THE NAVAL AND SUBMARINE EXHIBITION.

The Naval and Submarine Exhibition was opened on Easter Monday. Very great exertions were made by Mr. Barnett's staff and by the exhibitors to get their arrangements completed; and considering the multitude of articles to be got into place, and the great weight of not a few of the machines, heavy castings, forgings, anchors, and boilers handled, it may be said that success attended their efforts. On Monday morning the Exhibition was fairly complete, and it will be found to fully repay the time spent in visiting it. As we have already stated, the enterprise is unique of its kind; never before have been got together such a number of inventions, materials, and machines applicable to naval engineering operations. The Exhibition will remain open for ten days from Easter Monday. It is indisputable that certain very great advantages are secured by reducing within narrow limits the duration of the period during which an exhibition of this kind lasts; yet it is difficult to avoid a feeling of regret that a display so interesting should endure but a few days.

In dealing with the present contents of the Agricultural Hall, we shall make no attempt to describe everything to be seen. The utility of such an exhibition greatly depends on the lessons that can be drawn from it, and we shall endeavour as far as possible to confine our attention to those things which most deserve notice. In all such exhibitions a good deal may be found which is neither new nor good. We have no intention of laying before our readers a catalogue—which is the less necessary because a very good catalogue of the exhibits can be obtained in the building—but instead, to describe, illustrate, and criticise those things which are really worth the trouble of writing or reading about. Certain classes of exhibits we shall deal with in distinct articles; here we propose to say something concerning what may be termed miscellaneous exhibits, which can hardly be classed with accuracy under any special heads.

There are in the main building 542 stands, in the tank room there are ten stands, and in the galleries twelve others. The scope of the Exhibition is very large; but we are glad to find that a line has been drawn, and very little is exhibited which is not more or less closely connected with the sea or with hydraulic engineering. We shall not attempt in this article to follow any particular order, simply dealing with exhibits as they come.

The Stanners Closes Steel Company, Walsingham, near Darlington, have a stand—No. 154—which may be easily passed over, and yet deserves a good deal of attention. The company exhibits a great many articles made of steel, which illustrate very forcibly the advances which have been made within the last few years in rendering this metal available for use by engineers. The dredger bucket castings are perhaps most worthy of notice. They are rough, but they have to endure much rough usage, and for this they are infinitely better adapted than wrought iron. There are also toothed wheels, ships' cleats and eye bolts, and suchlike—all very good of their kind. The process used in making these things is Attwood's.

Messrs. Jessop and Sons, of Sheffield, make a more important display—stand No. 355. Here will be found a crucible cast steel shaft, built up on Turton's patent, illustrated on page 270, and 15½in. diameter. But the most noteworthy exhibit is a crucible cast steel sternpost for a ship of about 1000 tons. The rudder, also of steel, cast in one piece, is in place. It is fitted up with Cooke and Mylchreest's patent pintles. This is a wonderfully fine casting, standing nearly 19ft. high, and practically free from blow-holes. The casting is not painted. Close beside it will be found a screw propeller blade. On close examination this blade will be found to have a few cavities near the edges, but they are not of the least practical importance. The firm also exhibit steel castings turned up and finished to show texture, which is excellent. Messrs. Jessop have done more than any other firm, perhaps, to place large cheap steel castings at the disposal of the engineer; and in saying this we have no intention to disparage the work done by Messrs. Vicars, Whitworth and others. Messrs. J. Spencer and Sons, Newburn Steel Works, Newcastle-on-Tyne, show dredger fittings, especially Bagshaw's patent dredger bucket back, of cast steel. It will be remembered that last year the Institution of Mechanical Engineers made an excursion from Newcastle-on-Tyne to the Newburn Steel Works, to which we referred at the time at some length. It is difficult, when looking at the exhibits of these three firms, to imagine what it is that cannot now be made, and well made, in the shape of a steel casting.

While on the subject of large castings and forgings, we may refer to the anchors shown at Stand 316 by Mr. Wasteneys Smith, of Newcastle-on-Tyne. One of them weighs 5 tons. It is intended for H.M.S. Agamemnon, and will leave the Agricultural Hall for Chatham Dockyard. The anchor is almost too well known to need description. We illustrate a small anchor on page 270. The largest anchor is of precisely the same form. It will suffice to say that it has no stock and double flukes, which both take the ground at once. The shank and crosshead are forged in one piece, and the arms separately, and they are attached by a spindle passing through the crosshead. The various parts are carefully machined and finished, and are of first-class workmanship. Three types of this anchor are exhibited, one as supplied to various ships of her Majesty's navy, and to foreign navies; another, weighing 10 cwt., as supplied to the mercantile marine, and a third as supplied to yachts. They are also made of a special type for permanent moorings. That anchors made on this plan are in favour seems to be borne out by the fact that so many are already in use—about 500. No doubt it was not until they had been subjected to severe and prolonged trials that they were adopted by the Admiralty. Since then they have been ordered for various classes of ships, and the patentee is now making anchors of 3 tons and 5¾ tons for H.M.S. Amphion and Collingwood, the latter a barbette ship of over 9000 tons. Messrs. Brown, Lennox, and Co. show Admiral Inglefield's patent double holding self-locking anchor, and Morton's patent anchor, both very well known. We need not add that the workmanship leaves nothing to be desired. Messrs. Hawk, Crawshay, and Sons, Gateshead, also show one of Morton's 5-ton anchors for the Royal Navy, and sample pieces of chain, 2½in. and 3in., of tough material and well made.

As might have been expected, the display of wire ropes and hempen hawsers and ropes of all kinds is very large. The cables are shown both in coil and in lengths cut off and bestowed vertically in show cases. It is quite impossible by looking at the outside of a rope, whether of steel, iron, or hemp, to say what its quality is within a little. Thus, very inferior hemp indeed might be used in some types of hawser for core strands, while the outside strands were apparently excellent; the finish of the work can, however, be ascertained. Much must be left in any case to the reputation of the exhibitors, and we think it may be safely said that, on the whole, the ropes made in Great Britain, no matter of what material, are better than those of the same type made elsewhere. Two of the most interesting stands are those of Messrs. Felten and Guillaume, of Mulheim-on-the-Rhine, and Messrs. Bullivant, of Millwall. The last named firm has a very high reputation in this country. They show steel wire hawsers, blocks, and tackle, and a torpedo net, 20ft. by 15ft., made of a series of steel wire grommets connected to each other by small iron rings. The boundary is formed of iron cable with long links to which the net is attached by means of screw shackles. These nets are used entirely by the Admiralty, and also by most foreign Governments, and are intended to be boomed out from the side of a ship when lying at anchor. Messrs. Bullivant also show nippers, of which it may be said that on March 9th, 1881, in the presence of Mr. B. Martell, head surveyor of Lloyd's Registry of British and Foreign Shipping, Mr. J. H. Cornish, and Mr. Stromeyer, assistant surveyors of Lloyd's Registry, Mr. Morgan, of the Construction Department of the Admiralty, and others, a 5¾in. patent flexible steel wire cable and an improved patent automatic screw lever nipper stood the following tests with the results given:—At a stress of 50 and 81¼ tons respectively, the nipper was applied and released by one man. The rope broke at a strain of 86·3 tons, the guaranteed breaking strain being 80 tons. This firm also exhibits patent flexible steel wire hawsers and cables, the following particulars concerning which may prove useful to some of our readers. The figures show the relative strength of the flexible rope as compared with tarred hemp rope and chain:—

Patent flexible steel wire hawsers and cables.				Chain cable.				Tarred hemp rope.		
Size circumference.	Weight per fathom.	Guaranteed breaking strain.	Diameter of barrel or sheave round which it may be worked.	Size.	Weight per fathom.	Proof strain.	Breaking strain.	Size.	Weight per fathom.	Breaking strain.
In.	lb.	Tons.	In.	In.	lb.	Tons.	Tons.	In.	lb.	Tons
12	115	320	72	—	—	—	—	—	—	—
11	97	270	66	—	—	—	—	—	—	—
10	80	220	60	—	—	—	—	—	—	—
9	65	180	54	—	—	—	—	—	—	—
8	53	150	48	2 5/16	280	96¼	134¾	25	146	125
7	41	116	42	2 1/16	231	76½	107 1/16	23	123	106
6	33	88	36	1¾	166	55⅛	77⅛	19	84	72
5	23½	64	30	1 11/16	112	37⅛	55½	15	56	50
4	12	33	24	1	54	18	27	12	33	29
3	7	18	18	1/16	30	10⅛	15⅛	9	19	16½
2½	4½	12	15	—	—	—	—	7½	13	11⅓
2	2¾	7	12	—	—	—	—	5¾	9	8
1½	1¾	4	9	—	—	—	—	4	4	4
1	⅝	1¾	6	—	—	—	—	2¾	2	1¾

A comparison may be made between the contents of this stand and that of the German firm. This latter exhibits a much greater variety of exhibits than the English firm, and among them will be found some novelties worth notice. We may call particular notice to the cables used in connection with submarine mines, or torpedoes, in which there is a great variation of type, according to the purpose for which the rope is to be used. In mooring ropes for torpedoes it is very desirable that "kinking" should not take place; and to avoid this they are made with strands twisted to the right and left alternately. Ropes are also shown cased with lead pipes to prevent corrosion. The firm also exhibit ropes made of a multitude of very fine wires; they are said to be as pliable as hemp ropes of the same diameter, and very strong. We understand that this type of rope has recently been adopted by the German naval authorities, and has been spoken of very favourably by Lloyd's. A piece of cable is shown 8¾in. in circumference, each separate strand of which is wrapped with tarred manilla. Several advantages are claimed for this system of construction, which is, of course, not new. Among the specimens of wire exhibited we noticed some for plough ropes guaranteed to stand 110 tons per square inch; some of it has carried 120 tons, which is very good for such comparatively thick wires. The firm is one of the oldest in the trade, having been established in the last century. They have two works—Carlswerk at Mulheim, and Rosenthal at Cologne. They turn out about 30,000 tons of rope and wire annually, employ 2000 hands, and have 1400-horse power of steam. It may be convenient to some of our readers to know that the London offices of this firm are in Leadenhall-street, Mr. Dennis being their agent. At stand No. 279, Messrs. Geo. Cradock and Co., Wakefield, exhibit a number of samples of steel hawsers and hemp and manilla ropes for shipping and other purposes. This firm also exhibit samples of steel wire ropes, made on Lang's patent, suitable for colliery winding shafts and inclines. In ordinary wire ropes the wires of each strand are laid up in one direction to the left, while the strands are laid up to the right. The wires in this rope run both to the right, which gives a longer surface of the wire exposed to friction and a greater wearing face, and which also lessens, if not entirely removes, the cause of the wires breaking on the crown of the strands when passing over drums and pulleys. These ropes are doing a greatly increased amount of work over the old construction. A sample is shown of a haulage rope which has worn from ¾in. to ½in. diameter, and which has done fully 100 per cent. more work than ropes made upon the old principle. The surface of the rope resembles that of a bar of iron more than that of a rope, being worn quite smooth, while those of the other strands were broken. They have been, Messrs. Cradock inform us, equally successful where used as winding ropes, and we understand that the first pair of winding ropes made upon this patent have done more work to the extent of 115 per cent. than their predecessors of the ordinary type. Ropes and cables are exhibited in all at no fewer than twelve stands. We shall not attempt to describe the exhibits, because all closely resemble each other. But we may say that among the exhibitors will be found Messrs. Frost, of London-street, E.C.; the Belfast Rope Work Company; Stephens, of Falmouth; Wright, J. and W., of Birmingham; and the London Steam Ropery Company. There are many cable stoppers, spring compressors, &c., of various patterns, of which we may perhaps have more to say.

Among the various appurtenances of the modern marine engine, pistons are not the least important, and these are exhibited by several makers. The Phosphor Bronze Company, London, shows a piston ring 52in. in diameter and 6in. wide, taken out of the s.s. Gwalior after nineteen months' work, and showing no perceptible signs of wear. It also shows a large slide valve seat much worn, from the Poonah, and two shaft brasses 2ft. 6in. long for an 18in. shaft, from the Ebbw Vale Steel Works, after seven months' wear. These have been worn almost through; one still holds together although badly cracked; the other lies broken in two longitudinally. The company also shows a phosphor bronze bolt, 6in. diameter, for Kirk's propellers, fitted to H.M.S. Cleopatra by Messrs. J. Elder and Co. One half of a new brass of the same dimensions as those worn out is also exhibited; it is a very clean casting. We have of course seen quite as good in ordinary brass. The merit of the phosphor bronze lies in its toughness and good wearing qualities, not in any special aptitude which it possesses for making very clean castings. Messrs. Lewis Olrick and Co., Leadenhall-street, show Mather and Platt's patent pistons, too well-known to need a word of description. Messrs. Beverley and Atkins, Sheffield, exhibit Prior's patent compensating piston, and a nut lock. The piston is in section made thus. A, page 267, is a front view of a portion of the spring which is shown in place at B. Its action is too obvious to need explanation. The nut lock is very simple. It is shown in the sketch, page 267. A plate of brass has a sectional hole cut in it to fit the nut. As the slot is a little more than the sixth part of a circle long, the nut cannot be put into such a position that the plate cannot be put on. The piston is of much the same type as that of Messrs. Lockwood and Carlisle of Sheffield, but the spring rings in the latter's pistons are curved instead of being straight when viewed in cross section; and thus it is claimed that a special elasticity is gained. The piston made by the last-named firm is not very long before the public, but it appears to be giving satisfaction, for the firm exhibit a very well made piston 85in. diameter, complete, made for Messrs. Laird, of Birkenheard, and they have supplied some of the largest steamships in the world, one piston being no less than 112in. in diameter. The smallest piston made on this system is 4in. diameter. The spring is bent by special machinery constructed for the purpose, concerning which Messrs. Lockwood and Carlisle maintain a discreet silence. We venture to think, however, that few engineers would find any difficulty in designing just what was wanted. Pistons and piston rings are also shown by Messrs. Timothy Bates and Co., Sowerby Bridge, Rickaby of Sunderland, and Oldham of Dukinfield. All these are too well known to need a syllable of description here.

Various forms of metallic and other packings are exhibited in considerable numbers. Asbestos will be found at stands No. 120, 173, and 437, shown by the United Asbestos Company, Queen Victoria-street; Toope's Asbestos Covering Company, Stepney; and by Mr. Hooke, of Upper Thames-street. Asbestos as a packing may be said to have been first introduced into this country by Mr. St. John Vincent Day, a consulting engineer, of Glasgow, some ten or twelve years ago, and, after many vicissitudes its character as a packing is now fully established. We may digress for a moment to say that Toope's patent asbestos boiler and steam pipe covering deserves to be examined by those visiting the Exhibition. Katzenstein's metallic piston-rod packing is shown by Messrs. John Cran and Co., of Leith. This packing is pretty well known now, as it is used by the Cunard, Anchor, Guion, Inman, and several other great mail steamship companies. It consists of a series of rings put into the stuffing-box, the rings being shaped in cross-section as in sketch, page 267. A coil of Tuck's packing is put on top of the rings to keep them down. Messrs. Haacke and Co., of Lime-street, E.C., show specimens of "Fossil Meal" composition used for covering boilers and steam pipes. This fossil meal is neither more nor less than the shells of infusoria *Diatomacea*. The peculiar form of these shells gives the meal a high porosity. It will absorb water to two or three times its own weight still holding together in a mass. It is for this porosity that it is used in the manu

facture of dynamite, which is fossil meal saturated with nitro-glycerine. The value of a material as a non-conductor has been shown to be a function of its porosity, and for this reason Messrs. Haacke and Co.'s boiler clothing is extremely efficient. It is claimed that one inch of this composition is as good as three inches of any other in the market, and to prove this a vertical boiler is shown at Stand 45 clothed with one inch of it. Two thermometers are fitted side by side, one resting on the iron surface of the boiler, the composition being cut away to admit it, and the other close by on the surface of the cleading. On Tuesday morning we found that one thermometer stood at 84 deg. and the other at 261 deg. Fah., a difference of 177 deg., a very excellent result. The details of the manufacture of this boiler clothing are interesting. It is dug out in Westphalia from quarries, if we may so call them, in a condition not unlike friable chalk. The lower strata is greenish in hue. The upper strata slightly decomposed by the atmosphere are light brown, nearly white. The two are mixed together and burned in kilns; all organic matter is thus got rid of, and nothing is left but a nearly pure silica. This powder is packed in linen bags or tubes about 1½in. in diameter, and used for wrapping round steam pipes, for which it forms a very cheap and admirable clothing. To cover boilers it is mixed with water containing any cheap gluten, and converted into a plaster or mortar, which is spread over the boiler with trowels. It quickly dries without cracking, and can be left unpainted, its colour being an agreeable light brown, but it takes paint well. Messrs. Haacke and Co. also exhibit asbestos packing rings for steam joints, well made and apparently of good material.

A great number of governors is shown. They will be found at twelve stands. One is Durham's, which we have often had to speak of in high terms. In its newest form considerable improvements have been introduced, but its principle remains unaltered. A fan revolving in a cylinder filled with oil or water causes a resistance which suffices to prevent a nut from riding forward on a screw so long as the speed is steady; but any variation in the speed causes the nut, between the influence of the fan and a spring, to travel either way, admitting steam to, or shutting it off from, a small steam cylinder, a piston in which controls the throttle valve. Churchill's governor, which we illustrate at page 270, is exhibited by Mr. Oswald, of 75, Gracechurch-street. In this, also, there is a cylinder to be kept full of oil or water, in which runs a fan. The action is so similar to Durham's governor that no special description is needed.

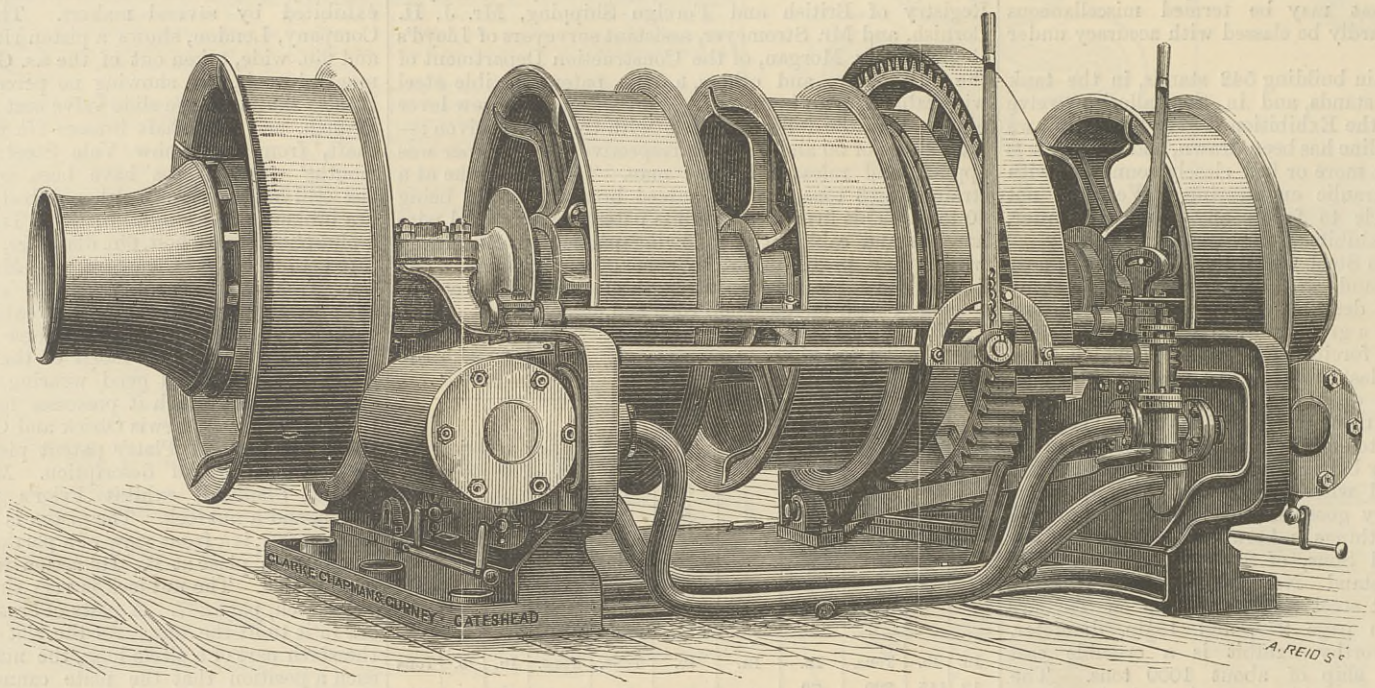
The refrigerators exhibited are not sufficiently numerous or interesting to demand a separate article. They are shown at five stands by Messrs. Hall, of Dartford; Bell-Coleman, of Glasgow; the Haslam Foundry and Engineering Company; Messrs. Thomas Piggott and Co., Birmingham; and Messrs. A. J. West and Co., of Southwark Bridge-road. The last-named firm show not a cold-air but an ether machine, intended to make about 10 cwt. of clear ice per day. This appears to be a very good and efficient machine of its kind, but it is, of course, quite inapplicable of the production of large volumes of cold air for meat preserving. Messrs. Hall, of Dartford, show one of their small machines in action. It delivers about 4500 cubic feet of air per hour, and is so similar to machines made by the same firm that we do not illustrate it; but instead the large machine which we recently described as at work at the Victoria Docks. The engraving will be found on page 266. It is one of a type specially intended for cargo ships. It is 21ft. long, under 7ft. 6in. high, and about as wide. Standing in front, we have at one end a crank shaft and fly-wheel; at the other end is the air-compressing cylinder. The steam cylinder is on the same plane, and both are at a higher level than the crank shaft. The steam cylinder is 15in. diameter, the compression cylinder 20·75in. diameter, and both have a stroke of 2ft. 6in. The air cylinder stands on top of the tubular air cooler. The steam cylinder is supported by a hollow frame, in the lower part of which is placed the air pump, lying horizontally under the steam cylinder. The air cylinder and the steam cylinder have one piston rod common to both, and in the mid length of this rod is a bearing, which carries the two sides of a double vertical lever, about 5ft. long, the lower end of which works on a link, while near the top are secured the two radius rods of a parallel motion. These radius rods work the air pump, which has two piston rods side by side. To the middle of the vertical beam is jointed the small end of a connecting rod, which passes through the hollow framing before referred to, and works in a vertical plane between the steam cylinder and the air pump, and so drives the crank shaft. At the extreme forward end of the engine is a rectangular box, which is the jet condenser. The top of the air-compressing cylinder is nearly 7ft. above the floor line; indeed, it is nearly as high as the top of the fly-wheel. Nearer to the front of the machine, and at a considerably lower level, lies the air expansion cylinder 16in. in diameter and 2ft. 6in. stroke. This has two parallel piston rods which lay hold of a slipper crosshead carrying the small end of the connecting rod, which works a second crank on the crank shaft. The admission valves of the expansion cylinder are flat slides with Meyer's adjustable cut-off slides on the back; the exhaust valves are silent poppet valves, worked by positive motive cams.

The Haslam Foundry Company exhibit a 7000 cubic feet refrigerator. It is similar in its action to most cold air machines. The power cylinders are so connected, however, that there is no dead centre. This is effected by putting the air expansion cylinder in a vertical position at the end of the bed-plate. The air is cooled down by water in the usual way, and still further by return cold air from the meat chamber. In this way it is claimed that very dry air is delivered and no snow is produced. We have never seen Mr. Haslam's machine at work, but we are informed by independent authorities that it is very efficient, capable of doing excellent duty, and as it is probable that we shall have more to say about it at another time, we shall not now extend our notice of it. We may digress slightly for the moment, however, to call attention to the hulk Seawitch, which has been fitted up as a cold meat store by Messrs. Haslam. The drawing explains itself.

The refrigerator shown by Messrs. T. Piggott and Co., of Birmingham, is a large and heavy machine. It is the first of the kind made by the firm, has as yet done no work, and being short of steam at the Agricultural Hall, it is impossible to form the least idea of its capacities. In its present form it appears to be unsuitable for use on board ship, being much too straggling; but this objection would not apply to a machine intended for use on shore. It is a combination of a fairly well designed engine made for some time now by the firm, with the cooling cylinders. The engine is fitted with a jet condenser. The principal novelty is the use of a compressing cylinder which has no inlet valves, but instead a series of holes disposed in a belt round it at the middle of its length. The sketch shows the liner in which works the deep piston P. This is supposed to have just completed its stroke, and to return in the direction of the arrow. During the previous stroke it gradually expanded the air behind it, until it uncovered the perforations in the liner A B, when the air rushed in from the return pipe from the meat room, and will now be compressed and delivered into valve chambers at the end of the cylinder. The advantage claimed is that the whole area of the cylinder ends can be given up to delivery valves. The expansion cylinder is fitted with four Corliss valves. The coolers are four in number, vertical cast cylindrical columns; within two the air is cooled by water outside thin pipes; in the next two it is still further cooled down by the cold air coming back from the meat room. It then passes to the expansion cylinder. There are some very good features about this machine, and when Messrs. Piggott have had more experience in this class of work, and have reduced their refrigerator to a shape suitable for use on board ship, we hope to say more about it; as we have no practical acquaintance with its performance we can say nothing on this point. The representative of the firm told us that it had run for fifteen hours continuously without producing any snow, and that a very low temperature had been obtained; but the truth is that the makers do not as yet know what it will or will not do.

The 10,000ft. machine exhibited by the Bell-Coleman Mechanical Refrigerator Company presents some points of novelty; the system is too well-known to require description. We illustrate it at page 266. A is the steam cylinder, E expansion cylinder, P the compression cylinder, W the circulating pump, T the tower. It is specially designed to let the fly-wheel stand close up to a bulkhead; the whole is thus rendered more accessible. The pipes for drying the air in the way peculiar to the Bell-Coleman process are fixed in the sole-plate of the machine instead of in the walls of the chamber being cooled. The steam cylinder is 13in. diameter and 12in. stroke. This is the first of this pattern made, and alterations in detail will probably be made with advantage in future machines.

Messrs. Fielding and Platt, of Gloucester, exhibit a large collection of hydraulic rivetting machines, principally made under Mr. R. H. Tweddell's patents. This firm has succeeded in making the hydraulic rivetter so far portable that it is difficult to imagine the situation in which it cannot be applied. Thus it can be used, on the one hand, for deck beams of ships, and on the other for their keels. A specimen is shown similar to a portion of the keel of the s.s. Servia, planed through to show the quality of the work done, which is very good indeed. We illustrate on page 263 the pumps used for supplying pressure. These are very simple and well arranged, stopping automatically when the accumulator is up, and going on again when it falls, in a way too well known to need description. We also illustrate a new form of portable rivetter, in which Mr. Tweddell uses a curved cylinder. The cylinder, which is about 8in. in diameter, and as much deep at the deepest side, is bored out by using the centre-pin hole or fulcrum as a centre, and as the cylinder is advanced on the boring machine to keep it up to the cutter it, of course, describes a curve of a proper radius. The rivetter is fitted with a small subsidiary plunger to open the jaws. This is always under pressure, and its resistance is overcome by the main plunger, which is of much larger area. The pressure employed is 1500 lb. to the square inch. A safety lever is fitted to shut off the water as soon as the jaws have approached each other sufficiently. The firm show a model of a flanging machine for heavy boiler work, intended to take the place of malls, and we illustrate a somewhat similar machine in regular use on the Tyne. The principle of its action is the substitution of a progressive system of flanging in place of doing a plate all at once in a mould or die; this materially reduces the cost of the moulds, an important matter when the sizes and shape of the work vary so much, as is the case in marine boilers. The press consists of a strong cast iron frame or standard, in which are three hydraulic cylinders, two vertical and one horizontal; the outer vertical cylinder acts as a vice or nipper to hold the plate tight to the block or die, while the other on its descent turns the plate over, the horizontal cylinder squaring the work and the flanging. Great accuracy is thus obtained, and the material much less strained than by hand, while the economical results are, we understand, extremely satisfactory. At this stand will also be found a large collection of photographs well worth examination.

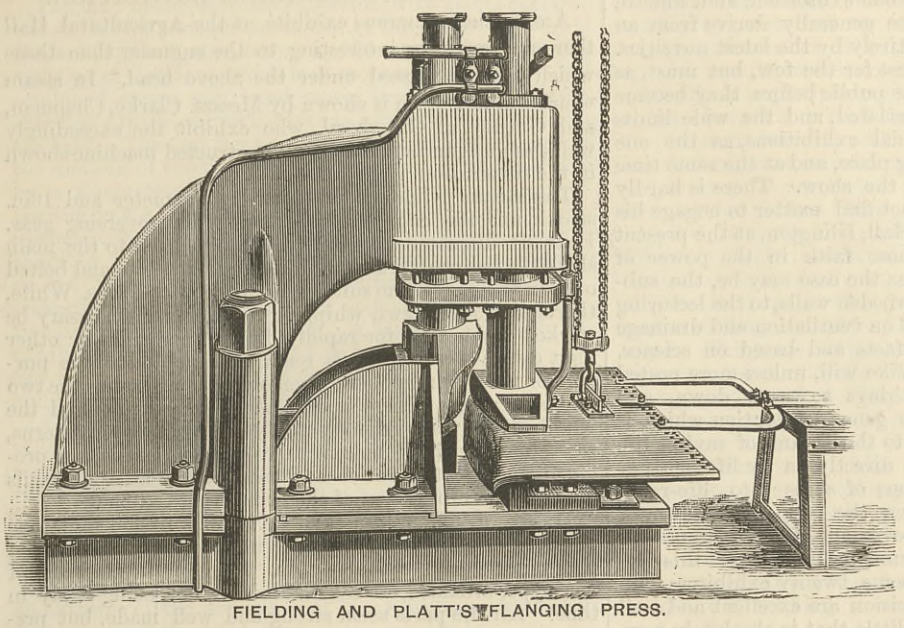


CLARKE, CHAPMAN, AND GURNEY'S STEAM WINCH.

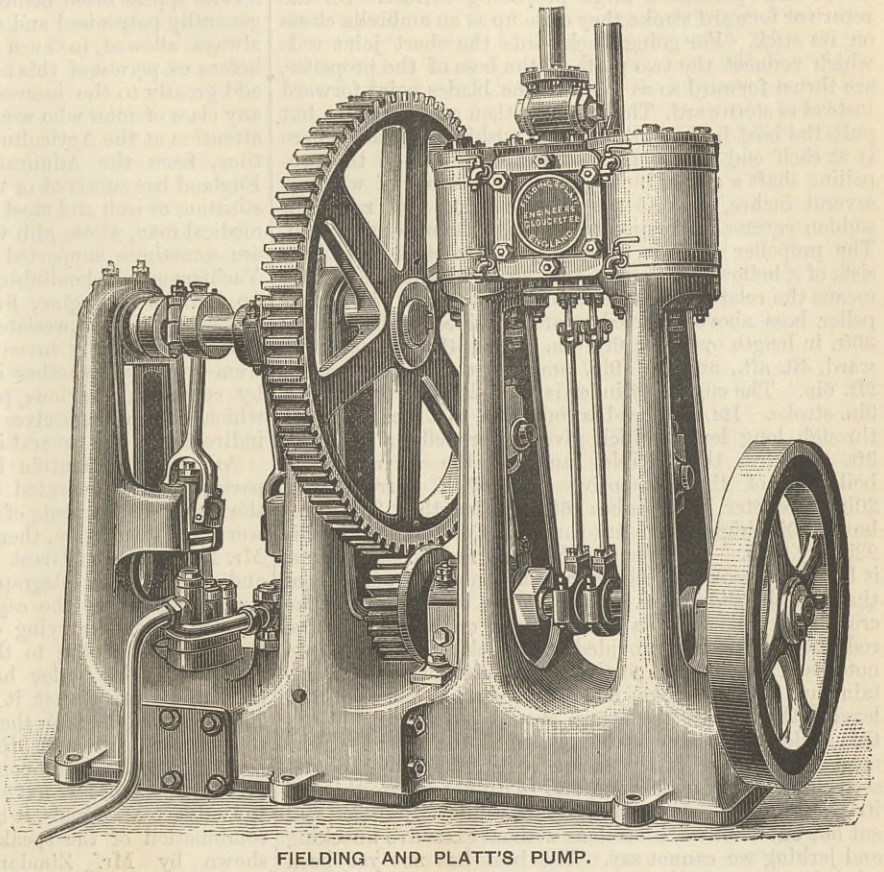
A great many steam pumps are exhibited. We shall notice a few of them here. Messrs. Loudon Bros., of Glasgow and London, exhibit what they term a "Clyde" steam pump, which we illustrate. The drawing explains itself to engineers. The workmanship is good, and the design satisfactory enough. Messrs. Carrick and Wardale, of Gateshead—Stand 42—exhibit an air compressor with a steam cylinder 13in., and an air cylinder 10in. diameter, with a stroke for both of 12in., and a ballast pump for discharging tanks, which we illustrate at page 270. This engraving explains itself. The usual suction and delivery valves are replaced by a slide valve without lap or lead, and it is claimed that in this way coal, corn, or shavings can be pumped as well as clean water. Every sea-going engineer knows what this means. The pump is better finished than is the rule with this class of machinery; and it appears to be a highly efficient machine, doing its work at the Exhibition—although, of course, under no heavy load—with great steadiness and freedom from jerking.

Messrs. Blundell Bros., of Limehouse, show at Stand 47 a large collection of the well-known Downton "Waterwitch" pump. In this pump there are no valves in the pistons, four pistons working on the same barrel, and alternately dilating and contracting the spaces between them. The firm also show a model of the first Downton pump ever made, constructed in 1825, and an impression from an original copper-plate engraving, dated 1826, will be found in the circular issued by the firm, accompanied by the following words—"The principle of this pump is its having three buckets in one barrel, which are worked by a crank motion constructed in such a manner that one or other of the buckets is always rising, so as to produce a continual

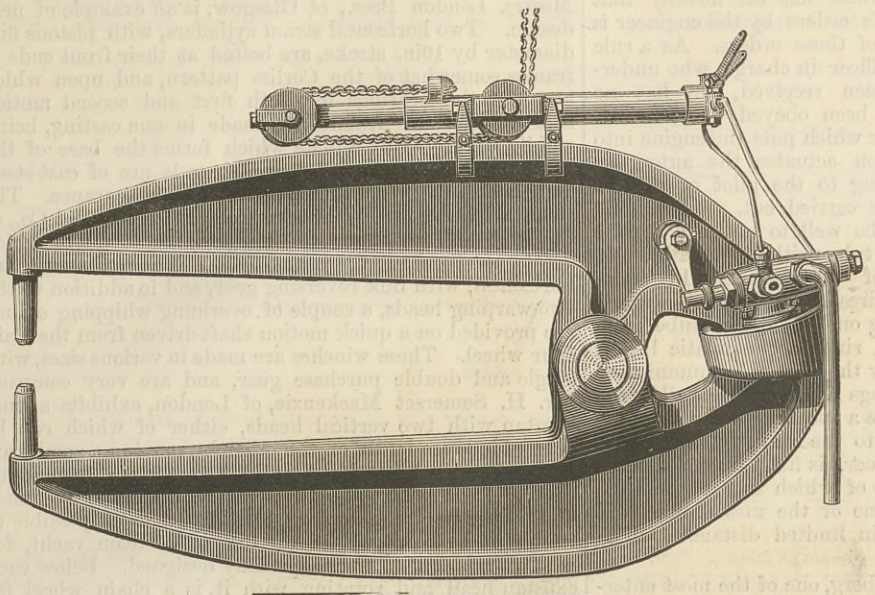
EXHIBITS AT THE NAVAL AND SUBMARINE EXHIBITION



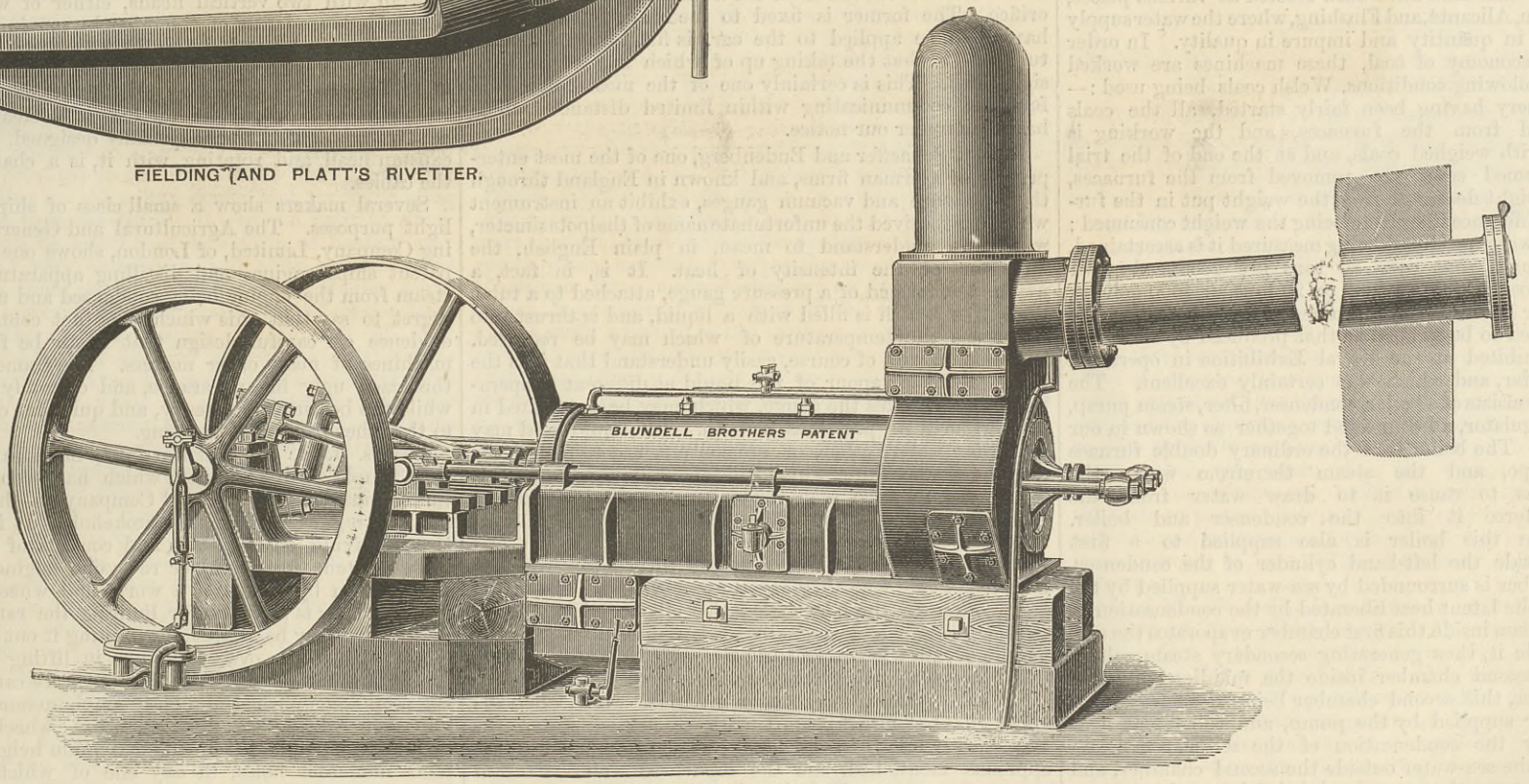
FIELDING AND PLATT'S FLANGING PRESS.



FIELDING AND PLATT'S PUMP.



FIELDING AND PLATT'S RIVETTER.



BLUNDELL'S WATERWITCH PUMP.

stream of water from the nozzle or jet." In this pump there were bucket clacks. In the "Waterwitch" there are, as we have said, no bucket clacks. At the stand will be found a photograph of a large pump recently erected at Silvertown for the West Ham Local Board, of which pump we shall have more to say. We illustrate a horizontal "Waterwitch" pump of nearly the same type above. The firm also exhibit a collection of ship's closets well worth attention, the objectionable storm valve being dispensed with. They also show what is known as the "Thorneycroft" closet, originally intended for torpedo boats, and dispensing altogether with the use of a tank. This closet is, we understand, coming into extensive use for yachts. When we state that pumps will be found at no fewer than twenty-seven stands, we shall, perhaps, have justified ourselves in not noticing all in the Exhibition. Of others than those we have noticed we may say more in another impression.

As an indication of the extent to which shipowners are now appreciating the value of plenty of pumping power on board steam vessels, reference may be made to the long list of vessels fitted with pulsometer pumps by the Pulsometer Engineering Company. From a list of 128 vessels so fitted, we gather that vessels of all sizes, including the largest afloat, such as the City of Rome, are fitted with pulsometers for circulating through condensers, emptying bilge compartments by connection with one central set of valves, deck washing, as a fire pump, and in some large passenger ships for maintaining a constant cleansing flow of water through the water-closets, a sanitary application which all passengers of the White Star liners so fitted will appreciate. Experience in the use of these pumps shows that one advantage attending their use is the absence of working parts, which makes skilled attendance unnecessary, prevents any difficulties in starting even after long periods of disuse, enables them to be worked under water, so that if connected to a donkey boiler on deck they may be set to work in a flooded engine-room, and, what is of considerable value in passenger ships, they are quiet in action. The ease with which the valves may be renewed and the small space occupied, and the absence of an exhaust pipe, are also advantages which point to the extensive use of these pumps in steamships. Amongst other articles exhibited by the Pulsometer Engineering Company are the "Thames" filter, as used for filtering turbid water used in the boilers of river steamers, and the centrifugal pumps now made by it.

Mallet's buckled plates and a modification of these presumably as proposed for use in the construction of ships, are exhibited by Messrs. P. and W. Maclellan, Glasgow. The plates are of steel, about 3ft. 4in. × 3ft. 4in. outside the marginal flat rim or flange, and 3ft. × 3ft. within that margin, $\frac{1}{4}$in. in thickness, and having a rise of $2\frac{1}{2}$in. Messrs. Maclellan's modification consists in giving a radial corrugated form to the plates, and this appears to increase their strength, as shown by the figures given by the firm, according to which the plain Mallet plate gave a deflection of $\frac{5}{32}$in. with a load of 5 tons resting on a block 12in. × 12in. fitting on the centre of the plate, $\frac{7}{16}$in. deflection with a load of 10 tons, and $\frac{13}{16}$in. with a load of $12\frac{1}{2}$ tons, while the corrugated plate gave a deflection of $\frac{1}{16}$in. with 10 tons and $\frac{1}{8}$in. with 15 tons, the flanges being firmly fixed, in which case, according to Mallet's numerous experiments, the plates would carry double the weight necessary to cripple them with unfixed flanges. Mallet's experiments were made with dead loads, while those of Messrs. Maclellan were made with a hydraulic press. The structural value of the buckled plate, with but small depth or buckle, has been greatly overlooked, but in the hands of an energetic firm this may be brought prominently forward, and with great advantage in respect of strength, weight, and space occupied, as compared with any other mode of strengthening plates.

An attractive feature in the centre of the Exhibition is a large circular water tank for the exhibition of diving and ship-raising apparatus and submarine boats. It is exhibited by Mr. Samson Barnett, jun., and is 20ft. in diameter and 10ft. in depth. It is of wrought plates 0·375in. in thickness, and is put together in sixteen vertical segments, each being two plates wide, the joints being made with rubber held between angle irons. The bottom plates are also held together in eight radial segments with joints made in the same way. Eight glass windows about 2ft. by 1ft. 6in. are let into the circumference of the tank at a convenient height for visitors to look into the water to see the operations going on inside. These windows are each of one sheet of glass about 0·6in. thickness held in cast iron frames jointed with india-rubber.

A full sized boat, which is attracting attention, exhibited by Messrs. Duncan Brothers, London, is fitted

with Welton's feathering propeller, and designed for use as a tug-boat on a South American river, where the depth of water is limited. This boat and its propeller we illustrate by the engravings on page 267, from which it will be seen that the propeller consists of two blades which have a reciprocating motion, by which they open on the sternward stroke and present a large propelling surface. On the return or forward stroke they close up as an umbrella closes on its stick. For going backwards the short joint rods which connect the two parts of the boss of the propeller, are thrust forward so as to make the blades point forward instead of sternward. The propeller then acts as before, but pulls the boat backward instead of pushing it ahead. There is at each end of the path of the crosshead on the propelling shaft a spring buffer, the flexible range of which is several inches, so that the propeller does not receive a sudden reversal of motion from one to the other direction. The propeller shaft is, of course, double—that is, it consists of a hollow shaft and a solid shaft within it. By this means the relative movements of the two parts of the propeller boss above referred to are obtained. The boat is 36ft. in length over all; 6ft. 6in. beam; 4ft. 6in. deep forward, 4ft. aft., and 3ft. 9in. amidships. The draught is 2ft. 6in. The engine cylinder is 10in. diameter, and has a 9in. stroke. Its crosshead is connected to a rocking shaft through long levers, which give the propeller a stroke of 3ft. 6in., less the flexible range of the spring. The boiler is of the locomotive type, with barrel about 20in. diameter, and tubes 6ft. in length. The fire-box is 20in. high above fire-bars, and the grate surface is 22in. by 20in. As the engine has only reciprocating parts, it became necessary to obtain a pause motion from one of these for the slide valve. This is done by a link from the crosshead connected to a sliding block on the slide valve rod, the block being provided with hooks which take into notches in the enlarged portion of the slide valve rod at a certain part of the stroke, move it a certain distance and leave it there until the steam should be cut off. When this is done the valve again rests until the return stroke needs the opening of the steam port. We have not yet seen this valve gear at work, and so cannot say anything of its performance. It certainly gives a quick admission and cut off, but whether this is done without excessive knocking and jerking we cannot say. The boat has not yet been tried, but a speed of 12 knots is expected to be attained.

The illustration on page 267 shows an arrangement of Normandy's improved patent treble distilling machinery for producing from sea-water 30,000 gallons, or 134 tons, of pure ærated drinking water with 6½ tons of coal, and machines of this kind have been erected at various places, such as Aden, Alicante, and Flushing, where the water supply is deficient in quantity and impure in quality. In order to test the economy of coal, these machines are worked under the following conditions, Welsh coals being used:—The machinery having been fairly started, all the coals are removed from the furnaces, and the working is continued with weighed coals, and at the end of the trial the unconsumed coals are removed from the furnaces, and their weight deducted from the weight put in the furnaces, the difference therefrom being the weight consumed; and on the water produced being measured it is ascertained, we understand, that over 30 tons are produced with 1½ tons of coal, which is equal to 20 tons, or 4500 gallons, of water per 1 ton of coal consumed. The quality of the water is stated to be as good as that produced by the small machine exhibited at the Naval Exhibition in operation with sea-water, and which was certainly excellent. The machinery consists of a boiler, condenser, filter, steam pump, and feed regulator, all connected together as shown in our illustration. The boiler is of the ordinary double furnace Cornish type, and the steam therefrom works the pump so as to cause it to draw water from the sea, and force it into the condenser and boiler. Steam from this boiler is also supplied to a first chamber inside the left-hand cylinder of the condenser, which chamber is surrounded by sea-water supplied by the pump, and the latent heat liberated by the condensation of the boiler steam inside this first chamber evaporates the sea-water outside it, thus generating secondary steam, which is led to a second chamber inside the middle cylinder of the condenser, this second chamber being also surrounded by sea-water supplied by the pump, and the latent heat liberated by the condensation of the secondary steam evaporates the sea-water outside the second chamber, and the tertiary steam thus generated is led into a third inner chamber, inside the upper part of the right-hand cylinder of the condenser, and also surrounded by sea-water from the pump, and is condensed therein. The fresh water condensed inside the three inner chambers as above explained is aërated by mixing air with the steam by means of the air pipe, and this aërated water next passes through a fourth chamber inside the lower part of the right-hand cylinder of the condenser to be cooled to about the same temperature as the sea-water supplied by the pump—the difference is usually about 4 deg. Fah.—and the cooled fresh water next passes through the filter to be purified, and from thence through the feed regulator to the pump, which forces it into the tanks or where desired. By thus utilising the latent heat liberated during condensation, one boiler yields nearly as much fresh water as would be yielded by three boilers if the steam was condensed at once into water.

INSTRUMENTS AT THE NAVAL AND SUBMARINE EXHIBITION.

That the Naval and Submarine Exhibition should have secured Easter Monday as an opening day and reaped the benefit which the fine weather of the Bank Holiday could afford, will be a matter for congratulation to all concerned in its success, and the interest which the general public has displayed in the first days is a good augury for the ultimate "meeting of both ends" of this affair. Exhibitions have become so common of late years, not only in England, but on the Continent, where town councils actually promote them with a view to relieve the ratepayers, that it would be unreasonable to look for any very large proportion of novelties in any one exhibition, and, indeed, the benefit which the populace generally derive from an exhibition is not produced entirely by the latest novelties. These have their special interest for the few, but must, as a rule, appear often before the public before they become generally patronised and appreciated, and the wide limits always allowed, in even special exhibitions, as the one before us, permit of this taking place, and at the same time add greatly to the interest of the show. There is hardly any class of man who would not find matter to engage his attention at the Agricultural Hall, Islington, at the present time, from the Admiral, whose faith in the power of England has survived or not, as the case may be, the substitution of iron and steel for wooden walls, to the lecturing medical man, whose glib views on ventilation and drainage are sometimes supported by facts and based on science. Yachtsmen and landlubbers alike will, unless more posted up than we imagine, find things to note down, and everybody will appreciate the general attention which is now being paid by inventors to the means of saving life from drowning, whether it be directly, as by life-belts, or by converting various portions of ships into life-rafts, which detach themselves when the ship goes down, or indirectly by the general improvement of navigation.

Among the scientific instruments, although this department is represented by some twenty exhibitors, and the usual instruments of precision are excellent and well worthy of inspection, there is little that is absolutely new. Mr. Kuhlmann, of Great St. Helens, E.C., shows a bridge and engine-room telegraph, which has the novelty that the answering of the captain's orders by the engineer is effected by the carrying out of those orders. As a rule the engineer replies to the officer in charge, who understands that his order has been received, but has no mechanical proof that it has been obeyed. But in Mr. Kuhlmann's telegraph the gear which puts the engine into the proper speed and direction actuates the automatic reply apparatus, thus conveying to the pilot or officer a proof that his orders have been carried out. While upon the subject of signals, it may be well to notice a capital combination of the speaking tube with pneumatic bells, shown by Mr. Zimdars, of Gray's-inn-road, stand No. 307. Here the shrill and tiresome whistle is dispensed with, and the action of taking one end of the tube from its position, in order to use it, rings a pneumatic bell at the other extremity. Similarly the person communicated with, by loosening his end rings a pneumatic bell at the first end. At each end there are a speaking and a listening orifice. The former is fixed to the wall, but the latter, having to be applied to the ear, is fixed upon a flexible tube, and is that the taking up of which has actuated the signal bell. This is certainly one of the most convenient forms of communicating within limited distances which has come under our notice.

Messrs. Schaeffer and Budenberg, one of the most enterprising of German firms, and known in England through their pressure and vacuum gauges, exhibit an instrument which has received the unfortunate name of thalpotasimeter, which we understand to mean, in plain English, the measurer of the intensity of heat. It is, in fact, a pyrometer, formed of a pressure gauge, attached to a tube, the end of which is filled with a liquid, and is thrust into any space the temperature of which may be required. Our readers will, of course, easily understand that it is the pressure of the vapour of the liquid at different temperatures that actuates the gauge, which may be graduated in temperatures or pressures, or both. The liquid used may be either water, ether, or quicksilver, according to the range of temperatures which will be encountered. At this stand also may be seen Budenberg's patent self-acting steam trap for discharging condensed water. This apparatus consists of two hollow brass pipes slightly bent, and placed so that the concave sides are turned towards each other. At one end they are connected by an elbow, and at the other are the inlet and outlet elbows. These tubes are compressed longitudinally by a rod of iron. In the middle of the tube attached to the outlet elbow is a valve, which is opened when the distance between it and the iron chord is less than the regulation distance. Now, when the apparatus becomes charged with condensed water the temperature falls, and the tubes contract, which causes the approach mentioned, and the condensed water is forced out at the outlet. The dry steam soon warms up the bars again, expansion of the tubes shuts the valve, and the discharge ceases. We have never seen one of these dischargers at work, but we should imagine that unless the pressure of the steam in the boiler were maintained very uniform the action of the apparatus would be very variable. Messrs. Schaeffer and Budenberg also exhibit a patent double indicator. In this instrument the piston rod of the indicator is elongated into another cylinder situated below the usual one, and carries another piston of the same dimensions. This second cylinder is connected with the other end of the engine cylinder in such a way that pressure in this end would tend to lower the indicator piston. Such a pressure is, in fact, back pressure during the period of admission and expansion into the end connected with the top cylinder of the indicator, and inversely when that cylinder receives back pressure, the under cylinder is subject to the pressure during admission and expansion; so that it is manifest that the real balance of pressure on the piston is given by the indicator directly at any point, and is measured by the distance of the point of the diagram from the atmospheric line. Of course as the resulting diagram will be as much below the atmospheric line as above it, the atmospheric line must be given in the middle of the card. By closing the connection with one side of the cylinder, a diagram of the ordinary kind will be obtained, giving the back pressure directly of the other side. Besides the convenience of obtaining in one diagram an expression of the work done in an entire revolution, there is the further advantage that the actual force acting on the little piston being less than in the usual instrument, the oscillations due to its momentum will be less also.

LIFTING AND HAULING APPLIANCES AT THE NAVAL AND SUBMARINE EXHIBITION.

Among the numerous exhibits at the Agricultural Hall there are few more interesting to the engineer than those which may be classed under the above head. In steam winches a new form is shown by Messrs. Clarke, Chapman, and Gurney, of Gateshead, who exhibit the exceedingly well-designed and substantially-constructed machine shown in the illustration, page 262.

The steam cylinders are each 8in. diameter and 16in. stroke, and the engine is fitted with link reversing gear. Four 3ft. diameter whipping drums are fixed to the main shaft, the two central drums being made in halves and bolted over an ordinary drum suitable for loads up to 4 tons. While, therefore, four 15 cwt. whipping ropes can if necessary be worked at one time for rapidly discharging grain or other light cargo, the machine is readily adaptable to one purpose or the other by merely removing or replacing the two central drums. There is only one set of gearing, and the wheels, being cast from specially prepared iron patterns, run almost without noise. Two warping heads are provided, and great attention has been paid to all the details down to the lubrication of the connecting rod ends.

Messrs. J. H. Wilson and Co., of Liverpool, show one of their ordinary standard pattern winches, with a pair of horizontal steam cylinders, 7in. diameter, a machine of new type, intended for the Exhibition, not being ready in time. All the parts seem strong and well made, but present no special novelty.

The "Clyde" horizontal steam winch, in the stand of Messrs. Loudon Bros., of Glasgow, is an example of neat design. Two horizontal steam cylinders, with pistons 6in. diameter by 10in. stroke, are bolted at their front ends to frames somewhat of the Corliss pattern, and upon which are cast the bearings for both first and second motion shafts. The two frames are made in one casting, being rigidly connected by a plate which forms the base of the machine. All levers and excentric rods are of cast steel, and though not polished are pleasing in appearance. The steam winch shown by Messrs. Robert Rogers and Co., of Stockton-on-Tees, is one of their ordinary type of which great numbers have been sold. The cylinders are horizontal, with link reversing gear, and in addition to the two warping heads, a couple of overhung whipping drums are provided on a quick motion shaft driven from the main spur wheel. These winches are made in various sizes, with single and double purchase gear, and are very compact. Mr. H. Somerset Mackenzie, of London, exhibits a dual capstan with two vertical heads, either of which can be rotated independently of the other by moving a small cam within the head itself, got at by removing a loose brass cover. In this machine the steam cylinders are vertical, and all the parts are kept as close together as possible to enable it to be placed in the bow of a steam yacht, for which purpose it has been specially designed. Below each capstan head, and rotating with it, is a chain wheel for the cables.

Several makers show a small class of ship's winch for light purposes. The Agricultural and General Engineering Company, Limited, of London, shows one of Chaplin's patent ships' engines and distilling apparatus, the waste steam from the engine being condensed and utilised. We regret to say that this winch does not contain the same evidence of careful design that is to be found in the machines of many other makers. The frames are, to say the least, ugly in appearance, and certainly seem weak, while the bearings are heavy, and quite out of proportion to the other parts of the casting.

Messrs. J. H. Hall, of Dartford, have in operation a very simple form of winch, which has been adopted by the Peninsular and Oriental Company in their steamers for hoisting ashes from the stokehole. It is shown by the engraving on page 270, and consists of a King and Cliffe's patent three-cylinder reversing engine, working a chain drum by means of a worm and wheel; automatic stopping gear is provided for limiting the range to whatever extent may be desired, thus taking it out of the power of the attendant to overrun either in lifting or lowering. This was found necessary, as the men were careless, and it has been accomplished in a most simple manner by adding the spur gearing as illustrated. A wheel makes one revolution during a lift of the maximum height, and contains numerous holes, in any one of which a pin can be placed according to the range required, the second pin being a fixture. The lever shown is moved in either direction by the pins, according as the bucket is being lifted or lowered, and shuts off the steam, instantaneously stopping the motion of the hoist. It is claimed by the makers that the slide valve of the King and Cliffe engine is superior to that of any other three-cylinder engine, inasmuch as it has an excentric motion imparted to it which prevents uneven wear. A very simple ash hoist is also exhibited by Messrs. Higginson, of Liverpool, no gearing being employed, but merely a drum driven direct by a reversing engine with three oscillating cylinders as in the "Steam Quartermaster," made by the same firm. This ash lift is being used by many of the large steamship companies, including the White Star, Guion, and Inman lines

Messrs. Tangye Bros., Limited, show one of Cherry's patent steam lifts at work. In this hoist a long stroke piston is caused to operate a winding drum by means of a steel pitch chain working over a toothed wheel on the drum shaft. The machine is made with either one or two cylinders—in the latter case two lifting chains being used—one ascending while the other descends. It is claimed that with this form of lift the number of working parts is very much reduced, while all noise of vibration is avoided. Either steam, water, or air pressure can be used, the only difference being in the form of piston employed.

Messrs. Napier Bros., of Glasgow, exhibit a compact little steam windlass of their usual type, suitable for a 300-ton yacht. The chief peculiarity in this machine is the differential brake, which is self-holding in the lowering direction, but can easily be slacked to allow the chain to be paid out at any desired rate, and it automatically frees itself for hauling in. The steam cylinders are

vertical, and all the parts seem strong and well made, though some of them appear difficult of access.

The only other windlass exhibited, with the exception of one or two for hand power shown in the gallery by Mr. W. R. Carel, of Rochester, is that by Messrs. Emerson, Walker, and Co., of London, which is at work under steam. It is combined steam and hand power, and being No. 5600 of this firm's make, shows the favour in which these machines are held. The two steam cylinders are horizontal, and all the motions of starting, stopping, and reversing are effected by a single lever. The power is transmitted from the gearing to the chain drum through a friction cone of large diameter, the drum itself being shifted bodily along the shaft by a fine pitched screw when required to be put in or out of gear. This friction contrivance also acts as a powerful brake in paying out, and enables even one or two links to be given at a time. A machine similar to that exhibited has just been fitted on board the Sunbeam, and the first windlass supplied by Messrs. Emerson, Walker, and Co. in 1857 is still at work.

A very ingenious and efficient form of pulley block with roller bearing—Brewer's patent—is shown by Mr. H. W. Carey, of London. The spindle, which is of steel, instead of running in a fixed bearing, works on a turned friction roller, which itself revolves on a steel pin, so reducing the friction by a sort of compound leverage. The principle is applied to gins and leading blocks of all sorts, and is equally suited to the pulleys of light cranes, whips, and cathead lifts. As an example of the endurance of these bearings, it is stated that on one of the Glen line of steamers a 14in. gin supplied last August has lifted 25,000 tons of cargo without any perceptible wear, and is still in use.

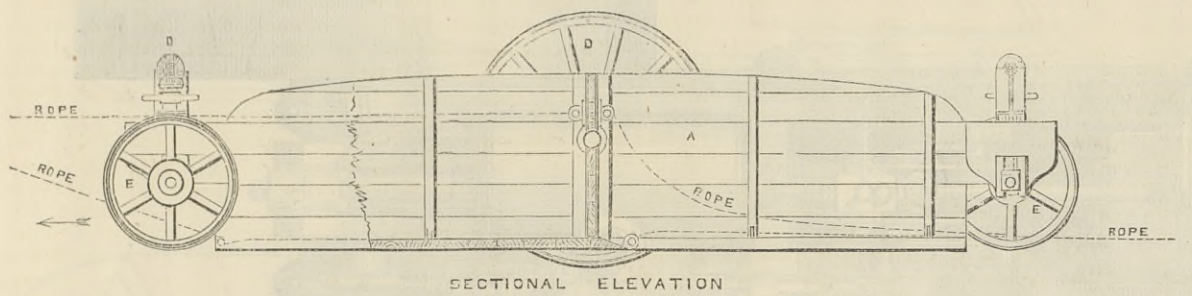
Steel wire ropes are now exclusively used by Messrs. Day and Summers, of Southampton, in the lifting tackle of their well-known sheer legs, of which a model is shown. They have a set in hand at present for the Russian Government which will lift 150 tons by a rope. Messrs. Day and Summers also show a model of their non-fleeting slipway hauling gear. This is simply a very powerful steam crab with a large drum, round which a wire rope is coiled at the rate of from 10ft. to 15ft. a minute, a second drum being provided on an intermediate shaft with a light rope for hauling up the empty cradle, and for unwinding the large rope from the drum. Up to the limit to which a wire rope can be safely used, this form of hauling gear will be found very convenient, and more economical as regards time than most of the usual hydraulic gears. There must, however, be considerable loss of power from friction in the gearing, and as in slipways of even moderate size a hauling stress of no less than 400 tons is sometimes required, it would appear that a single or even a double wire rope would be quite insufficient for the purpose. The spur gearing, too, for such enormous strains might probably present some difficulties of construction.

Messrs. Clark, Bunnett, and Co., of London, exhibit an ordinary hand-power winch with a cupped drum, instead of the ordinary winding barrel. We should question the advisability of this innovation, considering the carelessness of the men in whose hands such apparatus is placed. They also show a wooden model of a novel dredging appliance for harbours, invented by Mr. Smith, of Aberdeen, but which has not yet been put into practical operation. It is proposed to construct a truck of wood or iron with two vertical sides A, each about 14ft. long, and 3ft. 6in. deep, spaced about 7ft. apart, and connected at the middle by the plate B. The sides are turned in at the bottom to form internal grooves, on which a sliding bottom-plate can rest, this plate being only sufficiently long to act as a bottom for one partition at a time. The truck travels on a pair of large centre wheels D, and two pairs of rollers E, placed at the extreme ends. Wire ropes from the hauling engines are attached to each side of the middle partition, just above the centre of the axles, while tight bridle ropes are fixed to each end of the sliding bottom, so as to draw it to one compartment or the other, according as the direction of motion is forward or backward. On drawing the truck across the channel the front compartment would be gradually filled by the soil or sand scraped up by the bottom. On reaching the side the motion would be reversed, the bottom plate drawn over to the other compartment, and the contents of the full division deposited. By this means it is claimed that any depth can be dredged and maintained without the use of costly floating apparatus, while operations can be carried on in weather when ordinary machinery could not be worked at all. The materials dredged are deposited at each side of the channel in comparatively shallow water, and may be raised and conveyed away at leisure by ladder dredgers or diggers, though Mr. Smith proposes a form of basket, lowered by gravitation and closed by hydraulic pressure.

Messrs. Bruce and Batho, of Westminster, show a number of well-finished working models of their patent hydraulic dredging and excavating machinery. In the floating dredger the apparatus consists of a wrought iron vibrating beam, carrying at one end a segmental digger, and at the other a counterweight, the up-and-down motion being given by two direct-acting hydraulic cylinders, one placed on each side of the fulcrum. A well, formed in the hull of the vessel, permits the digger to be forced down through the water to the bottom, when it is held until closed by a hydraulic ram suspended in a universal joint from the end of a beam, and which opens or closes the segments according as the water is admitted to one side of the piston or the other. On raising the beam the dredging basket is lifted, and at the proper height is opened, and deposits its contents on a shoot, which is automatically brought into position or removed by the upward and downward motion of the beam. The engine supplying the water pressure is controlled by the rise and fall of an accumulator ram, which maintains a steady pressure, and proportions the revolutions of the engine according to the demand for water. Many of these dredgers have been supplied for use in India, and have given great satisfaction. They are cheap in first cost, require less expenditure for maintenance, while the expenses for working are considerably below those for the old-fashioned plant with ladders and travelling buckets. Models of two forms are exhibited. The same firm also show one of Bruce's patent cranes and excavators for removing silt close to dock walls, or any purpose when a large dredger cannot be employed. For working in hard soil an arrangement has been added for forcing in the blades of the excavator and insuring a full lift every time. This consists of a long tube fixed to the excavator, and working through a socket at the end of the jib, which can be held in any position as desired by a lever or other apparatus worked by the attendant. The tube, acting as a pillar, prevents the excavator rising when the segments are being brought together, as it otherwise would do if working in hard soil when simply suspended by a chain.

Messrs. Priestman Brothers, of Hull exhibit models of their patent crane and dredging appliances, together with a good collection of photographs of various kinds of machines at work in different parts of the world for dredging docks, rivers and canals, and for excavating on railway cuttings. The bucket is in the form of a large divided scoop, the two parts of which are made to open and close rapidly in the act of discharging or taking in its load. The scoops take different shapes according to the nature of the material to be lifted, but the accompanying illustration will give a general idea of their construction. For dredging mud, silt, and other soft material, the bucket is made entirely of plates, while for shingle a grab with strong steel fingers or tines is used, and a still stronger and more powerful form is made for dredging blasted rock and specially hard material, so saving the cost of divers. Messrs. Priestman Bros. make special cranes for working these scoops, but one great advantage of the system is that it can be easily adapted to any existing crane, which is thus rendered applicable for one kind of work or the other. A cheap and efficient dredger for dock and canal purposes, shown on page 267, is constructed by placing a crane on an ordinary barge, the mud being deposited in the usual way into hoppers brought alongside. The dredging apparatus is equally applicable to discharging grain from ships' holds, one machine, requiring the attention of but one man, being capable of treating 60 tons of grain per hour, which is just about equal to the regular work on a cargo of what is called a 100-ton American elevator. Orders for this dredging plant have been received from a great number of Governments and dock companies, and it no doubt is a very cheap and efficient appliance for removing obstructions and accumulations of mud and deposit in harbours and canals, as well as for a variety of other analogous purposes.

The East Ferry-road Engineering Company, Limited, have at their stand a number of specialities in hydraulic machinery, chiefly in the shape of models. Different patterns and sizes of Mr. F. E. Duckham's suspended weighing machines are exhibited, varying from a capacity of 100 tons to 2 tons. These machines are well made, and are all accurately tested before leaving the works, the dials being marked to foreign weights if required. The Millwall Dock Company weighed "Jumbo" by one of these machines, which is of thirty tons capacity, and has been in use for over six years. A model of a large platform lift with four hydraulic cylinders is shown. It was designed by Mr. F. E. Duckham, the chief peculiarity being the introduction of coupling bars between each pair of hydraulic rams, and two transverse horizontal shafts for the purpose of insuring a perfectly level rise of platform, no matter how irregularly the load might be distributed. Several models of Mr. C. R. Parkes' patent portable hydraulic cranes are exhibited in connection with the grain-lifting and storing machinery in use at the Millwall Docks. In this plan the grain is picked up in the hold of the vessel by a Priestman digger or other form of bucket suspended from the crane, it is then lifted, swinging round, and deposited in the travelling hopper, where it is weighed and then run out into sacks, or if for consignment into railway trucks or barges. The Millwall Dock Company have several thousand trucks engaged in the work, and when required they are stored full of grain in specially built sheds until wanted by the purchasers. This plan of storage is considered preferable to spreading the grain on the floors of warehouses, as it enables small parcels to be kept separate without trouble. Not very long ago a vessel with 1734 tons of grain was discharged by this machinery in an ordinary working day, and the whole weighed and delivered to trucks and barges. The East Ferry-road Engineering Company, Limited, also show some examples of their standard hydraulic valves.



SECTIONAL ELEVATION

SMITH'S DREDGING TRUCK.

Mitchell's net hauling winch is illustrated on page 270, and from the engraving it will be seen that the hauling grip is obtained by passing the headback of the net over two grooved sheaves and under one, so as to make a friction bite which ordinarily is sufficient to haul in and empty fish rapidly, but which allows the headback to be easily thrown off, instead of surging, and breaking is prevented. The winch is fixed by one bolt with a hand lever nut, so that it may be shifted and re-fixed with little trouble, and the construction of the sole plate allows it to be swung to any point as required. The winch is useful for all the purposes of a fishing boat, and is made by Messrs. D. Mitchell and Son, of Aberdeen.

Messrs. Geo. Cradock and Co., of Wakefield, exhibit one of Taylor's patent combined capstans for a 1300-ton vessel, arranged to be worked by a messenger chain. The vertical spindle, upon which the drum receiving motion from this chain is fixed, carries a worm working into two wheels, actuating two parallel shafts revolving in massive cast iron frames. Overhung on these shafts are on one side a pitch wheel for ordinary chain cable and a warping head, and on the other two treble-grooved rollers for wire rope. The rope is wound three times backwards and forward round these rollers, the slack end being led through the deck and wound on a large drum, turned by the vertical spindle with scroll gear. This combined rope and chain windlass has been designed to meet Lloyd's Rules, which only admit of one wire rope being used; but as the advantages of rope over chain are so obvious, it is probable that this barrier may be removed, and that before long vessels will be entirely fitted with steel ropes. In the case of the 1300-ton vessel, the substitution of even one rope in place of chain cable means a saving in weight of no less than 8 tons. The paying-out motion is controlled by friction clutches in each drum, these also serving in the case of the wire rope to regulate the maximum tension that can be carried when the ship is riding in a heavy sea. Taylor's patent holder is also shown by the same firm, and in it the principle of two treble-grooved rollers controlled by friction clutches is again introduced. It is expected that with this apparatus the breakage of towing hawsers can be obviated, the maximum strain imparted to the rope, even in a heavy sea, being capable of adjustment with the greatest nicety.

As an example of what can be done in the manufacture of large wire ropes, Messrs. Binks Bros., of London, show a specimen 17in. in circumference, with an estimated breaking load of over 600 tons.

MODELS OF SHIPS OF WAR AT THE NAVAL AND SUBMARINE EXHIBITION.

The Admiralty have lent several models of ships from the Royal Naval College. These, with others supplied by Sir W. Armstrong and Co., Messrs. Samuda, and Palmer and Co., represent ships of the most notable types except the broadside. The whole are situated in the same quarter of the building, namely, blocks Nos. 22 and 25, immediately west of the centre tank. As a whole, the collection is injured, as was sure to be the case, by the enormous and irregular variation in scale in the models. Even those most familiar with vessels must experience an effort at grasping the dimensions of each vessel. What really happens is that the model gives no information as to size, and the observer's own knowledge of the subject more or less perfectly supplies the difficulty. It would be a great thing, we think, if a few definite scales were adopted, on which all models should be made, and the scale employed distinctly noted on the model. Why scales should be supplied for drawings and not for models it is difficult to say. The Admiralty vessels are as follows:—

Stand No. 238.—The Devastation, a capital model, shows the class of ship which is rather the speciality of the English fleet, that is, a mastless turret seagoing ship. She carries four 35-ton guns, and from 10in. to 14in. of armour. The model is interesting as showing a trace of the effect on our plans of construction produced by the loss of the Captain. The Devastation was originally designed as a breastwork ship, but afterwards superstructures were added so as to carry the breastwork deck to the full width of the vessel as well as extending some distance aft. The actual armoured breastwork far back may be seen projecting slightly from the surrounding superstructure. The Dreadnought had the armour brought forward to the ship's side.

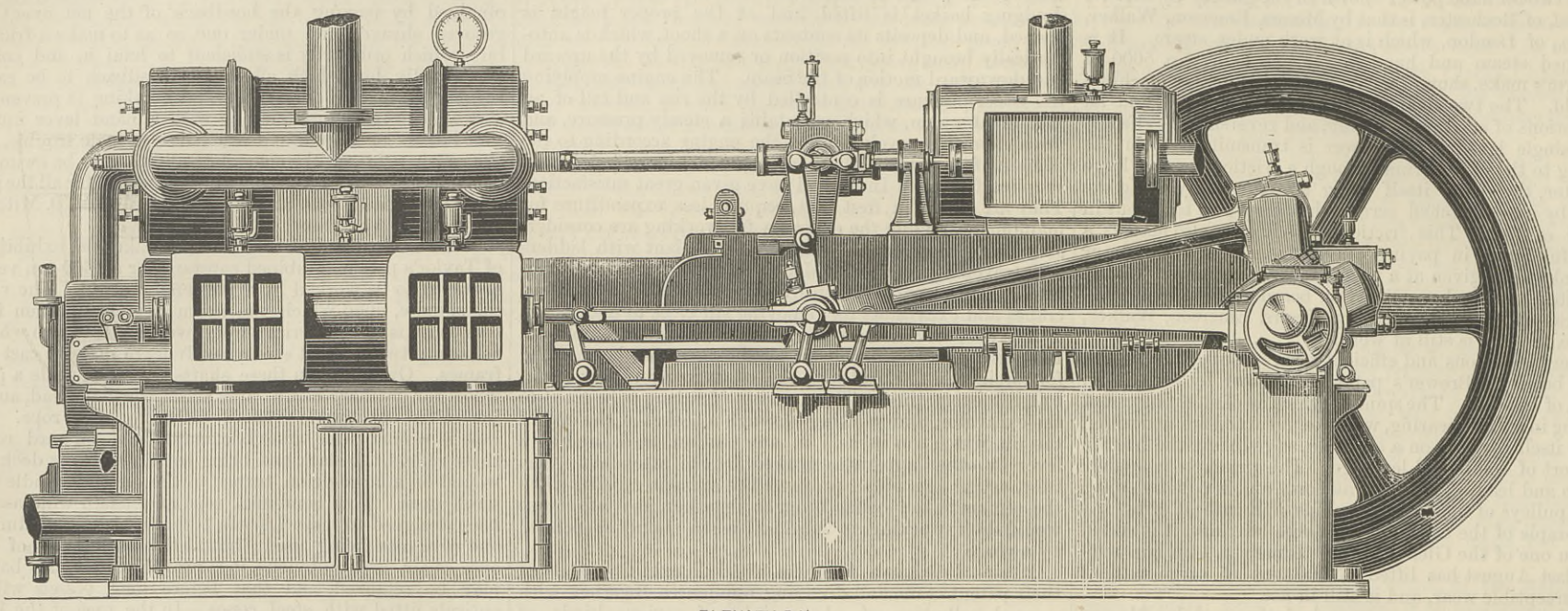
The Monarch was our first masted turret ship. Her forecastle, &c., interfere seriously with her power of all-round fire. She has four 25-ton guns and two 6½-ton guns, and 8in. to 10in. of armour.

The Popoff is one of the two extraordinary circular coast defenders built by Russia, one carrying two 40-ton guns and the other two 27½-ton guns. Their diameters are 121ft. and 101ft. They possess the advantages of small draught of water and steady platform, coupled with the disadvantage of low speed and great exposure to the attack of torpedoes, rams, and guns; for any kind of blow aimed at the apparent centre point strikes normally. Circular vessels obey their helm in one way; that is, they turn but they are apt to run on some distance in the former course after turning, *i.e.*, sideways.

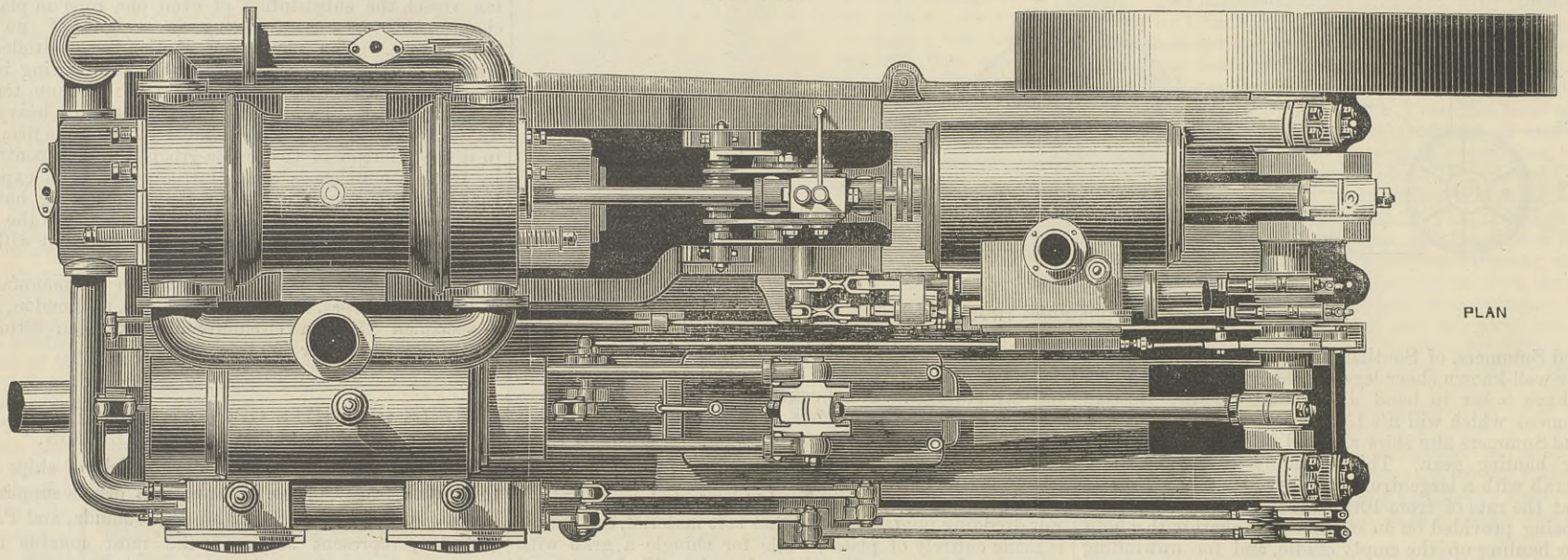
The Polyphemus is a minute model—giving an idea of the appearance of the finished ship, which many may hardly recognise from the fact that all the drawings we have hitherto had were of the ship in her half-finished condition, when the cigar shape of her main structure was undisguised by the addition of any superstructure.

Messrs. Samuda Brothers exhibit at stand 258 the Neptune, built as the Independencia for Brazil and bought by England, is a vessel closely resembling the Monarch but much more powerful. She carries four 38-ton guns in her turrets, and two 12-ton guns in her forecastle. These latter she certainly needs;

EXHIBITS AT THE NAVAL AND SUBMARINE EXHIBITION.



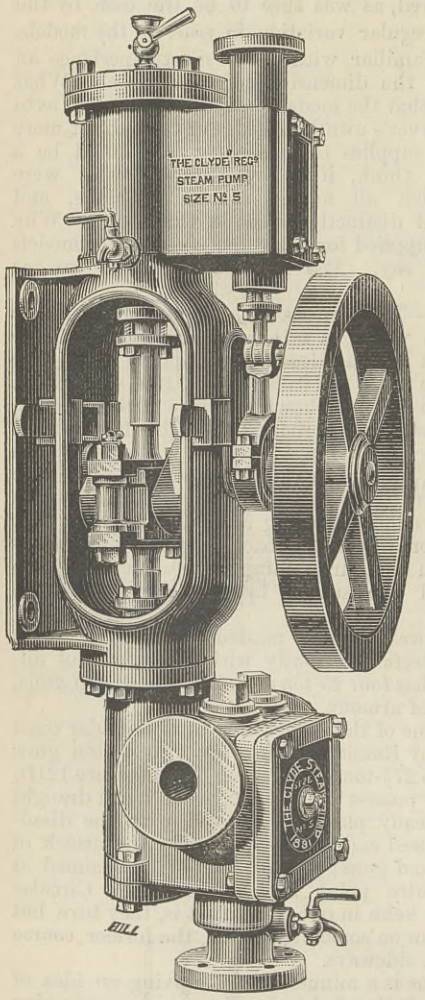
ELEVATION



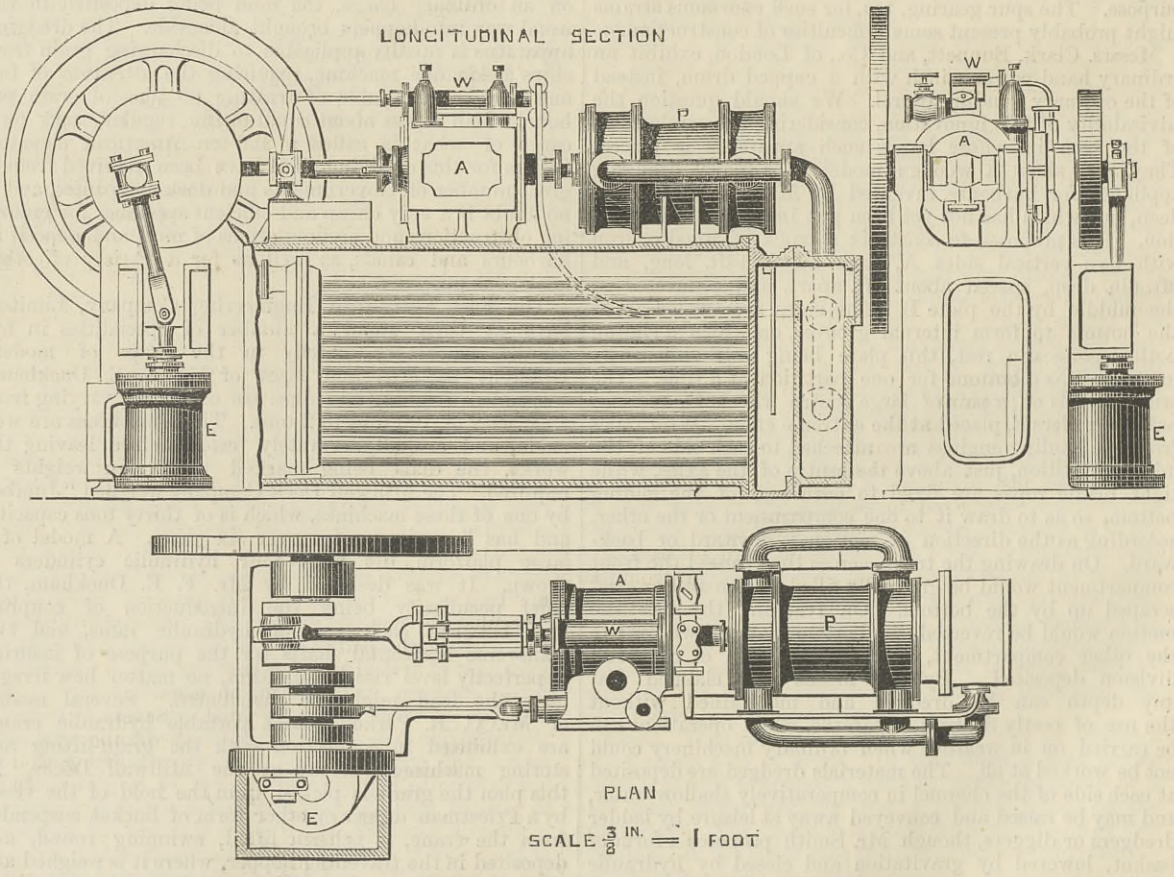
PLAN

SCALE 0 1 2 3 4 6 FT.

HALL'S REFRIGERATOR



LOUDON'S PUMP.

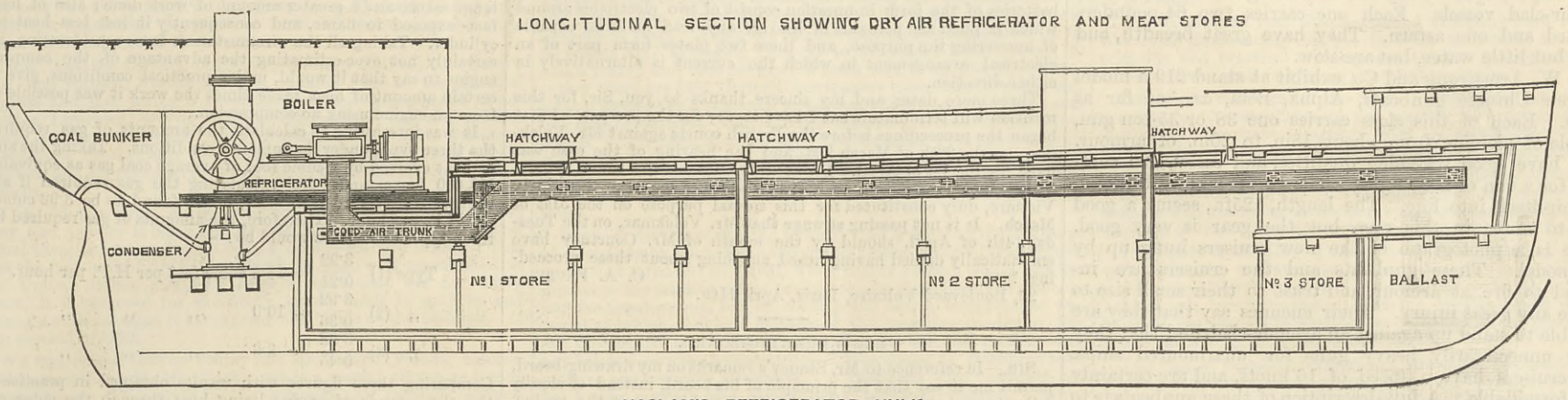


THE BELL-COLEMAN REFRIGERATOR.

her forcastle interferes with fire head on and her poop prevents her from firing astern. She is barque rigged now. This is shown in the model, which is very fine, although the rigging is not quite perfect. The armour is from 9in. to 13in. thick. The Belleisle, built for Turkey, as the Peiki Sheref, ought to be a broadside ship, but she is not this in the sense of having any considerable broadside fire, for she manages to combine the paucity of guns of a turret ship with the limitations of fire of a broadside ship. She has an octagon citadel with a 25-ton gun at each of the four sides, crossing the angles of what would be a square, which sides make 45 deg. with her fore and aft line. These guns are capable of firing abeam or ahead; if a forward gun abeam, and astern if an aft gun. A little consideration will show that she can fire two guns in any direction, and never more than two. This is not a satisfactory result, though certainly the Glatton, which is decidedly larger, has only two 25-ton guns. The Belleisle carries 12in. and 8in. of armour on her belt and 10in. to 5in. on her citadel. She has some good sea-going qualities, answering her helm very readily, but rolling terribly.

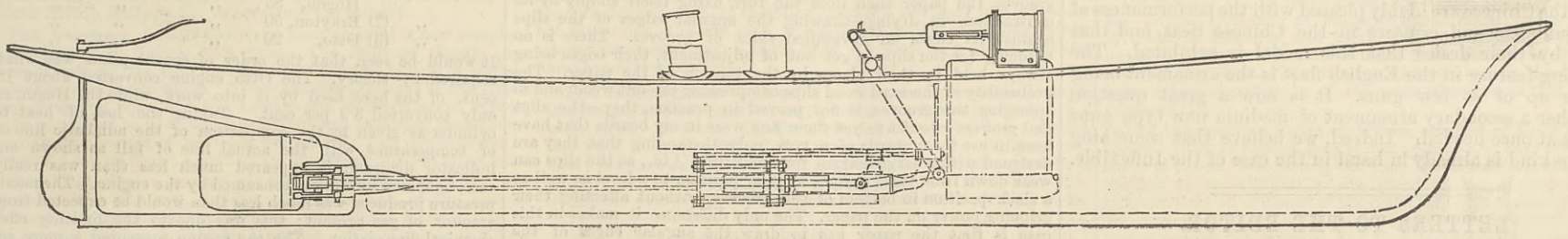
EXHIBITS AT THE NAVAL AND SUBMARINE EXHIBITION.

LONGITUDINAL SECTION SHOWING DRY AIR REFRIGERATOR AND MEAT STORES

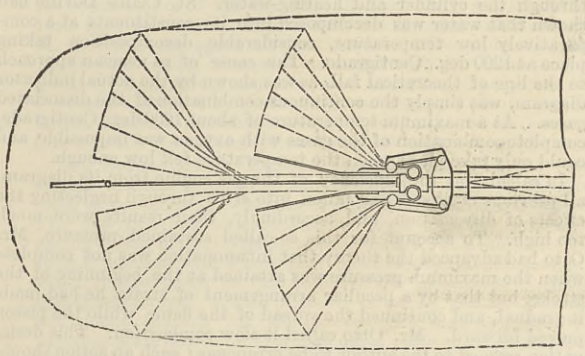


HASLAM'S REFRIGERATOR HULK.

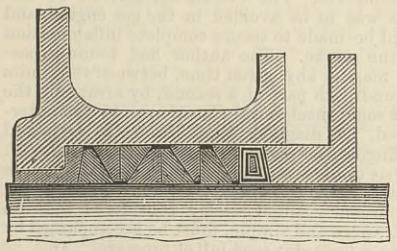
SIDE ELEVATION OF WELTONS ELASTIC FEATHERING PADDLES



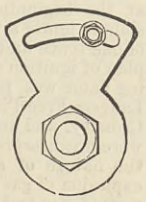
DUNCAN'S STEAM LAUNCH.



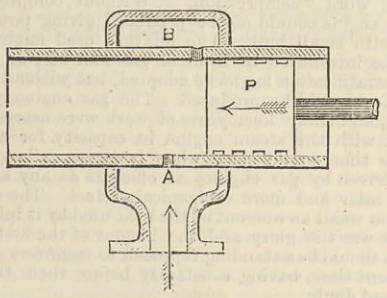
PLAN OF WELTON'S PROPELLER.



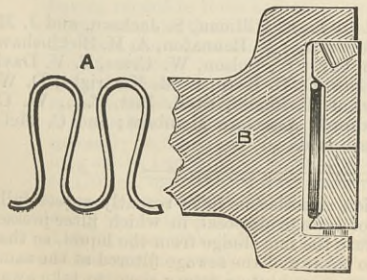
KATZENSTE N'S PACKING.



NUT LOCK.

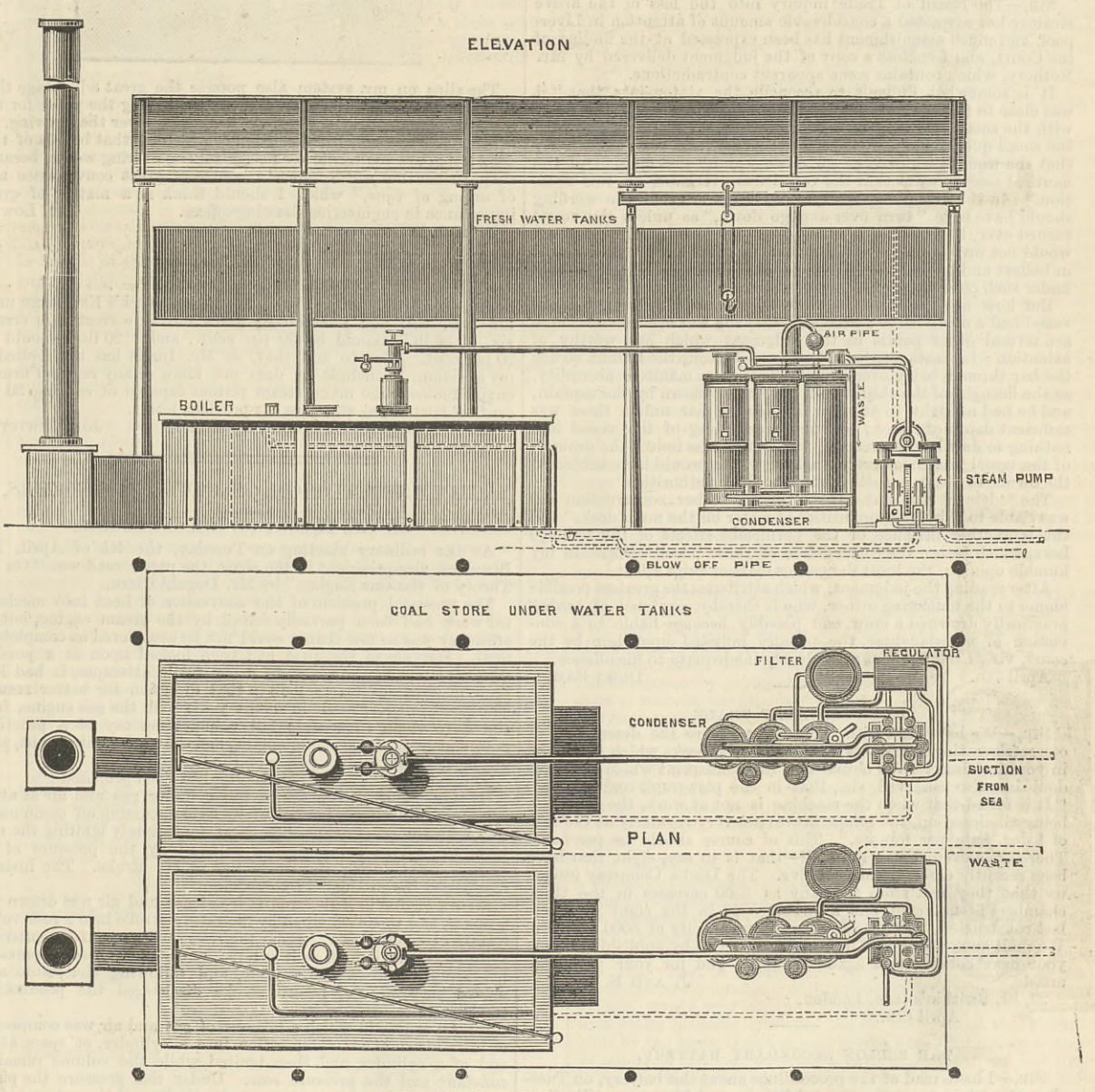


PIGGOT'S COMPRESSOR

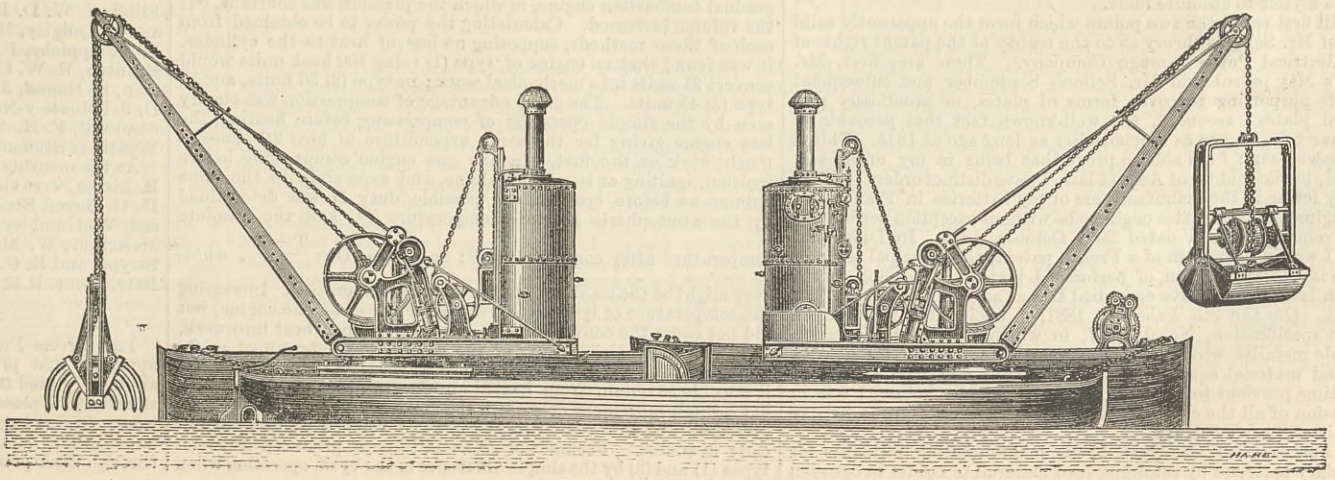


PRIOR'S PISTON

ELEVATION



NORMANDY'S CONDENSER.



PRIESTMAN'S DREDGER.

Messrs. Palmer exhibit at stand 222 a gunboat of a class especially intended for river service, comprising the Medina, Medway, Sabrina, Spey, Tay, Tees, Dee, Don, Esk, Slaney, Trent, and Tweed; length, 110ft.; breadth, 34ft.; depth, 9½ft. They are not designed to cope with armour-clad vessels. Each one carries two 64-pounders forward and one astern. They have great breadth, and draw but little water, but are slow.

Sir W. Armstrong and Co. exhibit at stand 219 a model of their Chinese gunboats, Alpha, Beta, &c., as far as Theta. Each of this class carries one 38 or 35-ton gun, capable of piercing from about 18in. to 20in. of armour. They have good sea-going qualities, and carry coal sufficient for a run of 2000 miles. The gun is laid by bringing the ship itself into line. The length, 125ft., seems a good deal to move in this way, but the gear is very good. There is a photograph of the new cruisers hung up by the model. These gunboats and the cruisers are intended to fire at armour, and trust to their small size to escape any great injury. Their enemies say that they are not able to stand up against an armour-clad, and that they carry unnecessarily heavy guns for unarmoured ships. The cruisers have a speed of 16 knots, and are certainly very formidable. A full description of these gunboats is to be found in The Engineer of August 1st and 22nd, 1879, and some notice of the cruisers in July, 1881, in an account of a visit to Elswick Ordnance Works. We believe that the Chinese are highly pleased with the performances of the gunboats and cruisers in the Chinese Seas, and that it is by their desire that this model is exhibited. The striking feature in the English fleet is the armament being made up of so few guns. It is now a great question whether a secondary armament of medium new type guns is not at once needed. Indeed, we believe that something of the kind is already in hand in the case of the Inflexible.

LETTERS TO THE EDITOR.

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

THE LOSS OF THE BALLINA.

Sir,—The Board of Trade inquiry into the loss of the above steamer has attracted a considerable amount of attention in Liverpool, and much astonishment has been expressed at the finding of the Court, and I enclose a copy of the judgment delivered by Mr. Rothery, which contains some apparent contradictions.

It is somewhat difficult to reconcile the statements, that "it was clear to the assessors that if she shipped a sea on her deck, with the small quantity of metacentric height she had, and with the small quantity of cargo she carried, there was every probability that she would turn over or go down," and "the opinion of the nautical assessors was that the vessel was overladen on this occasion." In the first paragraph quoted, it appears that the wording should have been "turn over *and* go down," as unless the vessel turned over, having only a small cargo on board, shipping a sea would not involve foundering, but on the other hand a vessel, light in ballast and having a small range of stability, might turn over under such circumstances and subsequently founder.

But how are the statements to be reconciled, First, that the vessel had a small cargo; Secondly, that she was overladen? There are several other points in the judgment which are worthy of attention; for instance, "that on five occasions the Ballina struck the bar through being overladen." This is a manifest absurdity, as the draught of the ship should have been known by the captain, and he had no right to attempt to cross the bar unless there was sufficient depth of water; and the overloading of the vessel had nothing to do with his error of judgment, unless indeed the draught of the vessel was incorrectly marked, which would have subjected the owner to heavy penalties from the dock authorities.

The judgment also states that "owing to her construction she was liable to ship large quantities of water on the main deck," and this is another instance of the pernicious effects of the tonnage laws, which foster the construction of these "well" ships—in my humble opinion, the most dangerous class of ships afloat.

After reading the judgment, which attributes the greatest possible blame to the managing owner, who is thereby convicted of having practically drowned a crew, and possibly become liable to a conviction of manslaughter, the penalty inflicted upon him by the court, viz., £150, appears ridiculously inadequate to his offence.

April 7th. Dicky Sam.

THE COLD MEAT TRADE.

Sir,—We have read with very great pleasure the description of our refrigerating machinery at the Victoria Docks which appeared in your last issue. We notice one little misprint which you have doubtless also observed, viz., that in the paragraph commencing: "It is found that when the machine is not at work, the chambers being all closed up, the temperature rises very regularly at the rate of 1 deg. Fah. per minute." This of course should be per *hour*. There are eleven chambers in all—that is to say, eight that have been recently erected, and not five. The Docks Company inform us that they can store as many as 2500 carcases in the three chambers first erected, and a further 5500 in the eight chambers last constructed, making a total storing capacity of 8000 carcases. We shall be much obliged if you will favour us by publishing this in your next edition, and again thanking you for your very able article, J. and E. Hall.

23, St. Swithin's-lane, London,
April 6th.

THE SELLON SECONDARY BATTERY.

Sir,—I have read of the proceedings anent this battery, on Tuesday, the 4th inst., at the Crystal Palace, and I beg you will allow me space in your valuable paper to answer some of the statements made by two of the speakers. I will be as brief as possible and confine myself to absolute facts.

I will first recall the two points which form the apparently solid basis of Mr. Sellon's theory as to the reality of the patent rights of the Electrical Power Storage Company. These are, first, Mr. Swan's May patent and Mr. Sellon's September and subsequent patents purporting to cover forms of plates, or practically perforated plates; secondly, the well-known fact that peroxide of lead has been known as a depolariser as long ago as 1844. This is my answer, viz.: I am able to prove that being in my office, 446, Strand, in the middle of August last, I gave distinct orders verbally and by letter to the manufacturers of my batteries in France and in Belgium, that all plates ought to be without exception perforated. My French patent is dated 20th October, 1880. In December, 1880, I was in possession of a French patent, the principal claim of which is the application of perforated plates. According to the French law I might have embodied this as an addition to my first patent. On the 9th February, 1881, I again filed in France a patent specification, No. 141,057, in which I distinctly mention suitable metallic wire gauze as a substitute for felt, for holding the lead material against my plates. Thus you will see that a long time previous to any date mentioned by Mr. Sellon, I was in possession of all the elements of what he led his hearers to believe was his or Swan's battery.

In February of last year I was manufacturing elements for secondary batteries by retaining lead material or oxides in between two perforated coverings; this mode of manufacture I am carrying on, and all these facts were well known in England by men of standing.

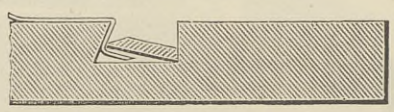
Respecting the mention that peroxide of lead has been used as a depolariser in primary batteries, it might as well have been mentioned that it has also been used as a paint. Secondary batteries of the form in question consist of two electrodes around which is piled the peroxide of lead or any lead material capable of answering the purpose, and these two plates form part of an electrical arrangement in which the current is alternatively in either direction.

Three more dates and my sincere thanks to you, Sir, for this mention will terminate what I have to say for the present. I first began the proceedings before the French courts against Mr. Volckmar, on the 28th of March last, and the hearing of the case was fixed for the 1st of April. I was duly met at the court by Mr. Volckmar, in the person of Maitre Cortot, Avoué, 88, Rue de la Victoire, duly constituted for this special purpose on the 31st of March. Is it not passing strange that Mr. Volckmar, on the Tuesday, 4th of April, should by the mouth of Mr. Courtney have emphatically denied having heard anything about these proceedings? C. A. Faure.

22, Boulevard Voltaire, Paris, April 11th.

LOW'S DRAWING-BOARD.

Sir,—In reference to Mr. Stoney's remarks on my drawing-board, permit me to say that the principle of his board, instead of closely following mine, is so far different that on his system the wedge-shaped slips have to be tapped into the grooves to fix the paper, whereas on my system the flat slips when placed in position have their outer edges merely pressed down inside the outer edges of the grooves, the paper then does the rest, fixing itself simply by its contraction—in drying—drawing the angular edges of the slips against its edges on dovetailed sides of grooves. There is no tendency for the slips to get out of adjustment, their edges being always held in their places by the tension of the paper. The probability of the hard wood slips compressing the soft wood, and so enlarging the grooves, is not proved in practice, they—the slips and grooves—do not as yet show any wear in my boards that have been in use for upwards of a year, notwithstanding that they are designed with a large margin for wear fully $\frac{1}{10}$in., as the slips can wear down from their normal angular position to a level as well as a slack position in bottom of the grooves, without affecting their gripping power on the paper. The only difference it makes in this case is that the paper has to draw the angular edges of the slips higher up on the dovetailed edges of the grooves before jamming itself.



The slips on my system also possess the great advantage that they can be easily taken out without disturbing the paper for the purpose of mounting tracing cloth or paper over the drawing. I venture to disagree with Mr. Stoney's opinion that boards of this description are too trivial for notice in engineering works, because they, to use his words, "are a source of great convenience and of saving of time," which I should think is a matter of great importance in engineering drawing-offices. Geo. Low.

Bishop's Hill Cottage, Ipswich,
April 11th.

STEAM ENGINE ECONOMY.

Sir,—As I did not see my letter in last week's Engineer until too late, will you now kindly allow me to correct two errors, viz., "30 lb." should be 30 per cent., and "20 lb." should be 20 per cent. Also to add that, as Mr. Inglis has not replied to my question, I conclude he does not know of any reputed firm of engine makers who make steam pistons capable of causing 30 per cent. of friction, as stated in his previous letter.

Iron Exchange, Birmingham, April 12th. John Swift.

THE INSTITUTION OF CIVIL ENGINEERS.

ON THE THEORY OF THE GAS ENGINE.

At the ordinary meeting on Tuesday, the 4th of April, Mr. Brunlees, vice-president in the chair, the paper read was "On the Theory of the Gas Engine," by Mr. Dugald Clerk.

The practical problem of the conversion of heat into mechanical work had been partially solved by the steam engine, but its efficiency was so low that it could not be considered as complete or final. Hot air in the past had been looked upon as a possible advance. Owing, however, to many futile attempts, it had long been deemed useless to look in that direction for better results. The great progress made in recent years with the gas engine, from the state of an interesting but troublesome toy to a practical, powerful rival of the steam engine, had shown that air might, after all, be the chief motive power of the future.

Three distinct types of gas engines had been proposed:—

(1) An engine drawing into the cylinder gas and air at atmospheric pressure for a portion of its stroke, cutting off communication with the outer atmosphere, and immediately igniting the mixture, the piston being pushed forward by the pressure of the ignited gases during the remainder of its stroke. The instroke discharged the products of combustion.

(2) An engine in which a mixture of gas and air was drawn into a pump, and was discharged by the return stroke into a reservoir in a state of compression. From the reservoir the mixture entered a cylinder, being ignited as it entered, and without rise in pressure, but simply increased in volume, and following the piston as it moved forward, the return stroke discharged the products of combustion.

(3) An engine in which a mixture of gas and air was compressed or introduced under compression into a cylinder, or space at the end of a cylinder, and then ignited while the volume remained constant and the pressure rose. Under this pressure the piston moved forward and the return stroke discharged the exhaust.

Types (1) and (3) were explosion engines, the volume of the mixture remaining constant, while the pressure increased. Type (2) was a gradual combustion engine, in which the pressure was constant, but the volume increased. Calculating the power to be obtained from each of these methods, supposing no loss of heat to the cylinder. it was found that an engine of type (1) using 100 heat units would convert 21 units into mechanical work; in type (2) 36 units, and in type (3) 45 units. The great advantage of compression was clearly seen by the simple operation of compressing before heating, the last engine giving for the same expenditure of heat 2·1 times as much work as the first. In any gas engine compressing before ignition, igniting at constant volume, and expanding to the same volume as before ignition, the possible duty D was determined by the atmospheric absolute temperature T^1, and the absolute temperature after compression, T; and it was $D = \frac{T - T^1}{T}$, whatever might be the maximum temperature after ignition. Increasing the temperature of ignition increased the power of the engine, but did not cause the conversion of a greater portion of heat into work. That was, the possible duty of the engine was determined solely by the amount of compression before ignition. Compression made it possible to obtain from heated air a great amount of work with but a small movement of piston, the smaller volume giving greater pressures, and thus rendering the power developed more mechanically available. Seeing the great difference produced between types (1) and (3) by the simple difference in the cycle operation when there was no loss of heat through the sides of the cylinder, the question arose which engine in actual practice, with the cylinder kept cold by water, would come nearest this theory. In which of the engines would there be the smallest loss of heat? Comparing the two engines, with equal movements of piston, it was found that the compression engine had the advantage of a lower average temperature and a greater amount of work done; also of less surface exposed to flame, and consequently it lost less heat to the cylinder. Taking all the circumstances into consideration, it was certainly not over-estimating the advantage of the compression engine to say that it would, under practical conditions, give for a certain amount of heat three times the work it was possible to get from an engine using no compression.

It was interesting to calculate the amounts of gas required by the three types under the supposed conditions. Taking the amount of heat evolved by 1 cubic foot of average coal gas as equivalent to 505,000 foot-pounds, and calculating the gas required if all the heat were converted into work, it was found to be 3·92 cubic feet per H.P. per hour. Therefore, the amounts of gas required by the three types of engines would be:—

Type (1) $\frac{3{\cdot}92}{0{\cdot}21}$ = 18·3 cubic feet per H.P. per hour.
,, (2) $\frac{3{\cdot}92}{0{\cdot}36}$ = 10·9 ,, ,, ,,
,, (3) $\frac{3{\cdot}92}{0{\cdot}45}$ = 8·6 ,, ,, ,,

Comparing these figures with results obtained in practice from the three types of engine losing heat through the sides of the cylinder, it was ascertained that the amount of gas consumed was as follows:—

Type (1) Lenoir, 95 cubic feet per I.H.P. per hour.
Hugon, 85 ,, ,, ,,
,, (2) Brayton, 50 ,, ,, ,,
,, (3) Otto, 20 ,, ,, ,,

It would be seen that the order of consumption was what was required by theory. The Otto engine converted about 18 per cent. of the heat used by it into work, while the Hugon engine only converted 3·9 per cent. Taking the loss of heat to the cylinder as given by the comparison of the adiabatic line of fall of temperature with the actual line of fall as shown on the indicator diagram, it appeared much less than was really the case, as shown by the gas consumed by the engine. The maximum pressure produced was much less than would be expected from the amount of gas present; this was due to the limiting effect of chemical dissociation. The gas engine presented a more complicated problem than a hot-air engine using air heated to the same degree. Analysing the disposal of 100 heat-units by Clerk's gas engine, it was found to convert 17·8 into work, to discharge 29·3 with the exhaust gases, and to lose to the sides of the cylinder and piston 52·9 units. About one-half of the whole heat used passed through the cylinder and heating-water. St. Claire Deville had shown that water was decomposed into its constituents at a comparatively low temperature, considerable decomposition taking place at 1200 deg. Centigrade. The cause of so near an approach to the line of theoretical fall, as was shown by the actual indicator diagram, was simply the continuous combination of the dissociated gases. At a maximum temperature of about 1600 deg. Centigrade, complete combination of the gases with oxygen was impossible, and could only take place when the temperature fell low enough.

In calculating the efficiency of the gas engine from its diagram, all previous observers had fallen into error through neglecting the effects of dissociation, and, accordingly, their results were much too high. To account for this so-called sustained pressure, Mr. Otto had advanced the theory that inflammation was not complete when the maximum pressure was attained at the beginning of the stroke, but that by a peculiar arrangement of strata he had made it gradual, and continued the spread of the flame while the piston moved forward. Mr. Otto called it slow combustion. This designation seemed to the author to be erroneous; such an action should rather be called slow inflammation. It existed in the Otto engine, but only when it was working badly, and was attended with great loss of heat and power. This was proved by a diagram, and by certain considerations deduced from Bunsen and Mallard's experiments on the rates of propagation of flame through combustible mixtures. The conclusion arrived at was that slow inflammation was to be avoided in the gas engine, and that every effort should be made to secure complete inflammation at the beginning of the stroke. The author had found it possible to ignite a whole mass in any given time, between the limits of one-tenth and one-hundredth part of a second, by arranging the plan of ignition so that some mechanical disturbance by the entering flame was permitted. A diagram taken from the Otto and Langen Free-Piston Engine, as given in a paper by Mr. F. W. Crossley, and an analysis of his reasoning, showed that the results were misinterpreted, and false conclusions arrived at concerning the nature of an explosion. Mr. Crossley considered that an explosion of gas and air, pure and simple, must be accompanied by a rapid rise and an almost instantaneous fall of pressure. This, he thought, was proved by the diagram, but in this statement the author could not concur.

From the considerations advanced in this paper it would be seen that the cause of the comparative efficiency of the modern gas engines over the old Lenoir and Hugon type was to be summed up in the one word "compression." Without compression before ignition an engine couuld not be produced giving power economically and with small bulk. The mixture used might be diluted, air might be introduced in front of gas and air, or an elaborate system of stratification might be adopted, but without compression no good effect would be produced. The gas engine was as yet in its infancy, and many long years of work were necessary before it could rank with the steam engine in capacity for all manner of uses. The time would come when factories, railways, and ships would be driven by gas engines as efficient as any steam engine, and much safer and more economical of fuel. The steam engine converted so small an amount of the heat used by it into work that, although it was the glory and the honour of the first half of this century, it should be a standing reproach to engineers and scientists of the present time, having constantly before them the researches of Mayer and Joule.

It was resolved that, in order to avoid holding a meeting in Easter week, the discussion on this paper should be adjourned to Tuesday, April 18th.

It was announced that the Council had recently transferred W. Elliot, J. W. D. Harrison, T. Hennell, A. Latham, W. L. Owen, and R. Quigley, B.A., to the class of Members; and had admitted P. V. Appleby, F. T. Bagshawe, A. M. Booth, A. K. Brown, J. F. Brunton, E. W. Cowan, W. A. Ducat, F. A. Fulford, H. R. Hackman, S. Hanna, J. H. Hargrave, R. C. Ivy, S. Lynch, C. D. Man, D. del Monte-y-Navarette, A. J. Morley, A. E. Nicholl, J. L. Shadwell, F. H. Smiles, J. A. Wallace, W. P. Ward, and E. W. Wyatt, as Students.

At the monthly ballot C. La F. Hillman, S. Jackson, and J. M. R. Lisboa, were elected Members; N. Bennaton, A. H. Birkinshaw, H. G. Boyce, Stud. Inst. C.E., W. Colson, W. Cross, T. V. Davison, W. Gumbley, H. Gore, D. B. Horn, L. M. Kortright, D. W. McArthur, W. Matthews, J. T. Shand, Stud. Inst. C.E., W. G. Strype, and E. G. Woodford, Associate Members; and C. McG Bate, Lieut. R.E., an Associate.

The Rivers Purification Association have recently successfully applied a new process of sewage disposal, in which filter presses are largely used to separate the fine sludge from the liquid, so that the sludge is pressed into cakes and the sewage filtered at the same time. The sewage is first passed into a rotary sieve to take away large solids, is then chemically treated, and afterwards passes through filter presses made by Messrs. S. H. Johnson and Co.

RAILWAY MATTERS.

Signor Fambri, the director of the Venetian Public Works Company, which has undertaken the piercing of a tunnel between Reggio and Messina, has left for France and England, to visit the works of the Channel Tunnel.

A company, called the Vancouver Land and Railway Company, has been formed to construct a railway from Victoria to Nanaimo in British Columbia. A grant of 1,900,000 acres of coal-land is asked for in support of the scheme.

Now that the London and North-Western Railway Company's new line through Northampton is opened, some of the principal express and fast trains between London and Birmingham, Manchester, Liverpool, Wolverhampton, Shrewsbury, Carlisle, and the North, will travel *viâ* and call at Northampton—Castle Station—affording a considerably accelerated service to and from Northampton, and all principal towns on the London and North-Western system.

The old iron truss bridge over the Erie Canal between West Troy and Cohoes is being removed by the Delaware and Hudson Canal Company to replace it with a double-tracked bridge. This was the first iron bridge of any length of span ever constructed in the United States, and now, after a continuous use for thirty years, it is removed for the above stated cause in as firm and strong a state as when it came from the hands of the builders. It was erected in 1852.

We understand that on Friday last Mr. Joseph Woods, banker, Silloth, together with Mr. Towns, made a special survey and took measurements of the route for the proposed new railway, connecting Silloth with Maryport, *viâ* Allonby, a distance of about twelve miles. Public meetings in furtherance of the scheme are to be held at Maryport, Mawbray, Allonby, and Silloth shortly, when strong representations will be made for the purpose of memorialising the North British Railway Co. to construct the railway.

The four-track line of the New York Central is now complete from Albany to Buffalo, 298 miles. The *Railroad Gazette* says there is nothing like this four-track road from Albany to Buffalo anywhere else in the world. There are short sections of four-track road on several lines, and the London and North-Western expects to be compelled to have separate freight and passenger tracks for a considerable portion of its road, we believe; but nowhere else in the world can be found a continuous four-track line 300 miles long.

The Mont Benere section of the St. Gothard Railway was opened on the 9th inst., Sunday. Two members of the Federal Council took part in the proceedings. The official inauguration of the complete system is fixed for May 21st. The rejoicings at Milan, Lucerne, and elsewhere will extend over five days. It is now stated that not King Humbert, but either the Duke of Aosta or the Duke of Genoa, and probably a Prince of the German Imperial House will be present. The line will be opened for traffic on June 1st.

A Reuter's telegram from Belgrade says that the contract for the construction of the Servian railways, which was signed on the 10th inst. between M. Mijatovitch, the Minister of Finance, and M. Amilhot, the agent of the Comptoir d'Escompte de Paris, is 12,000,000f. under the price arranged with M. Bontoux. The assets of M. Bontoux are estimated to realise 50 per cent., and as the losses sustained by Servia in consequence of the failure of the Union Générale amounted to 24,000,000f., the whole loss, taking into account the reduced price of the new contract, will be covered.

The South-Eastern Railway Company has absorbed into its system the line connecting the Hundred of Hoo, on the western bank of the Medway, with the line between London and Gravesend. The new line has been constructed by a separate company consisting chiefly of South-Eastern shareholders. This line is intended to form a junction with a new port opposite to Queenborough, from which it is proposed to run traffic to the Continent, in rivalry to the Queenborough route. Unless, however, greater punctuality and more concern for the convenience and comfort of the passengers are shown on this than other parts of the South-Eastern line, few people will be likely to go that way to Queenborough, especially if the London, Chatham, and Dover start a day service of steamers to run in connection with the Zealand night steamers which it already serves.

On Wednesday the northern section of the Didcot, Newbury, and Southampton Junction Railway was opened. The new line begins at the Didcot Junction of the Great Western Railway, and runs through a deep cutting at Upton, skirting the famous training grounds for racehorses at Ilsley and Compton, and, passing thence through a fertile and picturesque agricultural district to Hampstead Norris and Hermitage, it enters Newbury on the eastern side of the town, crossing the rivers Lambourne and Kennett. The length of the section just opened is about 17 miles. The contractors for the new line are Messrs. Falkiner and Tancred, and the engineer is Mr. John Fowler. Another junction is effected with the Great Western Railway at Newbury, where extensive alterations have been made to accommodate the extra traffic. The line from Didcot to Newbury is but the first instalment of an important and long-projected scheme, intended to establish direct railway communications between the southern ports and the great manufacturing districts of the north. The second section, between Newbury and Whitchurch, is now in course of construction, and a Bill is before Parliament this session, supported by the corporations and inhabitants of Winchester, Southampton, and Newbury, to authorise the extension of the line to Winchester and Southampton, and also to establish a new route between those towns and the metropolis *viâ* Whitchurch, Burghclere, and Aldermaston.

An account has been given in the *Times* of a paper recently read by Herr Heim, Professor of Geology in the University and Polytechnicum of Zurich, on the Mont Blanc tunnel project, with special reference to its practicability and the difficulties which its execution is likely to involve. He exhibited many geological specimens from the valley of the Dora Baltea, from Courmayeur, Pré St. Didier, and Chamounix, and illustrated his remarks by plans and sections, in the preparation of which he had been assisted by Dr. Stapf, the official geologist engineer of the great St. Gothard tunnel. The gist of the Professor's observations was that the piercing of Mont Blanc would be a work of immense difficulty. Between Courmayeur and Pré St. Didier the tunnel would have to be driven through a formation of anhydrous gypsum, of similar quality to that of the celebrated 'windy stretch' of the St. Gothard tunnel, which swells on exposure to the air, and is almost impossible to stay. Another great difficulty would arise from the temperature in the interior of Mont Blanc. Judging from the experience gained in tunnelling the St. Gothard, and from the position, elevation, and direction of the proposed Mont Blanc tunnel, Dr. Stapf holds it as certain that the temperature in the galleries would range from 86 deg. Fah. as a minimum, to 122 deg. as a maximum. The maximum temperature of the St. Gothard tunnel, while making, was about 87 deg. Fah.; of the Mont Cenis, 84 deg. The temperature of a mountain tunnel depends, not only on its vertical depth, but on the configuration of the superincumbent mass; and having regard to these and other circumstances, Dr. Heim ond Dr. Stapf estimate that the maximum temperature of the proposed Simplon tunnel, while in execution, would be 97 deg. Fah. They are of opinion, however, by giving the galleries a somewhat different direction from that which was at first contemplated, a more moderate temperature might be obtained. As to the heat which it is possible for human beings to bear and work in, it is not found necessary in the Comstock Mine, Nevada, to suspend operations so long as the temperature remains about 115 deg., but when it rises to 120 deg. operations are generally discontinued. The anticipated temperature of the Mont Blanc tunnel would not therefore necessarily prevent the execution of the project. On the other hand, high temperature could not fail to increase vastly the cost of such an enterprise; for the greater the heat the shorter must be the time men can work in it, and the more numerous will be the relays required.

NOTES AND MEMORANDA.

At the end of last year there were in circulation in Germany 4413 newspapers. Of these 98 were older than the present century. Among them the *Frankfürter Journal* 261 years old, the *Magdeburg Zeitung* 253 years old, the *Leipziger Zeitung* 221 years old, the *Jenaische Zeitung* 207 years, the *Augsburger Postzeitung* 195 years, the *Gothaische Zeitung* 190 years, the *Vosetsche Zeitung* 159 years, the *Berlin Intelligenzblatt* 128 years, the *Kolnische Zeitung* 84 years. There are 200 newspapers averaging from 80 to 50 years; 1127 averaging from 50 to 21 years; 1542 between 20 and 6 years; and 1380 between 5 years and 3 months old. Altogether there are 1491 German newspapers more than 20 years old. That a newspaper's existence in Germany is often a very ephemeral one may be inferred from the fact that 20 per cent. of the newspapers which circulated through the German Post-office in 1880 came first into existence within the same year, and the average existence of those newspapers was not more than six months. Some have been more hardy, and have survived into the present year.

Prof. F. Guthrie, F.R.S., recently read a paper on the discharge of electricity by heat. "He showed by means of a gold leaf electroscope that a red-hot iron ball, when highly heated, would neither discharge the positive prime conductor of a glass electrical machine nor the negative one, but on cooling the ball a temperature was found at which the ball discharged the negative conductor, but not the positive one. Lastly, on cooling the ball still further—but not below a glowing temperature—it was found to discharge both positive and negative electricity. A platinum wire rendered red hot by the current also discharged a negatively-charged electroscope more readily than a positively charged one. When placed between two electroscopes, one having a + and the other a − charge, it discharged neither. When the + one was withdrawn the − was discharged; but when the − was withdrawn the + was not discharged. There therefore seemed a tendency in a hot body to throw out + rather than − electricity." These are interesting experiments and open a little room for discussion *versus* positive and negative electricity.

The following have been given as lacquers for brass:—(1) Seed lac, dragon's blood, annatto, and gamboge, each 4 oz.; saffron, 1 oz.; wine spirit, 10 pints. (2) Turmeric, 1 lb.; annatto, 2 oz.; shellac and gum juniper, each 12 oz.; wine spirit, 12 oz. (3) Seed lac, 6 oz.; dragon's blood, 40 grains; amber and copal triturated in a mortar, 2 oz.; extract of red sanders, ½ drachm; Oriental saffron, 36 grains; coarsely powdered glass, 4 oz.; absolute alcohol, 40 oz. (very fine.) (4) Seed lac, 3 oz.; amber and gamboge, each 2 oz.; extract of red sanders, ½ drachm; dragon's blood, 1 drachm; saffron, ½ drachm; wine spirit, 2 pints 4 oz. (5) Turmeric, 6 drachms; saffron, 15 grains; hot alcohol, 1 pint; draw the tincture and add: gamboge, 6 drachms; gum sandarac and gum elimi, each 2 oz.; dragon's blood and seed lac, each 1 oz. (6) Alcohol, 1 pint; turmeric, 1 oz.; annatto and saffron, 2 drachms each. Agitate frequently for a week, filter into a clean bottle, and add seed lac, 3 oz. Let stand, with occasional agitation, for about two weeks. (7) Gamboge, ½ oz.; aloes, 1½ oz.; shellac (fine), 8 oz.; wine spirit, 1 gallon.

If gaseous fuel is to become the fuel of the people, something like what is proposed in America may become common in this country. A Pennsylvania company, under the title of the "Gas Light Transportation Company," is said to be in the course of formation, with the object of mining coal and manufacturing gas in Pennsylvania, and piping the gas to Eastern cities. A director of the company is reported to have stated that they propose to erect gasworks that will manufacture 40,000,000ft. of gas per day. This would require 1,460,000 tons of coal annually. The coal can be bought at the mines for 55 cents per ton, but the gas companies pay 4·62 dols. per ton for it. They save something by the sale of coke, tar, and ammoniacal liquor, so that their coal costs them 3·14 dols. per ton. The cost of pumping the gas is offset by the value of the coke. The deterioration of the gas in the long pipe they expect to counterbalance by making the gas extra rich at first, part of the initial richness being obtained by using coal direct out of the pit. The pipe is to be of iron, 6ft. in diameter, laid in cement.

The four potash mines of the great potash salt district of Stassfurt, Germany, now produce daily about 3000 tons of crude potash salts, from which thirty-two works make daily 500 tons of chloride of potassium. The price of the latter, which was about 28s. per 100 lb. in the beginning of the year 1874, steadily fell, until it reached 3s. 6d. This naturally crippled the manufacturers, two of whom failed, while fifteen others suspended operations, and still the stocks continued to accumulate, until they reached the enormous amount of 15,000 tons. In the beginning of 1879, according to the *Chemiker Zeitung*, the four mines made an agreement for five years, the principal points of which were the following:—A committee of representatives settles the total quantity of crude salt to be mined, of which the Prussian mines furnish 25 per cent.; the Anhalt, 50 per cent.; and Douglashall and New Stassfurt, each 12·5 per cent., the price of the crude 15 per cent. salt to be fixed at 10 cents per 100 lb. In consequence of this action, the stocks have been lowered, production has increased to 3000 tons per day, and the price of 80 per cent. chloride of potash has risen to about 5s. per 100 lb.

Although Whewell spent a good deal of time on the value of a blow as a momentary pressure, an American contemporary gives the following and says:—It is impossible to say what blow per square inch any particular hammer will give, as it varies with the height and size of the mass being forged, the steam pressure in the boiler, &c. The following table gives, however, the equivalent in foot-tons for each hammer, supposing the block to fall the full stroke of the cylinder and the steam pressure to be about 50 lb. on the square inch (Owen):—

Nominal weight, &c., block.	Actual weight of block.	Diameter of cylinder.	Length of stroke.	Steam pressure on piston.	Blow on anvil.
	Tons.	In.	Feet.	Tons.	Ft. T's
Nasmyth's, 40 tons	40	55	10·5	53	977
,, 12 ,, ...	16	38·25	7·6	25	314
,, 10 ,, ...	14	37·60	8·4	25	328
,, 7 ,, ...	8	29·12	6·3	15	146
Morrison's, 4 ,, ...	4	26·50	4·7	12	76
Condie's, 3½ ,, ...	3½	23·20	4·8	9·5	63

According to the *Evening Standard*, from the inquiry instituted by the American Government into the manufacture of agricultural implements, and the census taken thereon, it appears that there are in the United States 1942 establishments for the production of these implements. Of these, 221 are in Illinois, 265 in NewYork, 220 in Pennsylvania, 155 in Ohio, 143 in Michigan. The total capital employed is 62,315,968 dols.; amount paid in wages, 15,499,114 dols.; value of timber used, 5,791,216 dols.; value of iron and steel, 18,424,052 dols.; value of other materials, 7,878,202 dols.; total, 32,094,107 dols. The largest number of persons employed during the year was 49,180. The total value of all products was 68,373,086 dols. In 1850 the total product was 6,842,611 dols. In 1860 it was 17,487,960 dols. In 1870, 52,066,875 dols. During the census year there were made 325,057 cultivators, 131,003 harrows, 286,654 dozen of hoes, 212,147 dozen of shovels, 308,732 dozen of hand rakes, 1,361,443 ploughs, 211,738 dozen of hay forks, 1,244,264 scythes, 43,717 scythe snaths; mowers, 72,000; seed sowers, 20,289. In 1850, 7220 persons were employed; in 1860, 14,814; in 1870, 25,249; and in 1880, 49,180. The figures thus given show a remarkable increase.

MISCELLANEA.

Queretaro, 150 miles north of the Mexican capital, may now be reached on the completed part of the Mexican Central Railway.

Of foreign goods imported into England, about 72·2 per cent. are carried in British ships. Russia does 13·5 per cent. of its own foreign trade, the United States about 21·5 per cent., and France 28 per cent.

We understand that the Hammond Company have started an Electrical Engineering College, in order to provide the thorough scientific and practical training necessary to young men of good education who wish to become electrical engineers.

The Director-General of the Spanish Post-office has proposed a measure for the establishment and working of a telephone system in Spain. The State telegraph lines are also being put in communication with the railway stations, as in other countries.

A new canal from Nantes to the sea is to be constructed forthwith. The contract has been undertaken by M. Couvreux, whose name is well known in connection with the Panama Canal scheme. The cost of the Nantes Canal will be about 14,000,000 francs.

That part of the City of London which is lighted on the Brush system is said to have cost rather less than was paid for gas, making the allowance for the difference between the quantities of light given; but it is stated that the brilliant light now given by large gas burners in Fleet-street costs about four times as much as the electric light, as above ascertained

The ring of detached forts round Strasburg, the construction of which has cost many millions of marks, is now all but completed. Eleven in all, they are variously situated at between five and eight kilometres from the *enceinte*, and enclose, besides the city, five suburbs and sixteen villages. The average diameter of the entrenched camp thus protected is about 14 kilometres.

On Monday a large party visited the works of the French Channel Tunnel Company at Sangatte, near Calais. The shaft is 17ft. 6in. in diameter, and 280ft. deep. A heading 10ft. by 10ft. has been driven, which now extends for a distance of 300ft. eastward of the shaft. The stratum through which the heading is being driven is said to be of the same character as that at Shakespeare's Cliff.

The Metropolitan Board of Works, mindful of their increasing responsibility as regards fires in the metropolis, have just ordered three of Shand, Mason, and Co.'s most improved form of steam fire-engines as an addition to the plant of the Metropolitan Fire Brigade. As an evidence of the durability of this class of machine, we may state that the same firm last week delivered a similar engine to take the place of one that had been eighteen years in constant use.

A steamer, named the S. J. Oteri, which has been built by Messrs. Raylton Dixon and Co., of Middlesbrough, left the Cleveland Dockyard on Saturday morning last on a trial trip for speed of her engines. She is an elegant passenger steamer of 244ft. length over all, by 31ft. beam by 16ft. 6in. depth of hold. She is fitted with engines by Messrs. R. and W. Hawthorn, of Newcastle, of a nominal horse-power of 210, but with large boilers working to 90 lb. pressure. She attained on her trial trip an indicated power of 1480-horse power, giving a continuous speed of 15·6 knots, or about eighteen miles per hour.

Messrs. J. O. and C. E. Brettell, of Shrub-hill, Worcester, have recently manufactured and erected a new bridge over the river Bandon. The length of the iron work is 1350ft. The superstructure is laid upon four rows of girders, which rest upon screw piles, each of which has been driven to the rocky bottom. At the southern end there are two passages for vessels, which are opened by a swing bridge of 40ft. span, which works upon a turning table that rests upon a cylinder of 20ft. in diameter. The land end of the bridge rests upon a solid buttress, and the opposite end is supported by two cylinders each 6ft. in diameter. The lower flooring consists of a bed of concrete of 12in. thick, over which is laid a stratum of tar concrete, bound with a gravel surface heavy rolled.

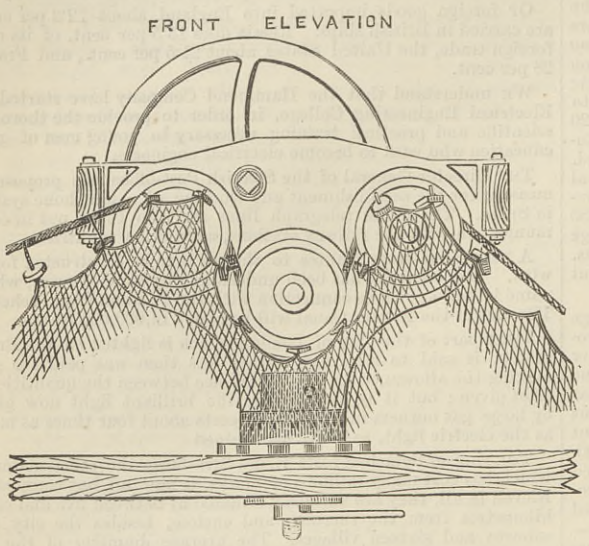
The bell hanging in the belfry at the Episcopal church at Ellicotville, N.Y., one of the oldest in America, has a long history. It was cast in Moscow, in 1708, and was one of a chime of bells in a cathedral in that city. The cathedral was burned by Napoleon in 1811. Several years afterwards the bell was sold in a lot of old metal which became ballast for a vessel sailing to New York without cargo. Andrew Meneely, of Troy, discovered it in a scrap pile in New York years afterward. He bought it, and for a long time it was kept by him at his bell foundry in Troy as a curiosity. In 1831 a resident at Ellicottville went to Troy to buy a bell for the Episcopal church, which had just been completed. He induced the foundryman to sell him the old Russian bell. It has been in use there ever since.

The Paris Electrical Exhibition, according to a report recently presented by M. Cochery, had 1764 exhibitors, viz.:—France, 937; Germany, 148; Austria, 36; Belgium, 281; Denmark, 5; Spain, 23; England, 122; Hungary, 10; Italy, 81; Japan, 2; Norway, 19; Netherlands, 18; Russia, 38; Sweden, 23; Switzerland, 21. The admission by payment numbered 673,473, and the free admissions to schools, workshops, &c., were very numerous, the last two free days having 80,000 visitors. The receipts, including 200,000f. from the State and 25,000f. from the Municipality, amounted to 1,048,417f. The expenses already paid reach 689,490f., and after clearing off a few outstanding bills, the net surplus is expected to be 325,000f. This sum is to be devoted, as previously announced, to a central laboratory for electrical experiments, thus continuing the work of the Congress, and developing a science with so large a future.

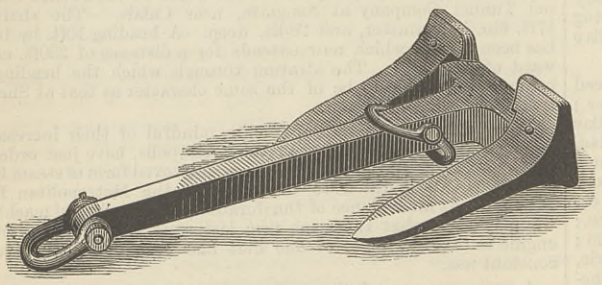
On the 6th inst. Messrs. John Key and Sons, Kinghorn, launched a fine modelled screw steamer of 850 tons gross, built to the order of the Australasian Steam Navigation Company of Sydney, N.S.W. The following are the general dimensions of the vessel:—Length, 210ft.; breadth, 29ft.; depth of hold to main deck, 12ft.; and to awning deck, 19ft. The building has been under special survey, and the vessel is classed 20A at Lloyd's. Her engines are of 160-horse power nominal, with cylinders 30in. and 60in. diameter by 39in. stroke, and intended to develope on trial 1000-horse power, with boiler pressure of 90 lb. As in the case of the Mentmore, built by the same firm, the keel blocks were split out by charges of dynamite, a method, we believe, then applied for the first time in Britain to the launching of vessels. On a given signal the charges were successively exploded, and on the dogshores being then let go, the vessel glided into the water—the whole launch being completed in twenty minutes, the employment of six men for that time being sufficient to complete the whole operation.

After some experimental trials during the last few weeks to assure the smooth and perfect working of every part of the arrangements, a demonstration of Mr. Edison's system of lighting the buildings and streets of a district may now be seen in London. From Newgate-street westward, across the Holborn Viaduct, to Hatton-garden, the street and most of the buildings on either side of the street are now, and for the next two months, will continue to be lit by Edison incandescent lamps and the plant we have already described and illustrated. The district lighted is supplied by four circuits. In the first circuit there are 66 street lights and 78 lights, of 16-candle power each distributed in 11 buildings; in the second circuit, 40 street lights and 49 lights in seven buildings; in the third circuit, 24 street lights, 26 lights in the Imperial Hotel, six in a shop, 68 in Messrs. Spiers and Pond's Hotel, of which 20 are in the restaurant, nine in front of the London, Chatham, and Dover Railway Station, and 52 in six warehouses; and in the fourth circuit 31 street lamps, 147 16-candle and 14 8-candle lamps in the City Temple, seven 16-candle and four 8-candle lamps at No. 31, 216 16-candle and 16 8-candle lamps in the company's central station, and nine 16-candle and 22 8-candle lamps in the Viaduct Tavern. In this circuit also will be placed 50 16-candle lamps, which are to be tried in the General Post-office.

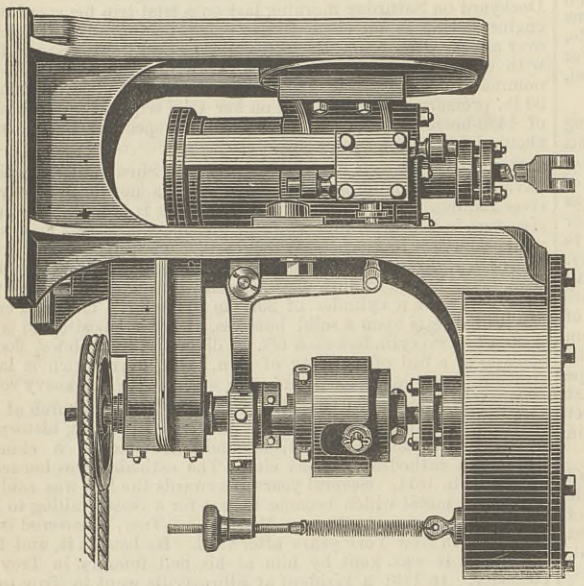
EXHIBITS AT THE NAVAL AND SUBMARINE EXHIBITION.



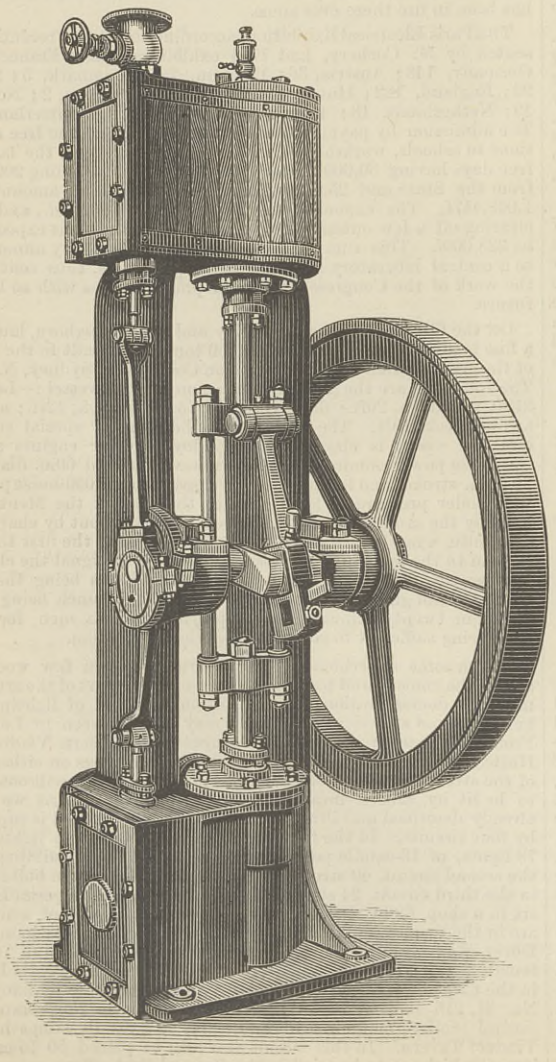
MITCHELL'S NET HOIST.



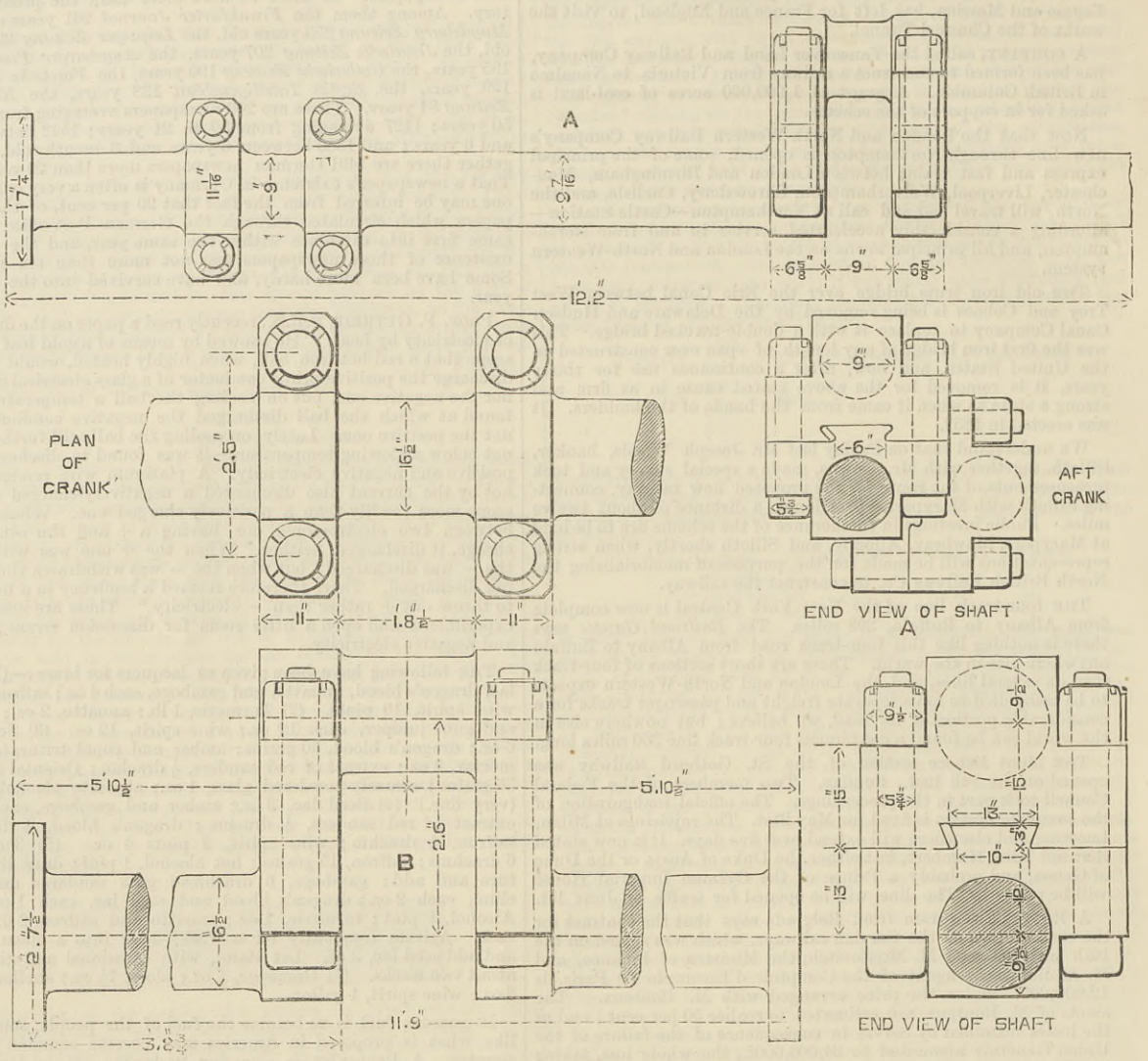
WASTENEY SMITH'S ANCHOR.



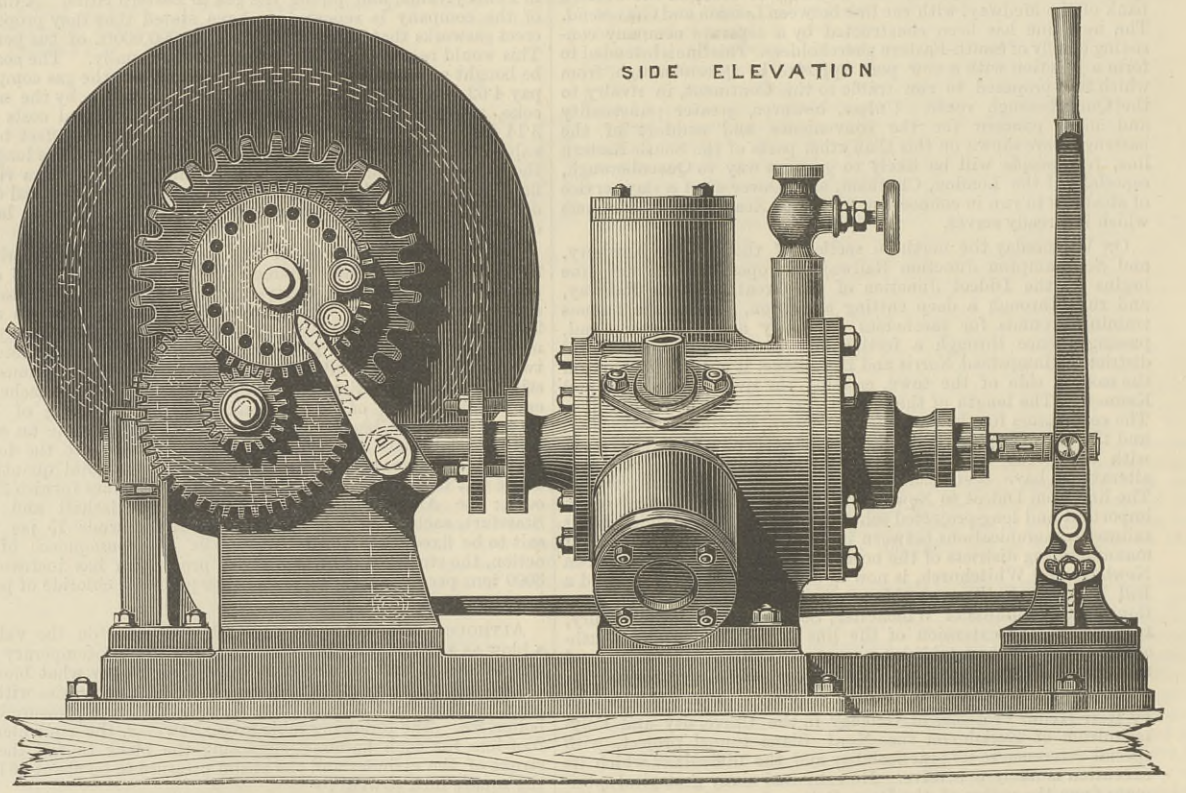
CHURCHILL'S GOVERNOR.



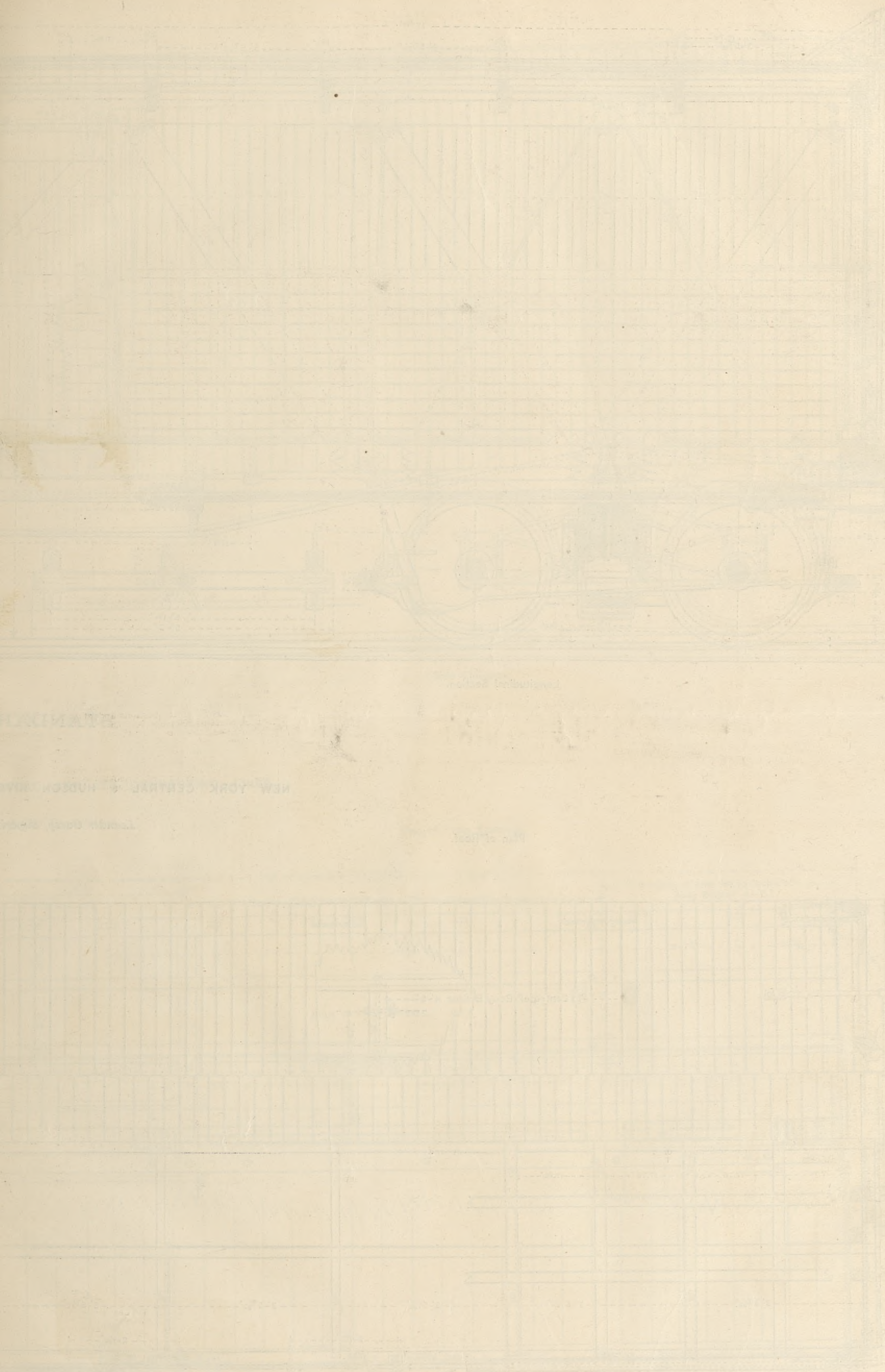
CARRICK AND WARDALE'S PUMP.

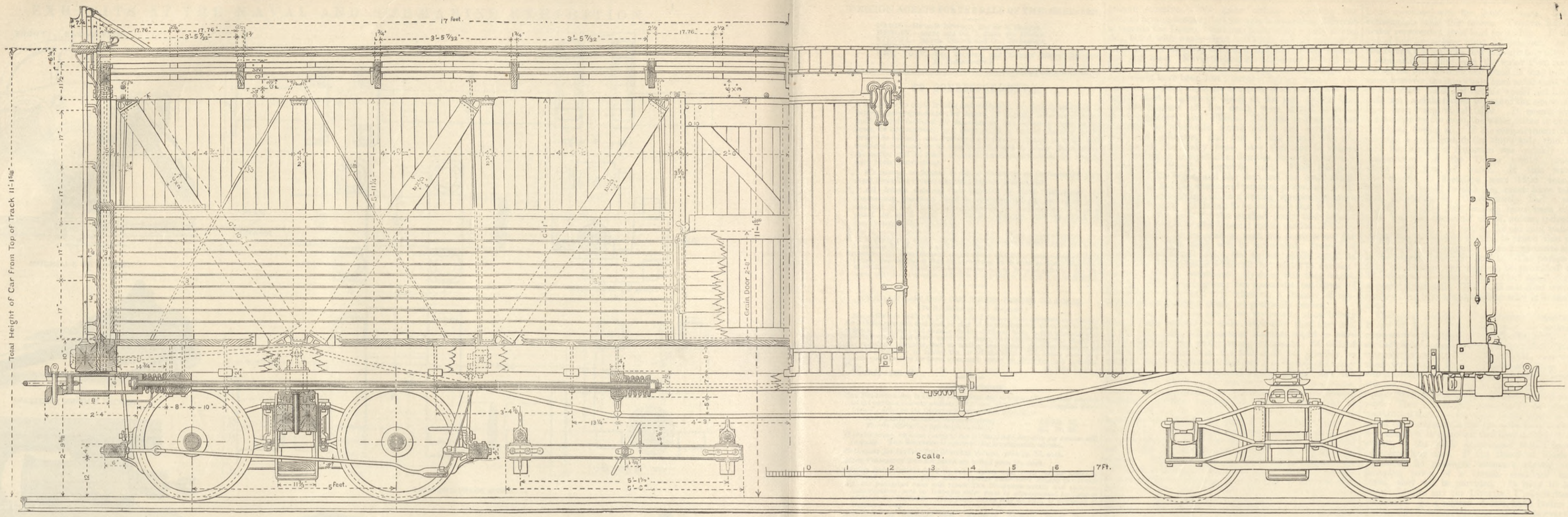


TURTON'S CRANK SHAFT



HALL'S ASH HOIST.





Longitudinal Section.

Side Elevation.

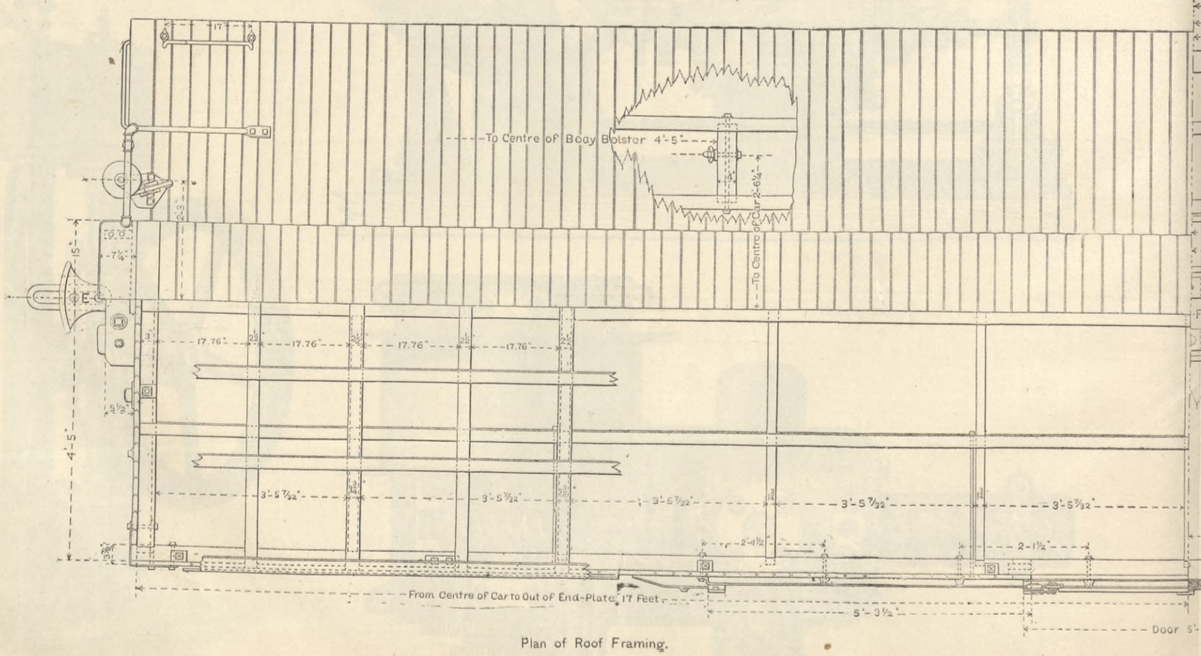
STANDARD BOX-CAR

FOR

NEW YORK CENTRAL & HUDSON RIVER RAILROAD AND ITS CONNECTING LINES.

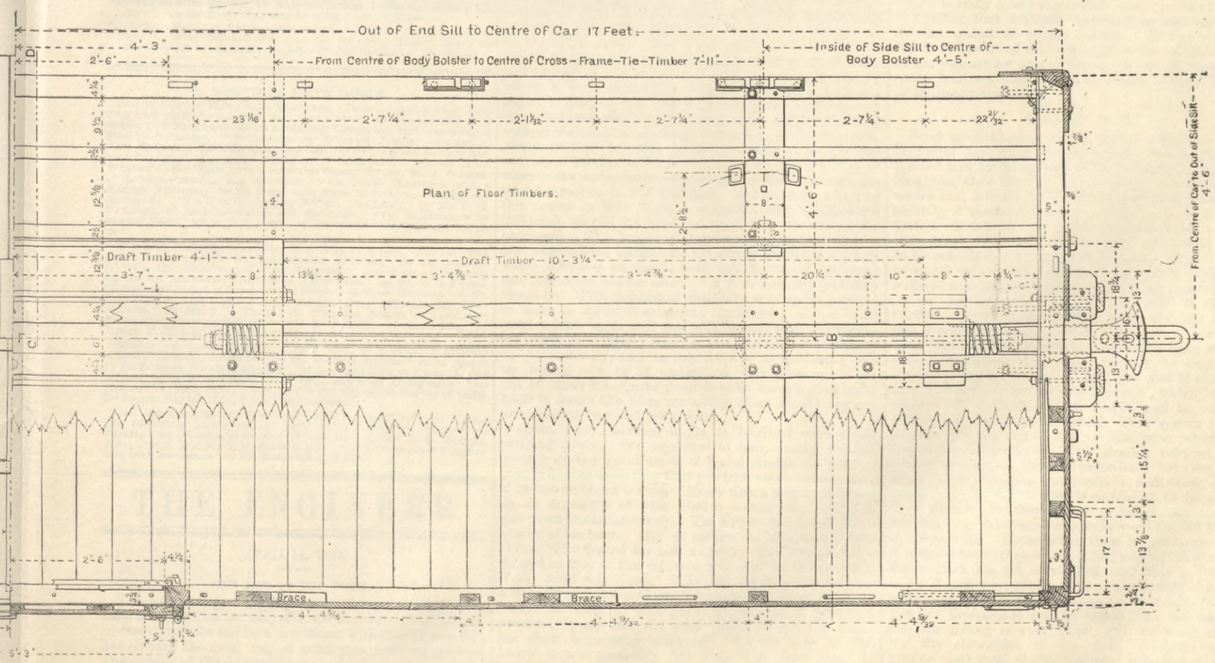
Leander Garey, Superintendant of Car Department.

Plan of Roof.



Plan of Roof Framing.

Plan of Floor Framing.



Plan of Floor

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TO CORRESPONDENTS.

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

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(*To the Editor of The Engineer.*)

Sir,—We are unable to procure sound boxes when recesses are cast in for holding grease, and shall be glad of any assistance from your many readers. We have cut recesses in the chill and then put a core made of fire-clay waste and sharp sand into them, and projecting the depth of the required chamber, but in casting we cannot prevent blowing, as there is no means of taking the air off the cores. We fancy there is a special preparation for these cores, and would be glad for any information.

R. and F. K.

Ireland, April 4th.

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

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

MEETINGS NEXT WEEK.

Institution of Mechanical Engineers.—Thursday and Friday, April 20th and 21st, at 3 p.m. each day. The business for the meeting is as follows:—"Memoranda on the Hardening, Tempering, and Annealing of Steel"—discussion. "Memoranda on Rivetted Joints"—discussion. "On Hydraulic Lifts for Passengers and Goods," by Mr. Edward Bayzand Ellington, of London—discussion. "On Improved Appliances for Working under Water, or in Irrespirable Gases," by Mr. W. A. Gorman, of London—reading and discussion. "On Power Hammers with a Movable Fulcrum," by Mr. Daniel Longworth, of London—reading and discussion. "On Wool Combing by Modern Machinery," by Mr. F. M. T. Lange, of Amiens—reading and discussion. "On Implements for Sowing Seed," by Mr. J. J. Smyth, of Peasenhall—reading and discussion.

Chemical Society.—Thursday, April 20th, at 8 p.m. The following papers will be read:—(1) "On Specific Volumes," by Dr. Ramsay. (2) "On the Behaviour of Zinc, Magnesium, and Iron as Reducing Agents on Acidulated Solutions of Ferric Salts," by Mr. T. E. Thorpe. (3) "On the Action of Oxychloride of Sulphur on Silver Nitrates," by Mr. T. E. Thorpe. (4) "On the Action of Thiophosphoryl Chloride upon Silver Nitrates," by Mr. T. E. Thorpe. (5) "On the Action of Acetone on Phenanthraquinone, both Alone and in Presence of Ammonia," by Messrs. F. R. Japp and W. Streatfield.

Society of Arts.—Wednesday, April 19th, at 8 p.m.: Eighteenth ordinary meeting, discussion "On the Channel Tunnel," to be opened by Sir Edward Watkin, Bart., M.P. Friday, April 21st, at 8 p.m.: Indian Section, "The Mineral Resources of India and their Development," by Professor V. Ball, M.A., F.G.S., late of the Geological Survey of India. Sir Joseph Fayrer, M.D., K.C.S.I., will preside.

The Meteorological Society.—Wednesday, April 19th, at 7 p.m.: The following papers will be read, "Barometric Gradients—Wind Velocity and Direction at the Kew Observatory," by Mr. G. M. Whipple, B.Sc., F.M.S., and Mr. T. W. Baker, F.M.S. "On Difference of Temperature with Elevation," by Mr. George Dines, F.M.S.

THE ENGINEER.

APRIL 14, 1882.

THE LOSS OF THE DOURO.

The foundering of the Royal Mail Company's steamship Douro, on Sunday morning off Cape Finisterre, within half-an-hour after she had been in collision with the Yrurac Bat, has elicited the usual crop of comments and suggestions. The details of the catastrophe are too well known to require description here. The Yrurac Bat appears to have struck the Douro on the side aft of the centre, and was so much damaged herself that she sank in a quarter of an-hour. With her, as she was not a British ship, we shall not concern ourselves. We know nothing concerning her internal arrangements; but the case is somewhat different as regards the Douro. She was presumably a very strong ship, fitted with water-tight bulkheads, and all manner of appliances for securing her safety and that of her passengers and crew. Nevertheless, she foundered in half an-hour. If she had remained afloat a few minutes longer no lives would have been lost; but she did not float for the short time needed to secure the safety of all hands, and her captain died a glorious death at his post to the last, and the honours of his death were shared by some of his engineers and officers. The case is just of that character to stimulate men's minds and evoke comment and criticism, and this is the reason why the columns of the daily press have abounded in letters, some written by competent authorities, others by obviously incompetent though ingenious men. Fault has been found with the boats, and the drill, and the construction of the ship, and the absence of pumping power, and so on. So far as we can judge, all this writing represents so much waste of energy. It is not to be supposed that it will do any good. We have not the smallest doubt that precautions could be taken which would reduce the loss of life by collisions at sea by one-half at least, but there is not the least chance that they will be introduced. Instead of attacking individual ships, the British public ought to attack the system under which all that relates to our mercantile marine is controlled. By doing this they might, perhaps, effect some good; but spasmodic outbursts of indignation, which find vent whenever a steamer of considerable size founders at sea, are practically useless.

It may serve a good end if we try here to show briefly what is really wanted to make ships safer than they are. In the first place, all passenger steamers ought to have double bottoms and really strong bulkheads. It will, of course, be objected that the first could not possibly be adopted. But as a matter of fact they are adopted, and many steamers are now constructed on this system; but the tonnage laws, which really deserve to be called iniquitous, compel the shipowner to pay a high price for double bottoms. In this respect the tonnage laws ought to be amended, and it should be a rule that no structural cavity introduced for the purpose of working a ship or securing her safety should be rated for tonnage dues. It is quite notorious now that spaces into which cargo could not possibly be stowed are rated as though it could be stowed. All this ought to be changed. Again, the bulkheads in passenger steamers ought to be strong enough to stand, without shoring or supporting in any way, the full pressure of a body of water as high and as wide as the bulkhead. If we take the midship section of a steamer of large size, with a flat floor, we shall find that the superficial area of the bulkhead may be about 780 square feet. Assuming that the partition rises to a level at least 18ft. above the ship's keel, the pressure on this will be about 8 lb. per square inch when a compartment bounded by the bulkhead is filled with water. The total strain on the bulkhead then will be about 370 tons. Towards the top the load will be reduced; near the bottom augmented. How many bulkheads are there made which can endure this strain without being on the point of giving way? Few, if any. It is almost always urged that the bulkhead is calculated to resist the pressure of any water that it can be called upon to keep out. That, in other words, its plates and angle-irons are sufficiently strong for the purpose. We do not dispute that the calculations are made; but we do assert that, whereas in all other structures designed by naval engineers a margin or factor of safety of from three to four to one is provided, in the case of bulkheads there is very often no margin at all, or next to none. The "touch-and-go" bulkhead is a recognised institution. A bulkhead in other words, so weak that whether it will or will not hold out against the strain put on it, is touch and go. It is no easy matter, be it observed, to design a flat wall built up of light angle iron and thin ship-plates which will sustain a strain of 200 or 300 tons without buckling or bending; but as soon as this happens, certain portions are sure to be overstrained, and then the working of the ship and the movement of the great body of water in the partly-filled compartment quickly lead up to the total destruction of the bulkhead. The amateur, aware of this, comes in here with a suggestion that longitudinal bulkheads should be used to strengthen the transverse bulkheads. The practical shipbuilder, however, knows that longitudinal bulkheads are simply intolerable; they would interfere so much with the stowage of the cargo that they could not be used. Nor is it necessary that they should be. With the aid of the decks, it is quite possible to make a quite trustworthy bulkhead; but it will weigh a little more and cost a little more than the worthless article now fitted; and for this reason its use must be made compulsory, and in this there is no hardship. We are dealing now, be it understood, with passenger ships, and in these it is quite possible to fit enough good bulkheads to insure the ship remaining afloat should any one compartment be filled with water.

Again, every steamer ought to be fitted with ample pumping power. We regretted to hear, during the last meeting of the Institution of Naval Architects, men of great influence asserting that powerful steam pumps were of no use on board a ship. Every time a ship founders at sea an argument of this kind is contradicted. No ship goes down instantaneously. The Yrurac Bat floated for a quarter of an hour. But to confine our attention to the Douro. She floated for half an hour. Her engines were stopped as soon as the collision was over, so no pumping of any kind was done. Why did she float for half an hour? Was it not because it required that time for water enough to enter to sink her? The amount of floatation possessed by all but the very largest steamers is much less than is usually supposed. In the case of the Douro it was probably not more than 1200 tons. It is clear then that the leak which sunk her did not admit water at a more rapid rate than 2400 tons per hour. Now, Messrs. Gwynne, of Hammersmith, to mention one firm out of several, make centrifugal pumps, taking up very little space, which will lift 1200 tons an hour overboard with the greatest ease. Let our readers contemplate what this means. Twelve hundred tons of water represents a great load for a ship. If this can be got out of her, her sinking must be delayed. In the case of the Douro, it is probable that immediately after the collision a compartment filled, and the water then rose through a hatch, ran over the deck and found its way below. At that time, however, the ship would have so far sunk that the level of the water inside and outside would not have been very different; and the further ingress of the sea would therefore have been comparatively slow. It seems that the ship went down by the stern, the water, after it overtopped the bulkhead, flowing aft. If the compartment filled at once, through a great gash in the ship's side, then it is evident that her margin of floatation was quickly reduced. A compartment of the Douro would probably hold about 700 tons of water. If this were so, and the margin of floatation were 1200 tons, then the 500 tons required to sink her must have taken half an hour in getting in. Consequently, had a steam pump capable of lifting 1000 tons an hour been on board, she need not have foundered at all, unless, indeed, her bulkheads gave way. Of course, the old and well-worn arguments may be brought up here to prove that pumps could not be used as we suggest. Such arguments are, however, in the present day simply fatuous. The pumps can be had, they can be fitted, and they can be provided with steam. The quantity of steam wanted is but small, for the power required is not great. We shall not deal with this point further; we have yet to consider why it is that nothing is done.

The great offender is the Marine Department of the Board of Trade. For years past its action has been oppressive to the shipowner and the shipbuilder, while it has entirely failed to secure safety for the public. Its rules are so incredibly absurd in some respects that, were we to publish them, we should be accused of practical joking. For example, will it be believed that the proper number of passengers for a steamer to carry is found by ascertaining the number of square yards of deck space, and allowing one passenger per yard. Thus a mere raft could carry as many as a well-constructed ship. The Surveyors to the Board are continually called on to compensate for the defects in these rules; and it is almost to be regretted that they do this to a very great extent, or the whole department would have been reorganised long since. If the Board of Trade insist that bulkheads for passenger steamers strong enough, and pumping power of a certain standard must be provided, they will be provided. It may be asked, why do not Lloyd's and the Liverpool Underwriters take the initiative? As a matter of fact, both bodies do a great deal in this direction, but they cannot do everything. We have the greatest possible objection to the interference of paternal governments in trading and manufacturing operations; but the Marine Department of the Board of Trade has interfered now for so many years that the shipowning public have become used to it, and a very little judicious presssure as regards bulkheads and pumps, accompanied by a little giving way on certain points connected with boilers and ships' fittings, would secure all that is wanted. We do not expect, however, anything judicious from the Marine Department of the Board of Trade; and, as we have already said, if those who now exert themselves to advocate certain modifications in the structure of ships, in the form of boats, in the drilling of crews, and such like, would concentrate their energies on advocating a reorganisation of the department which is really chiefly responsible, they would at all events —whether they achieved anything or not—direct their attacks against the proper quarter. In five cases out of ten it will be found that when great loss of life takes place at sea—we are not now referring to wrecks on our coasts —the Marine Department of the Board of Trade is directly or indirectly responsible.

BRIGHTON BEACH.

Some months having passed since we last had an opportunity of examining the works being carried out by Mr. Ellice-Clark for the defence of the Hove beach adjacent to Brighton, their effect in withstanding the action of the waves and currents, which threatened so disastrously the security of the foreshore, can now be to some extent estimated. It is certainly necessary to qualify any estimate of their result, for hitherto the effect of these works appears to be entirely confined to the Hove beach; that of Brighton, to which we predicted certain damage, not having as yet suffered appreciably. Before considering results as found on our last inspection, it may be as well to sketch the further operations undertaken since our last article on this subject was written, which appeared in our issue for May 13th, 1881. That article commented upon Mr. Ellice-Clark's letter to us of May 2nd, wherein he communicated his desire to test the effect of long groynes at considerable intervals with shorter groynes between, which last should successively be diminished in length, and be constructed at angles of increasing acuteness. This system is now in process of being carried out on the plan which accompanied Mr. Ellice-Clark's letter already referred to. The timber groynes, *i.e.*, those intermediate between the long concrete groynes, have not, however, sufficiently advanced towards completion to enable anything to be said as to their success; but they appear to follow out the theory which all our experience with such works seems to suggest as the true one. Nevertheless, there is one danger to which it must be feared they will be liable, and which possibly Mr. Ellice-Clark has not overlooked, and this is, that as the angle of each groyne becomes more acute, they become more and more exposed to the broadside—so to speak—force of the waves. Doubtless it may be urged that the strength of the sea rolling in upon them will be much mitigated by the obstruction of the first concrete or main groyne, and those timber groynes adjacent to it which approach a right angle with the shore line. This argument could be well applied if the course of the waves was always from south-west or thereabouts; but in the case of a gale from due south it is much to be feared the smaller timber groynes will suffer greatly. What the force is that

these will have to withstand can be realised from the fact that the head or, more correctly speaking, the terminal point—for this seemed to us to be dangerously slight—of one of the concrete groynes has already been washed away. If concrete has thus succumbed from an end-on blow, it is scarcely likely that a timber structure will stand one delivered almost full on its face.

We fear we cannot congratulate the Hove Commissioners that they have by their outlay hitherto secured immunity from danger. In fact, what we have all along asserted must occur is now taking place. At one spot there are two massive concrete groynes, situated, probably, about seventy yards apart, and not having any intervening works or protection whatever. The westernmost of these two groynes is connected with the beach by a root of heavy concrete work, forming a sea wall about 15ft. to 20ft. in length. In the angle formed by the connection of the groyne with this root, although the sea washes up its face with great violence, singularly enough there are signs observable that beach accumulates there; but it struck us as impossible to say whether this was a permanent lodgment, or just the result only of shingle thrown up with each succeeding wave. The sea was a dead calm on the occasion of our visit, yet, in spite of this, this sharp angle, at every lap of the advancing and receding swell, threw up a relatively considerable column of water. It was manifest that if such a result was visible on a day when the water had no motion to speak of, a rough sea might produce very serious effects, and we are decidedly of opinion that such sharp connections should be avoided. It was about midway, however, between these two groynes that we were enabled to realise how completely the fears at first expressed by us, as to the effect of these groynes, are being verified. As we have said, our inspection was made on an exceedingly calm day, but nevertheless each succeeding lap of the sea was carrying away portions of the unprotected bank, and we can fancy what must follow a south-westerly gale at this point. Indeed, we expect to hear of the whole of the lower esplanade in the immediate vicinity being carried away. It appears to us as if there can be no help for it. The encroachment here must, doubtless, have been sudden and unlooked for, or some protective measure would have been adopted. Such being the present aspect of affairs, it is evident that there is but one course open to Mr. Ellice-Clark—groyning must be carried out in the threatened interval between these two concrete groynes as it is in the other intervals. This is precisely what we have all along contended would have to be done, and when it is done—at great cost, as it must be—the Hove people may perhaps rest and be thankful; but then how about their Brighton neighbours? In our earliest remarks on this subject, we stated that the encroachment would be driven further and further eastward by these protective works at Hove, until that town was secured at the expense of Brighton. What we have detailed as now occurring at Hove will, when the protection of that shore is complete, be experienced most infallibly at Brighton, and the length of beach to be protected by its authorities so far exceeds that under the responsible control of those at Hove, that an expenditure will have to be faced which may well alarm the ratepayers.

We can well imagine that many will designate us as prophets of evil only, and as being unable to offer any suggestions by which it may be averted. We own that such a conclusion is just. There is no way now apparently by which all this expense can be saved. The evil has, in fact, travelled too far. Want of unity of action in this case by two adjacent towns was the beginning of the evil. Primarily, however, they should never have been left to themselves, either in union or disunion. The danger is one which needs Imperial control, and while this is absent, instances such as we have noticed must be for ever recurring. We hear of great trouble now being experienced by the trustees of Shoreham Harbour, more to the westward, who find their protective shingle rapidly failing them, and more independent patchwork—for so we cannot but term it—will have to be undertaken at that place. Although we heartily sympathise with Mr. Ellice-Clark in his endeavours to cope with his determined and harassing enemy, and certainly feel for the constant and annoying succession of disappointments to which he has been doomed, we cannot but think his great and skilful endeavours have been wrongly directed, and this for two reasons. Firstly, granting for the sake of argument that protective works of the extensive character Mr. Ellice-Clark has adopted are a necessity, we believe that a permanent sea wall, such as has stood in many other parts of England, could have been constructed at a less cost than has now been, and will have to be, incurred for the purpose of retaining protective shingle. Better altogether, we should have said, to reject so treacherous an ally in the struggle with the sea, and have trusted to solid work. But secondly, and on the other hand, we believe that too much has been attempted. Not content with securing what Nature's forces had left to them, the object of the Hove Commissioners has been to regain what those forces have stolen away, and it is this consideration which leads us back again to our long-ago expressed opinion that groynes carried only to the level of the shingle as it stood would have stayed the travel of it to the eastward, and would have averted the setting-up of that action of lee-side scour, which is more destructive by far than mere gradual denudation, and which is only to be coped with by constantly extending works until the limits of responsibility are reached and other sections of the shore are affected.

Apart from such considerations of policy, however, Mr. Ellice-Clark's experiments will prove of the greatest value to engineers generally. If successful, they will determine the value of a new departure in the system of erecting groynes; and although we have taken exception to these having been adopted in this instance of Hove, where they will be instrumental in removing a neighbour's land-marks, there are many instances where local circumstances must compel their employment. In such, the experience likely to be gained by the engineer to the Hove Commissioners will certainly prove of the greatest value; for if the system of trending groynes should be found to avert the troublesome lee side action, and, further, should our fear as to their withstanding broadside wave force not be realised, the number of places where similar works will be invaluable is legion. Meanwhile, though entertaining grave doubts as to the policy of the plan pursued, we wish Mr. Ellice-Clarke every possible success.

In conclusion, we would notice that, judging from pumping apparatus now erected on the beach in the immediate vicinity of the works, it has been wisely decided to make use, as we before suggested should be done, of the water of the land springs which flow so freely between the beach in front of Hove, for the mixture of the cement used in the making of the concrete blocks. In our last article on this topic we strongly deprecated the use of salt water for this purpose that had been customary on the Hove works, and expressed our fear lest it might assist in some local decomposition of the concrete. We wonder if to some such cause as this may be attributed the partial failure above referred to of one of the concrete groynes.

IMPROVEMENTS IN THE CHANNEL PASSAGE.

Competition is bringing about still further improvements in the conditions for crossing to France by the two short sea routes, and the question of expense as compared with the resulting receipts has to be carefully considered by the two English railway companies interested in the Folkestone and Dover passages. At present the South-Eastern Railway Company has three passenger boats running, the Albert Victor, the Louise Dagmar, both new large boats, and one of the smaller ones belonging to the older fleet. A new steamship, 5ft. longer than any on the line, is now in course of construction by Messrs. Samuda Brothers, and will begin to run early in the autumn. Some apparatus has been tried on board the Albert Victor with the view of diminishing sea sickness; two inventors are trying to solve the problem; one of them is now exhibiting his apparatus at the Naval Exhibition, the other is making in his some improvements dictated by experience, but both will soon be again on actual trial. The principle of both is so to suspend each passenger that his body shall not share in the oscillations of the ship more than can be avoided. The new harbour works at Folkestone are progressing steadily; they consist of an extension of the present pier, the construction of a breakwater to shelter the pier from south-westerly gales, which will be the most serious part of the work after deeper water is reached, and the construction of another breakwater, already partly formed by nature, from Copt Point. The entrance to the new harbour will be 500ft. wide between the pier heads, and about 90 acres of water will be included in the works. The question whether animals suffer from sea-sickness, having been raised by the adventures of the elephant, Jumbo, Capt. W. Mortleman, who has been on the Folkestone-Boulogne boat service for thirty years, states that he has seen dogs sea-sick, and believes that cats suffer in the same way; the latter are not much seen at sea, from the superstition of sailors that a cat on board brings foul weather. He has noticed that horses and cows, which cannot be sea-sick because of their anatomical construction, become remarkably quiet when they get into rough water, however unruly they may have been before; they therefore appear to feel the effects of the rolling of the vessel. Altogether it is as probable that Jumbo felt the effects of sea-sickness on the second day out, as that his indisposition was due to thoughts of Alice or the after effects of beer and whisky. The Calais-Douvres is running again between Dover and Calais. The Dover people have long had an idea she is not strong enough for the winter passage, but Captain Morgan, R.N., marine superintendent to the London, Chatham and Dover Railway Company, states her strength to be ample, but that she is taken off the line during the winter because she is such an expensive boat. All the Calais and Dover steam fleet belongs to the Chatham and Dover Railway Company, although some of their vessels sail under the French flag for the carrying of the French mails. A larger and swifter boat than any hitherto in use on this line is in course of construction by Messrs. Maudslay, Sons and Field. This boat, the Invicta, will be 312ft. long, 3900 indicated horse-power, steam more than 18 knots an hour, and is expected, when she begins to run some two months hence, to accomplish the passage in an hour in fine weather.

OPEN HEARTH STEEL PRODUCTION.

Not the least interesting of the tables that are included in the mass of those issued by the British Iron Trade Association are those that relate to the production of open hearth steel. Although the quantity of this metal made is much below that of Bessemer steel, yet it is growing very rapidly, and with the extension of the building of steel vessels a further and perhaps more rapid expansion of the production must be looked upon as tolerably certain. The tables to which we have referred show that in the past year 338,000 tons of open-hearth steel were produced by the open-hearth process in Great Britain, an increase of about 87,000 tons above the quantity made in the corresponding year. Scotland contributes the largest portion of the production in the past year, and also the largest part of the increase, whilst South Wales is the only district that shows any large falling off in the total production for the past year. Put into the order in which last year they contributed to the total output, the districts stand as under:—Scotland, 159,000 tons; South Wales, 102,000 tons; Sheffield, 34,000 tons; Lancashire and Cheshire, 24,000 tons; North East Coast, 12,000 tons; and other districts in the total, 6300 tons. These figures point to the growth of steel shipbuilding in Scotland in the past year; for it is that great growth that has enabled the district to take the first place amongst the producers of Siemens steel, for about a third of the whole production of that metal has in the past year taken directly the form of plates and angles. At the present time the facilities of production represent something like 440,000 tons, and to this there are additions in course of being made, so that before the end of the year it is tolerably certain that a very large production of this class of steel will become possible. Hitherto one of the difficulties that the builders of steel vessels have had to meet has been the smallness of the production of Siemens steel, and in some cases of the distance of the place of manufacture from the shipbuilding district; but the extension of the trade and the widening of the area in which the metal is produced is lessening the cost of production for use in some of the parts where shipbuilding is planted.

THE PETER THE GREAT'S GUNS.

This ship, which has recently been fitted with new engines and boilers by Messrs. Elder, at Glasgow—the trial trip of which was reported in our impression of February 10th—has been lying at Cherbourg, and on Thursday week went for a short cruise in order to fire her guns, and to test the hydraulic machinery for running out and taking up the recoil of their which has been fitted to the carriages by Messrs. Easton and Anderson, of London and Erith. There are two 12in. 42-ton guns in each turret, mounted on carriages which are free to slide on two girders, the paths on which are inclined forward at an angle varying from 3 deg. to 5 deg. The gun is run out by means of two hydraulic rams fixed between the girder paths, a crosshead connecting these rams bearing against a projecting bracket underneath the lower part of the carriage. The recoil when the gun is fired is also taken up by these rams, which by means of graduated relief valves are made to offer the necessary resistance. To run the gun back into the turret for drill purposes when the guns had not been fired, there are two smaller rams placed one on either side of the forward part of the carriage, and a vertical ram placed underneath the gun carriages raises the trunnion bearing of the gun if necessary. A water pressure of 50 atmospheres is maintained by a set of duplex steam engines and pumps, hand pumps also being provided for the same purpose. The various movements of both guns in each turret are effected by the action of Luthy valves worked with levers at the rear of the gun. The trials consisted in firing three rounds from each of the guns in the forward turret, and two rounds from those in the after turret. In the first trials the original friction compressors were used as well as the hydraulic recoil cylinders; in the latter ones, the hydraulic cylinders alone took up the recoil, which, with a charge of powder of 160 lb. (Russian) and shell 736 lb. (Russian), the valves being loaded to 40 atmospheres, measured 3ft. 10½in. The results of the trials were considered very satisfactory, and it was not deemed necessary to continue them further with diminishing pressure on the recoil valves, and consequently increasing recoil.

PROFESSOR OSBORNE REYNOLDS ON THE STEERING OF SCREW STEAMERS.

On Wednesday evening Professor Osborne Reynolds gave a lecture upon the steering of steamers, in the lecture room of the Agricultural Hall, Islington, in connection with the Naval and Submarine Exhibition now going on there. We are not able this week to give a full account of this interesting discourse, but we hope to be in a position to do so in a subsequent issue. Professor Reynolds many years ago was struck with the frequency of collisions in which one or both vessels concerned was a screw steamer, and he has since watched these events in a critical and scientific way. The result has been in his case a conviction that the effect of the rudder upon a ship's course when the screw is reversed, the ship's motion being onwards but undergoing continual diminution, is opposite in character to what it would be with the engines going ahead. This theory the lecturer explained very clearly to his audience, without dealing with the matter in too quantitative a way, and, like most earnest men when dealing with a subject involving such serious issues as the prevention of disasters of large scale, succeeded in carrying his hearers with him. Of course he could not avoid exposing the way in which courts of inquiry have continually treated theories of this kind, where what are supposed to be established opinions are called in question, but this was done in the philosophic method of a man who fully recognised the inertia of official procedure, and made every allowance for the forces operating in human verdicts. It was to a certain extent consoling to English vanity that Professor Reynolds did not exclude foreign countries from his reflections, as he attributes the running down of the Grosser Kurfürst by the König Wilhelm to the fact that the steering of the latter vessel had the very opposite effect upon her course to that it was intended to have; and points out that the verdict of the German Court of Inquiry was, in spite of direct evidence, based upon a neglect to take into consideration the effect upon a vessel's course which a reversal of the screw may have.

HOW NOT TO MAKE A GOOD SHAFT.

It seems that they have something yet to learn in America as to how to make a big shaft. The *Scientific American* says:—"The beam engines for the Old Colony steamboat, to be called the Pilgrim, are now building at the Morgan Ironworks in this city. The boat, which is to be of iron, and about 70ft. longer than the Providence and Bristol, is now building in Roach's shipyard at Chester, Pa. The engines are to be very large. The cylinders have a diameter of 110in., with 14ft. stroke. The two shafts for these engines are the largest ever forged. One of them is ready to be turned and finished, and the other, under the direction of Thomas F. Doirity, is in the forge. The process in so large a work is interesting. The iron used is made up of scraps of boiler-plates, nuts, and screws, and horseshoes. These are first run together into bars 2ft. or more in length. The shaft is built by adding from four to six of these bars at a time to the end, welding them on in the furnace and beating them into shape with the powerful steam hammer. Then more are piled about the end of the shaft at a white heat, and welded on in the same way. The two shafts now making measure 40ft. long each, with a diameter varying from 27in. to 30in. They weigh over 81,000 lb." It is practically impossible to make a large sound scrap shaft in this way; some of the iron is sure to be burned and nearly all to be deteriorated in quality. We hear so much about American steel just now that we are surprised to find scrap iron being used under circumstances where steel would have answered very much better. It will be understood that the boat has but one pair of paddle-wheels, although she has two shafts.

SHEFFIELD TRADE WITH THE UNITED STATES.

We are indebted to Dr. Webster, the United States Consul, for early and official details of our trading with his country for the quarter ending March last. The total value of Sheffield exports to the States for the three months was £334,670, as compared with £281,326 for the corresponding quarter of last year. Steel we exported to the value of £107,325; cutlery, £63,909; as compared with £77,659 and £63,457 respectively, for the similar period of 1881. It will be noticed that there is a very large increase in steel, while cutlery remains almost stationary. During the month of March the value of the exports was £102,920; steel ranking for £46,039, and cutlery for £25,239. For March, 1881, the total was £136,911, steel being sent to the value of £33,459, and cutlery, £18,465. Both items, it will be noticed, are much larger this month than in 1881, but the gross total is £34,000 less—a falling off which is entirely due to American orders for rails having been largely delivered during the previous month, when the total value of exports was £135,027. On the whole, the figures are exceedingly satisfactory, particularly in regard to our staple trades of steel and cutlery. Next month there will probably be heavy consigments of steel rails to the States, which will again bring the gross amount much higher than for March.

LITERATURE.

The Action of Lightning and the Means of Defending Life and Property from its Effects. By Arthur Parnell, Major in the Corps of Royal Engineers. Crosby Lockwood and Co. 1882.

Major Parnell has done what many authors try to hide, viz., given us in this work the materials upon which he has based his conclusions. From many points of view this is an advantage. We can determine for ourselves the trustworthiness of his authorities, and we can also obtain some idea of how he arrives at his conclusions. It may be inferred that Major Parnell has for some time kept a common-place book, and under the heading "Lightning" entered everything he came across in his reading which seemed to bear on the subject. The author commences his work by furnishing a list of his authorities; and then gives the extracts from the authorities, followed by a long catalogue of incidents of the action of lightning. In Part II. is given the theory of the action of lightning, and in Part III. the practical measures advocated for protection of life and property against the effects of lightning. We may at once dismiss more than half of the authorities mentioned as valueless, inasmuch as their contributions to the literature treating on lightning are more or less a popular *rechauffée* of what other writers have written. Other authorities must not be taken as infallible. Snow Harris, for example, good as he was, and bespattered with praise as he is by those who know no better, had a worthy antagonist in Sturgeon, a name too little remembered in the minds of electricians of to-day, who successfully combatted many of Harris' proposals. It would be invidious to mention the popular treatises from which the author has gleaned, but we may say once for all that there is not a popular work on electricity which does not teem with errors, or which should not be used very carefully in such investigations as this, if at all. Let us, for example, test authority by authority. The first sentence in Major Parnell's work reads thus: "Electricity is one form of energy, and therefore necessarily force and not matter" (*Preece* 337).

Clerk Maxwell—than whom a greater authority never lived—says: "There is, however, another reason which warrants us in asserting that electricity, as a physical quantity, synonymous with the total electrification of a body, is not, like heat, a form of energy." ("Electricity and Magnetism," vol. i., p. 37, 2nd edition, edited by Niven.) We must leave our readers to decide between the doctors—one quoted by the author, one by ourselves.

The following quotations will give a fair idea of the contents of Part I. of this work. We have selected them for two reasons—(1) shortness; (2) because we think the repetition of such extracts to be a mere waste of space. Had the author said that most authorities agree as to the necessity of frequent inspection, we fancy it would have sufficed to carry the weight to the mind of the reader of the book.

"Inspection of rods (p. 74): (1) The state of the earth should be tested by means of galvanometers (*Mann*, 1875, 537). (2) M. de Fonvielle has recommended an arrangement of a short circuit wire, with a galvanometer, to be fixed to each separate conductor, so that examination can always be made (*Do.*). (3) A convenient form of galvanometer for testing conductors has been devised by Mr. R. Anderson (*Do.*, 1878, 339). (4) Lightning rods should be periodically examined as to points, continuity, and earth, and tested with a galvanometer and current (*Preece*, 347). (5) Frequent inspections are needed (*W. O.*, 1875, 43)." And so on. The table giving a list of some of the accidents from lightning is well arranged, and in the latter part of the book is admirably analysed and discussed.

This brings us to Part II., that portion of the book where the work proper of the author commences. The whole of this and the remaining portion of the book deserves careful attention, although we doubt if many will be converted to all the author's conclusions. One point, however, we must strongly condemn, viz., the introduction of new terms. "Restraint" may be better than "specific inductive capacity," but the latter is commonly used, whilst the former is comparatively new. This mixture of nomenclature is a thing to be avoided. Some, again, might object to the ponderosity of the definitions given, it being an axiom in scientific writing with the best authors that simplicity, the use of Anglo-Saxon words, and clearness, go hand-in-hand. We give one example of the author's definitions:—"Electricity is a temporary state of fixed separation of a physical property, normally dormant in all bodies, with two active agencies, each possessed of a power due to a tendency to reunite." The author justly compares the phenomena of lightning to that of a large condenser, and we agree with him when he concludes that the evidence of the action of lightning is that of an upward and not a downward force. Another interesting table in this part of the book is one on the influences of various substances. As we have previously said, the whole of this part of the work deserves attention. Whether the author be treating of the "rationale of thunderbolts," or the "accumulation of electricity on the earth's surface," or the influence of rain, or the action of smoke—he says something worth reading. After discussing in the latter part of Part II. the present system of lightning rods, Part III. deals with the system advocated. Major Parnell's conclusion is, on the whole, decidedly against the existing system of protection. He says that usually the roots of the rods are in a position adverse to the protection of the house, and that the rod itself is more often productive of harm than good. He believes more in the efficacy of water and gas-pipes, of railways and telegraph lines, for protection. He would have a Government inquiry into the accidents over large areas, and attempt to provide means of protection for such large areas, while the municipal authorities should provide for the protection of towns; and lastly, he suggests methods for protecting various kinds of buildings and places requiring protection, as well as precautionary measures to be taken in a variety of situations by human beings.

THE INSTITUTION OF NAVAL ARCHITECTS.

After the discussion on Thursday the 6th inst. of Mr. Denny's paper on launching velocities, the following paper was read by Mr. J. T. Milton, on

Lloyd's Rules as Affecting Marine Boiler Construction.

This paper, by Mr. J. T. Milton, was designed to show that the rules of Lloyd's Register do not act obstructively in the development of the use of high-pressure steam. First, as to the restrictions regarding forms or types of boilers. Lloyd's rules require any novelty in the construction of either boilers or machinery to be specially submitted to the committee at as early a date as possible. The merits and demerits of each plan thus submitted are very carefully considered, and in very few cases indeed have the Committee of Lloyd's Register refused entirely to sanction any arrangement which has been proposed to be actually used. Nine types of novel boilers have been passed unconditionally by Lloyd's Register, six types have been approved of, subject to frequent re-survey, while the Perkins' and Howard boilers are the only types which have been strongly objected to and disallowed. Of these novel boilers, those of the last-mentioned types have already been taken out of the s.s. Wanderer and Howard respectively, at the instance of their owners, and replaced by others of ordinary form; of the nine passed unconditionally, two have been taken out of the vessels in which they were fitted, and two have been materially modified. Of the five types of boiler approved of, subject to frequent examinations, the results in every case have proved that the restrictions prescribed have been absolutely required. Next, with regard to the restrictions imposed by Lloyd's Register in the matter of strength. All structures must be made with a strength in excess of the load which they are designed to bear, in order to provide for their safety in the event of the occurrence of any or all of the following contingencies:—Latent defects or plans in the material; errors or defects of workmanship; exceptionally severe strains which may possibly be brought to bear upon the structures by causes other than those which they are designed to resist; the weakening effects of corrosion or wear and tear. First, let us take the case of cylindrical shells, the great thickness of which is the greatest obstacle at present to the carrying of increased pressures with the present type of boiler. Lloyd's Rules provide a different coefficient of stress for boiler shell-plates, according as the longitudinal seams are made with lap or butt-strapped joints, and as the rivet holes in these joints are drilled or punched, the coefficients also varying with the thickness of the plate employed. They provide for a stress of about 10 per cent. less being borne by punched plate than by the same plate in which the holes are drilled; as rivets are not any stronger in drilled than in punched holes, the same stress is practically allowed upon them in each case by reducing the larger coefficients of stress by 10 per cent. so far as the rivets are concerned for cases in which the holes are drilled. Practically, if boiler-plate unpunched is credited with a strength of 20 tons per square inch, Lloyd's Rules credit the punched plates and also the rivets either in punched or drilled holes with a strength of 18 tons per square inch. Lloyd's Rules in new boilers made with lap joints allow a stress of 7750 and 8500 lb. per square inch with thin plates, say $\frac{6}{16}$ thick, according as the holes are punched or drilled, in $\frac{9}{16}$ plates they allow 8250 and 9000 lb., in $\frac{13}{16}$ and thicker plates they allow 8500 and 9500 lb. per square inch respectively. These figures, neglecting all possible imperfections of workmanship, and assuming a strength of plate of 18 and 20 tons per square inch respectively give a margin of strength of 5·2, 4·9, and 4·7 times respectively. If these plates become uniformly corroded to the extent of $\frac{1}{16}$in., the same working pressure will produce stresses of about 9300 lb. and 10,200 lb. per square inch in each case, the margin of strength being in all cases reduced to about 4·4 times, while a corrosion of $\frac{1}{8}$in. in the three cases reduces this margin to 3·5, 3·8, and 4·0, and a corrosion of $\frac{3}{16}$ brings these numbers to 2·6, 3·3, and 3·6 respectively. This amount of corrosion is not an uncommon amount to be met with in boiler shells six or eight years old, and would so lessen the strength of the thinner plate as to demand a considerable reduction of the working pressure, while even in the thicker plate the margin of strength is less than many prudent engineers would care about working with, considering that these figures do not provide for any contingency as to defective material or workmanship. The rules as they are at present for flat plates do not throw any serious obstacle in the way of working with a pressure of 200 lb. per square inch. A very thin coating of greasy deposit appears to be quite as non-conducting as a much thicker deposit of crystalline scale. Several collapses are traceable to a deposit of common salt, through allowing the density of the water in the boiler to gradually accumulate up to the saturation point; and in one at least of the two or three cases in which the furnaces have lately collapsed, but have been found to be perfectly clean on the vessel's arrival in port, this accumulation of salt has been the cause of the accident, but the engineers have, by freshening the water after the accident, dissolved the deposit. All these cases come under the category of overheating, not of structural weakness. In investigating the strength of furnaces, and in deciding upon what margin of strength is necessary to provide for safety, it must be remembered that, unlike most other structures, their proof strength is also their ultimate strength. Many engineers are looking to the locomotive type of boiler as offering some advantages in point of weight over the marine boiler, but one of the boilers passed unconditionally by Lloyd's Register was of the locomotive type, but its performance during the first voyage of the vessel was so unsatisfactory that the owner ordered another boiler of ordinary type to replace it. The flat-sided fire-box does not seem to be well suited for marine boilers, and further experience with this and with other novel boilers has shown that when the fire-door is open, the cold air rushing in direct to the tubes contracts them at the ends, and causes them to leak; whereas, in the ordinary boiler this air has to pass close over the fire before reaching the tubes.

The discussion on Mr. Milton's paper was opened by Mr. Scott, who spoke of the high value of Fox's corrugated flues for marine boilers. Mr. MacFarlane Gray spoke with reference to some remarks in the paper, comparing Lloyd's with Board of Trade Rules, and claimed credit for the Board of Trade inspectors who carried out their duties in spite of the contumely of engineers and shipbuilders which they knew they were at all times risking. Lloyd's Rules were rules of expediency, and were framed to meet the shipowners' view as to what will and will not pay. Their—Lloyd's—Rules were made to protect property, and not with reference to what the population might be at the end of the year, while the Board of Trade Rules were to protect life, and its inspectors had to enforce things which might not pay. Mr. Martell opposed this by saying that Lloyd's Rules protected life, because before owners received the advantages of Lloyd's surveys, &c., they had to conform to rules which received the general support of the country, and which ensured proper structural design and material. Mr. Parker said that Lloyd's Rules as affecting marine boiler construction were sound, and took into consideration the various conditions involved more completely than those of the Board of Trade, and in particular they differed from the Board of Trade Rules in that they were made upon recent experiments made by themselves on a large scale, on the properties of modern material, which enabled them to construct economical boilers with factors of safety suited to thin and thick plates. In a thin or a thick plate the total corrosion in a given time would be about the same, so that the greater the thickness of the plate the smaller the proportionate loss due to corrosion. This was allowed for by Lloyd's Rules, and hence a boiler can be made which will safely carry a high pressure for working economical compound engines, and such boilers cannot be made under the Board of Trade Rules. Mr. Thorneycroft said that he had found locomotive boilers work well at sea, so far as large torpedo boats go to sea, but they had had some trouble with tube plates. In reply to the discussion, Mr. Milton said that to change the pressure continually at which a boiler should be allowed to work, as had been proposed by Mr. McGregor, would involve endless trouble, uncertainty, and loss, and would often mean taking out boilers. It was best to allow for corrosion from the first, and give a factor of safety that would take into consideration the usual life of a boiler. In reply to some remarks as to locomotive boilers, he said that it became necessary to scale boilers occasionally, even if surface condensers were used, and locomotive boilers could only be thoroughly cleaned at great trouble, and nothing would prevent the trouble at sea with the furnace tube plates. In reply to Mr. Gray, he remarked that it would not pay shipowners to adopt rules which made boilers that would burst, whether under Board of Trade or Lloyd's Rules.

The next paper read was by Mr. A. C. Kirk,

On Cracks and Annealing of Steel.

It is well known that occasionally steel plates have been cracked in a way very mysterious and unaccountable, and the general cause to which it has been attributed was want of annealing, or that process done badly. About the middle of June last year Mr. Kirk had his first experience of these cracks. The plate—a back tube plate—had been flanged at the smith's fire, heated all over in the furnace, straightened up, and allowed to cool in the usual way. The centres of the tube holes were marked off for boring, and two men were deepening the centres for the boring machine with a flogging hammer and punch, when the plate cracked and opened as shown at C D, Fig. 1, showing that there was a strain at that point on the plate. The plate simply cracked, and was not in the least reduced in thickness on either side of the crack, showing that no extension previous to fracture took place, in this respect agreeing with all the best information he has been able to collect of similar fractures which have occurred elsewhere. It is difficult to see how a material which can stretch 25 per cent. under a strain without fracture can break with no extension at all. This is confirmed by many things we see often; notably so in steel rivets shrinking and never breaking, flanged boiler fronts, with holes flanged in them, which have been heated and worked piecemeal, and which he has never found to crack, though tumbled freely about before they were put in the furnace and straightened; virtually annealed. From this we may deduce that when such fractures occur there is a presumption that there has been from the beginning—from the ingot state probably—a line of weakness, along which the fracture takes place. As this seemed worth testing he had the plate drilled across at the line A B, shown on Fig. 1. The remainder of the plate he had heated in the furnace all over to a bright red, removed, and laid outside, as in Fig. 1, and cold water and wet cloths applied to the shaded part marked "cold," till it was quite cold. At this time the unshaded part, marked "hot," was hot enough to just set fire to straw. The whole plate was now cooled as quickly as possible. Thus the upper part of the plate was placed in tension to the utmost degree possible by unequal cooling, and if steel must break when that is done it ought to have cracked in the flange marked "hot." Lying on a block of wood he had it struck six times over various parts of its surface by full blows of a 28 lb. hammer, which produced no effect. He then had a 28 lb. hammer held up against the flange at one side and struck four times with another, the only result being to bend the flange slightly. The same thing was repeated in the middle of the flange at the "hot" end, with the same result. He then had the flange at hot end at E, Fig. 1, nicked deeply on edge and both sides with a rod chisel and 28 lb. hammer, after which the plate was struck six blows on the surface without fracture. After that the flange was held up on one side of the nick by the same hammer and struck four times on the other side, without starting a fracture. He then had it next supported on two blocks under the steam hammer about 6in. apart, and bent the part between these 3in., still without producing a fracture.

Thus sound steel put intentionally into the greatest state of tension possible, by unequal cooling, does not crack, and cannot be cracked. It has been stated that contraction tears a plate, the fracture then commencing at the edge and gradually extending into the plate, and that thus extension as in a simultaneous fracture right across a piece of steel could not be expected. Mr. Kirk tried this. He prepared a plate of mild steel, shaped as in Fig. 2, with the object of tearing it by direct tensile strain. The thicknesses decreased in all directions towards the place of fracture, but more especially along the edge of the plate, and of the fracture, as will be seen on reference to Fig. 3. The plate stretched between centres 1½in., when rupture took place

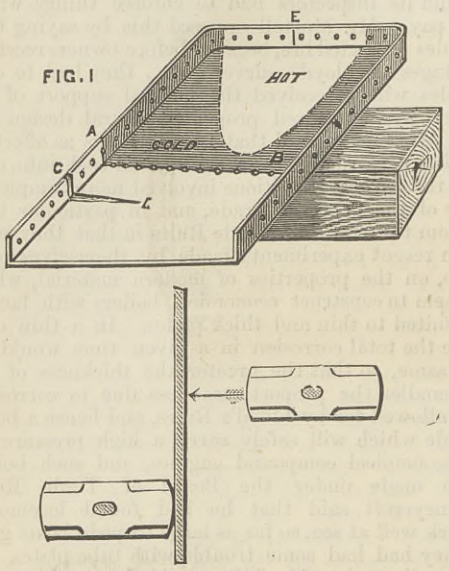


FIG. 1

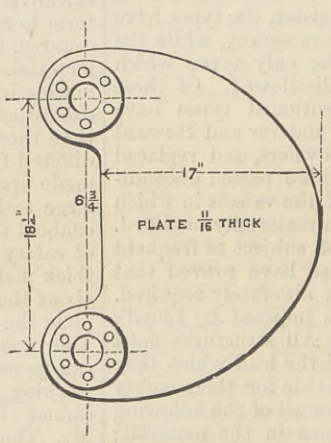


FIG. 2

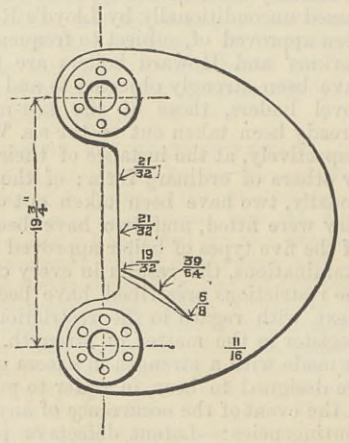


FIG. 3

under a load of 80 tons. The action of stress throughout the material is distinctly marked in clearly defined lines by the cracking of the surface skin or scale.

The discussion on Mr. Kirk's paper may be summed up in the remark that good uniform homogeneous steel does not behave in a mysterious manner, and that when steel does crack as shown in the paper it is because of an incipient crack or flaw which has had its origin in the ingot, as in a blowhole or impurity, and which has followed it in all the subsequent working.

The next paper read was by Mr. J. Farquharson, on

Corrosive Effects of Steel on Iron in Salt Water.

This paper detailed an experiment designed to ascertain the relative corrosion of iron and steel, and the corrosive effect on these of the combination when immersed in sea-water. Plates of iron and steel of equal size, with an aggregate surface of 48 superficial feet, were used. After having the scale completely removed by dilute hydrochloric acid, they were singly weighed, marked, and placed in a grooved wooden frame, parallel and 1in. apart, iron and steel alternately. The first, third, and fifth pairs were electrically combined by straps of iron at the tops; the second, fourth, and sixth pairs being left unconnected, and therefore each plate of which was only subject to ordinary corrosion, as if no other metal existed. The whole series so arranged were placed in Portsmouth Harbour, and left undisturbed for six months, when they were taken up and again weighed. The loss of each plate was found to be as under:—

	Oz.	Grains.
Steel } combined	0	427
Iron } combined	7	417
Steel	3	340
Iron	3	327
Steel } combined	0	297
Iron } combined	7	77
Steel	4	0
Iron	3	190
Steel } combined	2	337
Iron } combined	6	0
Steel	4	157
Iron	4	57

From the above it will be seen that the three iron plates combined with steel lost 21 oz. 57 grs.; that the three similar iron plates not combined lost only 11 oz. 137 grs. The plates were identical in size and all cut from the same sheet, the effect of combination with steel being to nearly double the loss of weight. The proof that the great excess of loss was not due to anything in the plates themselves will be clearly seen by comparing the combined and uncombined steel plates, thus:—The three combined with iron lost only 4 oz. 187 grs.; the three uncombined lost 12 oz. 60 grs., or nearly three times as much as those protected electrically by the iron.

It would be a completely unnecessary waste of space to give the discussion on Mr. Farquharson's paper, because it added absolutely nothing to the paper, the remarks being of exactly the same tenor as those we have reported in the discussion on papers on corrosion before the Iron and Steel Institute and the Institution of Mechanical Engineers for the last three years.

The last paper read on this day was by Mr. W. J. Norris

On Corrosion of Steam Boilers.

This was rather a long paper, the gist of which was to show that the presence of air in water was one of the chief causes of boiler corrosion, the paper concluding with the following remarks:—"The study of this subject points to the remedy to the evil being to supply the boilers with water free from air or gases in solution, and as oil or grease within a boiler can do no good, they should be kept out; if this was done boilers would, doubtless, last very much longer." It was past 10 o'clock when the reading of this paper was commenced, and with it the much too long day's proceedings terminated.

On Friday morning proceedings commenced at noon, when Lord Ravensworth said that the attention of the Council having been called to the small number of balloting papers sent in, it was decided that in future the papers, instead of being sent out in February, would accompany the synopsis of the meetings, so that members would not have time to lose them or forget them.

A paper was then read by Mr. H. H. West, of the Liverpool Underwriters' Society,

On the Quality of Materials Used in Shipbuilding.

This paper was a condemnation of what are known as "ship plates," the author citing Fairbairn as an authority to prove that they are very bad. The author would not say that our shipbuilding iron is universally bad, but from investigations which it had occasionally been his duty to make, he had found that the quality of iron delivered to our shipbuilders is by no means universally what it ought to be. The process of working the iron into the ship does not necessarily reveal its defects. The greater part of the plates of an iron ship have but little curvature, and the ordinary processes of preparation afford but a very slight test of quality. The plates which are shaped to any considerable degree are usually ordered of special quality of iron, and being furnaced, are not likely in ordinary cases to show failure. For manifest reasons he could not quote the names and details of particular cases, but some of the facts which had come under his official cognisance were such as made it a duty to call attention to the deterioration in this matter into which we are running the risk of sinking. Iron has been, and not infrequently is, delivered for shipbuilding purposes which would certainly not pass the Admiralty regulation tests for ordinary B iron. These tests were indicated on a drawing, which showed the angles to which the various thicknesses must bend cold without fracture, and the tensile resistance required with and across the grain, as follows:—

Thickness in 1/16 of an inch.	With the grain. Angles.	Across the grain. Angles.
16 and 15	10°	
14 and 13	15°	
12	17½°	5°
11	20°	5°
10	22½°	7½°
9	25°	7½°
8	30°	10°
7	37½°	12½°
6	45°	15°
5	55°	17°

It will readily be admitted that these tests are far from onerous. During the last few days he had had samples of iron taken promiscuously from shipyards in all parts of the country; and the fractures of these could be inspected by those interested as the samples lay on the table. It is clear that the scantlings required by the rules of the classification societies must be based, not on the maximum quality, but on the minimum, or at least on the average quality in ordinary use; so that, in consequence of the comparatively low quality of some of the iron used in ship construction, an increased quantity has to be demanded; and thus the practical outcome of all this is a tax—a permanent tax—on the whole civilised community, the full extent of which it is almost impossible to estimate. It would probably be impracticable, on account of the immense quantities to be dealt with, to submit shipbuilding iron to the same official tests which steel now undergoes; but he would urge upon ironmakers, in their own interest to pass all their material through systematic tests of their own before issuing it to constructors.

This paper was received with some disapprobation by the members of Lloyd's who were present. Mr. Martell urged that the specimens of iron shown must be from rejected plates, as no inspector who did his duty would permit such stuff to be worked into a ship. His experience was that very good iron was put into ships. Mr. Samuda held a contrary opinion. He thought thanks were due to Mr. West for a very able paper. Iron was worse now than it used to be, and it was important to find out why. Lloyd's great influence made their certificates very valuable, but they never tested an iron plate. Long before Mr. Martell's time Mr. Marten and Mr. Ritchie went to Mr. Samuda and got information from him as to his practice, and on the data he and others gave them they prepared a table of scantlings, but not long after they altered their scantlings making them heavier, adding 100 tons dead weight to a 500 ton ship. He asked why was this, and the reply was that the iron used as a rule was not as good as his—Mr. Samuda's—and they must make up for bad quality by quantity. He—Mr. Samuda—never used any iron worse than boiler-plate quality. He cited the case of a ship of large size, rated of highest quality in Lloyd's books, which when knocked against by a barge had four plates broken at once like glass. If Lloyd's had not failed to keep up their standard, iron would not be what it was. Mr. Raylton Dixon did not hold with Mr. Samuda. Boiler plate qualities could not be used, as they would be too dear, unless all shipbuilders were required to use them by Lloyd's Rules, so that one man could not undersell another by using worse iron. Mr. John endorsed the views of Mr. Martell and Mr. Dixon. His experience was that boat plates as a rule were good. He inserted once in a contract that the plates must stand an elongation test, and so confident were makers that their ordinary iron would stand it that they only charged 2s. a ton extra to pay for the testing, and he had bent the plates ⅝ thick 87 deg. with and 34 deg. across the strain. Mr. Rundell pointed out that although the samples on the table did not seem to be good, it was pure assumption that they would not stand a strain of 20 tons per square inch. Mr. Withey held that it was the shipowners who should insist on iron being tested, not the shipbuilder. Boiler-plates were not wanted because the ship was not strained by heating and cooling. Forgings were now tested by Lloyd's, and he was glad of it. He had known a 12in. balk to go through the side of a ship on the launching ways. It might be held that 95 per cent. of the shipbuilders and iron makers were honest men, and this was a great guarantee of good quality.

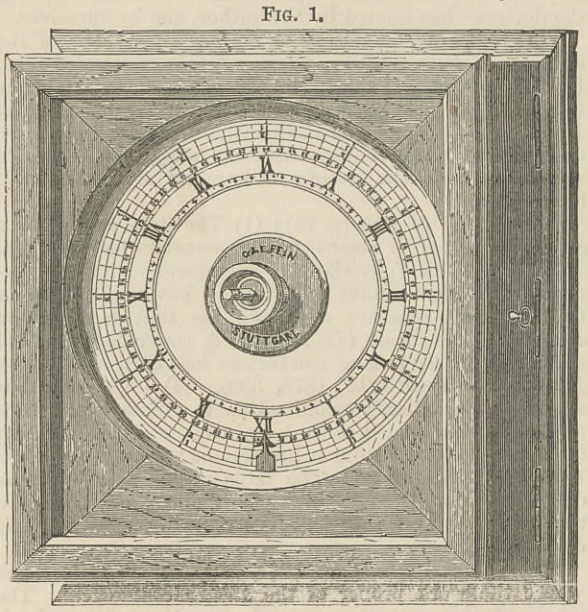
Mr. West, in reply, said that the samples were not picked, nor were they from rejected plates. It was true that in Lloyd's Rules there were stipulations as to quality of plates, such as they must bear a tensile strain of 20 tons per square inch, but the rule was not insisted on. It was only when some question arose that plates were tested to see if they conformed to this rule or not. He looked to the iron makers to improve the quality of the product, which would be much to their own advantage. A vote of thanks was passed to Mr. West.

We postpone our account of the remaining proceedings.

AN INDICATOR CLOCK.

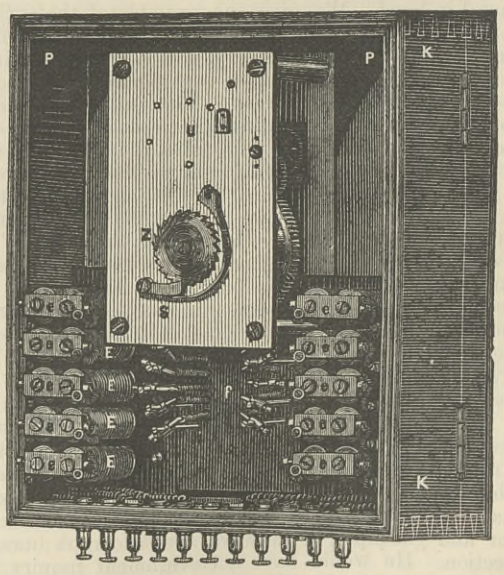
A little time ago we illustrated a watchman's detector of very simple design, and yet effective in operation, made by Messrs. Elliott. We now illustrate a somewhat similar piece of mechanism made by Messrs. Feur, of Stuttgart. It is, like that of Elliott's, intended to record the movements of the watchman, and show that he visits the various parts of the factory, &c., at

Fig. 1.



the proper times. The clock is under lock and key, so as to prevent wilful or ignorant tampering. At each point where it is desired to record the watchman's visit is a signalling key, when by means of a button or push, similar to that of an electric bell, the circuit can be completed. The clock contains as many electro-magnets *e e e e*, Fig. 2, as there are signalling keys, and when the circuit is completed the current passes through the corresponding electro-magnet and its armature is attracted. This armature carries a needle to perforate a paper dial. This

Fig. 2.

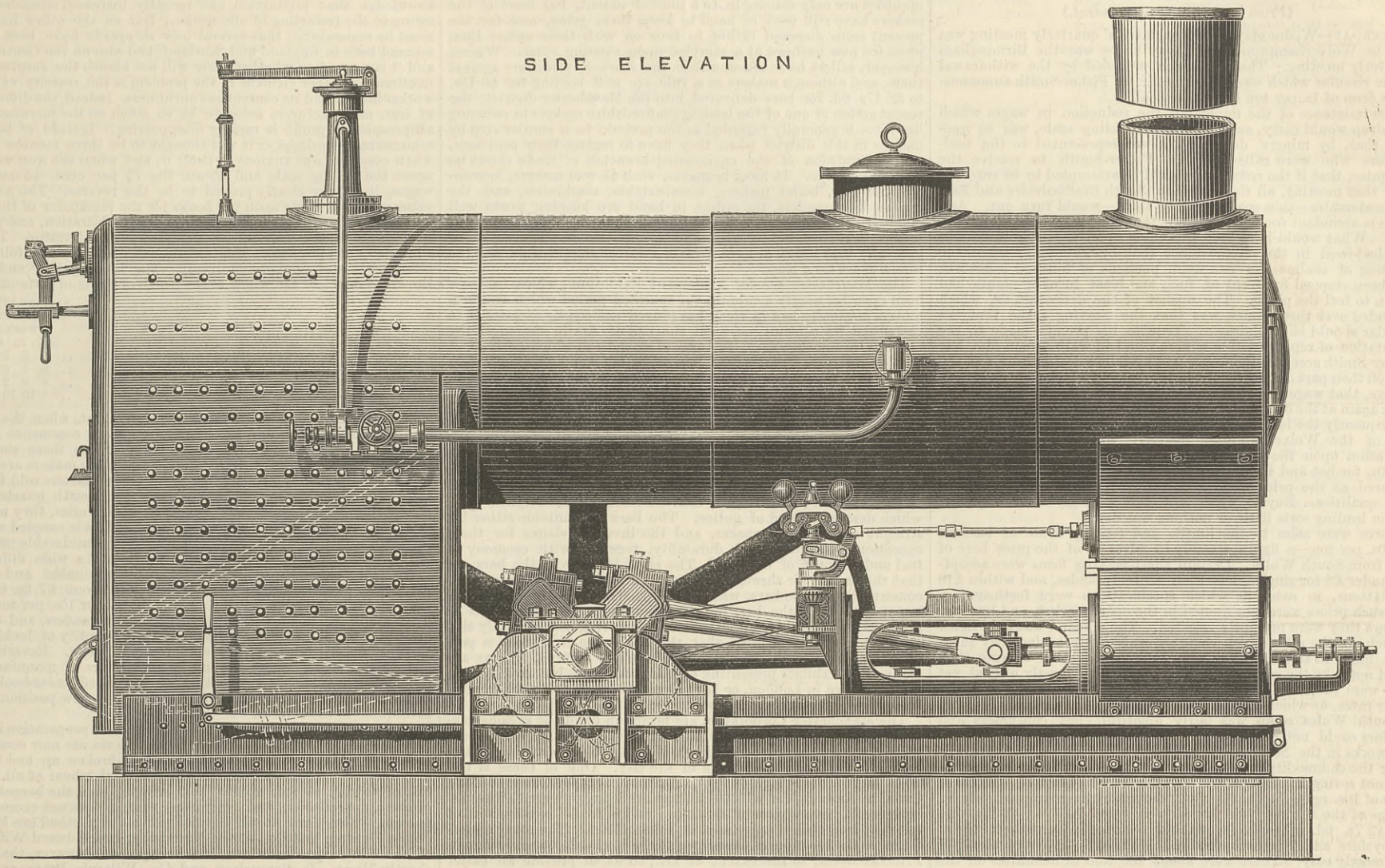


paper dial is marked as shown in Fig. 1, and makes a complete revolution in twelve hours, after which it must be replaced by a new one. A hand may be placed in front of the dial, to allow of its being used as an ordinary timepiece. The position of the perforations on the dial shows the time at which the watchman made his signal, and the point from which it was made. The interior of the clock is shown in Fig. 2, where P P K K indicates the case, and S part of the clockwork arrangement; the whole arrangement, in fact, being clearly shown.

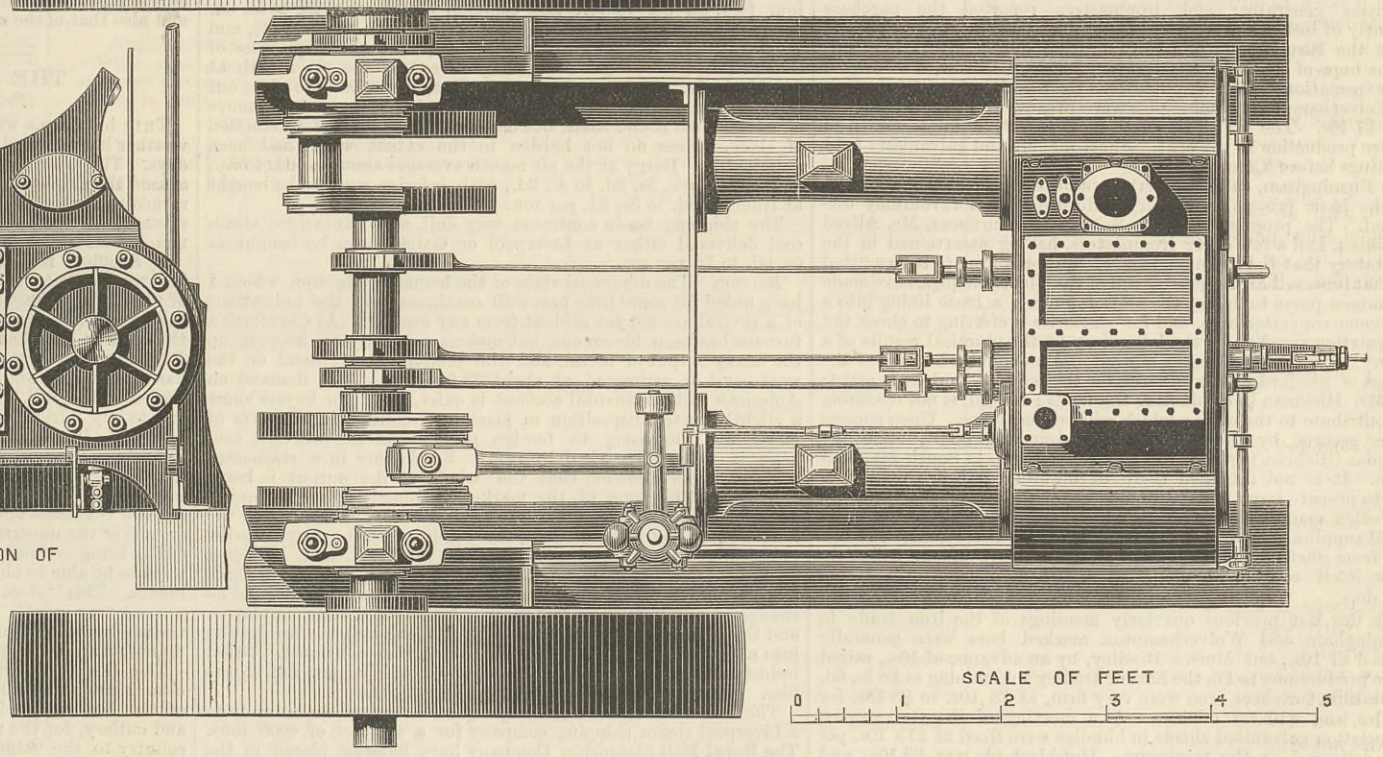
COMPOUND ENGINE AT THE CRYSTAL PALACE.

MESSRS. JOHN FOWLER AND CO., LEEDS, ENGINEERS.

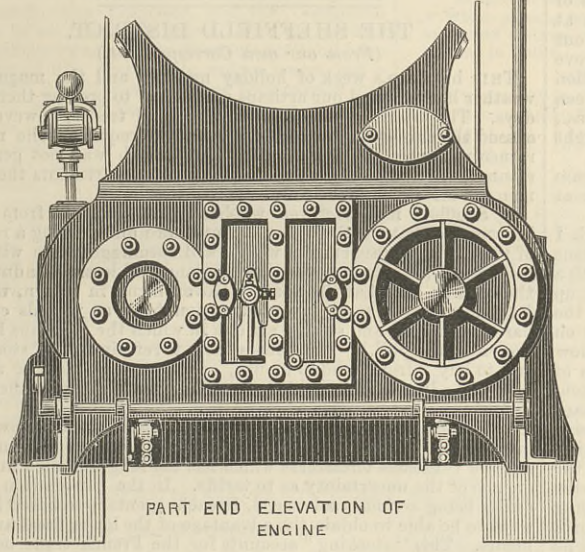
SIDE ELEVATION



PLAN



PART END ELEVATION OF ENGINE



SCALE OF FEET

0 1 2 3 4 5

We illustrate above a semi-portable engine 25-horse power nominal, of the "Yorkshire" type, shown at the Crystal Palace by Messrs. J. Fowler and Co., Leeds. The engine stands in the shed at the side of the corridor from the Low Level station, back to back with Messrs. Davey, Paxman, and Co.'s engine, illustrated in The Engineer for March 24th, 1882.

The engine has a high-pressure cylinder 9½in. diameter, and a low-pressure cylinder 16in. diameter, the stroke of both being 18in.; number of revolutions per minute 120. The heating surface in the fire-box is 52·8 square feet, and the tubes 303 square feet, in all 355·8 square feet. The grate surface is 12 square feet. In all the compound engines made by this firm 10 circular inches per nominal horse-power of low-pressure cylinder are allowed, not less than 14 square feet of heating surface, and 0·4 square feet of grate surface. The Crystal Palace engine has an extra large fire-box for inferior fuel. It drives two No. 7A Brush machines, feeding 32 arc lights. We have not yet indicated the engine, but we are informed by Messrs. Fowler that diagrams which they have taken show that the engine indicatss nearly 50-horse power. Now it will be remembered that the Davey Paxman engine drove two No. 7A dynamos with 43-horse power, and it is well known that the reputed resistance of the 7A dynamo is not over 20-horse power. It would appear, therefore, either that Messrs. Fowler's engine works with much friction or that there is some error in the diagrams. We hope to have an opportunity of checking the results in a few days, when we shall place the results before our readers.

The engine is a well made, strong machine, not remarkable for finish, but like all Messrs. Fowler's engines well adapted to do a great deal of hard work in a satisfactory way. It is fitted with two fly-wheels, and the cranks are well balanced. In our engraving only one fly-wheel is shown. The governor is sensitive of the Buss type. The engine runs very steadily, and gives regular turning. It is quite competent to drive a third dynamo if pressed.

Society of Arts.—The following are the arrangements for the papers at the Society's ordinary meetings after Easter:—April 19th: Discussion on the "Channel Tunnel," to be opened by Sir Edward Watkin. April 26th: "Telephonic Communication," by Colonel Webber. May 3rd: "The Fire Risks Incidental to Electric Lighting," by T. Bolas, F.C.S. May 10th: "The Fish Supply of London," by Spencer Walpole, H.M. Inspector of Fisheries—W. H. Gladstone, M.P., in the chair. May 17th: "The Constant Supply and Waste of Water." by G. F. Deacon—Sir Frederick Bramwell, F.R.S., in the chair. The last ordinary meeting of the session will be held on the 24th May.

Water Power in the Punjab.—There are numerous canals in the Punjab offering every facility for the establishment of manufactories for making up the raw materials which are plentiful there. Cotton, wool, hides, hemp, &c., are to be had in abundance in the Punjab; there is also a population sufficient to supply the labour required for factory operations; but the scarcity and dearness of fuel is such that it is almost impossible to make a manufactory remunerative where steam power is necessary. For this reason the Lieutenant-Governor notifies the localities where water power is available, and the conditions under which it will be leased. On the Bári Doáb Canal there are twenty-six sites at which water power in excess of 200-horse power is available. A metalled road passes at a short distance from them, and a railway is about to be constructed from Amritsar to Pathánkot, which will pass within a few miles of all of these sites. On the Western Jumna Canal there are four sites at which there is water power in excess of 200-horse power, and eight other sites where from 100 to 200-horse power is available. The Grand Trunk road is at no great distance from any of these sites. The Government are prepared to grant the use of the water for working machinery for periods not exceeding twenty years on the following terms:—For the first three years, *nil*; for the second five years, Rs. 60; for the third six years, Rs. 100; for the fourth six years, Rs. 150. In the first fifteen miles from the head of Bári Doáb Canal there are nineteen falls, varying from 4·5ft. to 9·5ft. in height, where the minimum supply of water is 1500 cubic feet per second. They are so close together that there would be little difficulty in joining two or even more of them by a channel for the supply of the mill, if it were proposed to use machinery requiring a greater fall than is available at any one site. This has already been done for the "Punjab Sugar Works Company, Limited," which has been established at Sujánpur between the fifth and sixth falls. There is a flour mill at the seventh fall of four pairs of stones, worked by native machinery. The first fall available on the Western Jumna Canal is at the crossing of the Grand Trunk road from Umballah to Delhi, about two miles from Karnál. The second is about one mile, the third two miles, and the fourth five miles from the metalled road, the communication being by the unmetalled road along the canal bank. At each of these sites there is more than 500-horse power available, and it need hardly be pointed out that some of this may be used for electric lighting purposes.

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

(From our own Correspondent.)

Yesterday—Wednesday—the ironmasters' quarterly meeting was held in Wolverhampton; and to-day there was the Birmingham quarterly meeting. These had been preceded by the withdrawal of the circular which was issued by Mr. E. Fisher-Smith announcing a drop of 1s. per ton in furnace coal.

The resistance of the miners to the reduction in wages which this drop would carry, according to the sliding scale, was so resolute that, by miners' delegates, it was represented to the coalmasters who were called by Mr. Fisher-Smith to receive the delegates, that if the reduction should be attempted to be enforced after that meeting, all the miners in South Staffordshire and East Worcestershire—thin coal as well as thick—would turn out. And there is abundant room to conclude that that would have been the case. What would have been the effect upon the iron trade was foreshadowed in the circumstance that by Thursday, when the meeting of coalmasters was held, portions of finished ironworks had been stopped for want of fuel, and blast furnace plants had begun to feel the pinch. The upshot of the deliberations, which extended over three hours, was that the meeting asked that the circular should be withdrawn. True to his promise made to the deputation of representative miners who had waited upon him, Mr. Fisher-Smith accepted the decision of his fellow coalmasters, and the men on their part did not persist in the demand which they had begun to urge, that wages should be advanced. They are all therefore at work again at the old wages, and the prices of coal remain unchanged, consequently the leading quotations announced upon at the opening of the Wolverhampton quarterly meeting were without alteration upon the three months. Lilleshall pigs were quoted £3 10s. for hot and £4 10s. for cold blast sorts, and £7 10s. was redeclared as the price of marked bars, with £8 2s. 6d. for Round Oak qualities. Buyers would not, however, give these figures; and in leading sorts little or nothing was done.

There were sales to the hurdle and fencing firms of bars at £6 10s. per ton—a figure scarcely in advance of the price here of bars from South Wales. Certain sheet-making firms were accepting under £8 for singles, less than £9 for doubles, and within £10 for lattens, in cases in which specifications were forthcoming. But such prices were not quoted in the open market, and by some makers they were promptly rejected. The demand was only light.

Such are the rates which some galvanisers are taking that there were firms in that industry who were not quoting because they could not take the rates at which orders were mostly offered, yet they were prepared to give their customers the advantage of the lower rates, at which they are able to buy black sheets.

South Wales scrap was fairly plentiful, but consumers and vendors could not come to terms. Shearings cannot be got from the works in the Southern Principality at under 55s. per ton. To bring the commodity to this district costs another 10s. Yet buyers will not spring anything upon an offer of 60s. per ton. This is a drop of 10s. upon the quarter; but the sellers have dropped only 5s.

Pigs of the Spring Vale brand were quoted £3 5s., £2 17s. 6d., and £2 7s. 6d. respectively, without securing sales at those prices. Derbyshire and Northampton and Wiltshire pigs were plentiful and mostly easy. There were about 100 tons of hematites on the market, offered by a broker on the behalf of a speculator who is now anxious to realise; but 70s. was still makers', quotation for Barrow, and 72s. 6d. for Tredegar sorts without sales.

Cokes were firmer. This was due to the decreased output of slack coal. Derbyshire sorts were quoted 15s. to 16s.; South Wales qualities, 14s. 6d. to 18s.; and Wigan and North Staffordshire, 14s. to 16s.

Coal was easy at 7s. per ton as the unrivalled quotation for forge qualities generally; and ironmasters reported the purchase recently of heavy lots from the Derbyshire pits.

At the Birmingham quarterly meeting to-day buyers held off, in the hope of getting better terms. Sellers, however, discouraged the expectation. Crucial quotations were declared unchanged, as in Wolverhampton all-mine pigs were 67s. 6d. to 70s., and marked bars £7 10s. The Welsh tin-plate makers met, and determined to reduce production 15 per cent. Sheet makers and galvanisers held meetings before 'Change opened.

In Birmingham, as in Wolverhampton, the project to make steel by the basic process in South Staffordshire was favourably discussed. The proprietor of the Spring Vale furnaces, Mr. Alfred Hickman, and a few other ironmasters, having ascertained in the laboratory that the common pigs of Staffordshire are better fitted for that process than the general run of the Cleveland pigs, have made a common purse to defray the cost of putting a basic lining into a Bessemer converter here, and for otherwise preferring to check the information supplied by the laboratory by the practical results of a 6-ton "blow." Mr. Thomas himself has no doubt whatever of the fitness of Staffordshire crude iron for the purpose, and he is assisting Mr. Hickman in conducting the trials; indeed, is not declining to contribute to the outlay which will be necessary. Upon success being secured by these trials, a steel-making plant, upon the Thomas-Gilchrist method, will be at once begun in South Staffordshire. It is not intended there to roll either rails or ship-plates, but to prepare ingot metal and blooms for the use of the hardware and other manufacturers in this district who at present obtain the small supplies they as yet need mainly from the Llandore Works and from Sheffield, for it is held that the basic bloom will early show itself capable of doing what the Siemens-Martin bloom will do.

At the last previous quarterly meetings of the iron trade in Birmingham and Wolverhampton marked bars were generally quoted £7 10s., but Messrs. Bradley, by an advance of 10s., raised their productions to £8, the Earl of Dudley's remaining at £8 2s. 6d. Quotations for sheet iron were very firm, at £8 10s. to £8 15s. for singles, and £10 for doubles. At a meeting of the Galvanisers' Association galvanised sheets in bundles were fixed at £15 10s. per ton, delivered, as the minimum. Hot-blast pig was £3 10s., and cold-blast 20s. over. Part-mine was £2 17s. 6d. to £3, and cinder sorts £2 5s. to £2 7s. 6d.

NOTES FROM LANCASHIRE.

(From our own Correspondent.)

Manchester.—The Easter holidays and the quarterly meetings combined have, during the past week, to a large extent, caused a practical suspension of business both in the iron and the coal trades of this district. The ironworks and the collieries have in most cases been stopped for half the week, and large buyers are holding back further orders until they see the result of the meetings at Middlesbrough and Birmingham. What trade there has been doing has consequently been of the most meagre description, and not sufficient to afford any actual test of prices beyond the fact that an easier tone unquestionably prevails in the market.

There was only a very poor attendance in the iron section of the Manchester Exchange on Tuesday, and the finished iron makers especially were conspicuous by their absence. There were a few inquiries for odd lots of outside brands of pig iron from small consumers, but beyond a few trifling sales there was no business done, and any quotations of prices can be regarded as little more than nominal. For Lancashire pig iron delivered equal to Manchester makers are asking 47s. to 48s. per ton less 2½ for forge and foundry qualities, and during the week sales to a small amount have been made at about these figures, with further inquiries in hand which it is hoped may lead to business. In outside brands of pig iron prices vary considerably. Both Lincolnshire and Derbyshire irons are to be bought at very low figures, sellers in some cases offering at as low as 47s. and 47s. 6d. less 2½ delivered into this district, whilst in other cases makers are asking 48s., and for Derbyshire as high as 50s. and 51s. per ton less 2½. Middlesbrough iron is nominally quoted at 51s. 4d. to 51s. 10d. per ton net cash delivered equal to Manchester.

In the finished iron trade new orders are very scarce, and inquiries are only coming in to a limited extent, but most of the makers have still work in hand to keep them going, and for the present seem disposed rather to tour on with their orders than press for new business at a sacrifice upon existing rates. Where, however, sellers have to come into the market, prices are against them, and although makers as a rule are still holding for £6 15s. to £6 17s. 6d. for bars delivered into the Manchester district, the recent action of one of the leading Staffordshire makers in reducing list rates is generally regarded as the prelude to a similar step by makers in this district when they have to replace their contracts.

The condition of the engineering branches of trade shows no material change. In most branches, such as tool makers, locomotive builders, boiler makers, wheelwrights, machinists, and the leading ironfounders, the orders in hand are keeping works well employed, but complaints are still made of the low prices at which orders can only be secured, and there does not appear to be generally that influx of new work or even of inquiries as was the case a short time back.

The Manchester Smoke Abatement Exhibition, which has now been open for nearly a month, the specified period which the promoters originally had in view, has proved sufficiently successful to encourage its continuance until the end of April. Amongst the exhibits presenting some features of novelty to which I have not already referred, I noticed an ingenious, but simple arrangement, which the Whittaker Heating Apparatus Company, of Bolton, has adopted for automatically regulating the fire in connection with their well-known convoluted stoves. This is effected by simply placing metal rods between a series of convolutions, which expand or contract according to the heat to which they are exposed, and by their expansion and contraction operate upon a lever, which opens or closes the draught door of the furnace, according as it is regulated to the heat required. Mr. J. Redgate shows a set of furnace bars and fittings, which he terms "The Triplex," and which deserve a word of notice. The bars are suitable either for straight or circular furnaces, and the inventor claims for them exceptional lightness and durability, together with economy of fuel and strength of draught. The chief features of the bars are that they admit air through their entire length, and by the peculiar construction of the bars, which have grooves in the sides, converging at the top of the bar, the air currents are so arranged as to produce a threefold concentration on entering the fire. By this arrangement it is claimed that the adherence of clinkers is prevented and an equal combustion of fuel is secured. There are many other exhibits presenting excellent features, but as they were mostly shown in London, or have already been exhibited elsewhere, I need not refer to them in detail here.

The Manchester Corporation are taking in hand the re-construction of a couple of bridges which, when the work is completed, will be a great improvement in facilitating the increasing heavy traffic in the business portions of the city. One of these is the widening of the bridge over the Ashton, Stockport, and Oldham Canal in Ancoats, for which drawings are being prepared. The new bridge will have a span of 45ft. 6in., and is to be constructed of wrought iron girders supported on brick pillars. The other undertaking is the lowering of the crown of the Rochdale Canal bridge in Princess-street, to the extent of 1ft., so as to provide an easier gradient for the heavy traffic in connection with the large shipping warehouses in the immediate neighbourhood.

The coal trade has been extremely quiet during the past week, and although quoted rates are nominally unchanged, there is so much stock on offer in the market that the actual selling prices, so far as all classes of round coal are concerned, are very irregular. Best Wigan coals at the pit mouth average about 8s. 6d. to 9s.; good second qualities, 8s.; inferior sorts, 6s. to 7s. Pemberton four feet, 6s. 6d. to 7s.; and common round coals, 5s. to 5s. 6d. per ton. Inquiries for gas coals are coming into the market, and judging from the prices already being quoted—best qualities of screened Lancashire gas coal being offered at the pit mouth at 6s. 6d. to 7s. per ton—consumers will again be able to place out contracts on very favourable terms. Engine classes of fuel move off better than round coals, but considering the limited production of slack, prices do not harden to the extent which had been anticipated. Burgy at the pit mouth averages about 4s. 6d. to 5s., and good slack, 3s. 9d. to 4s. 3d., with inferior sorts to be bought at from 2s. 6d. to 3s. 3d. per ton.

The shipping trade continues very dull, and Lancashire steam coal delivered either at Liverpool or Garston can be bought at 6s. 6d. to 7s. per ton.

Barrow.—The depressed state of the hematite pig iron which I have noted for some time past still continues, and the indications of a revival are not yet evident from any quarter. At Carnforth a furnace has been blown out, but makers generally are keeping up the heavy output of metal, and the production of metal on the west coast is estimated at about 35,000 tons. The demand on American and continental account is quiet, but home buyers show a slightly better disposition in placing of contracts. Exports of metal are increasing to foreign ports; but the heaviest tonnage is being dispatched by rail. Stocks are in a stationary position, thus showing that the whole of the output is being delivered. The tone of the market, although decidedly quiet, does not appear to be in a state to cause anxiety, as it is hoped the lowest point has been reached, the condition of the market being practically the same during the past few weeks. No. 1 Bessemer is quoted at 57s. per ton, No. 3 forge 55s. 6d., net f.o.b., three months' delivery. The position of the steel trade has undergone no change of any note since last week. Makers are fully employed, and the demand is well maintained. Iron shipbuilders are getting into a better position, having secured further contracts. Other industries in steady work. Iron ore 14s. to 15s. per ton at the pits. Shipping better employed.

The Barrow Shipbuilding Company have received an order from a Liverpool steam shipping company for a steamer of 4000 tons. The Royal Mail Steamship Company have likewise placed in the hands of the same company an order for a steamer of their line. This is the second order given to the Barrow Company by this firm, the previous one being as yet in the initiatory state of construction.

The Distington Iron Company is putting its furnaces into a thorough state of repair for relighting. These furnaces it will be remembered were all blown out some time ago. The Lonsdale Company have blown out a furnace, but have put another in blast. The extensive boring operations which are being carried out in Cumberland show no sign of slackening. The Birks Company is boring on land in close proximity to its present pits; and the Mowbray Company is opening out its No. 1 pit, and extending No. 2, 3, and 4. The tramways which are being constructed for Mr. Stirling and for the Carron Company in order to facilitate the transit of ore are being pushed on rapidly.

THE NORTH OF ENGLAND.

(From our own Correspondent.)

The quarterly meeting of the Cleveland iron trade was held in Middlesbrough Exchange on Easter Tuesday. The attendance was, however, extremely small, and by no means equal even to an average weekly meeting of the trade. There was little or no business done. The general tone of the market was firm at previous prices. Merchants now quote precisely the same as makers, viz., 43s. 6d. per ton f.o.b. for No. 3 g.m.b. Iron for prompt delivery continues scarce. It can only be had from the warrant stores, or from makers, and warrant holders seem as averse to part with it as producers. The stoppage of the manufactured ironworks for the Easter holidays will relieve, it is expected, the severity of the pressure for a time. All of them have been laid for four shifts.

The manufactured iron trade continues steady at previous prices, viz., £7 5s. for plates and £6 12s. 6d. for angles and bars. Large buyers of shipbuilding material are still holding back from making fresh contracts, in hopes of more favourable prices, which they think likely to ensue shortly. These hopes are built upon the knowledge that production has recently increased considerably, owing to the restarting of idle works. But on the other hand, it must be remembered that several new shipyards have been commenced both in England and Scotland, and also on the Continent; and it is a question whether these will not absorb the surplus production. Another element in the problem is the scarcity of ironworker labour, and its consequent unruliness. Indeed, the difficulties of iron manufacturers seem to be so much on the increase that all prospect of profit is rapidly disappearing. Instead of being a remunerative business as it was thought to be three months since, when everyone was anxious to enter it, and when the iron workers upset the sliding scale and obtain the 7½ per cent. advance of wages, it is now clearly proved to be the reverse. The average value of all contracts upon the books for the remainder of the year has just been ascertained by the Board of Arbitration, and placed as evidence at the disposal of Mr. Pease, the arbitrator. Taking ship-plates as the basis, this ascertainment shows the following remarkable and unexpected result. The investigation embraced the order books of the whole of the North of England plate-makers:

	Weight of iron plates sold.	Average price per ton net cash at works.
	Tons.	£ s. d.
First quarter	105.540	6 2 3·35
Second quarter	115,627	6 4 6·69
Third quarter	77,223	6 8 2·74
Fourth quarter	27,776	6 10 10·05

The first quarter is taken to end on March 21st, when the ascertainment took place; and the second quarter to commence at the same date, and to extend to June 30th. From these statistics it would appear that the North of England plate makers are fully sold for the second quarter of the year, three quarters sold for the third quarter, and one quarter sold for the fourth quarter; or, condensing all the sales into consecutive deliveries, they may be said to be fully sold for six months ahead. This is coupled with a present abundance of specifications, and even considerable pressure for quick delivery. It will be noticed what a wide difference there is between the prices theoretically attainable and those practically obtained. The former are now about £7 2s. 6d. net cash at works, and the latter about £6 7s. 6d., or 15s. per ton less. This ought to open the eyes of the men's leaders, and of the arbitrator in the present reference, to the absurdity of looking to current quotations as any guide to realised prices. Reverting to the existing struggle between buyers and sellers of manufactured iron, it seems probable that with such well-filled order-books the latter are scarcely likely to be forced into any new position more favourable to the former.

The arrangements which have long been under preparation by Mr. E. F. Jones for taking blast furnace slag to sea are now complete, and seem to answer admirably. The slag is broken up and tipped into hopper barges, with scarcely any manual labour at all. The cost of towing to sea, tipping, and bringing back the barges, with interest, depreciation, and every other charge, does not exceed 1¼d. per ton. The firms at present adopting this method are Messrs. Jones, Duning, and Co., of the Normanby, and Edward Williams, of the Linthorpe Ironworks. It is expected, however, that very shortly Messrs. B. Samuelson and Co., Wilson's, Pease, and Co., and the Tees-Side Co., will be forced to do the same. The Cleveland Institution of Engineers are endeavouring to get the pioneers of this branch of engineering to lay their experience before them, and it will then no doubt be thoroughly discussed, and an impetus will be given to the further adoption of the practice. This will not be before it is needed, as the immense heaps of slag which are being piled up on the banks of the Tees in some places are not only unsightly but are endangering the level of the bed of the river and also that of the contiguous properties.

THE SHEFFIELD DISTRICT.

(From our own Correspondent.)

This has been a week of holiday making, and the magnificent weather has tempted our artisans and others to prolong their play days. The briskness of several of the local trades, however, has caused the employers to be more strict in requiring the men to return promptly to their employment, which was not generally resumed till Wednesday, and in one or two departments the workmen are certain to make a full week of it.

A Sheffield manufacturer who has just returned from Spain informs me that the Spanish merchants are anticipating a revision of their tariff arrangements which will encourage trade with this district. They are in hopes that England will lessen the duties on their wines, and that the Spanish Government, in return, will put England on the most favoured nation basis as regards cutlery, hardware, steel, and similar articles in which the Germans have at present "the pull." This causes them to refrain from "stocking," and to buy "from hand to mouth," so that they may be able to take full advantage of the new arrangements the moment they come in force.

In France—the same gentleman informs me—there is now every prospect of the cutlery trade with Sheffield being carried on without the vexatious uneasiness which has too long prevailed in consequence of the uncertainty as to tariffs. In the expectation of the duties being seriously advanced, French agents purchased largely so as to be able to obtain the advantage of the lower fiscal arrangements. This "stocking" accounts for the French trade being at present very quiet. There is now no fear, however, of its future—the settlement of the tariff question having again encouraged local manufacturers to push business in the Parisian and other markets.

The Board of Trade returns for the quarter bring out very clearly how rapidly Russia has fallen away as a customer for some of the leading productions of the Sheffield district. Hardware and cutlery, for the month of March, were only sent to the great country to the value of £2671; pig iron, £1685; bar, angle, bolt, and rod, £788; iron rails, *nil*; steel rails, £1000 (nothing in January and February); hoops, sheets, and boiler and armour-plates, £6479. On the other hand, the demand for English steam engines in Russia has increased from £1429 in March, 1881, to £10,753 in March, 1882. The United States shows the greatest increase, taking during last March hardware and cutlery to the value of £52,183; pig iron, £157,732; bar, angle, &c., £22,880; steel rails, £127,369, as compared with £34,396, £113,041, £9211, and £105,886 respectively, Australia is another rapidly improving market, as I have indicated in my weekly reports for many months. In hardware and cutlery Australia has risen from a value of £41,023 in March, 1881, to £77,872 in March, 1882; bar, angle, bolt, and rod, from £17,718 to £41,972; hoops, sheets, &c., from £68,777 to £99,097. In steel rails there is a falling off on March, 1881, but the value (£28,713) is double what was exported in March, 1880. Germany shows a remarkable advance in pig iron (from £43,132 to £81,934); in bars, angle, &c., £2237 to £8525; hoops, sheets, &c., £9817 to £12,947.

Messrs. Atkinson Brothers, of the Milton Cutlery Works, who recently took a 13,000 dozen order for cutlery for the Government, have this week booked a 2000 dozen Government order for knives for the Navy.

Messrs. Tasker, Sons, and Co., of Angel-street, Sheffield, who have shown great enterprise in the introduction of the telephone and the electric light, intimated to the Sheffield Corporation on Wednesday their intention to form a local company for the introduction of the electric light in Sheffield. Messrs. Charles Cammell and Co., Limited, have received an important order for armour-plates from the Italian Government, who are contemplating the construction of another heavily-plated warship, capable of resisting the most formidable ordnance yet invented. The plates are after the compound—steel-faced—type patented by Mr. Alexander Wilson, and which are largely coming into use in the French Navy.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

The Glasgow iron market was closed from Wednesday, the 5th, until Tuesday last, the 10th inst., on account of the holidays, and the result has been that there is less to record with reference to the course of business than usual. The market has, however, reopened with a fairly satisfactory feeling. The export trade of the week in pig iron was comparatively good, amounting to upwards of 12,000 tons, against 10,000 odd in the preceding week. There has also been a diminution of from 500 to 600 tons in the stocks in the public stores, and merchants doing business with the Continent report that some fresh inquiries have just come to hand. The American department of the Scotch pig iron trade continues dull, the selling prices at New York being 2s. to 2s. 6d. per ton less than the terms offered at Glasgow. There is a probability, however, of an improvement being experienced in the Canadian demand for Scotch pig iron.

When the market reopened after the holidays on Tuesday business was done at 48s. 3d. to 48s. 4½d. cash.

The market opened firm on Wednesday morning, but was flat in the afternoon, at 48s. 3d. to 47s. 11½d. cash. To-day—Thursday—business was done for 48s. 0½d. to 47s. 11d. cash.

The demand for makers' iron being steady for home consumption and export, there was not much change in prices. The quotations are as follow:—f.o.b. at Glasgow per ton, No. 1 Gartsherrie, 58s. 6d. ; No. 3, 51s.; Coltness, 58s. 6d. and 52s. 6d.; Langloan, 59s. and 53s. 6d.; Summerlee, 57s. 6d. and 49s.; Calder, 57s. 6d. and 51s.; Carnbroe, 52s. and 48s. 6d.; Clyde, 51s. 6d. and 49s.; Monkland, 49s. and 47s.; Quarter, ditto ditto; Govan at Broomielaw, 49s. and 47s.; Shotts at Leith, 58s. 6d. and 54s. 6d.; Carron at Grangemouth, 50s. 6d. (specially selected, 53s.) and 49s. 6d.; Kinneil at Boness, 47s. 6d. and 46s. 6d.; Glengarnock at Ardrossan, 52s. 6d. and 48s. 6d.; Eglinton, 49s. and 46s. 6d.; Dalmellington, 49s. and 47s. 6d.

It is worthy to note that at the present date the imports of Middlesbrough pig iron at Grangemouth show a comparative decrease since Christmas of 1283 tons compared with those of the corresponding period of last year. This is due to the fact that No. 3 Scotch iron is being largely used to displace Cleveland, in consequence of the price of the latter at present making it unprofitable for shipment.

There is nothing fresh to report with reference to the condition of the manufactured iron trade, in almost every branch of which there is steady employment. The engineering and ironfounding branches continue busy, and there is some prospect of the moulders' strike in the ornamental ironfounding branch coming to an early termination. In the course of the past week £13,600 worth of machinery were shipped from the Clyde, besides £1750 worth of sewing machines, £23,800 worth of other iron manufactures, and £3155 worth of steel manufactures for America and New South Wales.

The coal trade is rather more brisk, a number of good orders having been booked for shipment to Canada, San Francisco, and the Continent. There is no change in prices. For the present the colliery owners of the West of Scotland have abandoned the proposal to reduce wages, but a reduction of 12½ per cent. has been carried into effect in Mid and East Lothian and in Fife and Clackmannan.

A meeting of the Clyde Coal Company (Limited) has been held in Glasgow, to confirm resolutions for winding up the present concern and transferring it to a new company. Mr. W. D. Gillies, the chairman, explained that the nominal kind of liquidation which the scheme involved would not come into effect immediately but would only do so when they find that their object can be carried out. He stated that the additional share capital to be raised under the new scheme was not to increase the capital now in the undertaking but to substitute share capital for liabilities, and enable the directors at once to complete the purchase of their wagons instead of purchasing over a term of years at a high interest.

WALES & ADJOINING COUNTIES.

(From our own Correspondent.)

The sod has been cut on the Treferrig Railway, which will open out a new field for the Taff Vale. It is evident that the Taff Vale Co. is awakening to the necessity for new enterprise, and I shall not be surprised if it does not run from the Clydach colliery into the Ogmore, and divert some of the mineral traffic that now runs down the Great Western. The Taff Vale line has also a connection with Llancaiach, from the Aberdare junction, and in a short time this will be opened to passenger traffic. At Swansea there is a divided opinion with respect to the merits of the Swansea Bay and Rhondda Railway, which is now an accomplished fact, and the Glyncorrwg, and it is certain that though a large section of the leading men in Swansea are gratified that the Swansea Bay Bill was passed, strenuous effort will be made in another session to get the Glyncorrwg also. At the rear of the Rhondda Valley large tracts of virgin coal lie undeveloped, but before many years have passed, all these will be thoroughly opened out. I hear of one tract of 300 acres of No. 3 Rhondda, a coal that is now fast becoming exhausted.

The coal trade is in a depressed state, notwithstanding that last week there was a tolerably good export. Some of the principal men tell me that the trade is very dull, that they find it difficult to secure good contracts, and that business is only done by concessions that are not at all satisfactory to coalowners. It is evident that the stiff prices maintained in South Wales have sent buyers to other quarters, but I believe that the special merits of the four-feet steam and the bituminous coals will soon bring them back again. As an illustration of the excellence of the bituminous seams of the Llantwit series, I was in a district this week which has generally been regarded as worked out. But an enterprising man had discovered that a small piece of coal had been left unworked, and this he had literally gone in for, and, succeeding in getting it, had found ready customers. For many years the colliery had been abandoned, but the merits of the seam had tempted fresh enterprise. This coal, an excellent bituminous kind, is now sold at 7s. per ton, admirably adapted for house purposes, and if there were sufficient of it could be put into the London market at about 17s. per ton.

Speculation is rife as to the successor of Mr. Menelaus, of Dowlais. I am now in a position to solve the query. Mr. Darling, a relative of Mr. Menelaus, and who has had the advantage of being trained under the immediate supervision of the late ironmaster, will be the new manager. Mr. Menelaus was a shrewd far-seeing man. When the steel era dawned he had secured extensive supplies of Bilbao ore at the lowest rates, and his works were in a condition to meet the demand for steel. He looked far ahead. Of late years he has collected cinders from all parts ready to adopt the basic process if found successful; and so in all things relative to the iron and steel industry. The works are in excellent trim to meet any variation, and Mr. Darling, who has been initiated into the views of his relative, is thus in a position to take the reins and conduct the works with success. There was a rumour current that a divided management was probable. This is not likely. Amongst the names suggested as likely to figure at Dowlais was that of Mr. Colquhoun, of Tredegar; but that gentleman is doing good work in his own place, and so also is Mr. Edward Martin, also a pupil of Mr. Menelaus, but he too is thoroughly engrossed at Blaenavon, and bringing the works there into excellent condition.

I am glad to see the Coppee principle of coke ovens spreading. Good work has been done at Dowlais, and Ebbw Vale, and Blaenavon is now adopting the process, and I hear that there is a likelihood of the ovens being built in the Rhondda Valley.

The long stagnation at Cyfarthfa is coming to an end. I have from the first maintained that a restart with steel was certain. Mr. W. T. Lewis and Mr. W. Jones were actively engaged amongst the works a few days ago, and a practical indication of business is not far off. The iron trade is not so brisk as one could wish and the tin-plate makers are lessening supply. This step promises to be a good one. Best qualities of plate are selling at 15s. 6d. London and Liverpool.

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 April, 1882.

1620. Plaster, P. M. Justice.—(*M. B. Church, U.S.*)
1621. Photographic Exposer, G. L. Addenbrooke, London.
1622. Rock Drilling, H. D. Pearsall, London.
1623. Bicycles, A. E. Gorse, Birmingham.
1624. Tunnels, C. Abel.—(*F. Rziha & F. Reska, Austria.*)
1625. Lead, E. A. Cowper and T. Sopwith, London.
1626. Electric Light, J. Munro, West Croydon.
1627. Separating Metallic Bodies, B. Tillett.—(*E. S. Bennett, Denver, U.S.*)
1628. Printing Blocks, &c., J. Noad, East Ham.
1629. Shoes, W. E. Litt, Shrewsbury.
1630. Caustic Soda, &c., J. B. Spence, London, and A. Watt, Charlton.
1631. Cooling Millstones, A. W. L. Reddie.—(*H. Dorrity, New York, U.S.*)
1632. Cranes, &c., E. Priestman, Sheffield.
1633. Driving Gear, H. Clegg, Accrington.
1634. India-rubber Coated Fabrics, W. R. Lake.—(*H. W. Burr, Cambridgeport, U.S.*)
1635. Toys, W. R. Lake.—(*W. A. Webber, G. B. Kelly, E. L. Rand, and J. L. Given, U.S.*)
1636. Fire-arms, W. R. Lake.—(*C. M. Spencer and S. H. Roper, U.S.*)
1637. Bearings, J. H. Johnson.—(*A. Fesca, Berlin.*)
1638. Vessels, J. H. Johnson.—(*N. B. Clark, U.S.*)
1639. Electro-depositing Copper, W. Walenn, London.
1640. Electric Machine, R. Kennedy, Glasgow.

5th April, 1882.

1641. Measuring Liquids, J. M. Smales, Leavesden, and H. J. Rogers, Watford.
1642. Electric Lamps, W. H. Akester, Glasgow.
1643. Buttons, G. W. von Nawrocki.—(*C. Brandt, Gössnitz, Saxony.*)
1644. Extinguishing Fires, &c., M. Vinning, London.
1645. Rolling Steel, &c., A. Riche, Brixton.
1646. Bobbins and Spools, J. Spence, Shipley.
1647. Electric Lamps, St. G. L. Fox, London.
1648. Mills, F. V. Wyngaert. -(*O. Soldan, Germany.*)
1649. Conduits, A. J. Boult.—(*J. D. Thomas, U.S.*)
1650. Steam Engines, J. Penn, Greenwich.
1651. Fire-escape, W. R. Lake.—(*L. D. B. Shaw, U.S.*)
1652. Road Curbs, J. J. Wheeler, London.
1653. Travelling Bags, T. A. Mitchell, Chislehurst.
1654. Felt Leathers, C. J. Shaw and E. Nördlinger, Glasgow.
1655. Water-closets, H. Conolly, London.
1656. Carriages, H. J. Barrett, Kingston-upon-Hull.
1657. Pianofortes, W. R. Lake.—(*F. E. Moore, U.S.*)
1658. Driving Belts, T. Wheelhouse, Baliffe Bridge.
1659. Utilising Sea Waves, R. J. Scott, London.
1660. Food, W. McDonnell, Limerick.
1661. Mills, W. R. Lake.—(*N. Holt and R. Noye, U.S.*)
1662. Colliery Corves, &c., R. Hadfield, Sheffield.
1663. Circuits, F. D'A. Goold, London.

6th April, 1882.

1664. Checking Tickets, J. Lawson and J. Sirech, Bordeaux.
1665. Tannin, E. A. Brydges.—(*A. Mitscherlich, Münden, Germany.*)
1666. Steam Boilers, G. Stevenson, Airdrie.
1667. Tricycles, &c., T. Forshaw, Smalley.
1668. Torpedoes, W. N. Hutchinson, Wellesbourne.
1669. Tipping Frame, R. Hadfield, London.
1670. Electric Lamps, J. Jameson, Akenside Hill.
1671. Extinguishing Fires, P. A. C. de Sparre, Paris.
1672. Cigarettes, P. Everitt, London.
1673. Knitting Machinery, H. Barratt, Nottingham.
1674. Safety Apparatus, C. D. Abel.—(*F. Pelzer, Dortmund, Germany.*)
1675. Slide Valves, D. Halpin, London.
1676. Scaleboard, A. Millar, Glasgow.
1677. Fishing Tackle, R. Clark, Edinburgh.
1678. Boring Machinery, J. Orton, Durham.
1679. Cleaning Grain, M. Church.—(*D. Lukins, U.S.*)
1680. Bicycles, W. Scantlebury, Lower Clapton.
1681. Brakes, J. P. Davies, Chester.
1682. Railway Signals, J. Harrisson, London.
1683. Peroxides, L. Mond, Northwich.
1684. Telephonic Instruments, A. Dolbear, London.
1685. Filtering Apparatus, E. Fiechter.—(*G. Baier, Wurtemburg.*)
1686. Label-holders, J. Parker, Woodstock.
1687. Motor, C. J. Griffith, jun., London.
1688. Packing Cases, D. Nicoll. London.
1689. Electric Lamps, G. S. Young, Blackwall, and R. J. Hatton, Stratford.
1690. Nickel, P. C. Gilchrist & S. G. Thomas, London.
1691. Mounting Tobacco Pipes, W. Rest, London.
1692. Dynamo-electric Machines, D. Piot, London.

8th April, 1882.

1693. Checking Apparatus, W. M. Llewellin, Bristol.
1694. Cornice Poles, C. F. Grimmett and J. Cook, Birmingham.
1695. Breakwaters, G. H. T. Beamish, Queenstown.
1696. Fishing Bait, M. Carswell, Glasgow.
1697. Electric Lamps, Hon. R. Brougham and F. A. Ormiston, London.
1698. Boxes, M. I. Verkouterin.—(*R. Chapin, U.S.*)
1699. Motive-power, A. Wilson, Handsworth.
1700. Galvanising Sheet Iron, T. H. Johns, London.
1701. Rotary Motors, W. J. Gurd, Sarnia.
1702. Rotary Motors, W. J. Gurd, Sarnia.
1703. Projectiles, E. Palliser, London.
1704. Rowlocks, E. J. Robertson, Ipswich.
1705. Condensers, A. M. Clark.—(*R. E., M., and M. Williams, U.S.*)

10th April, 1882.

1706. Distilling, &c., C. M. Pielsticker, London.

Inventions Protected for Six Months on Deposit of Complete Specifications.

1636. Fire-arms, W. R. Lake, London.—A communication from M. Spencer and S. H. Roper, U.S —*4th April*, 1882.
1645. Rolling Bars of Steel, &c., A. Riche, Brixton. —*5th April*, 1882.
1679. Cleaning, &c., Grain, M. Church, U.S.—A communication from D. Lukins, U.S.—*6th April*, 1882.

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

1320. Printing Presses or Machines, H. H. Lake, London.—*3rd April*, 1879.
1506. Nutritive Foods, &c., J. Fordred, Tottenham. —*17th April*, 1879.
1346. Umbrellas, &c., W. Carter, London —*4th April*, 1879.
1351. Looms, R. L. Hattersley and J. Hill, Keighley. —*5th April*, 1879.
1429. Tramway, &c., Engines, J. Matthews, Clifton.— *10th April*, 1879.
1431. Carding Wool, &c., I. Holden, Bradford.—*10th April*, 1879.
1362. Rolling Mills, J. M. While, Sheffield.—*5th April*, 1879.
1378. Spinning, T. Mitchell, Bradford.—*7th April*, 1879.
1407. Studs for Boots, &c., G. H. Ellis, Stevenage.— *9th April*, 1879.
1410. Purifying, &c., Gas, H. J. Haddan, London.— *9th April*, 1879.
1416. Range-finder, F. Weldon, Trichinopoly.—*9th April*, 1879.
1432. Sewing Machine Attachment, B. Hunt, London. —*10th April*, 1879.
1542. Centrifugal Dressing, &c., Machines, H. Simon, Manchester.—*19th April*, 1879.
1809. Drilling Apparatus, J. K. Gulland, London.— *7th May*, 1879.
1389. Slip Shackle, C. F. C. Morris, London.—*8th April*, 1879.
1491. Travelling Cranes, &c., G. A. Newton, Liverpool.—*17th April*, 1879.

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

1549. Waterproof, &c., Fabrics, J. Young, Silvertown.—*27th April*, 1875.
1353. Printing Machinery, W. J. Ingram, London.— *14th April*, 1875.
1499. Ventilators, W. P. Buchan, Glasgow.—*23rd April*, 1875.
1303. Steaming Fabrics, J. Smith, Thornliebank.— *10th April*, 1875.
1378. Sewing Machines, A. Greenwood, Leeds, and J. and A. Keats, Newcastle.—*15th April*, 1875.
1602. Printing Machinery, W. C. Kritch and A. Greenwood, Leeds.—*30th April*, 1875.
1308. Feeding Furnaces with Fuel, E. Bennis, Limerick.—*10th April*, 1875.

Notices of Intention to Proceed with Applications.

Last day for filing opposition 28th April, 1882.

5091. Generating Heat, H. Defty, Middlesbrough.— *22nd November*, 1881.
5274. Insect Powder, A. C. Henderson, London.—A communication from E. Koch and L. Schulher.— *2nd December*, 1881.
5278. Purifying Coal Gas, J. B. Spence and J. Desvignes, London.—*2nd December*, 1881.
5288. Wardrobes, &c., E. Peyton, Birmingham.—Com. from J. H. Baxter.—*3rd December*, 1881.
5293. Steam Boilers, E. A. Brydges, Berlin.—A communication from J. Schreiber and F. H. Moldenhauer. —*3rd December*, 1881.
5307. Oil, &c., J. Darling, Glasgow.—*5th December*, 1881.
5326. Washing Machines, A. Mill, Glasgow.—*6th December*, 1881.
5334. Securing Main Sheets, &c., H. B. McIntosh, Lincoln.—*6th December*, 1881.
5360. Telephone Transmitters, E. H. Johnson, London.—*7th December*, 1881.
5370. Packing Embroidery, &c., F. W. Parker, London.—*8th December*, 1881.
5451. Secondary Batteries, J. Pitkin, Clerkenwell.— *13th December*, 1881.
5489. Bottles, F. Wirth, Germany.—Com. from H. Lamprecht and G. Hirdes.—*15th December*, 1881.
5618. Incandescent Electric Lights, D. Graham, Glasgow.—*22nd December*, 1881.
294. Heating Water, G. H. Nussey and W. B. Leachman, Leeds.—*20th January*, 1882.
351. Tanks, J. Holroyd, Leeds.—*24th January*, 1882.
660. Antiseptic Non-hygroscopic Powder, N. Bradley, Manchester.—*11th February*, 1882.
712. Cartridge Magazines, G. E. Vaughan, London. —Com. from J. Werndl.—*14th February*, 1882.
731. White Lead, E. V. Gardner, London.—*15th February*, 1882.
754. Hooks, M. Benson, London.—A communication from I. N. Doremus.—*16th February*, 1882.
835. Asbestos Paints, C. J. Mountford, Birmingham. —*21st February*, 1882.
1019. Fire-resisting Blocks, C. J. Mountford, Birmingham.—*3rd March*, 1882.
1057. Manufacturing Sugar, C. Scheibler, Germany. —*4th March*, 1882.
1103. Carding Engines, A. Holden, Gorton.—*7th March*, 1882.
1187. Slide Valves, W. Jones, Manchester.—*11th March*, 1882.
1199. Electric Lamps, R. Kennedy, Glasgow.—*13th March*, 1882.
1244. Expansion Valves, J. Hopwood, Cleveleys, Lancaster.—*14th March*, 1882.
1259. Weaving Tape Ladders, J. Carr, Manchester.— —*15th March*, 1882.
1265. Grain Clips, J. Smith Thornliebank, N.B.— *15th March*, 1882.
1271. Telephones, A. W. Rose, London.—*16th March*, 1882.
1306. Hearthstone, W. Simmons, Maidstone.—*17th March*, 1882.
1399. Furnaces, J. Burch, Stockport, and W. Evans Manchester.—*22nd March*, 1882.

Last day for filing opposition, 2nd May, 1882.

5301. Loom Pickers, J. Holding and E. K. Dutton, Manchester.—*5th December*, 1881.
5316. Lighting Railway Carriages, R. Laybourne, Newport.—*5th December*, 1881.
5327. Rivet Peg, J. Hewitt, Leicester.—*6th December* 1881.
5339. Checking Apparatus, A. J. T. Wild, Peckham.— *6th December*, 1881.
5349. Shearing, &c., Wool, T. R. Hutton, Manchester. —*7th December*, 1881.
5354. Indicating Apparatus, P. Cardew, Chatham.— *7th December*, 1881.
5359. India-rubber Boots, F. Richardson, Providence, U.S.—*7th December*, 1881.
5361. Nail Machines, J. Imray, London.—A communication from J. Coyne.—*7th December*, 1881.
5379. Ventilating Ships, &c., J. C. Baker, Liverpool. —*9th December*, 1881.
5385. Telephones, G. W. Foster, London.—*9th December*, 1881.
5388. Cutting Loaf Sugar, J. M. Day, W. R. Green, and H. C. Walker, London.—*9th December*, 1881.
5396. Electric Lamps, C. F. Varley, Kent, and F. H. Varley, London.—*9th December*, 1881.
5404. Protecting Surfaces of Steam Boilers, S. Schuman, Glasgow.—*10th December*, 1881.
5407. Electrical Insulation, W. Abbott and F. Field, London.—*10th December*, 1881.
5413. Blow Pipes, T. Fletcher, Warrington.—*10th December*, 1881.
5417. Constructing Steamers, &c., W. H. Marks, London.—*10th December*, 1881.
5447. Glove Fastenings, J. Hinks, T. Hooper, and F R. Baker, Birmingham.—*13th December*, 1881.
5465. Rails, &c., W. Seaton, London.—*10th December*, 1881.
5501. Pneumatic Railways, T. W. Rammell, London. —*16th December*, 1881.
5511. Ascertaining the Pitch of Screw Propellers, D. B. Hutton, Poplar.—*16th December*, 1881.
5537. Breech-loading Guns, T. Nordenfelt, London. —*17th December*, 1881.
5538. Breech-loading Fire-arms, T. Nordenfelt, London.—*17th December*, 1881.
5539. Breech-loading Fire-arms, T. Nordenfelt, London.—*17th December*, 1881.
5544. Treating Alkaline Lime Mud, J. Simpson, Liverpool, and W. Parnell, Widnes.—*19th December*, 1881.
5594. Knitting Machines, B. J. B. Mills, London.— Com. from N. W. Westcott —*21st December*, 1881.
5731. Direct-acting Gas Furnaces, R. S. Casson Stafford.—*30th December*, 1881.
5747. Roofs, A. M. Clark, London.—A communication from A. C. de Barbaran.—*31st December*, 1881.
119. Window-sash Fastenings, E. R. Wethered, Woolwich.—*9th January*, 1882.
473. Utilising Alkali Waste, J. Brock, Widnes.— *31st January*, 1882.
985. Lighting Gas, C. L. Clarke and J. Leigh, Manchester.—*1st March*, 1882.
986. Dynamo-electric Machines, W. H. Akester and T. B. Barnes, Glasgow.—*1st March*, 1882.
1026. Gas Engines, P. Niel, Millwall.—*3rd March*, 1882.
1097. Joints and Couplings, T. A. Bickley, Birmingham.—*7th March*, 1882.
1112. Protection of Harbours, J. Shields, Perth, N.B.—*8th March*, 1882.
1230. Elevators, P. M. Justice, London.—A communication from G. C. Tewksbury.—*14th March*, 1882.
1377. Producing Ammonia from Coal, &c., W. Young, Peebles, and G. T. Midcalder, N.B.—*21st March*, 1882.
1403. Gas-burners, J. Lewis, London.—*23rd March*, 1882.
1419. Spinning Fibres, F. Ripley and T. H. Brigg, Bradford.—*24th March*, 1882.
1465. Carbons, A. Smith, Brockley.—*27th March*, 1882.
1636. Magazine Fire-arms, W. R. Lake, London.— Com. from C. M. Spencer.—*4th April*, 1881.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the 6th April*, 1882.)

4374. Holding, &c., Photographs, R. Love, London. —*8th October*, 1881.
4391. Attaching Door Knobs to Spindles, B. W. Spittle, Wednesbury.—*10th October*, 1881.
4393. Safety Valves, C. Shields, Manchester.—*10th October*, 1881.
4399. Feeding Wool, J. and A. Leadbeater, Yorkshire.—*10th October*, 1881.
4402. Single-acting Compound Air Engines, G. W. Weatherhogg, Birmingham.—*10th October*, 1881.
4405. Producing Electric Light, A. M. Clark, London.—*10th October*, 1881.
4406. Knitted Fabrics, T. Thorpe, Nottingham.— *11th October*, 1881.
4410. Planing Wooden Hoops, W. Morgan-Brown, London.—*11th October*, 1881.
4417. Telescopic Music Stand, J. J. Gilbert, New Romney, Kent.—*11th October*, 1881.
4423. Slates, W. A. Barlow, London.—*11th October*, 1881.
4525. Heating Rooms, T. Stokoe, Headingley, Leeds. —*11th October*, 1881.
4428. Telephonic Apparatus, A. R. Bennett, London. —*11th October*, 1881.
4429. Preserving Hay, &c., G. W. F. Swarbrick, Tottenham.—*11th October*, 1881.
4446. Observing Working of Boiler Pumps, S. Lees and T. Allison, Huddersfield.—*12th October*, 1881.
4459. Grinding Curling Stones, A. Kay, Haugh, Ayr, N.B.—*13th October*, 1881.
4460. Tentering, &c., Fabrics, J. L. Norton, London. —*13th October*, 1881.
4477. Gymnastic Apparatus, A. W. Turner, Birmingham.—*14th October*, 1881.
4499. Looms for Weaving, S. O'Neill, Castleton.—*15th October*, 1881.
4517. Propelling Vessels, M. Hedicke, London.— *17th October*, 1881.
4538. Decorticating Ramie Fibres, J. C. Mewburn, London.—*18th October*, 1881.
4555. Production of Ozonised Oxygen, E. Hagen, Ealing.—*18th October*, 1881.
4557. Water-closets, J. A. Hornby, Anglesea.—*19th October*, 1881.
4569. Drying Sugar, &c., J. Roper, London.—*19th October*, 1881.
4607. Magneto-electric Machines, H. F. Joel, Dalston.—*21st October*, 1881.
4621. Beel or Spool, F. Wirth, Germany.—*21st October*, 1881.
4627. Horseshoes, J. Bidder and M. J. Rowley, London.—*22nd October*, 1881.
4635. Treating Ores, F. M. Lyte, London.—*22nd October*, 1881.
4687. Asbestos Material, S. Pitt, Sutton.—*26th October*, 1881.
4715. Wax Paper, W. R. Lake, London.—*27th October*, 1881.
4743. Preserving Milk, E. G. Brewer, London.—*29th October*, 1881.
4762. Producing Enamels, C. W. Heaton, Lessness Heath, and T. Bolas, Chiswick.—*31st October*, 1881.
4857. Drying, &c., Fibrous Materials, W. R. Lake, London.—*5th November*, 1881.
4911. Carding Engines, W. T. Cheetham, Manchester. —*9th November*, 1881.
5629. Shifting Grain, E. J. Power, London.—*23rd December*, 1881.
238. Lubricating the Spindles of Spinning Machines, J. Dodd and G. Little, Oldham.—*17th January*, 1882.

262. Wax-thread Sewing Machines, H. H. Lake, London.—19*th January*, 1882.
301. Sewing Buttons to Cloth, H. J. Haddan, Kensington.—21*st January*, 1882.

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

2783. Photographic Shutters, C. Sands, London.—25*th June*, 1881.
4440. Indicators, A. Budenberg, Manchester.—12*th October*, 1881.
4454. Measuring Electric Currents, J. T. Sprague, Birmingham.—12*th October*, 1881.
4464. Combing Wool, W. Terry and J. Scott, Bradford.—13*th October*, 1881.
4465. Stretching, &c., Woven Fabrics, J. Lodge, Huddersfield, and M. Oldroyd, Dewsbury.—13*th October*, 1881.
4470. Furniture, J. Middleton and G. J. Scott, Birkenhead.—13*th October*, 1881.
4479. Elliptical Springs, F. Joynes, Sheffield.—14*th October*, 1881.
4481. Rotary Pumps, L. A. Groth, London.—14*th October*, 1881.
4487. Lamps, J. A. B. Bennett, King's Heath, S. Herd and B. P. Walker, Edgbaston.—14*th October*, 1881.
4492. Velocipedes, W. Harrison, Manchester.—14*th October*, 1881.
4504. Electric Arc Lamps, J. Brockie, Brixton.—15*th October*, 1881.
4536. Hot-blast Apparatus, H. H. Lake, London.—18*th October*, 1881.
4537. Feeding Water to Steam Boilers, S. Hallam and J. W. Shepherd, Manchester.—18*th October*, 1881.
4545. Steam Boilers, G. Hill, Liverpool.—18*th October*, 1881.
4560. Steam Boilers, S. Fox, New Wortley, Leeds.—19*th October*, 1881.
4561. Destroying Putrescible Matter, J. B. Kinnear, London.—19*th October*, 1881.
4567. Drilling, &c., Rocks. J. McCulloch, J., and J. M. Holman, Cornwall.—19*th October*, 1881.
4574. Heating Metallic Tubes, &c., S. Fox, New Wortley, Leeds.—19*th October*, 1881.
4575. Testing Boiler Tubes, S. Fox, New Wortley, Leeds.—19*th October*, 1881.
4593. Cleaning Grits, A. Besser, Vienna.—20*th October*, 1881.
4652. Ships' Sleeping Berths, W. R. Lake, London.—24*th October*, 1881.
4688. Castors for Chairs, W. R. Lake, London.—26*th October*, 1881.
4774. Shaft Machines, W. A. Barlow, Manchester.—1*st November*, 1881.
4795. Kilns, G. W. von Nawrocki, Berlin.—2*nd November*, 1881.
4800. Removing Night Soil, &c., from Cesspools, A. M. Clark, London.—2*nd November*, 1881.
4840. Concrete, J. B. Spence, London, and E. Ormerod, Belvedere.—4*th November*, 1881.
4861. Permanent Way, J. Whiteford, Greenock.—7*th November*, 1881.
4882. Electric Timepieces, W. P. Thompson, London.—8*th November*, 1881.
4936. Extracting Glycerine, &c., W. R. Lake, London.—10*th November*, 1881.
4947. Electro-plating, F. Wirth, Germany.—11*th November*, 1881.
4980. Embroidering Machines, A. M. Clark, London.—14*th November*, 1881.
5095. Bricks, W. R. Lake, London.—22*nd November*, 1881.
5263. Textile Fabrics, C. D. Abel, London.—1*st December*, 1881.
5340. Looms, J. Baird, Glasgow.—6*th December*, 1881.
5468. Telegraph Conductors, J. Imray, London.—14*th December*, 1881.
5504. Locks of Fire-arms, E. Bled and E. Richoux, France, and J. Warnant, Belgium.—16*th December*, 1881.
5520. Locks of Fire-arms, E. Bled and E. Richoux, France, and J. Warnant, Belgium.—16*th December*, 1881.
5600. Electric Lighting Apparatus, S. Pitt, Sutton.—21*st December*, 1881
5723. Feeding Hurdles for Animals, A. J. Scott, Rotherfield.—30*th December*, 1881.
2. Refrigerators, P. M. Justice, London.—2*nd January*, 1882.
11. Dessicating, &c., Apparatus, A. Goutard, Mockau.—2*nd January*, 1882.
15. Transmitting Heat to Fluids, T. W. Duffy, Liverpool.—2*nd January*, 1882.
208. Spring Bed-bottoms, &c., A. M. Clark, London.—14*th January*, 1882.
231. Telephonic Conductors, C. W. Siemens, London.—17*th January*, 1882.
276. Ventilating Apparatus, T. Rowan, London.—19*th January*, 1882.
287. Earthenware, W. Boulton, Burslem.—20*th January*, 1882.
303. Stereotype Plates, T. Sowler and W. Ward, Manchester.—21*st January*, 1882.
380. Piano and Organ Players, C. N. Andrews, San Francisco, U.S.—25*th January*, 1882.
384. Producing Aniline, &c., W. R. Lake, London.—25*th January*, 1882.
409. Heating Apparatus, M. Ashworth, Stacksteads.—27*th January*, 1882.
513. Electric Meters, C. V. Boys, Wing.—2*nd February*, 1882.
564. Floating Coffer-dams, H. H. Lake, London.—6*th February*, 1882.
581. Treating Fibrous Plants, C. D. Ekman, London.—7*th February*, 1882.
605. Refrigerating Machinery, G. Barker, Birmingham.—8*th February*, 1882.
616. Purifying Middlings, W. R. Lake, London.—8*th February*, 1882.
650. Velocipedes, H. A. Dufrené, London.—10*th February*, 1882.
741. Urethral Syringes, A. M. Clark, London.—15*th February*, 1882.
819. Electric-lighting Apparatus, S. Pitt, Sutton.—20*th February*, 1882.

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

1780, 2d.; 2009, 6d.; 2167, 6d.; 2471, 6d.; 2595, 6d. 3390, 6d.; 3407, 6d.; 3454, 6d.; 3532, 4d.; 3568, 6d.; 3625, 6d.; 3647, 6d.; 3652, 6d.; 3655, 6d.; 3658, 6d.; 3663, 6d.; 3666, 6d.; 3669, 8d.; 3676, 6d.; 3683, 4d.; 3688, 6d.; 3701, 6d.; 3713, 6d.; 3715, 6d.; 3717, 6d.; 3721, 4d.; 3728, 6d.; 3736, 4d.; 3738, 6d.; 3746, 4d.; 3758, 6d.; 3760, 8d.; 3768, 10d.; 3771, 6d.; 3774, 6d.; 3783, 6d.; 3789, 6d.; 3791, 6d.; 3793, 8d.; 3796, 6d.; 3797, 6d.; 3798, 4d.; 3799, 6d.; 3815, 4d.; 3820, 6d.; 3821, 6d.; 3824 6d.; 3828, 6d.; 3831, 6d; 3833, 6d.; 3839, 6d.; 3842, 4d.; 3854, 6d.; 3861, 2d.; 3868, 2d.; 3869, 2d.; 3871, 2d.; 3872, 2d.; 3873, 2d.; 3874, 6d.; 3875, 6d.; 3877, 2d.; 3879, 2d.; 3894, 2d.; 3898, 4d.; 3899, 2d.; 3900, 2d.; 3901, 2d.; 3903, 2d.; 3905, 2d.; 3906, 2d.; 3909, 2d.; 3916, 2d.; 3919, 2d.; 3923, 4d.; 3928, 2d.; 3930, 4d.; 3941, 2d.; 3942, 2d.; 3946, 2d.; 3947, 2d.; 3948, 2d.; 3958, 4d.; 3959, 4d; 4065, 4d.; 4297, 4d.

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

ABSTRACTS OF SPECIFICATIONS.

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

1780. Distilling Apparatus, *L. S. Lederer, Dalston.*—25*th April*, 1881.—(*A communication from C. Paulmann, Hanover.*)—(*Not proceeded with.*) 2*d.*

This consists of a still cylinder fitted with a series of trays and overflow guards, over which the heated mash or alcoholic liquor flows in succession, and is exposed to the boiling action of steam which passes up through the still and carries off the alcoholic vapours; the steam and alcoholic vapours then pass to a rectificatory cylinder, fitted with a series of sieve-bottomed trays, and then to a wine-heater and condenser.

2009. Combing Wool, &c., *J. F. Harrison, Bradford.*—9*th May*, 1881. 6*d.*

This relates to means for converting the cleaned fringes left on the inside of a Noble's comb into "top" instead of "noil," and it consists in fitting to the comb in place of one of the smaller inner circular combs a circular revolving nip constructed according to patent No. 4252, A.D. 1881.

2167. Valves, *W. Askew and A. Aird, Manchester.*—18*th May*, 1881. 6*d.*

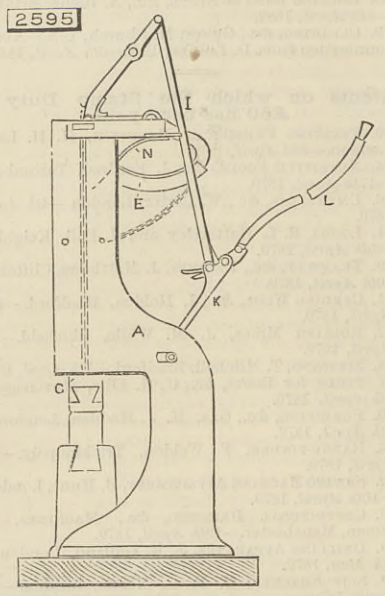
This valve is intended principally as a vacuum valve for steam cylinder and pipes, to prevent the collapse of same from atmospheric pressure, when a partial vacuum is created therein, and it consists of a socket screwed into the cylinder of the valve, and having a projecting screwed rim and a cross-bar supporting a central boss through which the lower end of the valve spindle works. The upper end of the spindle works through the centre of a screwed cap which forms the valve seat and fits on to the screwed rim of the socket. A spring is fitted between the valve and the top of the cap, and tends to keep the valve open.

2471. Cutting and Bruising Straw, *J. M. Gorham, Lincoln.*—7*th June*, 1881. 6*d.*

This consists of a drum fitted with beaters and revolving between two concave surfaces, one fitted with knives, and the other with bruising pegs, the knives and pegs being so arranged as to fall in a line drawn between the spaces of each other.

2595. Compound Manual Lever Hammer, *J. Cuthbert, Landport, and G. H. King, Portsea.*—15*th June*, 1881. 6*d.*

The object is to supply a more powerful hammer than the sledge hammer where it is inconvenient to employ steam power, and it consists of a suitable frame A with an excentric-shaped quadrant E



mounted in bearings at top and connected by chain to the hammer G, the quadrant being operated by a system of levers I K L. Springs N are compressed as the hammer is raised and tend to increase the force of its downward movement.

3390. Railways, *P. J. Neate, Belsize Park.*—4*th August*, 1881. 6*d.*

The nuts of the fish bolts are made of considerable length in relation to their width, and when in position lie with their upper edges parallel to the rail; should a nut work loose it will project above the rail and a passing train would force it down to its proper position. A key is secured by a wedge engaging partly with grooves in the chair and partly with the key, and situated under the overhanging portion of the tire of the wheels of the rolling stock, which depress it if it works loose.

3407. Churns, *N. Steward, Sussex.*—6*th August*, 1881.—(*A communication from A. Stewart, Ottawa.*) 6*d.*

This consists of imparting an oscillating motion to the body of the churn, which is so shaped as to cause the milk to circulate in a continuous path having the form of a figure 8.

3454. Wire Netting, *W. H. Johnson, Manchester.*—19*th August*, 1881. 6*d.*

This consists in attaching spikes or spires formed of separate pieces of wire to the wire netting, so as to prevent animals pressing against the netting, the spikes being secured by twisting around the meshes.

3532. Plates to Secure Hinges to Woodwork, &c., *J. R. Gough, Kennington.*—15*th August*, 1881.—(*Not proceeded with.*) 4*d.*

This consists in making the edges of the hinge plates in the form of attached segments of circles, so that the recess to be made in the woodwork may be effected by means of a brace and bit.

3568. Concertinas and Accordions, *B. Berry, Newcastle-on-Tyne.*—17*th August*, 1881. 6*d.*

This consists, First, in an arrangement of fingering by which the first six natural notes of any scale are sounded by one row of keys, and the five accidentals with the seventh natural note are sounded by the other row of keys; Secondly, in a special arrangement and the parts of the stop and the form of the reed chambers; and Thirdly, in the method for moving and fixing the stop.

3625. Pickers and Picker Spindles, &c., *J. and H. Wallwork, Ashton-under-Lyne.*—28*th August*, 1881. 6*d.*

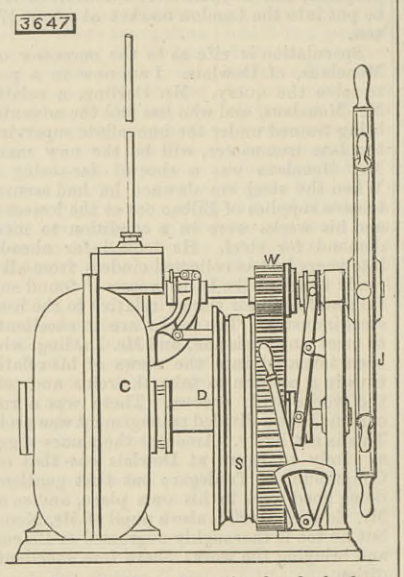
The object is to make the pickers more durable and to effect more effectual lubrication with less tendency for the oil to be thrown upon the work in the loom, and it consists in providing the picker with a metal bush formed with a rib through which pins pass to secure the bush in place. A hollow spindle is used and is perforated, the perforations being plugged with a porous material, to allow the gradual passage of the lubricant from inside the spindle to the bearing. Spindles of this construction may also be applied to spinning and other machinery.

3652. Coiling Machine, *C. L. Clarke and J. Leigh, Manchester.*—22*nd August*, 1881. 6*d.*

This relates to a machine designed principally to coil wire and thread side by side for forming induction and resistance coils, and it consists of the headstocks mounted on a frame, the fixed one being fitted with a revolving spindle carrying fast and loose pulleys, and having on its outer end a spur wheel, opposite to which, but not in gear, is a second wheel carried by a screwed spindle mounted at the back of the bed. This frame carries two horizontal parallel rods forming a slide, on which moves a carriage having a nut travelling on the screwed spindle and moving the carriage to the right or left. On a small bracket are mounted two small carrier pinions gearing together, and so arranged as to cause the spur wheel to drive the screw spindle either through the first pinion only or through both pinions, or that both shall be out of gear. The inner ends of both headstock spindles are fitted with chucks to hold the bobbins. To the carriage is attached a guide, over which the wire and thread passes to the bobbin.

3647. Steering Apparatus for Ships, &c., *J. Walker, W. Thompson, jun., and T. Thompson, jun., Durham.*—22*nd August*, 1881. 6*d.*

This consists essentially of a combined hand and steam steering apparatus, the second motion shaft of which, carrying the chain wheel, is rotated by a spur



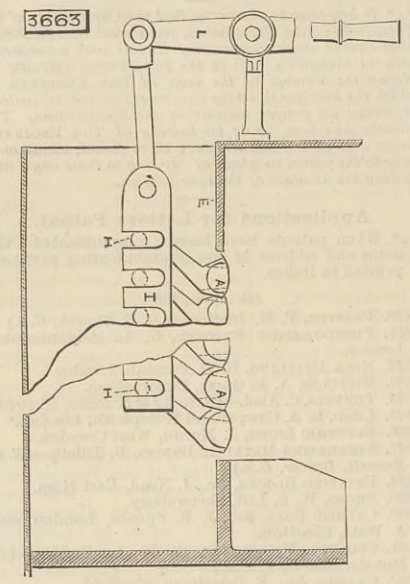
wheel and pinion by the first motion hand-wheel, or when desired by steam by a vane or flap piston attached directly to the second motion shaft and rotating in a circular flat-ended cylinder. D is the second motion shaft, carrying the chain wheel S and actuated either by wheel gearing W from first motion hand-wheel J, or by the vane or flap piston attached to it aud revolving in cylinder C.

3658. Harvesting Machines, *W. R. Lake, London.*—22*nd August*, 1881.—(*A communication from M. Denizot, Paris.*) 6*d.*

The means for cutting the grain consist of two series of blades arranged to operate like scissor blades, the lower ones being fixed to a cutter bar and the upper ones mounted on a screw pivot and guided in a sliding piece to which a to-and-fro movement is imparted by an excentric. The cut grain is carried by an apron to the sheaf former or to a binder.

3663. Movable Angled-feather Furnace-fire-bar, *J. G. Galley, Forest Gate.*—23*rd August*, 1881. 6*d.*

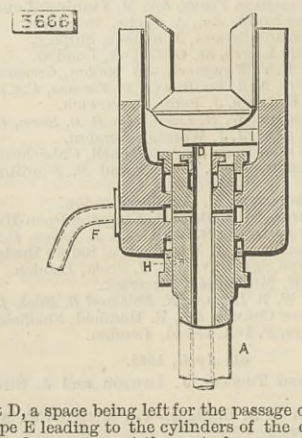
As applied to a steam boiler with internal flue it consists of a dead plate E arranged as usual inside the fire door, and on each side of the flue is fixed a longitudinal bar extending from the dead plate to the fire



bridge, and formed with bearings to receive the ends of transverse fire-bars A, each consisting of a transverse bar narrower at the upper than at the lower end, and having at its lower end a plate extending down towards the front of the furnace. At the lower end of each plate is a pin H, over which fits a longitudinal bar I actuated by lever L so as to rock all the bars simultaneously. Upon the back and front of the transverse bars a series of projections are formed tapering both in depth and thickness, and those on one bar arranged to fit into the spaces left between the projections on the next bar.

3666. Steam Pipes for Dredger and other Cranes, *W. D. and S. Priestman, Kingston-upon-Hull.*—23*rd August*, 1881. 6*d.*

The centre pillar A of the crane is made with a central passage H, through which passes the driving



shaft D, a space being left for the passage of the steam to pipe E leading to the cylinders of the engine. By a second arrangement the central passage in the pillar A only serves for the passage of steam.

3669. Devices for Containing Money, Applicable to Pocket-books, &c., *W. R. Lake, London.*—23*rd August*, 1881.—(*A communication from J. W. Meaker, New York.*) 8*d.*

This consists in the combination in a pocket-book of a central coin drawer of triangular cross section surrounded by a similarly shaped rigid shell, with an outer flexible leather cover fitted with pockets, and a handle secured to a thinner margin of the pocket-book body.

3675. Sorting or Separating Seeds or Grain, *K. H. Sander, near Leipzig.*—23*rd August*, 1881. 6*d.*

This relates to improvements on patent No. 654, A.D. 1881, in which the seed was subjected to the action of a laterally inclined travelling web, and it consists in subjecting the sorted seed into a further sorting or separating action by a shaking apparatus consisting of a pan attached to a pivotted arm suspended by a spring and connected by a lateral rod to a rocking lever worked by a cam. The bottom of the pan consists of a screening surface.

3683. Winding Gear for Mines, *J. Craven, Wakefield.*—24*th August*, 1881. 4*d.*

The object is to prevent the wear of the ropes by one coil chafing against the other, and also to obviate the necessity for coiling the ropes round the drums usually employed, and it consists in the employment of a single winding rope, an upper set of grooved head gear pulleys, and a lower set of grooved winding pulleys, each consisting of two pulleys and an intermediate grooved pulley between the two sets. The rope is attached at one end to one of the cages, passes over one of the head gear pulleys, under one of the winding pulleys, and back over the intermediate pulley, then under the other winding pulley, and thence over the other head gear to the other cage, to which the end of the rope is attached.

3688. Sewing Machines, *A. Watkins, Regent's Park.*—24*th August*, 1881. 6*d.*

This relates to improvements on patent No. 4326, A.D. 1877, and consists, First, in adapting to sewing machines an apparatus to regulate the tension of the thread, and comprised of two plates pressed together by means of a screw and spring; Secondly, in the lower thread holder, which is formed of a bar screwed to a movable plate and fitted with a spring, on the end of which is a brush to hold the loop previous to its being drawn up; Thirdly, in means for working the looper; Fourthly, in the use of an instantaneous brake; and Fifthly, in improvements in the driving apparatus.

3701. Bending Rails, Bars, &c., *J. H. Johnson, London.*—25*th August*, 1881.—(*A communication from L. Vojacek, Prague, Bohemia.*) 6*d.*

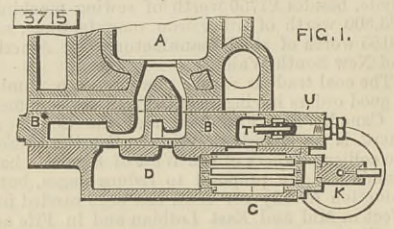
This relates to apparatus to bend rails, &c., by causing it to travel along the article to be bent, and it consists of three parallel rollers, two capable of turning freely in bearings in the frame, whilst the third is mounted in bearings adjustable laterally in a direction perpendicular to a plane drawn through the axes of the other two rollers. These bearings are formed in the extremities of two bars sliding in guides in the frame, and connected at their opposite extremities by a crosshead provided with a screw, one end of which is fitted with a handle, and the other bears against the frame of the two rollers. The adjustable roller is caused to revolve by means of long levers fitted to its spindle.

3713. Baths, *C. D. Douglas, London.*—25*th August*, 1881. 6*d.*

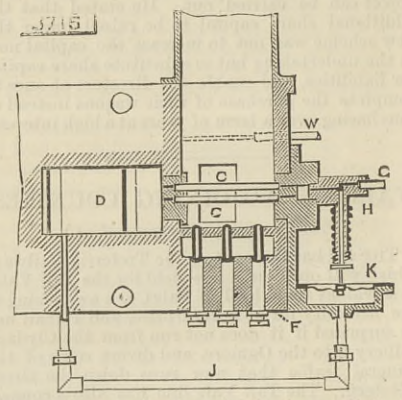
This relates to improvements on patent No. 1538, A.D. 1880, and consists in forming in the casting process a chamber, which acts as the ordinary stand or rod pipe, such chamber being formed in one with the end or side of the bath, and at its bottom is attached an ordinary valve. An opening is left in the wall of the bath to give access to the valve and the working parts from inside the bath, without disturbing its setting.

3715. Gas Engines and Automatic Generation of Gas Therefor, *H. Williams, Southport.*—25*th August*, 1881. 6*d.*

This relates to engines worked by gas from petroleum or other hydrocarbon oil; and Secondly, to the means for igniting the charge by means of a flame of petroleum or other oils. In the slide valve B of



cylinder A a set of retorts C are formed of platinum tubes, and once in every double stroke of the valve petroleum is injected into the retorts, which are heated either by the ignition light or by special heating medium. The gas produced flows into the chamber D, and thence through slide B to cylinder A, mixing in its passage through slide B with the air necessary to form a combustible mixture, which is ignited and expanded in cylinder A in the ordinary manner. If the pressure increases in chamber D the



gas acting through pipe J on the diaphragm K closes the valve H through which the oil passes to the retorts. To ignite the charge a chamber T is formed in valve B, and in it is placed a plug of carbon carried by holder V forming a wick or burner, which is supplied with oil through a pipe W, and which at a certain moment communicates by a passage in the slide B with the master burner F.

3717. Cotton Cloths known as Cotton Cords, *J. Winter and T. Ivers, Farnworth.*—25*th August*, 1881. 6*d.*

This consists in weaving cotton cords with twelve or twenty-four warp threads to the draught or gait over, the raising of either three or six consecutive warp threads simultaneously, and binding them with the weft threads.

3721. Rope and Hawser Stoppers, *T. Edmond, Plymouth*—25*th August*, 1881. 4*d.*

The object is to hold mooring ropes after they have been hauled on board, and while they are being made fast to the vessel; and the apparatus consists of a bar with an eye at either end, one being secured by a shackle and bolt to the deck, while to the other are pivotted two gripping jaws. One jaw is formed with ratchet teeth on its back, and to the other end of it is pivotted one end of a link, which takes over the pivotted jaw, and to the outer end of which a pawl lever is pivotted, and serves to act on the toothed jaw and force it inwards. At the same time, the lever is brought down parallel with the bar, to which it is secured by a sliding strap.

3728. Production and Application of Ozonised Oxygen for Bleaching, &c., *E. Hagen, Ealing.*—26*th August*, 1881.—(*A communication from L. Q. and A. Brin, Paris.*) 6*d.*

This consists, First, in the electrification or ozonisa

tion of oxygen by placing it in a cool attenuated condition in an electric circuit, which it closes itself, the electric current being continuous or in the form of sparks; Secondly, in the ozonisation of water or other liquids by impregnating it with ozonised oxygen; Thirdly, in the bleaching and purifying of sugary juices and other materials by means of ozonised oxygen, or ozonised water, or other liquid ozonised medium; and, Fifthly, in the apparatus for producing and applying ozonised oxygen and ozonised water.

3736. Glass Holders for Gasaliers and Lamps, *H. Joy, Birmingham.—27th August*, 1881.—(*Not proceeded with.*) 4*d*.

This relates to the application of movable slotted clips to one or more arms of the holder, so that when raised and turned the glass may be withdrawn, but which, when in its closed position, firmly holds the rim of the glass between it and the upper end of the bracket arm.

3738. Heating by Gas, *E. Haskell, Oxford-street, and J. P. Bayly, Paddington.—27th August*, 1881. 6*d*.

The object is to heat rooms by gas arranged in a form to be fitted in ordinary register stoves of any shape, and it consists of a metal case perforated at bottom, and fitted with rough rock-shaped pieces of glass to resemble live coal between the bars of two or more tiers, one above the other, and fixed to the outer case by catches, flanges, or rivets, the outer case being fitted with a cover dropped into a socket or flange to hold the heat, the foul air escaping through three or more tubes at the back of the cover into a condenser of cold water.

3746. Consuming Coal and other Fuel for Heating Purposes, *E. Haulback, C.E., Gray's-inn-road.—27th August*, 1881. 4*d*.

A closed metal box or cage is formed with open spaces all round to admit air, and is supported on trunnions capable of being moved along rails on either side, and also of being inverted, the object being to effect a more perfect combustion without smoke.

3758. Cutting out Fabrics, *J. Fox, London.—29th August*, 1881. 6*d*.

The object is to provide a knife to which an upward and downward movement is imparted through a slot in the cutting board at the same time that a backward and forward motion is given to the same.

3760. Sewing Machines, *H. Bland, Luton.—29th August*, 1881. 8*d*.

This relates more particularly to machines used for sewing straw hats, &c., and it consists in making the arm in the form of a projection from the lower part of the head, and of the smallest diameter practicable, and the needle is arranged so as to operate in an upward direction, the needle bar being in the form of an elongated vertical slide extending from beneath the cloth plate to the upper part of the machine, where it is actuated by a crank. From the lower end of the needle bar projects a block, passing through a slot in the arm of the machine, and carrying the needle, so that while the needle operates from below the actuating mechanism is at the upper part of machine. At the side of the needle bar is a second slide bar with a hook operating in an upward direction and arranged to work at a slight outward angle to the needle, so as to secure greater certainty of retention of the loop, the hook slide being actuated intermittently by the needle bar. The stitching is completed by a single looping instrument placed at a suitable angle to the line of shaft, so that the looping instrument engages the loop of the needle and passes across the end of the hook, and in the descent of the needle the thread is drawn off the looper on to the hook.

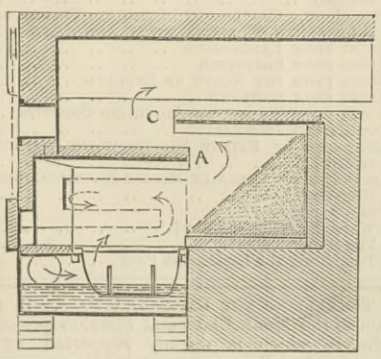
3774. Button-hole Attachments for Sewing Machines, *A. M. Clark, London.—30th August*, 1881.—(*A communication from J. K. Harris, Springfield, Ohio, U.S.*) 6*d*.

The object is to cause an oscillating cloth clamp to feed itself longitudinally forward and backward, that is, while oscillating on one side of a centre line to feed itself immediately in one direction, and when oscillating on the other side of such line, to feed itself intermittently in the opposite direction, the length of feed being self regulating, and always proportioned to the width of oscillation. Also to better work the ends of the button-hole and to simplify and cheapen the whole attachment. It consists of a cloth clamp having an oscillating movement laterally to the line of feed, and a progressive intermittent feed produced directly by the contact of such clamp against a relatively stationary stop abutment; also in a button-hole attachment formed essentially of a bed-plate, an oscillating cloth clamp, a lever for connecting with the needle bar, and devices for connecting the lever with the cloth clamp to oscillate it when the centre of oscillation is between the needle hole and the oscillating devices; also in the construction and arrangement of devices to convert the oscillating movement into an intermittent progressive feed lengthwise of the button-hole, for which purpose a friction clutch and springs are used; and finally in the construction and arrangement of the slip-over devices for establishing a new line of feed parallel to the first for working the other side of the button-hole.

3783. Furnaces, *J. H. Johnson, London.—30th August*, 1881.—(*A communication from M. Perret, Paris.*) 6*d*.

This relates chiefly to the construction and arrangement of fire-bars or grates for furnaces, and it consists in forming the bars with webs of considerable depth partially immersed in water, so as to be continually cooled and thereby protected from rapid deterioration or burning, and in order to prevent the bars breaking under the strain resulting from the difference between the expansion of the part in con-

3783



tact with the fire and the part cooled by the water, the cooled portion is divided by one or more slots perpendicular to the plane of the grate. The spaces between the bars are made widest at top, so as to cause the air passing between them to spread outwards. The drawing shows a furnace adapted to burn pulverulent combustibles, the partitions A B preventing the blast carrying the same into the flues.

3789. Tentering, Stretching, and Drying Fabrics, *C. A. Barlow, Manchester.—31st August*, 1881.—(*A communication from C. Welter, Paris.*) 6*d*.

A series of pipes are placed longitudinally, extending from near one end to near the other end of the machine, and through them steam is passed to commence the drying of the fabric without tension before it is held by the clips or pins. On leaving the preparing machine the fabric passes under the pipes over a drum at one end and returns over the pipes, after which it passes over a series of transverse pipes at the top of the machine, the pipes being grooved, so as to present a large radiating surface. The fabric is tentered or stretched by means of a fly or suitable apparatus extending the whole length of the machine.

3791. Preparing Vegetable Fibres, *W. A. Barlow, London.—31st August*, 1881.—(*A communication from J. Roquet, Paris.*) 6*d*.

This relates to a machine which will effect the two operations of breaking up the external fibres and the ligneous parts, and clearing the fibres from all extraneous bodies, at the same time rendering them supple. The first operation is effected by two pairs of grooved cylinders, the grooves of such cylinders being of different size so as to break and divide the ligneous matter in as small parts as possible; and the second operation is effected by beaters, which expel the foreign bodies, and at the same time produce frictional shocks upon the fibres and strike them against the polished surface of bars placed concentrically to the breaking drum.

3793. Articles of India-rubber, &c., *B. J. B. Mills, London.—31st August*, 1881.—(*A communication from J. J. C. Smith and H. Gelpeke, New York.*) 8*d*.

According to one mode, a sheet of plastic composition, suitable for producing hard rubber by vulcanisation, is laid on a sheet of tin or other ductile metal, and covered with tinfoil, and the connected sheets are then placed between dies and pressed to the required form. In the case of hollow articles formed in two or more parts, a groove is made in the face of each die to produce a ridge, where a junction is to be made, and after removing the tinfoil from the surfaces to be joined, the two parts are united under pressure, and the hollow article vulcanised in water under pressure, the water being admitted to the interior to prevent collapsing.

3796. Lenses for Use in Pavement Lights, &c., *A. M. Clark, London.—31st August*, 1881.—(*A communication from P. Collarmore, Boston, and N. Boyle, Springfield, U.S.*) 6*d*.

This consists, First, of an illuminating lens of semi-prism form, and having an extensive reflecting surface in comparison to the quantity of material used; and, Secondly, in the combination with such lens of metal spurs for preventing slipping and to prevent abrasion of the exposed surfaces.

3797. Bottle-washing Machines, *D. C. Foster, Hull.—31st August*, 1881. 6*d*.

The object is to enable a number of bottles to be washed at one time both internally and externally, and it consists of a number of brushes mounted on spindles in a trough and driven by suitable means, and also of rinsers or jet nozzle fixed on the trough and supplied with water under pressure, racks being provided to hold the bottles inverted over the nozzles whilst being rinsed.

3798. Heating or Boiling Water by Means of Gas or Oil Burners, *L. Dove, London.—31st August*, 1881.—(*Not proceeded with.*) 4*d*.

The apparatus consists of an outer water space or hollow cylinder open at bottom and closed at top, and with which are arranged a series of hollow spheres connected to the cylinder by vertical tubes, and to each other by other tubes. The whole is heated by gas or oil burners, the products of combustion passing off by the opening in the top of the cylinder.

3815. Stay Busks, *H. and B. G. Simpson, Sheffield.—2nd September*, 1881. 4*d*.

The object is to provide a large supporting surface with increased elasticity, and it consists in dividing the bottom end of each half of the busk into a number of strips or fingers spread outward in the form of a fan.

3820. Facing or Enamelling Certain Kinds of Bricks or Tiles, *T. G. Pearson, Dudley.—2nd September*, 1881. 6*d*.

The clay is put into a pug mill or brick machine with a die at the end, through which it is forced in a continuous stream, and then enters one side of a box having adjustable dies at either end and in the interior, so as to admit any sized stream. The box is filled with an enamel composed of Cornwall clay, Cornwall stone, and bone ground fine, and formed into thick "slip," this enamel being applied by a brush mounted in the first compartment of the box, and as the stream travels on it passes through other dies and finally emerges at the opposite end of the box coated with a white enamel, when it is cut off into strips and dried and baked.

3824. Utilising the Volatile Products given off from Coffee-beans while being Roasted, *J. Wetter, Surrey.—2nd September*, 1881.—(*A communication from R. S. Jennings, Baltimore, U.S.*) 6*d*.

The vapours are utilised by saturating a liquid with the products given off from roasting coffee, and at the same time freeing such liquids from other volatile products given off from the coffee, but which would render the liquid worthless until refined.

3828. Raising and Lowering Gaseliers and Chandeliers, &c, *M. Merichenski, Poplar.—2nd September*, 1881. 6*d*.

This relates to means for raising and lowering gaseliers, and is also applicable to corkscrews and other appliances having a like action, and it consists of a screw placed centrally within the case of the gaselier, and secured at top to a spring mounted within a cape. The sliding tubes are fixed to a nut working on the screw.

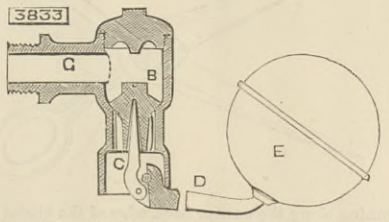
3831. Milking Cows, *A. B. Crees, Ilminster, Somerset.—2nd September*, 1881. 6*d*.

This consists in drawing off the milk by applying a sliding pressure to the teats, so as to imitate the pressure of the hands thereon, and it consists in the use of rollers caused to revolve, and between which the teats are pressed.

3833. Valves or Regulators, *A. E. Lucas, Hatton Garden.—3rd September*, 1881. 6*d*.

The drawing shows the invention applied to a ball valve, but it may also be applied in place of screw-down taps or valves. The cistern being full, the ball E is in the position shown, and its lever D withdraws the spindle C from acting on the valve B, which the

3833



pressure of water in pipe G forces to its seat. When the ball falls, the spindle C raises the valve, and the water enters the cistern. In screw-down valves an excentric on the valve handle stem actuates the spindle C.

3839. Firegrates for Burning Dense and Filamentous or Fibrous Fuel, *C. D. Abel, London.—3rd September*, 1881.—(*A communication from A. Godillot, Paris.*) 6*d*.

This grate is formed of sets of bars arranged so as to form two or more triangular faces set up at an angle to each other and to the furnace bed, with the apex resting against either a flat vertical wall or in the angle formed by two walls of the furnace. The fuel is fed so as to fall on to the apex of the grate in a thin divided layer, whereby the particles are effectually brought into contact with the air, so as to become thoroughly consumed.

3342. Shuttles for Weaving, *S. Tweedale, Accrington.—3rd September*, 1881. 4*d*.

This consists in applying near the eye of the shuttle a pin to receive a small wheel with a milled edge. The weft is threaded between the arms of the wheel, and thence through the eye of the shuttle, and when a "float" or imperfect shed is formed, the traverse of the shuttle brings the milled rim of the wheel in contact with the ends of warp not properly shedded, so imparting rotation to the wheel, whereon the weft is wound around the boss of the wheel and broken. The weft fork motion then, by reason of the absence of weft, comes into operation and stops the loom.

3854. Making Clouded, Flaked, or Spotted Yarn, *B. Norton and C. Turner, near Huddersfield.—5th September*, 1881. 6*d*.

The object is to produce clouded, flaked, or spotted yarn, and consists in placing the variously coloured fibres on the swift of a carding engine previous to being formed into a thread by the "rubbers."

3861. Moulding Machine for Moulding Railway Wheels, &c., *J. Mosedale, West Drayton, and E. Urry, Stoke Newington.—6th September*, 1881.—(*Not proceeded with.*) 2*d*.

A mould is made for casting the wheel, and the tire heated sufficiently for all necessary expansion is placed therein, and the wheel cast, the tire being formed of a dovetailed section, so as to become embedded in the molten iron. A special machine for forming the mould is also described.

3868. Fastenings for Gloves, &c, *W. L. Wise, Westminster.—6th September*, 1881.—(*A communication from N. A. C. J. Ondor, Luxembourg.*)—(*Not proceeded with.*) 2*d*.

This consists in the use of eyelets on each side of the glove opening, and through which an elastic lace is threaded and the ends secured.

3869. Motive Power Engine, *W. T. Whiteman, London.—6th September*, 1881.—(*A communication from B. Roettger, Brunswick, and H. de Bay, Brussels.*)—(*Not proceeded with.*) 2*d*.

This relates to a motive power engine actuated by heat and cold acting alternately on a compound bar, plate, or blade, composed of two metals, the expansion or linear dilatation of which is different.

3872. Extraction of Oleomargarine and other Fatty Matters from Raw Butchers' Fat, *R. Wheen, jun., Deptford Creek.—7th September*, 1881.—(*Not proceeded with.*) 2*d*.

The fat, after proper disintegration, is subjected to pressure while heated sufficiently to cause the fatty matter that it is desired to obtain to liquefy, so as to separate from the other parts.

3873. Preventing the Efflux of Deleterious Gases from Drains, Pipes, &c., *C. F. Rolfe, Westminster.—7th September*, 1881.—(*Not proceeded with.*) 2*d*.

A trap is used consisting of a funnel-shaped casing containing a dish. The inlet dips for a distance below the edge of the dish, such distance representing the depth of the seal.

3874. Looms, *E. Smethurst, Manchester.—7th September*, 1881. 6*d*.

This relates to improvements on patent No. 1027, A.D. 1880. A stationary cop held in a shuttle, or by other suitable means, is employed and fixed in a convenient situation to the side framing of the loom. The "lap weft" from this cop passes through an eye at the top of a vertical sliding rod or bar, which has an up-and-down motion imparted to it by means of a lever connected to its lower end, which lever is actuated by a link connecting it to a second lever, which is moved by an excentric on the tappet shaft. Another similar excentric is screwed on the tappet shaft in the reverse position to the first, and imparts an up-and-down motion to a second vertical sliding rod or bar, which is provided with an arm resting upon the excentric. This rod carries a kind of weft fork, which as it rises and falls continually bears gently upon the lap weft, which passes beneath it and over the face of a plate in which slots are cut, and which is provided at either side with grinding eyes to keep the lap weft in position.

3875. Starting Engines, *A. B. Brown, Edinburgh.—7th September*, 1881. 6*d*.

This relates to engines for controlling the action of larger engines, and it consists in providing such engines with a motive cylinder worked by steam and an hydraulic locking cylinder, the pistons of both being connected, so as to move together. The motive cylinder is provided with a slide valve worked by a rod having both longitudinal and rotary movements, the parts being arranged so that when by a longitudi-

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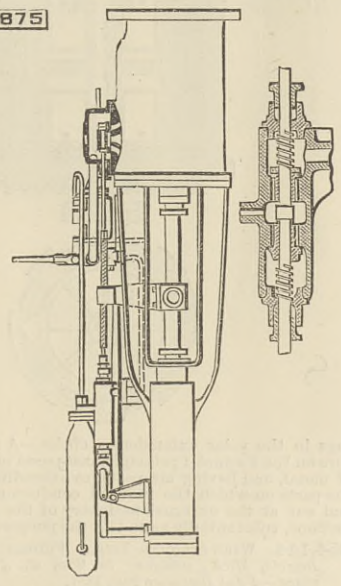


nal movement the valve has been shifted to cause steam to act in one direction or the other in the cylinder, the consequent movement caused by the steam whilst being transmitted to the valve gear of the main engines at the same time imparts to the valve rod of the starting engine a rotation, which by a screwing action restores the valve to its neutral position.

3877. Gasholders, *A. Fleming, Glasgow.—7th September*, 1881.—(*Not proceeded with.*) 2*d*.

This consists essentially in forming the sides or sides and crown or top parts of gasholders with jackets or double casings, the spaces between the inner and outer shells being traversed by heated air or filled with a suitable non-conducting composition.

3879. Apparatus for the Manufacture of Gas for Heating and Illuminating, *A. M. Clark, London.—7th September*, 1881.—(*A communication from F. Egner, Norfolk, U.S.*)—(*Not proceeded with.*) 2*d*.

This consists mainly of a revolving retort heated externally, and provided with inlet and outlet mouthpieces and valves for supply and discharge of coal and coke.

3894. Railways and Tramways, *A. Berhard, Paris.—8th September*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to the shape of rails and to the means of securing them on the sleepers.

3899. Brake Mechanism for Tram-cars, &c., *T. W. Duffy, Liverpool.—8th September*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to the employment of a shaft or shafts with right and left-handed screws thereon, which bring cross-bars with their shoes or chocks up against or away from the wheels.

3900. Loom Shuttles, *J. S. Crowley, Manchester.—8th September*, 1881.—(*A communication from J. S. Jacques and Co., Lowell, Mass., U.S.*)—(*Not proceeded with.*) 2*d*.

This relates to improved bearings for the rollers of shuttles, appliances for holding the spools or bobbins, and also for holding cop tubes on shuttle tongues, improved springs for shuttle tongues, and improved tips for shuttles.

3901. Manufacture of Gas, &c., *J. H. Johnson, London.—8th September*, 1881.—(*A communication from F. Coignet, Paris.*)—(*Not proceeded with.*) 2*d*.

Two vertical retorts of cast iron or cylinders or other suitable material are arranged concentrically one within the other; these retorts are placed in a furnace working by preference with a reversed or return flame, so as to admit of the temperature being suitably regulated.

3903. Utilising a Stream of Water as a Motive Power or as a Brake, &c., *A. Galland, London.—8th September*, 1881.—(*A communication from G. Falconnier, Nyon, Switzerland.*)—(*Not proceeded with.*) 2*d*.

This relates to applying the motive force of a stream of water so as to propel vehicles or a train, or boats, in a contrary direction to the current of a stream, or for such current, or to regulate the speed or effect stoppages, as required.

3905. Casks, Barrels, &c., *H. Blair, Glasgow.—8th September*, 1881.—(*Not proceeded with.*) 2*d*.

This consists essentially in forming or fitting the casks or vessels with an internal bag-like diaphragm of suitable elastic material.

3906. Producing Patterns upon Certain Woven Fabrics, *J. Barlow and J. Warburton, Bolton.—8th September*, 1881.—(*Not proceeded with.*) 2*d*.

In the manufacture of unbacked cloth two warps—fine and very coarse—and two wefts—fine and very coarse—are required. There are eight fine ends between each coarse end and eight fine picks between each coarse pick.

3909. Apparatus for Indicating the Speed and Direction of Motion of Machinery, &c, *J. C. Pattulo, North Shields.—9th September*, 1881.—(*Not proceeded with.*) 2*d*.

By means of a steel rope or other conductor of motion a spindle on the bridge of a steam vessel is caused to rotate at the same velocity and in the same direction as the engine shaft. This spindle works the hand of a dial.

3916. Bicycles, *R. H. Froude, Kensington. —9th September*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to the construction of the seat or saddle and of its supporting spring, so as to enable the rider to change readily the position of his centre of gravity according as he is moving up hill or down hill.

3919. Rollers used for the Printing and Treating of Cloths, Paper, &c., *J. Bardsley, Manchester.—9th September*, 1881.—(*Not proceeded with.*) 2*d*.

The rollers are made of glass or other similar vitreous material.

3923. Explosive Compounds, *W. R. Lake, London.—9th September*, 1881.—(*A communication from P. Sandoz, Paris.*) 4*d*.

One compound is composed of nitrate of potash, 69 parts; washed sulphur, 9 parts; charcoal, 10 parts; metallic antimony, 3 parts; chlorate of potash, 5 parts; flour—preferably rye flour—4 parts; chromate of potash, a few hundredth parts.

3928. Box or Receptacle for Bobbins of Thread, &c., *R. M. Clark, Paisley.—10th September*, 1881.—(*Not proceeded with.*) 2*d*.

This consists of an outer casing divided into a number of divisions in accordance with the number of kinds of bobbins of thread or the like to be held in the box, and of a width about equal to the length of the bobbins.

3930. Manufacture or Purification of Albumen, *W. P. Thompson, Liverpool.—10th September*, 1881.—(*A communication from U. H. Hillman, New York.*) 4*d*.

This relates principally to the process of manufacturing albumen from fish spawn, consisting in adding to the crushed spawn sufficient water to dissolve the albumen and evaporating the albuminous water by boiling under a vacuum sufficiently low to preserve the ready solubility and the coagulative power of the albumen.

3941. Propelling and Steering of Screw Steamers, *F. H. F. Engel, Hamburg.—12th September*, 1881.—(*A communication from G. W. Claussen, Bremerhaven.*)—(*Not proceeded with.*) 2*d*.

This relates to improvements in steering ships by means of the propeller screw.

3942. Striking Mechanism for Clocks, *J. Wetter, New Wandsworth.—12th September*, 1881.—(*A communication from O. O. Lövaas, Moss, Norway.*)—(*Not proceeded with.*) 2*d*.

This relates to a means of simplifying the construction of the striking mechanism.

3947. Velocipedes, &c., *G. M. F. Molesworth, Bideford.—12th September*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to the general construction of tricycles.

3948. Boxes for Containing Safety Matches, *S. Pitt, Sutton.—12th September*, 1881.—(*A communication from F. W. Thompson, Kandy, Ceylon.*—(*Not proceeded with.*) 2*d*.

The outer case and the tray are both formed of thin sheet metal. At the side of the exterior of the case, which is to carry the strip of igniting material, the top and bottom plates are made to project over or beyond the side, and the edges of the top and bottom plates are doubled towards one another, leaving a slight interval between the exterior of the side of the case and these edges, so that a strip of the igniting material may be slipped in between them and be so held along the exterior of the side of the case.

3958. Refining and Crystallising Starch Sugar, *P. Jensen, London.—13th September*, 1881.—(*A communication from Prof. Dr. F. Soxhlet, Munich.*) 4*d*.

This consists in the production of anhydrous crystalline starch sugar by the crystallisation of a mixture of starch sugar and wood spirit.

3959. Refining Starch Sugar, *P. Jensen, London.—13th September*, 1881.—(*A communication from Prof. Dr. F. Soxhlet, Munich.*) 4*d*.

This relates to the method of purifying starch sugar (glucose) by dissolving the foreign substances, which for the most part are unfermentable, and enclosing the solid sugar particles with the aid of ethyl or methyl alcohol, and then separating the thin liquid syrup from the solidified glucose by means of presses, centrifugal machines, or other suitable appliances.

4065. Building Walls so as to Render them Damp-proof, &c., *W. White, Abergavenny.—21st September*, 1881. 4*d*.

The wall is built in two thicknesses with a space between them, which is filled up with a mixture of asphalte, pitch, and sand.

4297. Asphalte Apparatus, *B. D. Healey, Brighouse.—4th October*, 1881.—(*Complete.*) 4*d*.

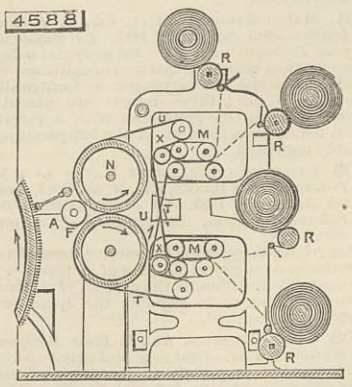
This consists, First, in constructing the apparatus with arrangements for collecting and decomposing the gases from the pan; Secondly, in the use of an overflow spout at the back end of the pan, together with an improved construction of the charging holes and covers; Thirdly, in constructing the central flues of asphalte apparatus with fire-clay blocks and iron combined, and with iron false crown over fire of small-sized apparatus.

4352. Axle-boxes, *G. E. Vaughan, London.—6th October*, 1881.—(*A communication from H. Cristin, Paris.*)—(*Complete.*) 4*d*.

This relates to the application to axle-boxes of a series of rollers with terminal pivots, in combination with notched metallic rings connected by tie rods.

4588. Fleece Dividers for Carding Machines, *C. Pieper, Berlin.—20th October*, 1881.—(*A communication from G. J. Erben, Austria.*) 6*d*.

This relates to apparatus for dividing the fleece produced on a carding machine into slivers, and converting them into round slub or roving to be delivered to a spinning machine. The fleece A detached from the doffer of the carding machine is conducted round roller F to the



main rollers N, which have flat grooves corresponding to the fleece ribbon to be produced, the grooves of one roller alternating with those of the other. In each groove runs a strap exactly filling the same, so as to present an unbroken surface where the fleece is introduced. These straps serve to divide the fleece into as many ribbons as there are straps, such ribbons being delivered by the rollers X to the rubbers M, and finally wound upon the bobbin rollers R.

5004. Tubes for Steam Boilers, and Devices for Securing Same, *W. R. Lake, London.—15th November*, 1881.—(*A communication from J. A. Reed, New York.*)—(*Complete.*) 6*d*.

This relates, First, to a joint between the end of the boiler tube and the tube plate, and consists in forming a V-shaped recess in the end of the tube, and a correspondingly shaped projection to fit such recess on each tube plate; and Secondly, to a cast metal tube, the body of which is in the form of an ogee helix with equal or nearly equal convex and concave curves, and which has circular ends flanged or thickened and small in diameter, but having the same axis as the helical portion.

5116. Incandescent Burners, *H. J. Haddan, Kensington.—23rd November*, 1881.—(*A communication from W. M. Jackson, Providence, U.S.*)—(*Complete.*) 6*d*.

This relates to improvements in devices for producing illumination by the incandescence of a suitable substance heated to a proper degree by means of burning gases or vapours, and is specially designed to utilise the non-luminous gases, such as hydrogen, carbonic oxide, or a mixture of such gases which either possess no carbon whatever, or do not contain it in such condition as to be rendered luminous when burning.

5221. Apparatus to be Controlled and Operated by Electricity for Stopping Trains and Giving Signals on Railways, *W. R. Lake, London.—29th November*, 1881.—(*A communication W. C. Schaffer, Philadelphia, U.S.*) 6*d*.

The apparatus connected to the steam, air, or other means of actuating the brakes, is set in motion or stopped in action by electric contrivances.

5328. Pounding and Cleaning Rice, &c., *S. Pitt, Sutton.—6th December*, 1881.—(*A communication from F. Brotherhood, Charlestown, U.S.*)—(*Complete.*) 8*d*.

This relates chiefly to mills having pestles, which are lifted and released in rapid succession so as to fall at short intervals into the rice to be treated in mortars, and particularly when such pestles are actuated by gripping rolls or revolving nippers acting on lifters to which the pestles are attached, and the objects of the invention are to provide improved gripping rolls and mechanism to adjust them and control their action upon the lifter, whilst admitting of the desirable amount of yield or self-adjusment of the rolls in the pressure or grip upon the lifter; to avoid breaking or straining either the rolls or their supports; to so construct a lifter and adapt gripping rolls to act thereon that it shall be tightly gripped between the rolls at the commencement of their action upon it, and afterwards gradually decreasing the pressure; to provide means for arresting the action of a lifter; to facilitate the operation of the pestle on the rice by presenting different grains to its action on its successive descents; and to provide means for the rapid discharge of the contents of the mortar and admit of its being readily cleaned.

5346. Target Trap, *H. J. Haddan, Kensington.—7th December*, 1881.—(*A communication from J. Reis, Cincinnati, U.S.*)—(*Complete.*) 6*d*.

The object is to furnish a trap especially adapted for throwing those flying targets which are provided with a projecting tongue or other grasping device, and it consists essentially of a throwing lever and clamp, a spring for actuating such lever, another for gradually arresting its motion, an adjustable trigger, a sectional standard, and devices for maintaining the standard at any desired inclination.

5463. Dies for the Manufacture of Horseshoes, *W. R. Lake, London.—14th December*, 1881.—(*A communication from G. Dunning, Chicago.*)—(*Complete.*) 6*d*.

This consists, First, in providing the dies with recess to form toe, heel and side calks, and projections to form the nail holes in the shoes; and Secondly, in the mode of constructing the dies by heating a steel block and forcing into it a former of the desired shape and size, the face of the block being then planed down and the former again forced into it, so as to make the points in the die long enough to form the nail holes in the shoe.

5464. Distilling Alcohol, *K. Trobach and A. Cords, Berlin.—14th December*, 1881.—(*Complete.*) 6*d*.

This consists, First, in the refining or distillation of alcohol, separating the fusel-oil from the alcohol by passing the alcoholic vapours through a compound of asbestos and chloride of barium; and, Secondly, in the combination with the mash apparatus or columns of corrugated boxes, dividing it into compartments in which the compound of asbestos and chloride of barium is placed; and, Thirdly, in the combination with the mash apparatus or column of a conical condenser of corrugated sheet metal.

5569. Revolving Cylinder Fire-arms, *W. R. Lake, London.—20th December*, 1881.—(*A communication from J. A. Wesson, Mass., U.S.*)—(*Complete.*) 4*d*.

This relates to a cylinder stop for a revolver which is controlled in its engagements with the cylinder by the hammer tumbler through the medium of the rear sear, with which the stop that extends through or past the trigger is immediately connected.

5584. Explosive Compound, *H. H. Lake, London.—21st December*, 1881.—(*A communication from S. R. Divine, New York.*)—(*Complete.*) 2*d*.

This consists of an explosive compound composed of a solid ingredient, such as chlorate of potash, and a liquid ingredient, such as nitro-benzole, combined to form the explosive compound by merely causing the mass of solid ingredient to absorb the liquid ingredient, a combination which can be effected by the consumer at the time when and at the place where the explosive is to be used.

5589. Refining Impure Copper, *H. H. Lake, London.—21st December*, 1881.—(*A communication from C. T. J. Vautin, Australia.*)—(*Complete.*) 4*d*.

This consists, First, in refining impure commercial copper by forcing a current of oxygen gas through it when in a molten state; Secondly, in refining impure commercial copper by thoroughly stirring or rabbling into it when molten an oxygen-producing mixture; Thirdly, in refining impure commercial copper by forcing a current of chlorine through or into intimate contact with it when in a molten state; and Fourthly, in refining impure commercial copper by thoroughly stirring or rabbling into it when molten a chlorine-producing mixture.

5590. Door-checks or Devices for Preventing the Slamming of Doors, *H. H. Lake, London.—21st December*, 1881.—(*A communication from L. C. Norton, Mass., U.S.*)—(*Complete.*) 6*d*.

This relates to door-checks in which compressed air is used to cushion a piston which moves with the door as the latter closes, and by which the motion of same is controlled, and it consists in the combination of the cylinder and piston with a cap so as to form a chamber for the compression of air, and provided with two outlets, one adjustable by hand only, and the other automatically.

5596. Cartridges for Blasting Rocks, &c., *H. H. Lake, London.—21st December*, 1881.—(*A communication from S. R. Divine, New York.*)—(*Complete.*) 2*d*.

This consists in making blasting cartridges by enclosing a solid substance in an envelope of cloth or other porous material which will absorb a liquid, and cause the solid substance to become saturated with it, the two substances being such that when mixed together a highly explosive compound will be formed, and preferably consisting of chlorate of potash or its equivalent, and nitro-benzole or its equivalent.

5670. Time-pieces, *W. L. Wise, Westminster.—27th December*, 1881.—(*A communication from W. E. Doolittle, West Haven, U.S.*)—(*Complete.*) 6*d*.

This consists of a timepiece in which the main springs is placed immediately behind the dial, and the time train is journalled in rear of spring, whereby each may occupy the entire space between the pillars and actuate the hands through the axis of the main spring.

5695. Backs and Handles for Brushes, Mirrors, &c., *H. J. Haddan, Kensington.—28th December*, 1881.—(*A communication from W. H. Miles, New York.*)—(*Complete.*) 6*d*.

This relates to the insertion of a metallic rim with crosspieces in the back of brushes, mirrors, &c., made of any brittle-moulded material, the object being to strengthen the same.

24. Removing Flocculent Matter from Spent Acids used in Treatment of Soluble Fibre, *W. R. Lake, London.—3rd January*, 1882.—(*A communication from M. C. Lefferts, New York.*)—(*Complete.*) 2*d*.

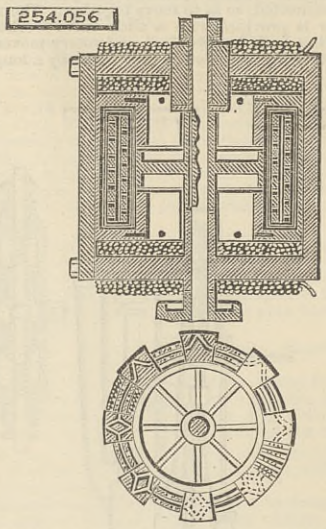
This relates to an improved process for removing flocculent matter from spent acids used in the treatment of soluble fibre, such as nitro-cellulose, gun-cotton, or the like, and consists in mixing with the acid after being used, and consequently containing flocculent matter or sediment in suspension, barium sulphate in powdered form, and then allowing the whole to stand until precipitation has taken place.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

254,056. Dynamo-electric Machine, *William E. Sawyer, New York, assignor to Bernard Lande, same place.—Filed December 3rd*, 1881.

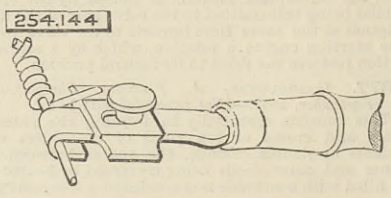
Brief.—The pole pieces of the field magnets nearly surround the cylindrical armature within and without. The armature is cast in one piece, and has air passages extending through those portions upon which the wire is wound, and having external open-



ings in the polar extensions. *Claim.*—A ring armature on the Pacinotti principle, composed of one piece of metal, and having air passages extending through the parts on which the induced conductor is wound and out at the external periphery of the polar projections, substantially as and for the purpose set forth.

254,144. Wire-splicing Tool, *William T. Lemon, Detroit, Mich., assignor to Wm. G. Avery, same place.—Filed December 2nd*, 1881.

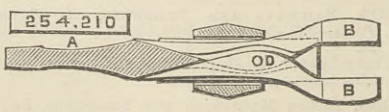
Claim.—The wire-splicing tool consisting of a metallic hook and an adjustable shoulder projecting



laterally from the shank of said hook, the hook being arranged to catch over a wire and the shoulder to engage the free portion of another wire being spliced therewith, substantially as described.

254,210. Adjustable Wrench, *William R. Godfrey, Sidney, Nebr.—Filed August 19th*, 1881.

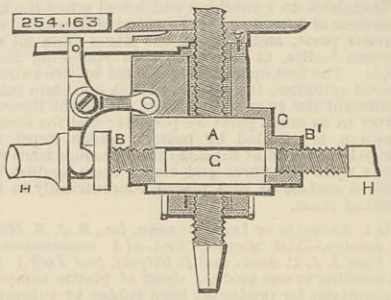
Claim.—As an improvement in wrenches, the combination, with the shank A, provided with straight



screw-threaded portion E having a central longitudinal slot, and a V-shaped portion of the jaws B B, pivotted in said slot and having their tops bevelled to fit said V-shaped portion and the single adjusting-nut C, arranged around portion E, substantially as and for the purpose herein shown and specified.

254,163. Stay Bolt Cutter, *Charles V. Rote, Lancaster, Pa.—Filed November 15th*, 1881.

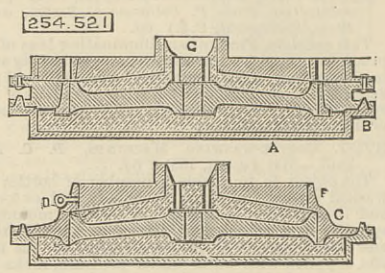
Claim.—In a bolt-cutter, the combination of the



cylinder C, having bosses B and B1, handles H and H1, with cylindrical ends, and the sleeve A, having the groove G, by which the said sleeve is held in the cylinder when the cutter is not being operated, substantially as herein set forth.

254,521. Mould for Casting Car-wheels, *Lucius W. Washburn, Boston, Mass.—Filed January 9th*, 1882.

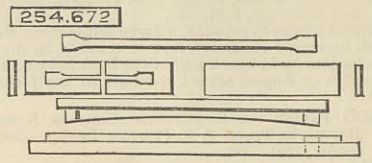
Claim.—The combination, with the base A and cope G of the mould, of the stop-ring consisting of the horizontal flange B and internal incline faces F and



C united by the horizontal face or shoulder D, all being formed of one continuous piece of metal, substantially as shown and described, as and for the purposes set forth.

254,672. Carbon for Electric Lamps, *Hiram S. Maxim, Brooklyn, assignor to the United States Electric Lighting Company, New York, N.Y.—Filed April 25th*, 1881.

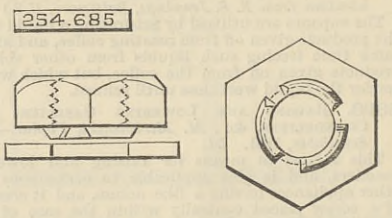
Claim.—The process of manufacturing carbon conductors for incandescent lamps by first carbonising at a high temperature in a flask sheets of proper material



then cutting or punching from these the conductors in any desired shape, and lastly heating the said conductors in a carbonaceous gas or vapour, substantially as set forth and described.

254,685. Nut-lock, *William H. Paige, Springfield Mass.—Filed November 14th*, 1881.

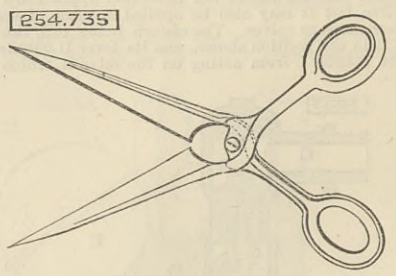
Claim.—(1) The nut A, comprehending the narrow flange or fillet 1, made on one of its faces and provided with transverse openings as 2, the interior of said flange or fillet being made on the same plane as the bore of the nut and its exterior made smooth and inclined or bevelled with reference to its interior substantially as and for the purpose described. (2) In an improved lock-nut, a sectional fillet made on one of



its facings with openings, as 2, between the sections, with the inner side of the sections on the same plane with the bore of the nut, and the exterior side of each section inclined to the interior side, and with one end of each section made thicker than the adjacent end of the next section, substantially as described.

254,735. Corrugated Scissors and Shears, *William S. Van Hoesen, Saugerties, N.Y.—Filed October 17th*, 1881.

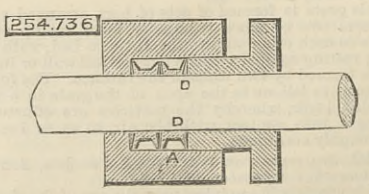
Claim.—Cutting blades of scissors and shears struck up of sheet metal with corrugation or corrugations



running along the near or back edge of the blades and through the handle, terminating in the bows, as and for the purpose specified.

254,736. Steam Packing, *Charles M. Van Tine, Matteawan, N.Y.—Filed July 6th*, 1881.

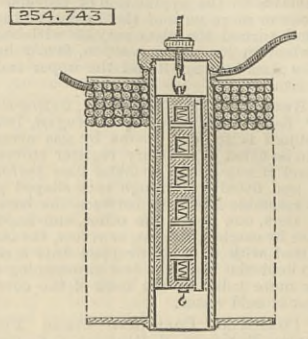
Claim.—(1) A packing ring consisting of a band adapted to closely encircle the rail to be packed, and having a flange or flanges which project outward from the same at an angle greater than



a right angle, and terminate at a point in near relation to the wall of the stuffing-box, substantially as specified. (2) A packing consisting of a ring or series of rings D having the flanges which extend outward at an angle greater than a right angle and terminate in near relation to the wall of the stuffing-box, substantially as and for the purpose set forth.

254,743. Electro-magnet, *Addison G. Waterhouse, New York, N.Y., assignor to the United States Electric Lighting Company, same place.—Filed August 1st*, 1881.

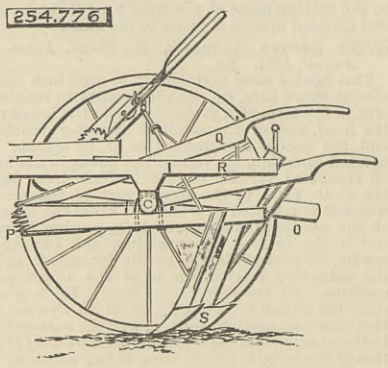
Claim.—(1) An electro-magnet consisting of a hollow core of non-magnetic metal, having a coil or coils wound thereon, in combination with a core composed of independent sections of iron, suspended at short distances apart by means of connections passing



through the sections, which allow the sections to be drawn together when magnetised, substantially as described.

254,776. Cultivator, *Gabriel Martin, Monroe Township, Logan County, Ohio.—Filed July 16th*, 1881.

Claim.—In a cultivator adapted for straddling the row of corn, the combination of supplemental cultivators O S, hinged near their centres to the axle, springs



P at the former end of the beams of said cultivators, handles, or levers Q, extending from said springs to the rear of the cultivator, and racks R, all arranged substantially as and for the purposes set forth.

CONTENTS.

The Engineer, April 14th, 1882.

Tunnelling the Lackmama Pass.—In addition to the Mont Blanc and Simplon projects, a scheme, which is warmly supported by the Austrian and Bavarian press, is being mooted for tunnelling under the Lackmama Pass. A line by the Lackmama, it is contended, would make the best and shortest route between South Germany and Italy. The *South German Bank and Commercial Gazette* states that a company is in the course of formation for carrying out the project.

Cost of Railway Carriage of Rails.—A Sheffield manufacturer writes to the *Sheffield Telegraph* in favour of "canal carriage for Sheffield:"—"The contract for the bulk of the rails for Hull and Barnsley Railway has been placed with Herr Krupp. The water rate from Essen to Hull is less than from Sheffield to Hull. If Sheffield is to prosper we must have water carriage to Hull free from railway control. If money is wanted, as there will be no doubt it will, I shall be glad to subscribe for one."