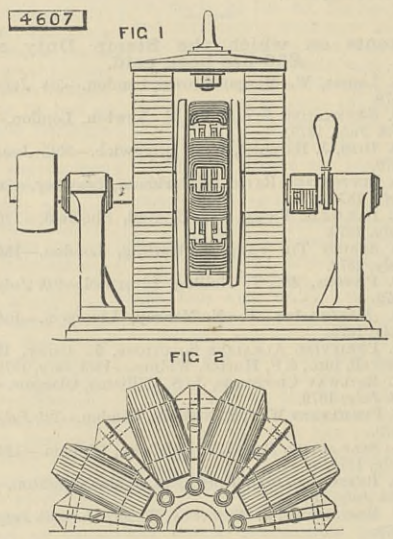
This relates to a clutch ratchet or gripping apparatus whereby a reciprocating action can be converted into a rotary motion, and it consists in casting recesses in a clutch box at suitable angles to receive one or more loose pieces of metal of wedge-shape, and which act as gripping or actuating catches by dropping into, a toothed pinion working loosely on a spindle inside the box.

4592. IMPROVEMENTS IN APPARATUS FOR GENERATING ELECTRICITY AND FOR THE PRODUCTION OF ELECTRO-MOTIVE POWER, PARTS OF WHICH IMPROVEMENTS ARE APPLICABLE TO OTHER PURPOSES, *A. Millar, Glasgow.*—20*th October*, 1881. 8*d.*

This relates to an invention for enabling electric currents to be produced with less expenditure of mechanical power than heretofore, and to provide against loss of current in transmission through wires. The inventor claims the construction of a magneto-electric machine, the electro-magnets of which are surrounded with water to prevent heat; also the insulation of the wires in their coils by the process of "japanning," &c.

4607. IMPROVEMENTS IN MAGNETO-ELECTRIC MACHINES, *H. F. Joel, Dalston.*—21*st October*, 1881. 6*d.*

This invention consists in structural improvements in magneto machines constructed on the Paccinnotti principle. Fig. 1 shows a side elevation, and Fig. 2 gives details of the armature. There are four upright field electro-magnets, arranged in pairs, with the wire so coiled as to make the north and south poles of each pair in the centre of the magnets and opposite to one another. The armature is constructed in eight or more—preferably nine—distinct sections, of which the iron cores are made of small plates joined together, so as to alternately overlap, and when fitted they form two separate iron wheels of flat surface. Each of these sections is separately wound with insulated



wire, and when fitted are attached to radial spokes with special iron cheeks. These cheeks bind the sections together and make a complete ring armature. The outer faces of the cheeks are grooved for better access of air. The commutator is constructed of separate pieces of metal of step shape, with their centres of narrow width, which fit into grooves cut in a ring of insulating material. Other improvements are also described and claimed.

4654. IMPROVEMENTS IN AND CONNECTED WITH INCANDESCENT ELECTRIC LAMPS, *G. G. André, Dorking.*—24*th October*, 1881. 6*d.*

The inventor uses vegetable fibre, such as rattan, for his carbons, and immerses it in a mixture of one part nitric to four parts sulphuric acid, for from twenty to thirty minutes. The nitro-cellulose thus produced is then washed and immersed in a solution of nitro-cellulose in ether or alcohol, where it is allowed to remain until it assumes a semi-dissolved state; it is then removed, subjected to pressure, and cut to the shape required; it is then carbonised and the pores filled up by heating in a vessel containing hydro-carbon gas, or by other means. The carbon is then fixed in a glass globe to platinum wires, either by clamps in the ordinary way or by other methods, and the globe exhausted. The inventor claims the method of preparing the carbons, connecting them to the wires, and a method of procuring a vacuum in the glass globe by means of a column of mercury forced into it.

4780. IMPROVEMENTS IN INSULATING ELECTRIC CONDUCTORS, &c., AND IN THE MATERIAL EMPLOYED FOR SUCH INSULATION, OR FOR WATERPROOFING PURPOSES, *A. T. Woodward, New York.*—1*st November*, 1881. 6*d.*

The inventor uses a waterproofing and insulating material composed of silica, glass, or quartz in a powdered state, and vegetable or mineral resin or pitch, also ground fine. To these are added paraffine and boiled or raw linseed oil, the proportion being silica 66 parts; resin or pitch, 34 parts; wax 26; and oil, 3. These are all combined by liquefaction, and wires drawn through the compound, or it is poured into the tubes containing the wires.

4824. IMPROVEMENTS IN ELECTRIC CURRENT METERS, *C. A. Carus-Wilson, London.*—3*rd November*, 1881. 6*d.*

This invention consists mainly of a method of obtaining a variable rotation of one shaft from another shaft rotating with a constant angular velocity; and Secondly, of means by which the pieces connecting the one shaft with the other are moved in accordance with variations in the current to be measured. The inventor claims the obtaining of a variable rotation of a shaft which works a counting apparatus from another shaft rotating at a constant angular velocity by means of two cones and an intermediate wheel, the angle which the axis of this wheel makes with the axes of the two cones, and therefore the speed of the shaft which works the counting apparatus, being varied by mechanical motion derived from variations in the current to be measured, said variations of angle being produced by combination with an electric motor and dynamometer. The inventor also claims the combination of all the above with a Wheatstone's bridge and a rheostat.

4924. MACHINE FOR FORMING THE IMPRESSIONS FROM WHICH TO PRINT, &c., *J. A. Marquez, Peru.*—10*th November*, 1881. 1*s.* 2*d.*

The object is to obtain a simultaneous impression from several matrices, and consists in mounting the type in holders placed over the matrices, which are caused to traverse beneath the type, on which needles actuated by levers descend and force it into the matrices.

4948. IMPROVEMENTS IN AND CONNECTED WITH ELECTRIC LAMPS, *G. G. André, Dorking.*—11*th November*, 1881. 1*s.*

This relates to arc lamps. The inventor feeds his positive carbon by a separate current, so that the feed is only applied when required, and then automatically. For this purpose he uses a shunt circuit in connection with feed magnets and feed-controlling magnets, which latter admit or refuse the entry of a current to the feed magnets, according as the arc requires adjustment or not, the said feed current passing through a relatively small independent wire common to a number of lamps, and the current being regularly intermittently supplied from some source by some suitable constantly revolving contact maker and breaker. The wire of the feed-controlling magnets is very fine, so as to take only a small portion of the lighting current if a short circuit is used. The positive carbon may be fed up by rack and pinion or otherwise. The inventor also provides an arrangement of a solenoid core and balance, combined with visible and audible signals, which is placed in the main circuit, and which gives warning of any irregularity in the current.

4977. STEERING APPARATUS FOR VESSELS, &c., *G. Knowling, Kew Bridge.*—14*th November*, 1881.—(*Void.*) 4*d.*

This consists in constructing steering apparatus for vessels where the power to give the required motion varies and is constantly increasing as it is applied. A chain pulley of excentric form is fitted to the rudder head and takes up the loose chains, so that the tension thereon is always equal, and the rudder rigidly fixed at any point. Chains are connected to the pulley and actuated by a screw worm and wheel. To provide against sudden shock two parts of the gearing are formed with friction surfaces, to allow slipping when extra strain occurs. A light hand-steering wheel is made of straight or curved iron or brass rods or tubes cast into a centre boss and connected together outside by other bosses cast on them.

5012. MAKING BILGE BARRELS, &c., *R. E. Gibson and D. Pope, Liverpool.*—16*th November*, 1881. 6*d.*

This relates to machinery in which jointed staves are fed between a collapsible core and hinged or removable forming or shaping pieces or rings, and in which the ends of the staves are cut and finished to receive the heads whilst around the core, and it consists in making the core so that the segments shall in collapsing and expanding move in a direction at right angles to the carrying shaft, such motion being effected by guide pieces secured to the shaft and to the segments. The operating levers are arranged so that the amount of end motion of the collar by which the collapsing and expanding of the core is controlled is greatly reduced.

5050. IMPROVEMENTS IN APPARATUS FOR AUTOMATICALLY TRANSMITTING AND RECEIVING SIGNALS FOR DENOTING PLACES AT WHICH ATTEMPTED BURGLARIES AND ROBBERIES MAY BE MADE, AND FOR OTHER PURPOSES, *F. R. Francis, Lawford-road, and C. Donovan, St. James's-square, London.* — 18*th November*, 1881. 6*d.*

The inventors fix contact makers on doors, &c., and connect them by wires with an audible and visible signal at the nearest police station or other house, and a battery. The signal receiver consists of a number of electro-magnets corresponding to the number of contact makers; each magnet is provided with a balanced horizontal bar carrying a disc, which is maintained in its normal position by the armature of the magnet, so as to obscure the name or number of the door, &c., to which the corresponding contact maker is affixed. As soon as a circuit is established by the contact maker, the armature is attracted, releases the balance bar, causes the disc to fall, and exposes the name, &c., to view. A bell is also provided to give audible signals. The inventors claim the general construction of a system of burglar alarms as indicated above.

5053. TELESCOPIC SIGHTS FOR ORDNANCE OR FIREARMS, *Capt. L. K. Scott, London.*—18*th November*, 1881. 6*d.*

This relates to a modification of the apparatus for giving "deflection," described in patent No. 31, A.D. 1877, and consists in making both the horizontal arc and arm described to revolve in a vertical plane in conjunction with the telescope when it is depressed for giving angles of "elevation." Deflection is given to the axis of the telescope by causing the diaphragm containing the cross wires to slide, and registering its lateral movement by a graduated scale. The invention further relates to the bracket for holding the sight and in the method of levelling; to the combination of a telescopic sight with a revolving sight; to the substitution of lines cut on the glass of the telescope for the cross wires; and also to the method of aiming to the rear when firing from behind a parapet, which prevents the line of sight being taken direct on the object.

5064. FIREPROOF FLOORS, *E. Homan, Turnham-green.* —19*th November*, 1881. 6*d.*

This relates to the construction of fireproof flooring of metal bars and concrete.

5070. A TELEPHONIC REPEATER, *C. Moseley, Manchester.*—19*th November*, 1881. 6*d.*

The object of this invention is to obtain the repetition in an earth return-circuit of the undulatory current of a metallic circuit, or the reverse. This the inventor accomplishes by means of one or more induction coils. If one coil only is used, he connects the two ends of the metallic line with the two ends of one of the helices of the coil, so that the helix forms part of the closed circuit, the ends of the other helix being connected respectively to earth and to a single line wire.

5071. IMPROVEMENTS IN AND CONNECTED WITH TELEPHONIC TRANSMITTING APPARATUS, SPECIALLY ADAPTED FOR PAN-TELEPHONES, *E. de Pass, London.* —19*th November*, 1881.—(*A communication from L. de Locht-Labye, Paris.*)—(*Not proceeded with.*) 4*d.*

This consists in the combination with batteries of a sound-receiving plate of unpolished wood or other material, of large surface but slight weight, and free to swing about one of its points of support; it carries a carbon contact piece, which bears against a stop of carbon.

5096. IMPROVEMENTS IN ELECTRICAL COMMUTATORS, *W. R. Lake, London.*—22*nd November*, 1881.—(*A communication from F. Blake, Weston, Massachusetts.*) 6*d.*

The inventor combines with a pile of plates of metal and hard india-rubber, put together alternately, a number of smaller metallic plates, one for each circuit, between which connections are to be made, the smaller plates being secured to one of the large insulating plates and a peghole extending through each smaller plate, and also through all the large ones. Pegs are provided, adapted to make connections between two of several insulated plates in a pile, and these two only, each pair of pegs being adapted for use with any of the line plates of the commutator, but with only one and the same connecting plate.

5104. IMPROVEMENTS IN ELECTRIC BATTERIES, *A. M. Clark, London.*—22*nd November*, 1881.—(*A communication from G. Fournier, Paris.*) 4*d.*

The inventor takes lead oxide in powder and mixes it with glycerine so as to form a thick paste fluid enough to run into moulds. After twenty-four hours in the moulds it sets in a mass which is insoluble in water. It is very reducible when immersed in dilute sulphuric acid, and in circuit with metallic zinc it becomes reduced to the metallic state as fast as the zinc is attacked. Thus is obtained metallic lead in a complete state of division, which will be readily deoxidised for use again as a depolarising agent, or become peroxidised, and can therefore be used in secondary batteries.

5126. A NEW HERMETICAL VOLTAIC PILE, *R. H. Brandon, Paris.*—23*rd November*, 1881.—(*A communication from C. A. Mystrom, Paris.*)—(*Not proceeded with.*) 4*d.*

This is an improvement on the original pile of Volta, and consists in the wet conductor being surrounded by an impermeable elastic substance which adapts itself hermetically to the metallic discs between which the said conductor is placed.

5159. GALVANIC BATTERIES, &c., *R. E. B. Crompton and D. G. FitzGerald, London.*—25*th November*, 1881. 4*d.*

This invention refers principally to the formation of porous lead plates for use in secondary batteries. The electrodes are formed by mixing other materials with lead, and afterwards removing the component or components other than lead by heat, chemical, or electrolytic methods.

5170. DRAWING OR PREPARING FRAMES, *R. Andrew, Bessbrook, Ireland.*—26*th November*, 1881. 6*d.*

This consists in an arrangement whereby the fallers of drawing or preparing frames are thrown on their sides, and carried back in a horizontal position in order that a brush may be applied to the gill pins and remove waste and dirt.

5185. IMPROVEMENTS IN ELECTRIC LAMPS, *E. G. Brewer, London.*—28*th November*, 1881.—(*A communication from A. G. Waterhouse, New York.*) 1*s.*

This relates to arc lamps in which the carbons are controlled by a clutch or wheel work governed by an electro-magnet, and to a novel device for shunting the current past the lamp. There are twenty-six claims.

5198. SECONDARY BATTERIES, &c., *C. H. W. Biggs and W. W. Beaumont, Strand.*—28*th November*, 1881. 6*d.*

Two claims are made—one referring to the use of chambered or hollow porous electrodes, the other to the construction of the porous plates for secondary batteries. Lead is deposited in the shape of crystals from acetate of lead, and the deposit pressed by hydraulic or other pressure into the shape and consistence required.

5201. MOTIVE-POWER ENGINES, &c., *W. W. Tonkin, Brixton-road.*—20*th November*, 1881. 1*s.*

This relates, First, to means for obtaining what is known as a stratified condition of the various gaseous fluids in the cylinder of a gas engine, and consists in forming the cylinder end conical, the gas entering near the base, and flowing along the internal surface away from the cylinder. The stream meets gradually in the centre, and has its velocity checked and destroyed; Secondly, to igniting the charge by conducting the gas into the cylinder port itself near its inner end, from which it issues into the outer air, and being lit by a small flame, burns quietly until the drawing-in action takes place; Thirdly, to jets for introducing water into the cylinders of engines in which water is used to cool the air; Fourthly, to compressing the charge by the return stroke, and then heating it by discharging burning gas or combustible vapour into the charge. Other improvements are described.

5226. IMPROVED MEANS OF JOINING OR COUPLING BRANCH TO MAIN CONDUCTING WIRES OR CABLES FOR ELECTRICAL PURPOSES AND OF INSULATING SUCH JOINTS, *A. W. Brewtnall, London.*—29*th November*, 1881. 6*d.*

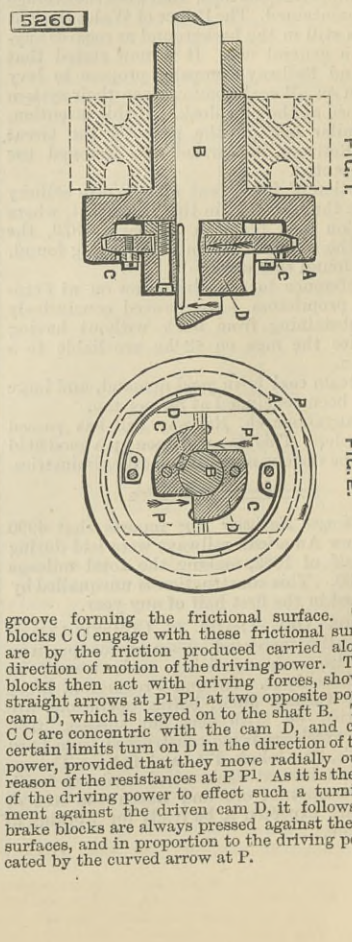
The coupling consists of two parts, a hook-shaped jaw to receive the main wire formed with a hole intersecting the hollow of the jaw to receive the branch wire, and a binding screw screwing up towards the jaw. The pressure of this screw causes the main wire to be tightly gripped in the jaw and held in forcible contact with the branch wire. We recently illustrated and described these couplings in our columns.

5229. IMPROVEMENTS IN AND RELATING TO THE UTILISATION OF ELECTRICITY FOR LIGHTING OR OTHER PURPOSES, AND IN APPARATUS THEREFOR OR TO BE USED IN CONNECTION THEREWITH, *W. R. Lake, London.*—30*th November*, 1881.—(*A communication from J. S. Williams, Riverton, New Jersey, U.S.*)—(*Not proceeded with.*) 4*d.*

The inventor proposes to produce light and heat by passing a current through pulverised particles of carbon enclosed in a transparent tube, the carbon being in vacuo.

5260. FRICTION COUPLINGS AND CLUTCHES, *J. C. Eckardt, Stuttgart.*—1*st December*, 1881. 6*d.*

The ring A shown in the drawings is supposed to be the driving part of a motor clutch and B the shaft. In the ring there is formed a conical-sided annular



groove forming the frictional surface. The brake blocks C C engage with these frictional surfaces, and are by the friction produced carried along in the direction of motion of the driving power. These brake blocks then act with driving forces, shown by the straight arrows at P1 P1, at two opposite points on the cam D, which is keyed on to the shaft B. The blocks C C are concentric with the cam D, and can within certain limits turn on D in the direction of the driving power, provided that they move radially outward by reason of the resistances at P P1. As it is the tendency of the driving power to effect such a turning movement against the driven cam D, it follows that the brake blocks are always pressed against the frictional surfaces, and in proportion to the driving power indicated by the curved arrow at P.

5233. IMPROVEMENTS IN AND RELATING TO THE UTILISATION OF ELECTRICITY FOR LIGHTING OR OTHER PURPOSES, IN APPARATUS THEREFOR OR CONNECTED THEREWITH, AND IN MEANS FOR PRODUCING OR MANUFACTURING SUCH APPARATUS, *W. R. Lake, London.*—30*th November*, 1881.—(*A communication from J. S. Williams, Riverton, New Jersey, U.S.*) 1*s.*

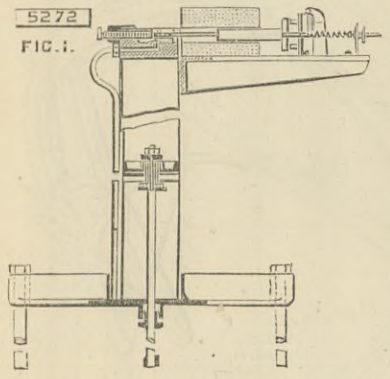
This relates, First, to the construction of incandescent lamps. The inventor sub-divides his carbon into several sections, each of small candle power, so that if one goes it does not make much difference to the total candle power of all the sections. The carbons are in vacuo. According to another method the inventor surrounds his carbon core by molten glass The invention relates, Secondly, to apparatus for heating rooms by electric currents, the apparatus being combined with a circuit closer and a thermometer, so that a certain definite temperature can always be obtained. The inventor also proposes to heat water and cause it to circulate through a house by means of an electric current. Other means of heating are also described.

5261. IMPROVEMENTS IN THE CONSTRUCTION OF SECONDARY BATTERIES, *H. E. Newton, London.*—1*st December*, 1881.—(*A communication from E. Volckmar, Paris.*) 6*d.*

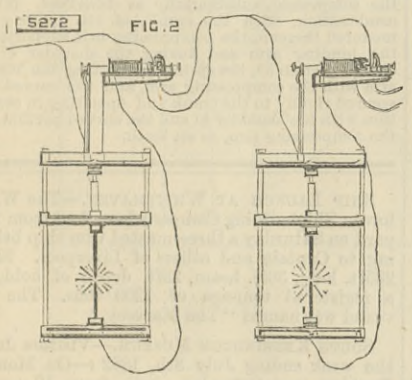
The inventor arranges a number of secondary couples in a single vessel, the plates he places horizontally one above the other in a closed water-tight vessel. Each plate is thus the positive electrode of one couple and the negative of the following couple, the first and the last plates forming the poles of the battery. This arrangement permits of the vessel being turned over, so as to reverse the position of the plates after the charging of the battery. The inventor claims reversible secondary batteries as above.

5272. IMPROVEMENTS IN AND CONNECTED WITH ELECTRIC LAMPS, *W. F. King and A. B. Brown, Edinburgh.*—2*nd December*, 1881. 6*d.*

This relates to an arc lamp. The upper carbon is held by the rod of a piston working in a vertical cylinder containing oil. The weight of the piston, &c., forces the liquid from the bottom through the



pipe shown on the left-hand side of Fig. 1, and the rate of flow through this passage is automatically adjusted to correspond to the rate of consumption of the carbons. For the purposes of adjustment the pipe has for outlet at its upper end a small port in a



horizontal port face, on which rests the small slide valve shown; this latter is connected to the iron cone of the solenoid, the coil of which is in the circuit of the lamp. The action of the current combined with that of the spring effects the adjustment of the carbons. Fig. 2 shows the method of shunting the current past a broken-down lamp.

5300. PUMPS, *H. Fauler, Freiburg, Germany.*—5*th December*, 1881.—(*Not proceeded with.*) 2*d.*

This consists in arranging the pump barrel within the tube in which the water rises, a plunger piston in rising effecting the suction and ejection of the liquid simultaneously. An annular pressure valve surrounds the pump barrel.

5301. LOOM PICKERS, *J. Holding and E. K. Dutton, Manchester.*—5*th December*, 1881.—(*Not proceeded with.*) 2*d.*

The picker is partly of wood, and is bored to slide on the spindle; a projecting pin on it passes through a slit in the strap. A pad of flannel or other absorbent material is applied to the spindle at the part in the rear of the check strap, and supplies oil or other lubricant to the spindle.

5303. IMPROVEMENTS IN THE CONSTRUCTION OF TELEPHONES, *J. Burton, Oldham.*—5*th December*, 1881.—(*Not proceeded with.*) 2*d.*

The inventor places discs of paper or other material between the diaphragm and the end of the telephone magnet to decrease the effects of induction.

5304. OPERATING THE KEYS OF ORGANS, PIANOS, &c., *H. J. Haddan, Kensington.*—5*th December*, 1881.—(*A communication from J. Bommelaer, Dunkerque.*)—(*Not proceeded with.*) 2*d.*

This relates to the application of electro-magnets to mechanical organs, &c., and which act on levers which depress the required keys as a current passes through the magnets, and releases them when the current is interrupted.

5306. LEVEL, *C. Beger, Berlin.*—5*th December*, 1881.—(*Not proceeded with.*) 2*d.*

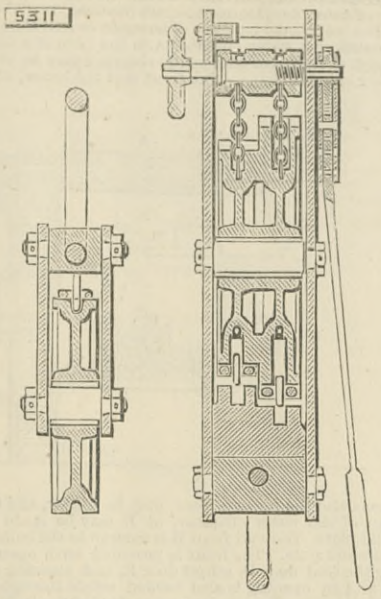
A heavy index pointer or plummet is mounted fast on an axis or pivot, which is free to rotate and carry the pointer with it.

5308. STEAM BOILERS, *L. McIntyre, Glasgow.*—5*th December*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to vertical boilers, and consists of a large fire chamber situated in the lower part of the boiler and projecting vertically upwards. In the centre of the fire-chamber is a second chamber of less diameter and communicating with the fire-chamber, and from it a number of rows of horizontal tubes project radially, their outer ends being fastened to the shell of the boiler, so as to communicate with the outside. A case surrounds the outer ends of the tubes and leads to a chimney at top.

5311. PULLEY BLOCKS, &c., *T. H. Ward, Tipton.*—5*th December*, 1881. 6*d.*

This consists, First, in placing the single sheave at top and the differential sheaves at bottom, and arranging the chain in connection therewith, and to pass over guiding rollers or surfaces; Secondly, in the means of driving the pulley blocks, consisting of a chain or chains passing over additional beds or grooves



formed in the sheave or sheaves, and over a pinion or pinions on the actuating or first motion shaft.

5313. MULES FOR SPINNING, *B. A. Dobson, Bolton.*—5*th December*, 1881. 6*d.*

Instead of the long lever for making the changes for backing off and drawing on, a rod is used, and extends from end to end of the headstock frame, and on it are two spiral springs, one retained by a collar near the end, and the other bearing against a bracket on the frame. The end of the back-off lever, through which the rod passes, is between the springs which bear against it. The latch retaining the lever is released by the strap lever going back, the outer springs having been tightened by the carriage, which in running out carries forward the rod, moves the lever, and puts the backing-off in gear.

5314. SPINDLES EMPLOYED IN SPINNING AND TWISTING WOOL, &c., *J. Farrar and F. H. Bowman, Halifax.*—5*th December*, 1881.—(*Not proceeded with.*) 2*d.*

This consists in constructing and arranging spindles, so that the revolving part is suspended and revolves upon a pivot placed within a stud mounted on a rail, and formed with a cup at the lower end for containing a lubricant.

5316. AN IMPROVED ARRANGEMENT AND COMBINATION OF APPARATUS FOR LIGHTING RAILWAY AND OTHER CARRIAGES BY ELECTRICITY, *R. Laybourne, Newport, Mon.*—5*th December*, 1881. 6*d.*

This consists in a combination of dynamo machines and secondary batteries placed in some part of the train, the dynamos being driven by gearing from the axle of said carriage. The secondary batteries supply current to electric lamps in the train when the train is at a standstill.

5317. TUNNELLING MACHINERY, *T. English, near Dartford.*—5*th December*, 1881. 6*d.*

The machinery described in patent No. 4347, A.D. 1880, is used, First, to form a heading only large enough to admit the workman and machinery, the tunnel being enlarged behind the machine to the required size, as the work progresses, by means of a second cutting machine, fixed either on the same frame as the front cutting machine or on a separate frame. A travelling chain of buckets conveys the *débris* from the front machine and deposits it in the enlarged tunnel made by the rear machine.

5318. DRESS SUSPENDERS FOR CHILDREN, *J. Imray, London.*—5*th December*, 1881.—(*A communication from F. Steeg, Düsseldorf, Germany.*)—(*Not proceeded with.*) 2*d.*

This relates to a dress suspender for children which will also at the same time take the place of corsets, chest expanders, and petticoat bodies, and also serve as an attachment for the stockings.

5319. INCREASING THE HEATING POWER OF DOMESTIC STOVES AND FIREPLACES, *S. Sturm, Cologne.*—5*th December*, 1881.—(*Not proceeded with.*) 2*d.*

This consists in placing horizontal perforated plates in the chimney flue, so that the products of combustion in passing through them give up their heat, and are then reflected and radiated downwards.

5322. IMPROVEMENTS IN ELECTRIC ACCUMULATORS, *J. Imray, London.*—6*th December*, 1881.—(*A communication from J. Carpentier and Dr. O. de Pezzer, Paris.*)—(*Not proceeded with.*) 2*d.*

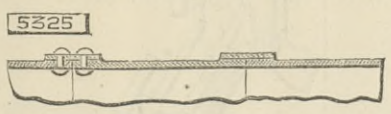
The inventors proposed to make their negative plates very thin and their positive ones about twice the thickness and half the surface area of the negative plates. Other modifications in the form of the plates are also proposed.

5324. IMPLEMENT AND RECEIVER FOR CLEANSING FLOORS, &c., *W. Saunders, Stepney.*—6*th December*, 1881.—(*Not proceeded with.*) 2*d.*

A block of wood of triangular form is attached to a handle in a slanting direction, and on one side a roller of india-rubber is supported to act as a squeegee, while on the under side of the block a brush is formed. A tube supplies water to the brush and a receiver is provided to collect the dirt.

5325. STEAM BOILERS, *H. Sharp, Bolton.*—6*th December*, 1881. 6*d.*

The invention consists principally in certain modes of joining or uniting rings or short cylinders of steel to form the outer shells or internal flues of the boilers,



such rings or short cylinders being weldless and formed by well-known rolling processes. The drawing shows one modification.

5327. RIVET PEG OR SCREW FOR BOOTS AND SHOES, *J. Hewitt, Leicester.*—6*th December*, 1881. 4*d.*

Wire of square, hexagonal, or other suitable section is twisted so as to form threads, and then cut into suitable lengths, and one end shaped into a head, the other end being pointed.

5329. MACHINE EMBROIDERY, *C. A. Barlow, Manchester.*—6*th December*, 1881.—(*A communication from Wetter Bros., Switzerland.*) 6*d.*

The object is to gather all parts of the fabric not covered by embroidery stitches or which do not make part of the design, and to form with them, combined with embroidery thread, the outlines of the design, and for this purpose an ordinary embroidering machine fitted with a perforating apparatus is used, the fabric being placed therein, and the space between the design perforated for a short distance. The embroidery thread then gathers the cut cloth from the side of the perforation into the outline of the design, the outline on one side being then connected by embroidery thread to the outline on the other side of the perforation.

5330. COMBING MACHINES, *B. A. Dobson and J. Macqueen, Bolton.*—6*th December*, 1881. 6*d.*

This relates to apparatus for nipping, detaching, and piecing the fibre. The nipper to hold the cotton while being acted on by the combing cylinder consists of two arms mounted on a shaft parallel to the cylinder axis and carrying a lower jaw, while other arms on the shaft carry a blade forming the top moving jaw, the former terminating in a sharp straight edge parallel to its shaft, and the latter being provided with an india-rubber cushion on its edge. The arms carrying the top jaw are actuated by a cam or lever. The detacher consists of levers mounted on studs at the front of the machine and carrying a shaft, on which is an oscillating plate. The cylinder has two or more sets of combing needles, and at a suitable distance from the last row an india-rubber cushion is inserted, and between it and the first row of needles of the following set the cylinder is recessed to allow the top comb to descend through the fibre without the necessity of raising the under nipper jaw. The invention also relates to a new method of nipping and piecing on the delivery side of "Imbs" or similar combing machines, and also to a method of constructing and operating the combs whereby they can be cleaned separately by a single brush.

5331. OPENERS AND SCUTCHERS, *B. A. Dobson and T. Wood.*—6*th December*, 1881. 8*d.*

The objects are to adjust the grate-bars of openers and scutchers so that the openings between their surfaces may be regulated and so that the edges of the bars may be presented at a suitable angle to the fibre passing over them to remove more or less dirt, and to set the vertical or horizontal opening cylinders nearer to or further from the grate-bars. Two pairs of racks support the grate-bars and are fixed one on each side of the dirt box, and on each is fitted a second rack capable of being moved longitudinally, the latter being placed below the fixed rack. The ends of the grate-bars extending across the dirt boxes are partly cut away, the bottom of each being shorter than the upper part, the longer part resting in the fixed racks, and the bottom entering the sliding racks, which are actuated by an excentric to regulate the openings between the bars and to present one edge of the bar at a greater or less angle to the fibre. To move the vertical conical opening cylinder nearer to or further from the grate-bars, the footstep for its shaft is formed in a boss and connected to a screw actuated by a nut, and for moving horizontal cylinders a screw is used working in a fixed nut and connected by a fork to an annular recess in the cylinder shaft.

5332. FEEDING MATERIAL TO PRINTING MACHINES, &c., *J. J. Allen, Halifax.*—6*th December*, 1881. 6*d.*

This relates to apparatus for automatically feeding and stamping paper to printing, embossing, or other like machines, and it consists of a table supported on springs and guide rods, and over which is an india-rubber roller. An adjustable delivery plate is used in combination with the table, at the delivery end of which are guides and the grippers or dies of the printing or embossing machine, so that the sheets on the table are passed in succession to them when the roller is caused to rotate. A roller rotating in a trough containing a suitable liquid is provided, if necessary, to damp the sheet, the level of the liquid being kept constant.

5333. LOCKING DEVICES FOR UMBRELLAS, &c., *A. J. Boult, London.*—6*th December*, 1881.—(*A communication from A. Ieal, France.*—(*Not proceeded with.*) 2*d.*

This consists in the employment of what is known as the letter lock to secure umbrellas in a closed position.

5334. SECURING MAIN SHEETS, &c., *H. B. McIntosh, Great Grimsby.*—6*th December*, 1881. 6*d.*

To the deck of the vessel is secured a frame with two journals to receive the trunnions of a swinging cylinder, inside which is a piston, between which and the cylinder cover an india-rubber or other spring is placed. To an eye in the piston-rod is shackled the bottom block to which the main sheet is attached, and when the sudden strain or shock, consequent on the going about of the vessel, occurs, its force is eased by the spring or buffer.

5335. MANUFACTURE OF PILLOW LACE, *W. R. Lake, London.*—6*th December*, 1881.—(*A communication from C. Jamnig, Vienna.*) 6*d.*

In pillow lace made by hand the production of a broad band forming the pattern of the lace occupies a deal of time, and to perform this more rapidly means are employed to effect the movement of the warp threads by mechanical means. The apparatus for this purpose, and by which two sets of warp threads can be moved to and fro past each other, consists of a number of two-armed levers with a hole at their angles, and provided with an eye at top, through which the warp threads of one set pass. A second set of levers similarly formed is provided for the other set of warp threads, the two sets of levers being arranged alternately on a spindle, and pins connect all those of each set with one another.

5336. PROTECTING RESPIRATION IN COLD OR VITIATED ATMOSPHERES, *E. Saunders, Hanover-square.*—6*th December*, 1881.—(*Not proceeded with.*) 2*d.*

A light metal frame rests on the chest of the wearer and carries an arm projecting upwards and fitted with a cross bar at top to receive a handkerchief or other light material to fit over the mouth.

5338. IMPROVEMENTS IN SECONDARY BATTERIES, *D. G. Fitzgerald, Brixton, C. H. W. Biggs and W. W. Beaumont, Strand, London.*—6*th December*, 1881. 6*d.*

This invention relates to the production of plates for secondary batteries. The method consists in drawing lead sheets between two metal surfaces, one of which is provided with a reciprocating motion of small range, and a number of fixed points, disposed so as to finely perforate the sheet. After perforation the plates are immersed in dilute sulphuric acid contained in a vessel from which air may be withdrawn, the object being to fill the punctures with the dilute acid, so as to produce a coating of lead sulphate within the perforations. The sheet so treated is then folded and pressed. The inventors also claim, in addition to the above, a method of constructing the plates by the electro deposition of lead on a fine net fabric, subsequently chemical treatment, with folding and pressing.

5340. LOOMS FOR WEAVING GAUZE FABRICS, *J. Bird, Glasgow.*—6*th December*, 1881. 6*d.*

This relates to apparatus for weaving both plain and figured gauze fabrics, and consists in producing the crossing of the warp threads by means of a reed heddle to which sideway motion is communicated; also in the arrangement and combination of parts constituting the mechanism by which such fabrics are produced.

5341. PLAIN OR ORNAMENTAL LACE EDGING, &c., *R. J. S. Joyce, London.*—7*th December*, 1881.—(*Not proceeded with.*) 2*d.*

The object is to construct lace edging or border with a fringe or trimming, and without beads or other ornamentation from its band or top in such a manner that it projects at intervals and hangs down between the flutings, and produces the effect hitherto only obtainable by sewing the parts together.

5342. TEMPLES FOR LOOMS, &c., *J. Hardaker, Leeds.*—7*th December*, 1881. 6*d.*

This relates to an arrangement whereby more selvage or list of the cloth, and that only, is gripped, thereby preventing temple damages, and at the same time more effectually performing the templing operation. For this purpose grippers in pairs or sets are provided, each consisting of a metal piece, to which is hinged a pawl or small lever provided with a pin to pierce and retain the material, and a relieving piece or gauge. These grippers are mounted on rods also in pairs or sets, and employed to transmit alternate movements to the grippers, one set holding the fabric stretched whilst the other is pushed forward to take a fresh hold.

5345. MACHINES FOR CUTTING-OUT CLOTH, &c., *J. Gracey, Belfast.*—7*th December*, 1881. 6*d.*

A knife is set at a slight angle from the perpendicular and attached by a movable joint to a tumbling bar or reciprocating lever driven vertically at a high velocity by an excentric, cam, or other suitable means. Instead of a reciprocating knife a rotating disc may be employed.

5347. SCALES OR WEIGHING MACHINES, *J. Post, Hamburg.*—7*th December*, 1881. 8*d.*

This relates more particularly to scales, which when loaded with all the weights are in their normal condition, the weights being removed in proportion to the weight of the article to be weighed, and it consists in the use of a straight index scale marked off into equal divisions, such scale forming a tangent of the arc described by the index finger. The beam with its gearing and weights is adjusted to the straight scale by means of regulating weights. A spring scale is used to indicate approximately the weight of the article, and then when the weights corresponding to such approximate weight have been removed, the exact weight to be added thereto is shown on the straight scale. Levers are used to lift the weights. The beam is in the form of a frame, and one side of the end knife edge is adjustable. To ensure the pendent frame moving truly parallel with the plane going through the middle knife edge of the beam and the under knife edge on the fixed frame, the latter is connected with the corresponding knife edge of the pendent frame by a link.

5349. APPARATUS FOR SHEARING, &c., THE WOOL OF ANIMALS, *T. R. Hutton, Manchester.*—6*th December*, 1881.—(*Not proceeded with.*) 2*d.*

One or more radial blades are fitted on a shaft driven by suitable means and turning in bearings in a frame, to which are connected prongs, in close proximity to which the blades revolve. The prongs are pressed against the hide of the animal and the hair or wool is cut off by the blade.

5350. ENGINES WORKED BY THE COMBUSTION OF GASEOUS FUEL, *C. W. Siemens, Westminster.*—7*th December*, 1881. 8*d.*

This relates to improvements on patent No. 2504, A.D. 1881, and consists of means for ensuring the ignition of the gaseous charge, particularly when a mixture of low combustibility is employed, and also to a modified form of engine, in which, instead of a gaseous combustible mixture, air is employed, either with a slight admixture of combustible gas or without such admixture. To ensure ignition of the gaseous mixture entering the cylinder, a portion of the charge is caused to be enriched by the addition to it of combustible gas unmixed with air, so that such portion is readily ignited and communicates ignition to the rest of the charge. In the modified form of engine heat is imparted to the currents entering the cylinder by a regenerator supplemented by jets of combustible gas or vapour, which may be previously heated, and which intermingles within the cylinder with a current of compressed air heated by its passage through a regenerator.

5352. APPARATUS FOR HOLDING AND MELTING THE COMPOSITION USED IN HEKTOGRAPHIC OR OTHER SIMILAR DRY-COPYING PROCESS, *R. Corsham, Stoke Newington.*—7*th December*, 1881. 6*d.*

This consists in forming the tray containing the composition to receive the impression of the document to be copied with a space beneath, into which hot water is poured, so as to melt the composition when it is desired to remove the impression from its surface, instead of removing the same by washing as hitherto.

5353. DIVINING RODS, &c., *C. F. Varley, Bexley Heath.*—7*th December*, 1881. 6*d.*

The object is to discover the existence and position of metallic lodes by means of observations made upon the surface of the ground, and it consists in the use of a rod or axis of from 1 to 3 metres in length, pivotted in a frame, and carrying on each end two helices of 20 to 30 centimetres in diameter. The planes of the rings are parallel with the axis, and the centres of the two helices are placed about 1 metre apart. These helices are connected together, so as to form one continuous wire, but are broken at a convenient part of the axis, and attached to two insulated semicircular pieces of metal, against which two springs press. The rod is connected by a pulley and cord with a wheel, so as to be rotated rapidly. A commutator is thus formed, and the contacts change during the rotation as the planes of the rings or helices become vertical. The two springs of the commutator are connected to a delicate astatic galvanometer at a convenient distance. At right angles to the plane of the rod projects a pointer, which is attached to the frame carrying the rod, which is mounted on pivots, so as to turn in any direction.

5354. IMPROVEMENTS IN APPARATUS FOR INDICATING THE SPEED OF REVOLUTION OF SHAFTS, *Lieut. P. Cardew, R.E., Chatham.*—7*th December*, 1881. 6*d.*

The invention consists of a magneto-electric machine and a galvanometer. The current generated by the machine is proportional to the velocity of rotation, the galvanometer or indicator measuring the current so generated. The galvanometer employed is similar to an ordinary "needle telegraph" instrument, with steel needle maintained at zero by a bent magnet which clasps the galvanometer coils, so that its poles are near those of the needle. The dial is graduated with a suitable scale on either side of the zero point, and this scale is so figured that the number of revolutions of the engine per minute can be read off at once. Resistance coils are also provided in the circuit to adjust the total resistance, until it is found that the instrument indicates truly. Other indicators in the shape of thermometers are also described.

5355. BELT FASTENERS, *W. H. Steil, Battersea.*—7*th December*, 1881. 6*d.*

This relates to means for joining the butt ends of driving belts without lacing or sewing, and it consists of a strip of leather, through which a number of pieces of wire are passed near one edge and their ends bent down at right angles. The strip is then inserted between the butting ends of the belt, leaving the wires on the top surface, the bent ends passing through holes formed in the belt, and then clinched on the under side of the belt.

5356. TEACHING HARMONY, *F. Clifton, Brixton, and J. N. Maskelyne, Piccadilly.*—7*th December*, 1881.—(*Not proceeded with*) 2*d.*

The object is to teach harmony, with its accompaniments of composition and orchestration, by means of apparatus which may be combined with a piano or organ, or may be used by itself.

5357. GRINDING CORN AND OTHER GRAIN, &c., *W. L. Wise, Westminster.*—7*th December*, 1881.—(*A communication from A. and A. Mariotte and E. Boffy, Paris.*) 6*d.*

This relates to the use of two or more pairs of flat milling discs of hardened metal, the first pair having its working surfaces coarsely grooved, while those of the other pair are smooth and traversed by radiating grooves to disengage the ground material.

5359. INDIA-RUBBER BOOTS AND SHOES, &c., *F. Richardson, Providence, U.S.*—7*th December*, 1881 6*d.*

This relates chiefly to the protection of the heels of india-rubber boots and shoes by a metal wearing surface secured to the heels by cementation or otherwise before vulcanisation.

5360. AN IMPROVEMENT OR IMPROVEMENTS IN OR CONNECTED WITH TELEPHONE TRANSMITTERS, *E. H. Johnson, New York.*—7*th December*, 1881.—(*Not proceeded with.*) 2*d.*

The inventor uses a transmitter, consisting of an electrode of metal of high specific resistance, such as tellurium, boron, &c., in combination with a diaphragm, an induction coil, and a battery.

5361. NAIL MACHINES, *J. Imray, London.*—7*th December*, 1881.—(*A communication from J. Coyne, Pennsylvania.*) 1*s.* 4*d.*

This relates to improvements of "Reed" or "American" nail-cutting machines, and consists, First, in

arranging a diagonally arched gripping lever with a heading lever pivotted below the gripping dies, so as to operate within the arch; Secondly, forming the heading lever with a transverse pivotted arm of a length on one side equal to the thickness of the lever, a recess for the heading die in its front side, and a socket for the end of the driver in its rear side; Thirdly, the combination with the heading lever of a toggle communicating movement, decreasing in velocity and increasing in power as it approaches the end of its stroke; Fourthly, the combination of the transverse arm of the heading lever with the recessed bed-plate, to prevent nails wedging between the bed-plate and lever; Fifthly, providing the heading lever with a lug on its transverse arm; Sixthly, making the cutting lever arched between its centres; Seventhly, the use, in combination with crank pins and pitman, of brasses with flanges bearing against the crank disc; Eighthly, the use for the lever centres of conical bushings, with oil-feeding ports in combination with oil chamber at inner end of bushing chamber; Ninthly, arranging the rear arm of gripping lever immediately behind and in line with gripping dies; Tenthly, the use of an ellipsoidal cam yoke combined with gripping lever and cam; Eleventhly, the use, in combination with gripping lever, of an adjustable cam friction plate, regulating the gripping operation; Twelfthly, making a large central opening in the stationary head; Thirteenthly, arranging a stop device behind the cutter gauge to permit the adjusting screw being placed centrally to the cutter; Fourteenthly, the combination with the machine of a rock shaft pivotted below the bed, and driven from the main shaft for working a self-feeder; Fifteenthly, the arrangement of brackets to sustain the nail selector and its movement in combination with an agitator rod and tappet rod; and Sixteenthly, the use for the orasses of the crank shaft of a bearing screw inserted through the housing.

5362. DRYING AGRICULTURAL PRODUCE, *E. Outram, Yorks.—7th December*, 1881.—(*Not proceeded with.*) 2*d.*

The products of combustion from a furnace are propelled by a fan so as to be brought into contact with the produce, which is placed on a travelling endless band.

5363. GAS EXHAUSTER, &c., *E. Dunn and J. F. Sleat, Surrey.—8th December*, 1881.—(*Not proceeded with.*) 2*d.*

Within a closed cylinder an annular piece is arranged excentrically so as to be in contact with the cylinder. A shaft extends centrally through the cylinder and carries three loose radial vanes working through slots in the ring, and each consisting of two parts, with a spring between tending to press them in contact with the edges of the slots. A cam on the central shaft drives the ring.

5364. APPARATUS FOR IMPROVING THE CRESCENDO AND DECRESCENDO OF SWELL ORGANS, &c., *W. Sweetland, Bath.—8th December*, 1881.—(*Not proceeded with.*) 2*d.*

The shades are made of different width according to the size of the swell box, and are arranged so as to open one before the other, the wide shades opening last to allow a greater volume of tone to come out of the swell at the end of the crescendo. The decrescendo commences by shutting the one after the other in the reverse manner. Mechanism is described for opening the shades.

5365. SELF-CLOSING COCKS OR VALVES, *J. Barr, Kilmarnock.—8th December*, 1881. 6*d.*

The invention consists essentially in the construction of self-closing cocks or valves, wherein the main outlet is closed by a piston block having through it a passage provided with a comparatively small valve, by the movement of which small valve that of the

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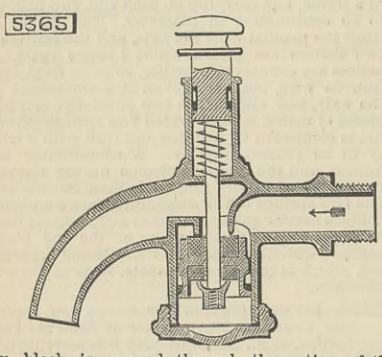

piston block is caused through the action of the internal pressure. The drawing is a vertical section of a self-closing tap or nose cock.

5366. EXTRACTION OF NICKEL FROM ITS ORES, &c., *W. Galbraith, Sheffield.—8th December*, 1881. 4*d.*

This consists, First, in the precipitation of nickel from its solution by means of the combination of sulphur and calcium either prepared or as waste or bye products from other processes; Secondly, in dissolving or separating the sulphide of iron, magnesia, alumina, and other impurities from the sulphide of nickel precipitated, as described, by means of hydrochloric acid, in which such impurities are easily dissolved.

5368. PHOTOMETER, &c., *J. D. Mucklow and J. B. Spurge, London.—8th December*, 1881.—(*Not proceeded with.*) 2*d.*

The instrument consists of a number of tubes, the top of each being closed by an opaque plate and the whole enclosed in a box. The bottom of the tubes are covered by stencil, and the bottom of the box is fitted with a cover to exclude light, and between which and the stencil plate the sensitive film to be tested is placed.

5370. PACKING SWISS EMBROIDERY, *F. W. Parker, Crouch Hill.—8th December*, 1881.—(*Not proceeded with.*) 2*d.*

The object is to pack embroidery, laces, &c., so as to allow it to be withdrawn without opening the packets, and yet allow the packets to be opened when required to see the quantity remaining without destroying the packets.

5372. MACHINERY FOR MAKING SQUARE PAPER BAGS, *F. D. Bumsted, Stafford.—8th December*, 1881. 8*d.*

This relates to machines in which bags are made in three or more operations, and it consists in the use of three or more mould-plates placed equidistantly round a wheel which revolves horizontally on a spindle, the movements being intermittent. Each mould-plate has a thin metal sheet hinged upon it, which comes in contact with and partly covers the mould-plate, the front edge of which is the line where the bag is folded back in forming the bottom. This plate is caused to come into its working position and released by the moving of the mould-plates spindle, together with a circular rail fixed over it, and which at parts is shaped to give the required movement to the plate.

5373. RABBIT, VERMIN, AND OTHER TRAP, *J. C. B. Fox, near Bristol.—8th December*, 1881. 6*d.*

This relates to an effective trap which by striking the animal with a powerful blow on the body will instantly kill it, and also which, if a man should be caught in it, will by a rebound action similar to the snap action of a gun allow him to withdraw his foot.

5374. DISENGAGING BOATS FROM LOWERING TACKLE &c., *W. Lowrie, Newcastle-on-Tyne, and J. A. Rowe, North Shields.—8th December*, 1881.—(*Not proceeded with.*) 2*d.*

To one end of a bar suspended vertically is jointed a curved hook extending through an arc of about two thirds of a circle, and on the end of the bar is a curved nose which completes the circle. The bar has a link jointed to it, the other end of which is by a rod connected to the hook midway of its length. Two hooks such as described are used, and their bars are attached by a rod hook uppermost to the keel of the boat.

5375. ROUNDABOUTS, *F. Savage, King's Lynn.—8th December*, 1881. 6*d.*

This relates to roundabouts with boat-like vehicles, to which a pitching movement is imparted as they pass round the circular track, and consists, First, in imparting such pitching motion to the vehicles by means of a curved guide course; and Secondly, in a special arrangement of gear for driving roundabouts by steam power.

5376. PORTABLE, EXPANSIBLE, AND COLLAPSIBLE FRAMES FOR MUSIC STANDS, &c., *J. F. Walters, Bayswater, and J. H. Rosoman, Soho.—8th December*, 1881. 6*d.*

This relates to improvements on patent No 3045, A.D. 1877, and it consists in dispensing with the ferule on the stretchers and connecting it to the legs, the stretchers being jointed to a fixed socket at the lower part of the central stem, so as to obtain great strength and stiffness on account of the legs being jointed higher up the stem.

5377. WATER-CLOSETS, &c., *D. G. Cameron, Lambeth.—8th December*, 1881. 8*d.*

This relates to an improved arrangement in combination of pan seal with overflow and trap, so that it can be used also as a slop closet, and to a flushing apparatus which will automatically deliver a flush and an after flush that can be exactly regulated.

5378. LOOMS FOR WEAVING, *W. H. E. and J. Smith, Kidderminster.—9th December*, 1881.—(*A communication from W. Talbot, Philadelphia.*) 1*s.*

This relates chiefly to looms in which the weft is inserted by a carrier to which it is delivered by fingers controlled by a jacquard, and principally intended for weaving "chenille filling," and it consists, First, in improvements to the jacquard to adapt it for selecting the coloured filling or weft yarn used in weaving a weft, which is cut into strips and used as filling or weft in weaving figured carpets and other articles known as "chenille fabrics;" Secondly, in the combination and arrangement of two filling or weft carriers with a filling roller or binder for introducing the filling or weft single into the warp shed; Thirdly, in the combination and arrangement of a swinging frame for carrying a series of filling fingers; Fourthly, in an improved selvage mechanism to be used when inserting the filling or weft double, and mechanism to stop the loom should the weft break; Fifthly, in an improved temple for keeping the fabric properly extended and making a straight selvage; and Sixthly, in the combination and arrangement of a shifting needle and guide-bar, guide reed and heddles for crossing the warp yarns to produce cross weaving.

5380. DETACHING BOATS, BUOYS, &c., *E. J. Hill and J. L. Clark, Westminster.—9th December*, 1881. 6*d.*

This relates to the employment of a float suspended from the boat, and which on touching the water disengages the slip hooks or other contrivances used for disengaging the boat.

5381. WATER-CLOSET APPARATUS, *D. Gill, Weston-Super-Mare.—9th December*, 1881. 6*d.*

This consists, First, in the use and application of a swing valve acted upon automatically by means of a float, to screen the outlet from the basin; Secondly, in making the flushing rim separate from the basin for the purpose of removal when necessary; and Thirdly, in improved ventilation by means of the flushing rim, an air pipe, and a self-adjusting valve.

5382. AUTOMATICALLY LIGHTING AND EXTINGUISHING GAS, *F. Wirth, Frankfort-on-the-Main.—9th December*, 1881.—(*A communication from C. Westphal, Frankfort-on-the-Main.*) 6*d.*

The consists, First, in an igniting burner placed in the centre of the apparatus in combination with a cap perforated laterally, and closed at top, through which the products of combustion of the igniting flame escape without disturbing the flame from the main burner; Secondly, in one or more diaphragms, each in combination with a pressure plate placed above it; Thirdly, in the combination of a valve with a valve guide provided with a seat and passages to conduct gas to the igniting burner, the igniting tube, and the main burner; and Fourthly, in the combination with an "argand" burner of a "Bunsen" burner for the igniting flame, fixed in the centre of the apparatus, and a glass chimney in centre of the argand burner, whereby an outer chimney and the protecting cap for the escape of products of combustion are rendered unnecessary.

5383. RIVETTING MACHINE, *T. Wallace, Dumbarton, N.B.—9th December*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to a rivetting machine worked by hand power, and consists of a frame, one projecting part of which is fitted with a die and the other with a screwed rod holding the other die, such screw being actuated by a wheel or handle.

5384. WEAVING REVERSIBLE FABRICS, *J. O'Neill, Lancashire.—9th December*, 1881.—(*Not proceeded with.*) 2*d.*

The object is to produce a cloth with a firm flat face and back each alike for printing, so that the threads of weft shall not swerve while being printed; and it consists in arranging the picks of weft alternately to back and face alike either with or without "binding picks."

5385. IMPROVEMENTS IN TELEPHONES, AND IN LIGHTNING ARRESTERS THEREFOR, &c., *G. W. Foster, Strand, London.—9th December*, 1881. 6*d.*

One form of the inventor's telephone consists of a case furnished with an exterior groove for receiving a coil; a hole for a magnet and two poles bored at an angle for the telephone wires. The permanent magnet has a screw-cut head, which fits into a fixed metal screw-cut adjustment collar, whereby the magnet can be adjusted with reference to the diaphragm. The invention also consists of a combined lighting and binding post device, consisting of two metal pieces arranged in a ring shape, provided with threaded connections for holding the contact points of the telephone wires, and suitably connected with the ends of the telephone helix, said pieces being fashioned with teethed surfaces and placed in close proximity.

5386. ROLLER MILLS FOR THE DISINTEGRATION, &c., OF GRAIN AND OTHER SUBSTANCES, *W. P. Thompson, Liverpool.—9th December*, 1881.—(*A communication from W. D. Gray, Milwaukee, U.S.*) 6*d.*

In order to feed the material uniformly and with certainty to the rolls, a second roller is used in combination with the usual feed roll in the bottom of the hopper, being placed above and driven in the opposite direction thereto, and is provided with longitudinal ribs. This roll serves to sustain the weight of the superincumbent mass, and to loosen and agitate the same and deliver it to the feed roll. To produce a roller grinding mill which may be adjusted at will to act with a cutting or with a crushing effect, the rolls are provided with driving mechanism by which either roll may be driven faster than the other, the rolls being so dressed that when one is driven the faster the ribs will act with sharpened edges forward, and when the other roll is driven the faster the ribs will act with rounded or inclined sides forward.

5388. CUTTING LOAF SUGAR, &c., *J. M. Day, W. R. Green, and H. C. Walker, London.—9th December*, 1881. 6*d.*

The carriage to receive the sugar is made so as to be readily adjustable to suit the shape and size of the sugar to be sawn. The cut slices are held and supported in position by furnishing each of the gripping bars, which are free to turn on pins passing through their centres, with a number of curved fingers or claws arranged to bear upon either side of the slices when cut. The invention further relates to the arrangement of a locking screw and nut whereby the gripping bars can instantly be brought to bear upon and secure the loaf or be withdrawn from it after being acted upon by the saws.

5439. BOILERS FOR HOT WATER APPARATUS, *W. C. Burder, Loughborough.—13th December*, 1881. 4*d.*

The boiler may be made of wrought or cast iron, and consists of a water chamber A in the form of a saddle closed at its upper end, or the chamber may be of any other suitable shape. The front B of the boiler, which

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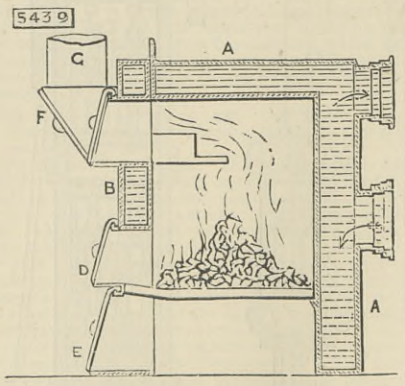

forms also the furnace front, may be hollow, and form part of the water chamber, or it may be made of a solid plate. The said front B is secured to the boiler by bolts and nuts. The front is provided with openings for the feed door D, ashpit door E, and cleaning door F, and an opening is also formed either through the said front or other convenient portion of the boiler for fixing a smoke flue or chimney G.

5563. FURNACES AND GRATES FOR STEAM GENERATORS, *W. L. Wise, Westminster.—20th December*, 1881.—(*A communication from G. B. Palmer and A. Worthington, Chicago, and G. A. Rowell, Brooklyn, U.S.*) 8*d.*

The invention consists, First, of an inclined grate having transverse bars lying nearly or quite flatwise, a portion being mounted stationary and another set

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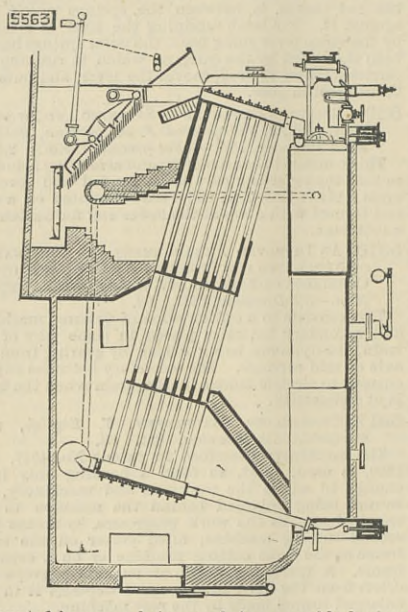

mounted in spaces between, being movable horizontally; Secondly, of a bottom grate with its front dead plate in combination with a separate inclined grate, with means for moving a portion of the latter forward and backward. Other improvements are claimed.

5395. BREECH-LOADING SMALL FIRE-ARMS, *W. Tranter, Birmingham.—9th December*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to drop-down guns, and consists in the construction and arrangement of parts for cocking the hammers by raising the breech ends of the barrels from the break-off for loading.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

259,846. GANGWAY FOR SHIPS, *James P. Garton, Jersey City, N.J.—Filed March 25th*, 1882.

Brief.—The steps make a flat platform or a stairway, accordingly as the gangway is level or inclined.

Claim.—(1) In a portable gangway, the combination of the truck A, having pivotted step, with the adjustable bridge B, having pivotted steps H and the levers I J, substantially as shown and described. (2) In a portable gangway, the combination of the truck A with the adjustable bridge B, having sides C C, hand-rails D D,

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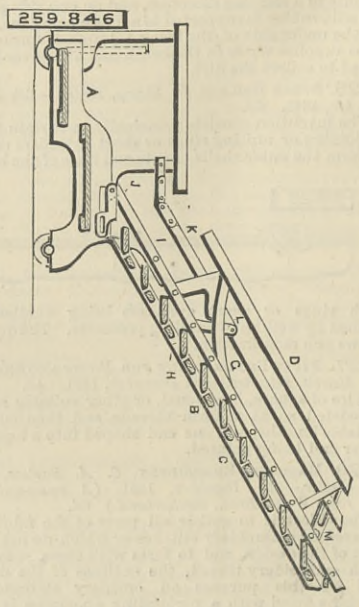

and pivotted steps H H, connected to levers I I, and levers J J, substantially as shown and described. (3) In a portable gangway, the combination with the truck A, having steps, hand-rails, and cross-bar A^1, of the adjustable bridge B, composed of the sides C C, cross-bars, hand-rails D D, supported by the standards E E, having knees and having pivotted steps H H, and curved braces G G, the levers I J K L, and the slotted bars M M, all constructed and arranged substantially as shown and described.

259,893. SHAFT FOR MACHINERY, *Bradford S. Miles, Gray's Summit, Mo.—Filed March 3rd*, 1882.

Claim.—A rotating shaft wrapped and re-enforced along its effective length by one or more spiral bands

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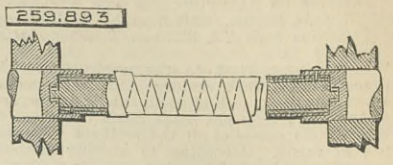

clasping and binding the same, each made fast thereto at one end and at the other to a sleeve, collar, or cap fitted upon the shaft to engage the same, after a partial independent rotary movement thereon, substantially as herein described.

259,897. BUNDLE COMPRESSOR AND EJECTOR FOR GRAIN-BINDERS, *Lewis Miller, Akron, Ohio.—Filed December 27th*, 1882.

Claim.—(1) The combination, substantially as described, of a rotating crank, a binding arm mounted upon the wrist of said crank, means for controlling the movement of the binding arm, a compressor supported wholly by the binding arm and moving therewith, and an arm secured rigidly to the crank wrist and adapted to strike the compressor and positively move it in advance of the binding arm to eject the bundle. (2) The combination of the binding arm, the compressor mounted upon and moving with the bind-

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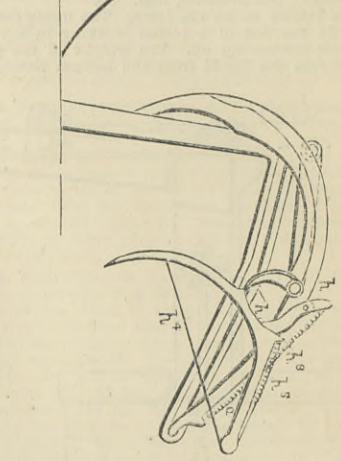

ing arm and having the shoulder, the spring connected at one end to the binding arm and at the other to the compressor, and the curved arm or cam on the crank wrist, operating in connection with the shoulder on the compressor, substantially as described. (3) The combination, with the crank, of the binding arm mounted thereon, the compressing arm supported by the binding arm and having the shoulder h^7 and curved portion h^8, the spring connecting the binding arm with the compressing arm, and the curved arm secured rigidly to the crank and operating in connection with the shoulder h^7 and the curved portion h^8 of the compressing arm, as set forth.

SHIP LAUNCH AT WHITEHAVEN.—The Whitehaven Shipbuilding Company launched from their yard on Saturday a three-masted iron ship belonging to Captain and others of Liverpool. She is 235ft. long, 36ft. beam, 23ft. depth of hold, and a registered tonnage of 1200 tons. The new vessel was named "The Maresby."

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending July 8th, 1882:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 10,401; mercantile marine, building materials, and other collections, 4515. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. till 6 p.m., Museum, 2604; mercantile marine, building materials, and other collections, 566. Total, 18,086. Average of corresponding week in former years, 16,867. Total from the opening of the Museum 21,122,130.

CONTENTS.

THE ENGINEER, July 14th, 1882.