may be used in propelling vessels, locomotive and other machines, for actuating drills, lathes, and in other mechanical contrivances. *Patent abandoned.*

146 F. P. H. CABUZAC. *Improvements in apparatus for ironing and dressing woollen and other tissues.* (A communication.) Dated January 18, 1865.

This apparatus consists of three ironing tables of dimensions varying according to the nature and requirements of the articles to be operated on; they are hollow, and made of two sheets of metal, the bottoms being flat and the tops, in the case of two, slightly convex; all are covered with cloth or canvas, and heated. When the articles to be pressed and ironed are large, and of stout material, the patentee makes use of a table having its top perforated with small holes to admit of free passage to steam or hot air, the cloth or canvas with which it is covered being of a sufficiently fine texture to allow of its penetrating to the article placed on the table, and thus damp it; after allowing it to remain a few minutes, on brushing, all creases and folds disappear; it can then be stretched and ironed or pressed. For felt hats, or bonnets and other similar materials, he makes use of moulds of any desired form, and made of two pieces of metal, the outer one being perforated with holes, and covered with cloth or canvas. *Patent completed.*

147 W. JEFFREYS. *Improvements in machinery for working switches and signals of railways.* Dated January 18, 1865.

This invention cannot be described without reference to the drawings. *Patent completed.*

148 A. B. BULL. *Improvements in reefing and furling sails.* Dated January 18, 1865.

For the purposes of this invention a boom or spar is attached to the sail midway between its head and its foot; the boom extends from one side of the sail to the other, and its ends project beyond the sides of the sail. To each end of these projecting ends a chain is attached, and some turns of the chain are wound around the ends; the chains are then led up through blocks at the ends of the yard to which the head of the sail is connected, and from them they pass to blocks attached to the mast, and are then led downwards and connected to any suitable hauling tackle. Other chains may also be wound round the projecting ends of the boom which are led downwards and through blocks on the yard to which the foot of the sail is attached, and from thence through blocks on the mast to hauling tackle. In order to reef the sail, the halliards of the sail are eased off, and the chains above mentioned are hauled on, so causing the boom to rotate, and both parts of the sail both above and below the boom are rolled upon it, and this action may be continued until the sail is close reefed. Should it be intended to furl the sail, the sheets are eased off, and the whole of the sail rolled up; the boom will then be close to the yard. *Patent abandoned.*

149 E. DEANE. *Improved bedstead suitable for camp and domestic purposes.* Dated January 18, 1865.

This bedstead consists of an outer jointed framework composed of brass, iron, steel, or any other suitable material, and may be made of solid or angle-shaped bars or rods, or of tubes, the joints being made either as knee joints or sector joints, such length being preserved between the joints that when opened out the bedstead may be of the required length. The joints should be made in the middle of each side of the said outer framework, and also in stretchers provided in the ends and middle of the main side frame. Although the patentee prefers to make the side or outer frames of angle bars or rods, or of tubes, he prefers that the stretcher should be made of solid material. The joints connecting the stretchers to the said side frames may be either knee-joints, so that the action of closing up the bedstead in order to render it portable shall collapse the stretchers and cause them to lie alongside, and preferably to fall within the outer or main framework, which will itself shut up together in similar manner to a carpenter's rule. The legs or supports for the bedstead, when in use, are attached to the outer or main framework aforesaid by similar or suitable joints. These legs are kept firmly in position by means of diagonal ties connected therewith, and also with the side frames or main outer framework by means of studs working in slots (for which a groove might be substituted if desired) in the said frames or outer framework, or by other suitable sliding apparatus; or other arrangements whereby legs are obtained which can be readily shut up and opened out in correspondence with the action of the said outer or main framework may be adopted. The sacking for the bedstead may be supported by lacing the cords in holes near the edge of the main or outer framework, or by hooks for attaching the webbing or canvas, or by other suitable attachments. *Patent completed.*

150 S. BALLARD. *An improved method of cooking, and apparatus to be employed therein.* Dated January 18, 1865.

In cooking, and especially in boiling meat, and other solid articles of food, there is great difficulty in properly cooking the interior; now this invention consists in cooking by the insertion of hollow skewers or tubes in and through the meat or other material to be cooked. This apparatus consists of a hollow tube fitted with a movable point and handle to facilitate the insertion in the meat or other article, which point and handle may be removed prior to the article being boiled, baked, or roasted. After the cooking the handle may be applied to remove the tube, if necessary. The handle and point may be fitted to the tube by screwing or otherwise. Sometimes the patentee dispenses with the movable point. *Patent completed.*

151 J. W. GREGG. *Improvements in street and other lamps and lanterns.* Dated January 18, 1865.

This invention relates to improvements in lamps or lanterns intended either for indoor or outdoor use, the object to be obtained being increased illuminating power, whether using gas, oil, or other inflammable fluid, without increasing the cost of burning, and without materially adding to the expense of construction. According to this invention it is proposed to make the glass of the lamp or lantern, or that part which encloses and surrounds the flame, of a shape tapering downwards, and to form the sides thereof of bent glass, in lieu of flat panes, as hitherto adopted in street lamps, whereby less resistance is offered to the wind. The top or dome of the lamp or lantern consists of an earthenware or china reflector, with or without a metallic covering, which is curved or otherwise shaped to suit the angle of reflection according to the position of the lamp. This reflector may or may not project or overhang beyond the circumference of the top of the lamp, and such projecting part may be made of tin or other bright metal on the underside, or painted white. Where gas is used, the tap or regulator may be situate near the centre of the lamp, and this tap may either be of the ordinary construction, or it may consist of two concentric tubes, one moving up or down inside the other, and having a slot formed therein to serve as a guide. The gas is let in through the inner tube when it is drawn down, and is shut off by pushing up that tube until it is arrested by a stop. At the bottom of the lamp or lantern there is fitted a trap door composed of metallic gauze, which admits air freely and affords access to the interior of the lamp or lantern when lighting. The hot air escapes through suitable apertures at the top. *Patent completed.*

152 W. E. NEWTON. *Improvements in breech-loading fire-arms.* (A communication.) Dated January 18, 1865.

This invention cannot be described without reference to the drawings. *Patent completed.*

153 J. BURCH. *Certain improvements in apparatus and looms for weaving velvet pile and terry-faced fabrics, and a certain mode of procuring designs on such like fabrics.* Dated January 18, 1865.

This invention cannot be described without reference to the drawings. *Patent completed.*

154 J. COULTER and H. HARPIN. *Improved means or apparatus for facing flags or smoothing the surfaces of stones.* Dated January 18, 1865.

This apparatus consists of a circular face plate mounted on a vertical spindle or shaft capable of rotating in suitable bearings, also of a frame supported on friction rollers, and capable of reciprocating over the face plate. Flags or stones to be faced or scoured are fixed upon the face plate betwixt flanges thereon, or by means of portable "dogs," stops, or blocks, temporarily fixed in holes provided in the face plate for that purpose, with wooden wedges driven in betwixt, and other flags or stones to be faced or scoured are placed within the reciprocating frame, resting upon those stones fixed on the face plate. When motion is given to the apparatus the flags in one part will rub those in the other part, sand and water being supplied thereto, as usual in scouring flags by hand. The reciprocating frame is also provided with upright guides for holding the flags on edge in proper position for scouring them. *Patent completed.*

155 W. R. FOSTER. *Improvements in the packings of pistons and piston rods of pumps and steam and other engines, which improvements are also applicable to hydraulic presses.* Dated January 18, 1865.

The patentee claims the application of a flexible tube or tubes as packing in stuffing-boxes and other similar adaptations, having the end or ends of such tube or tubes open and exposed to receive the pressure of the fluid. *Patent completed.*

156 S. F. VAN CHOATE. *An improved system and apparatus for facilitating the working of submarine cables and other conductors of electricity.* Dated January 19, 1865.

This invention cannot be described without reference to the drawings. *Patent completed.*

157 C. D. ABEL. *Improvements in the construction of watches.* (A communication.) Dated January 19, 1865.

This invention cannot be described without reference to the drawings. *Patent completed.*

158 T. MAYOR. *Improvements in machinery or apparatus for preparing cotton and other fibrous materials to be spun.* Dated January 19, 1865.

This invention relates to roving frames and other machines of a similar nature, and consists of an improved arrangement of the centrifugal presser. The presser is provided with a long or deep boss which works on the delivery tube of the flyer at or near its delivering point. In the said boss there is an inclined slot working on a pin fixed to the aforesaid delivery tube, and the length of the slot is so arranged that its ends may act as stops and prevent the presser from being pulled out too far or pressed too far in, and thus avoid any undue strain on the rod of the presser. *Patent abandoned.*

159 A. W. PREDER. *Improved arrangements for coupling steam engines, turbines, or other apparatus employed as motive power.* (A communication.) Dated January 19, 1865.

The patentee claims the system of placing the main or other shaft of one motive power through the main or other shaft of another motive power, so that, by means of clutch boxes, friction plates, or friction cones, the shafts can be connected and disconnected as required, and also the application of this system of coupling to any two shafts through which power is transmitted. *Patent completed.*

160 M. BELTZHOOVER. *Improved method of purifying and odorising metallic ores.* Dated January 19, 1865.

The object of this invention is to eliminate from auriferous, argentiferous, or other metallic ores, any sulphur, arsenic, or phosphorus contained therein, and to oxidise the baser metal thereof. For this purpose the patentee subjects the ore, either pulverised or in lumps, and in a raw or cold condition, to the action of highly-heated hydrogen and carbonic acid gases, tempered by steam, always introducing the ore into that part of the apparatus in which the temperature is the lowest, and removing it therefrom at or near the point of most intense heat. He prefers to generate hydrogen and carbonic acid gases for the improved process by the decomposition of steam and atmospheric air within a suitable fire chamber, which, although distinct from the chamber for containing and treating the ore, is connected and combined therewith so that the gases may freely pass from the former with the latter in an intensely heated state. *Patent completed.*

161 E. D. FARCOT. *Improvements in oars, and in the modes of actuating them.* Dated January 19, 1865.

This invention relates to oars and sculls for propelling boats, scullers, or other light craft or vessels, and to novel modes of actuating the said oars or sculls, and consists, in the first place, in giving to the paddle or blade of the oar, viz., that part intended to immerge and act in the water, certain improved shapes and arrangements affording greater propelling efficiency and lightness than with the oars hitherto in use. For this purpose the paddle or blade, instead of having, as hitherto, its axis situated in a line with the axis of the shank or stock of the oar or scull, deviates from that line at an angle of from 160 to 170 degrees, either in the vertical or in the horizontal plane, or in both, for the purpose of permitting a quicker immersing of a larger portion of the said paddle, which latter, instead of presenting, as hitherto, a flat or slightly convex surface on both sides, may be made more or less concave on the side intended to press against the water. The second part of the invention relates to certain improved modes of causing the motive power to act on the oars or sculls in such manner that if these latter are to be worked by manual power, the rower is by this invention facing the said direction in which the boat is to be propelled. *Patent completed.*

162 E. WILLIAMS. *Improvements applicable to throstle worsted spinning and doubling frames.* Dated January 19, 1865.

This invention has for its object the prevention of the thread or threads from flying off or outwards, and consists in the use and application of a cord or band (made of any suitable fibrous material) stretched horizontally across the frames at the rear or back of the thread, by preference about half way between the rollers and the eyelets, curls, or thread wires which guide the thread or threads to the flys or flyers of the spindle, and as close as possible to the said threads without touching them; and in the use and application of screws or studs fastened to the under side of the thread board about half an inch from the spindle points, and (by preference) situated about half an inch to the left of the said spindle points. The peculiar action of the cord or band is that, if a thread or threads become broken, it is, or they are, prevented from flying outwards by coming in contact with the said cord or band, and held by friction against it until the delivery end is wound round the roller, and the other end taken up by the bobbin. And in the case of snarling or snuffling, the threads are effectually prevented from breaking the neighbouring thread or threads by coming in contact with and being held by the screws or studs hereinbefore mentioned, and are at the same time held by the band or cord until safely taken up or wound round the roller. *Patent abandoned.*

163 G. F. BRADBURY. *Improvements in certain sewing machine shuttles, and in the mode of and tools for manufacturing the same.* Dated January 19, 1865.

The object of this invention is to construct sewing machine shuttles so that they will have greater strength than those of ordinary construction, and so that they can be hardened to resist wear and tear, and so that they may be frequently sharpened when damaged (the point being solid) before they are wholly worn out. The improved sewing machine shuttles are made out of a solid piece of steel or other metal which can be sufficiently hardened after it has been cut into the required form. *Patent completed.*

164 R. MALLET. *Improvements in the permanent way of railways, and in buckled plates to be used therein, the same being applicable to the construction of fireproof buildings, bridges, and other like structures, also in the machinery or apparatus for producing such improved plates.* Dated January 19, 1865.

This invention consists, firstly, in the application of buckled plates of the ordinary construction, or of the improved construction hereinafter described, and of any desired form or contour in plan, to the permanent way of railways for the purpose of supporting the rails thereof, in conjunction or not with ordinary or other chairs, and with or without timber. The essential property of the construction of hollow or other support for the chairs or rails according to this invention, is that the vertical pressure and transverse strains upon the immediate support of the chairs or rails shall be resolved into longitudinal strains of extension and of compression in the material of the buckled or hollow plate or covering plate beneath, and so an elastic support with a minimum weight of material in the supports is obtained. The second part of the invention relates to certain peculiar constructions or modifications of the forms of "buckled plates" to be used in the permanent way of railways, or applied to other purposes, and consists in making the curved or arched portions of such plates of variable eccentricity, as, for example, using a parabolic or hyperbolic curve in lieu of the arc of a circle. *Patent completed.*

165 J. A. SHIPTON and R. MITCHELL. *Improvements in shaping and forging metals and in the machinery and apparatus employed therein.* Dated January 19, 1865.

This invention relates to a new method of manufacturing gas fittings known as "ties, elbows, bends, crosses, couplings," and other gas fittings by machinery worked by steam, water, compressed air, or hand power, such machinery being applicable to shaping and forging other metallic articles. We cannot here give space to the details of the invention. *Patent completed.*

166 W. C. HICKS. *Improvements in steam engines.* Dated January 19, 1865.

These improvements in steam engines consist in a novel arrangement of the cylinders, pistons, and valves, whereby the piston and valve are combined, and are also enclosed within the same cylinder. By this means all external valves, valve gear, and steam chests are dispensed with, and all the principles of operation found in the ordinary slide valve engines are retained, securing thereby simplicity, economy of construction and repairs, portability and durability. In the arrangement four cylinders are employed, the pistons in which receive the pressure of the steam or other fluid in one direction only, or are what is called single-acting. *Patent completed.*

167 T. C. DURHAM. *Improvements in locomotive and other steam engines.* Dated January 19, 1865.

This invention consists in the employment in each cylinder of two pistons with separate piston rods, one of which is solid and passes through the other, which is hollow; each piston rod is connected by a separate rod to the crank. *Patent abandoned.*

168 T. LABEHOUSSE and J. KEILY. *Improvements in dyeing leather.* Dated January 19, 1865.

This invention consists in the application of aniline or analogous colours in the following manner:—The surface of the leather is first brushed over or coated with oil of vitriol diluted with warm water, then the violet blue, purple, or other aniline or analogous dye is applied by a brush or otherwise, after which oil of vitriol diluted with warm water is again applied. *Patent abandoned.*

169 W. CLARK. *Improvements in the manufacture of boots, shoes, saddlery, harness, and other articles.* (A communication.) Dated January 19, 1865.

This invention relates to an improved method of uniting leather and all other articles by means of a solution of gutta-percha, india-rubber, or other equivalent, boots and shoes, and all kinds of harness and saddlery, driving straps, and all articles of leather generally; or fabrics in certain cases may be manufactured according to this invention. The invention consists, first, in exerting considerable pressure on the above-mentioned articles by means of any suitable apparatus and means of compression hitherto known, but particularly by the employment of closed, or partially closed, matrices, enclosing all the parts of the articles in

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process of manufacture which are to be united by means of the adhesive substances. In this manner the articles may be made to assume the form given to the interior of the die. Secondly, in heating the uniting adhesive substances by means of a blow-pipe and heated air, which latter has never before been employed for softening the matters employed for uniting leather or fabrics. Thirdly, in forming hollow articles of leather or suitable fabrics by the aid of compressed air acting on an internal elastic core of india-rubber, vulcanised or otherwise, or it may be other material which may be caused to expand by its natural properties or arrangement. *Patent abandoned.*

170 D. MUNRO and T. WRIGHT. *Improvements in apparatus for painting Venetian blinds and similar articles.* Dated January 20, 1865.

This invention cannot be described without reference to the drawings. *Patent completed.*

171 G. A. CLARK. *Improvements in projectiles.* Dated January 20, 1865.

This invention consists in forming elongated cylindrical or conical-shaped projectiles, with grooves or recesses extending from the point to the base of the projectile in a helical, spiral, inclined, or other direction, the object and intention being by means of the said grooved or recessed channels to cause a projectile thus formed to commence and continue rotating after it has left the mouth of the gun, and during its passage through the air, instead of causing the projectile to rotate before it leaves the gun, as is now the case with projectiles fired from rifled guns. *Patent abandoned.*

172 J. TURNEY, jun., and G. WOOD. *Improvements in machinery or apparatus employed for fluting, dicing, cross graining, glazing, and all kinds of figgered work on skins or hides, and having a self-acting table and revolving friction wheel or roller.* Dated January 20, 1865.

This machinery or apparatus comprises a table or platform to receive the skins or hides to be operated on. This table or platform is made to slide upon a stationary framing, at or near the centre of the length of which, on each side thereof, are secured uprights which support the ends of a framing which lies above the framing. This framing has a rack on one or both sides near the top of the table; these racks receive a spur wheel or wheels secured on either end of a spindle, upon the centre of which is a wheel or roller having a plain or fluted surface. The spindle is supported on bearings in a frame capable of adjustment vertically, and also capable of being weighted as required. The frame and wheel have motion imparted to them so that they may travel across the table from side to side; for this purpose they are connected with a rod attached to the upper end of a rocking lever moved to and fro by a connecting rod attached to a wheel under the table, which wheel is mounted on a shaft furnished with pulleys for receiving a belt from any prime mover. This wheel is also provided with two or more trucks which revolve upon and are carried round with it, and strike upon the tails of clankers or drivers, which rock or drive two wheels, one wheel at either end of an axle which works in bearings on the under side of the table, and lies in a frame attached to the table. The wheels are toothed and take into a rack on each side of the main framing, so that at every revolution of the large wheel the table or platform, and the skin or hide upon it, will be twice racked or moved along the distance of the breadth of the above-named plain or fluted roller. *Patent completed.*

173 J. HEWES. *Improvements in puddling, heating, and other reverberatory furnaces used in the manufacture of iron and steel, and for other purposes, which improvements may also be applied to steam boiler furnaces.* Dated January 20, 1865.

The patentee claims dividing the body of the furnace by a low horizontal arch, so as to cause the flame and heated air from the grate to have their full effect upon the metal on the bed before they escape to the stack or chimney; also the arrangement for admitting air over the fire-place end of the furnace, and for regulating the draught of the furnace. He also claims the arrangement or combination of the parts described and represented for admitting air above and below the fire-grate, and for regulating or controlling the draught of the said furnaces, and for keeping the beds of the furnaces cool. Also the arrangement or combination of the parts of steam boiler furnaces described. *Patent completed.*

174 L. BALMA. *An improved machine for raising and carrying earth, sand, stones, and other similar solid or liquid materials for dressing, ventilating, or winnowing grain, or other analogous purposes.* Dated January 20, 1865.

This invention cannot be described without reference to the drawings. *Patent completed.*

175 C. SEARLE. *Improvements in apparatus for securing studs in shirt fronts and similar garments.* Dated January 20, 1865.

The essential feature of this invention consists in the employment of safeguards consisting of small pieces of leather or other suitable material, in each of which a stud hole or slit is made just large egough to allow of the insertion of the inner end of the stud therein, such pieces of leather or other suitable material being either separate or connected together by fine gut, silken or other filament of a length sufficient to admit of their being placed behind the respective stud holes in the shirt front. When inserting the studs into the shirts they are also passed through the slits in the pieces of leather, and are, consequently, retained securely in their places. *Patent abandoned.*

176 B. F. STEVENS. *Improvements in vulcanising compounds and vulcanised fabrics.* (A communication.) Dated January 20, 1865.

The first part of this invention relates to the preparation of the compound, and the second part to its application to fabrics to render the same impervious to air or water. The invention consists, firstly, in employing a concentrated preparation of sulphur and linseed or other similar vegetable oil, instead of free sulphur, as generally used, and combining this concentrated preparation or vulcanising compound with india-rubber, gutta-percha, or other similar gums, oxide or carbonate of lead, lamp-black, Paris white, or any other colouring matter usually employed, avoiding such as have an offensive odour. Secondly, the invention consists in the application of the said preparation or compound to fabrics, thereby rendering them impervious to water or air; also in coating such prepared fabrics with flocks or similar material to give them the appearance of fine woollen goods. *Patent completed.*

177 W. CLARK. *Improvements in apparatus for taking up and delivering mails and other parcels in railway trains while in motion.* (A communication.) Dated January 20, 1865.

This invention cannot be described without reference to the drawings. *Patent completed.*

178 J. SNELL and W. RENTON. *Improvements in facing woollen cloth and other textile fabrics.* Dated January 20, 1865.

We cannot here give space to the details of this invention. *Patent completed.*

179 W. MATHER. *Improvements in apparatus for facilitating communications between passengers, guards, and drivers of railway trains.* Dated January 20, 1865.

For the purposes of this invention a small air chamber, made of iron or other suitable material, is placed in the guard's van, in which chamber the air is compressed to any required pressure, and by preference by means of water forced in by a simple hand force pump. From this air chamber a small tube or pipe is taken through the roof of the van and connected to a similar pipe which lies along the top of each of the carriages of a train, and also on the tender. These pipes or tubes are permanently fixed, and the connection between carriage and carriage is readily effected by means of india-rubber or other suitable flexible tubes and couplings capable of being quickly joined to the fixed papers or tubes. In this way a complete communication is made between the guard's van and the tender, and also with the intervening carriages. The tubes or pipes on the carriages are furnished with small escape valves placed at distances apart, corresponding to the divisions or compartments of each carriage. These valves are capable of being opened suddenly when a cord or pull on the inside is slackened, or otherwise suitably acted on, so as to cause a weighted lever to which the cord or pull is attached to fall. The lever is arranged with a weight, or it may be a spring, at one end, and a signal board or instrument at the other, so that, when the lever falls, the board or instrument assumes an upright or elevated position, and thereby indicates the particular compartment from which the alarm has been given. *Patent abandoned.*

180 W. CLAY. *Improvements in the mode of working hydraulic lifts.* Dated January 20, 1865.

The object of this invention is to utilise the force of the dead weight of the platform, ram, and other moving parts of the lift when descending. In carrying out the invention the patentee pumps the water that is intended to set the hydraulic lift in operation into an accumulator or receiver, from which the water at a suitable pressure is discharged into the cylinder of the hydraulic apparatus in the usual manner for the purpose of raising the load required to be elevated. When the platform of the lift is descending, either with or without a load, the weight of the load will exert a considerable pressure on the water beneath it, and this pressure the patentee employs to assist in working the pumps which return the water from the lifting cylinder into the accumulator. *Patent completed.*

181 W. E. NEWTON. *Improvements in hammers and pile drivers to be worked by steam or other power.* (A communication.) Dated January 20, 1865.

This invention relates to an improved construction and combination of parts constituting a hammer or pile driver, which presents the following peculiarities:—First, a long stroke of piston, and, consequently, a heavy fall of the hammer, may be obtained with a comparatively limited height of apparatus. Second, great height of the anvil below the framing, and great width between the lower standards of the said framing, are obtained, by which the operation of forging is greatly facilitated. Third, a good vertical direction of the hammer is ensured throughout its entire stroke. Fourth, a cushion of air may be introduced between the cylinder and the hammer so as to prevent the sudden rising or jumping of this latter. *Patent abandoned.*

182 H. A. DOBSON. *Improved carriage step arrangements.* Dated January 21, 1865.

This invention consists in certain mechanical arrangements whereby, in the act of opening the door of the carriage, the step is drawn forward in position ready for use, and when the door is shut it is pushed back under the body of the carriage so as to be out of the way. *Patent abandoned.*

183 T. LESTER. *Improvements in steam engines.* Dated January 21, 1865.

This invention has for its object, first, an improvement in the form of the steam passages for admitting the steam from the steam chest and allowing the escape of the steam from the cylinder with greater rapidity. Secondly, an improvement in the slide valve and in the mode of actuating the same for more rapidly changing the position of the slide, thereby allowing the piston to work with the full power of the steam nearer to the end of the stroke, while by the first-mentioned improvement the back section of the waste steam is obviated or greatly reduced. *Patent completed.*

184 J. G. WILSON. *Improvements in the construction of permanent ways for railroads.* Dated January 21, 1865.

This invention consists in the application of a wrought-iron or malleable cast-iron combined sleeper and chair, made in either one or two parts, the part forming the chair or seat for the rail being shaped to suit the particular form of rail to which it may be applied, the part forming the sleeper being formed so that the ballast is retained by the sides, while with facility the ballast can be beaten in at the ends. The combined sleeper and chair is secured to the rail by wrought-iron tie-rods of suitable shape, the ends of which are screwed and pass through that part of the combined sleeper and chair which forms the seat for the rail, and the web of the rail, the whole being held together by nuts screwed on the ends of the tie-rods; cotters and keys may be used in lieu of nuts. *Patent abandoned.*

185 A. I. L. GORDON. *Improvements in clasps, snaps, or other similar fastenings.* Dated January 21, 1865.

The first part of the invention relates to a variety of clasp or snap used for jewellery and other purposes, whereby the body or fixed part of the clasp is in the form of a box, into an opening in which the tongue or movable part of the clasp fits. In one modification of this part of the invention, the part of the tongue which enters the box has a notch cut in the upper edge thereof, and a catch or tooth upon a lever (mounted on a pivot or pin in the upper part of the box) faces into the said notch; a spiral spring maintains the lever in this position until released by pressing on a projection at the other end of the lever, so as to raise the tooth out of the notch. In another modification of this arrangement the tooth or catch, instead of being on a lever, is formed on a slide. *Patent completed.*

186 J. H. WILSON. *Improvements applicable to pumps.* Dated January 21, 1865.

We cannot here give space to the details of this invention. *Patent completed.*

187 C. D. ABEL. *Improved apparatus for transmitting letter bags and parcels to and from railway trains whilst in motion.* (A communication.) Dated January 21, 1865.

This apparatus consists of a cylindrical or otherwise formed receptacle divided vertically into two halves, each half being hinged to one of two rods projecting horizontally from a swivelling post fixed at the side of the line. This receptacle, when in operation, is suspended at such a height, and projects such a distance over the line, that the tops of the carriages of the postal train pass a short distance beneath it, and when not in operation the post is turned into such a position that the receptacle does not project over the line. The points of suspension of the two halves of the receptacle are in such positions relative to their centres of gravity, that, unless the two parts are held together, they swing on their hinges, so as to open out at bottom, and they will thus let the bag or parcel contained in them fall on to the railway carriage passing beneath; and this opening out is still further accelerated by the action of a spring attached to the post, and made to press upon the top of one half of the receptacle. *Patent abandoned.*

188 J. SNIDER, jun. *Improvements in fire-arms and in ammunition for the same.* Dated January 21, 1865.

This invention cannot be fully described without reference to the drawings. *Patent completed.*

189 M. ROBINSON. *Improved machinery or apparatus for shaping the elastic dents of expanding and contracting combs.* Dated January 21, 1865.

We cannot here give space to the details of this invention. *Patent completed.*

190 J. EDIE. *Improvements in boots and shoes.* Dated January 23, 1865.

In carrying out this invention the inner sole of a boot or shoe is made with a number of perforations, or of a material which is freely permeable, whilst the middle sole is formed with grooves, channels, or holes, which may be arranged in various ways, provided they extend to the outer edge at a number of points, to give free ingress and egress to the atmosphere. With this construction the foot is kept comfortable under extremes of temperature, this being due to the ventilation and the dryness maintained thereby; even if water gets into the boot or shoe by the passages, the heat of the foot, aided by the ventilation, rapidly dries the small quantity that does not drain off again, but if it is wished to completely prevent the ingress of water in wet weather, small tubes of gutta-percha, or other suitable material, may be fitted to the passages instead of these being open at the edges of the sole, and these tubes may be led up over the top of the boot or shoe sufficiently far to be above the reach of wet. *Patent abandoned.*

191 C. B. W. KOEHL and W. GUNTHER. *Improvements in machinery or apparatus for ginning and cleaning cotton and other fibrous materials.* (Partly a communication.) Dated January 23, 1865.

In the specification of a patent granted to the aforesaid C. Brakell, dated 9th of March, 1864 (No. 587), is described an invention consisting in the employment of what is called a roller knife, in place of the ordinary reciprocating knife or beater in combination with the gin roller and doctor, or pressing knife of a Macarthy's cotton gin. Now the present invention consists partly in improvements in the last-mentioned cotton gin, and, like it, the roller-knife consists of a roller or axis having fixed thereon a series of circular plates or discs, or equivalent instruments, the edges of which come nearly in contact with the edge of the doctor or pressing knife, and also with the surface of the gin roller, in such manner as to cause the seeds and refuse to be beaten off, and at the same time to cause the fibres and seeds to be moved to and fro along the edge of the doctor or pressing knife, but according to the present invention the discs on the roller are made to overlap each other more advantageously than heretofore. *Patent completed.*

192 P. M. PARSONS. *A new or improved process or method of treating articles of cast iron and of cast iron mixed with other metals.* Dated January 23, 1865.

This invention consists in subjecting all descriptions of articles of cast iron, other than projectiles, after being cast in any ordinary manner, to a process of strengthening, hardening, and toughening, by plunging them, whilst in a heated state, into a bath of oil or oleaginous fluid, or greasy or fatty matter. The invention has reference to a former patent dated 2nd September, 1864 (No. 2,159). *Patent abandoned.*

193 J. BADCOCK. *An improved method for the suspension of curtains.* Dated January 23, 1865.

This invention consists in suspending curtains by means of hooks, &c., affixed to a tape or band by eyelets or sewing at regular distances, the curtain being sewn to the tape. *Patent abandoned.*

194 E. ATKINSON. *An improved apparatus for containing and dispersing scents and other liquids.* Dated January 23, 1865.

This apparatus consists of a combined reservoir and dispenser constructed substantially as hereafter described. The reservoir for containing scent or other liquid is formed with a neck open at top and with a tubular outlet from the side of the neck or other convenient part. Inside the apparatus the patentee places a bent tube sealed at bottom, and with its curved or bent part made to enter the tubular outlet. This bent tube has a hole formed in its side at a slight distance from the bottom. The dispersing of the scent or other liquid is effected by blowing down the open neck, when scent will be forced into the bent tube through the hole and out through the open mouth thereof, at the same time that air will be expelled with the scent in the state of fine spray from the tubular outlet. *Patent completed.*

195 E. TEMPLEMORE. *An improved window blind cord check.* Dated January 23, 1865.

This invention consists of a brass or other ring to which is secured one end of a piece of strong elastic or elastic tape, the other end being secured to a brass button or clip which is fastened by a nail or screw to the window frame; through the said brass ring passes the blind cord, which may be tied with a knot; the elastic allows for expansion and contraction, and thus avoids the breakage of the cords which so often occurs, and as so great a strain is not required as with the ordinary rack and pulley the wear and tear of the blind roller and brackets are much lessened. By holding the ring and stretching the elastic upwards the blind cord will be slackened, and the blind can be readily lowered by its own weight. *Patent abandoned.*

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197 J. B. WOOD. *Improvements in the manufacture of floorcloths.* Dated January 23, 1865.

The patentee claims manufacturing floorcloth from buffalo or other untanned hides or parts of hides reduced to pulp in combination with fibrous substances, as described. *Patent completed.*

198 A. SHELDON. *Improvements in apparatus for drying paper in sheets.* Dated January 23, 1865.

For the purposes of this invention endless bands, straps, or chains are employed carrying numerous framed trays, in which the sheets of paper to be dried are placed and held by framed lids or covers securely, which endless bands, straps, or chains are caused to move in a suitably heated or ventilated chamber. *Patent abandoned.*

199 T. BROWN. *Improvements in folding chairs and other seats.* Dated January 23, 1865.

For the purposes of this invention two frames are used, a longer and shorter one, which cross each other, and are pin jointed at the intersections of the two frames. The longer of these frames at its upper end carries the back rail against which the back of the person sitting in the chair is supported. The seat of the chair is framed together and is covered with rails of wood, or it may have a seating of cane, or the frame of the seat may be otherwise covered. The front of the seat is attached at the upper ends of the two sides of the shorter of the two frames in such manner as to allow the seat and the frame to which it is attached to fold together one within the other. The back of the seat, when the chair is set up for use, rests on a cross rail which connects the two sides of the longer of the two frames, and the seat is arranged to rest and catch upon such cross rail nearer to or further from the front of the seat, according as it is desired that a greater or less inclination should for the time be given to the back of the chair. The seat is thus the means of keeping the two frames from folding together whilst the chair is in use, but when the back of the seat is slightly raised, so as to free the holding parts from the cross rail, the shorter frame may be caused to fold outside of the lower parts of the sides of the longer frame, and the seat will fold between the lower parts of the longer frame. The back of the seat is prevented by stops from separating from the cross rail beyond what is necessary to free it and allow the seat to go forwards in order to fold down between the sides of the longer frame; when the chair is folded, it will not occupy a much greater space than that occupied by the longer of the two frames. *Patent completed.*

200 W. E. NEWTON. *Improvements in machinery for mowing and reaping.* (A communication.) Dated January 23, 1865.

This invention has for its object to simplify the construction of mowing and reaping machinery, and to dispense with toothed wheels as driving gear for actuating the working parts, and thereby to reduce the friction so that the labour required to drive the machine will be considerably diminished. The invention also consists in the adaptation to mowing and reaping machines of a system of automatic rakes of simple construction for the purpose of delivering the cut corn from the platform of the machine as it moves forward. *Patent completed.*

201 M. A. DIETZ. *Improvements in petroleum and coal oil burners and glasses.* Dated January 23, 1865.

We cannot here give space to the details of this invention. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated June 12, 1865.

1593 W. J. Hixon, Bayswater. Improvements in the permanent way of railways and in locomotives applicable thereto.

Dated June 20, 1865.

1653 P. Carlevaris, Genoa, professor of chemistry. Producing a light applicable to photographic purposes, to lighthouses, and to other illuminations.

Dated June 21, 1865.

1671 W. Roberts, Ranelagh-road, Pimlico. Improvements in machinery for cutting dovetails for joiners' work.

Dated July 1, 1865.

1750 W. E. Newton, Chancery-lane, civil engineer. Improvements in breech-loading fire-arms, and in cartridges to be used therewith. (A communication.)

Dated July 3, 1865.

1760 M. Benson, Hinde-street, Manchester-square, engineer. Improvements in steam pumping machines or engines.

Dated July 5, 1865.

1778 G. Low, Dublin, engineer. Improved machinery for boring rocks and hard substances.

Dated July 6, 1865.

1790 A. V. Newton, Chancery-lane, mechanical draftsman. Certain improvements in the manufacture of superphosphate of lime from guano. (A communication.)

Dated July 7, 1865.

1800 T. F. Henley, Pimlico, civil engineer. An improved material for stuffing seats, cushions, mattresses, and other articles. (A communication.)

Dated July 10, 1865.

1820 W. A. Lyttle, officer of the secretary's department, General Post Office, London. Improvements in the means and apparatus for increasing the mechanical power of steam.

1822 D. Cowan, Rose Cottage, Mansfield-road, Kentish Town. Improvements in lifts for transferring passengers, goods, and heavy weights from the lower to the upper floors of hotels, clubhouses, and other buildings with greater safety than heretofore.

1828 G. Firmin, Henley, Suffolk, flax manufacturer. Improvements in treating and preparing flax for scutching.

Dated July 14, 1865.

1843 J. B. Chatterley, Birmingham, manufacturer. Improvements in the manufacture of cruet frames.

1850 D. and J. Fulton, Glasgow, engravers to calico printers. Improvements in mandrels for rollers, such as are used for printing or embossing.

1852 W. P. Bayliss, Lambeth, engineer. Improvements in apparatus for the locomotion of trains on railways by atmospheric pressure.

1856 A. de Metz, Somerford Grove, Stoke Newington, and T. W. Fry, Downe-road, Clapton. Improvements in railway signals.

Dated July 15, 1865.

1857 R. V. Tuson, St. Paul's-road, Camden Town, chemist. Improvements in the preparation and preservation of foods for animals.

1858 S. Hingley, Hart's-hill Ironworks, Dudley, Worcester, ironmaster. Making skelps for iron or steel tubes direct from the rolls, and for machinery to be used in the same.

1860 J. C. Walker, Craven-street, Strand. Improvements in the construction of springs for railroad and other carriages.

Dated July 17, 1865.

1864 R. A. Brooman, Fleet-street, patent agent. Improvements in pumps. (A communication.)

Dated July 18, 1865.

1867 J. Armitage, Bury, Huntingdonshire, agricultural implement manufacturer. An improvement in drills for sowing seeds and depositing manure.

1868 J. P. Wint, Kensington-square, Kensington. Improvements in instruments used in cutting the soles of boots and shoes.

1870 T. W. Wood, Newark-upon-Trent, Nottinghamshire, corn factor. Improvements in the construction or arrangement of sluices or dams.

Dated July 19, 1865.

1872 J. B. Whitehall, machinist, and T. Pillings, lace manufacturer, Nottingham. Improvements in straight eye clearing guides or cleaners for winding silk, cotton, or other fibrous substances.

1876 M. Knowles, Blackburn, Lancashire, machine maker. Improvements in looms for weaving.

1878 C. Henderson, Parliament-street, Westminster, architect. Improvements in the mode of connecting rails for railways and tramways.

1882 D. Caddick, Ebbw Vale, Monmouthshire, furnace builder. Improvements in the construction and working of furnaces for puddling, balling, heating, and melting metals.

1886 J. Miles, gardener, Roslyn House, Hampstead. Improvements in vermin traps.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

Dated July 21, 1865.

1971 T. D. Stetson, Liverpool. Certain new and useful improvements in the construction of hats. (A communication.)

LIST OF SEALED PATENTS.

Sealed August 4, 1865.

325 R. A. Brooman	382 H. Emanuel
338 C. Langley	385 G. C. and J. B. Hassler
339 A. I. L. Gordon	
342 R. de Bray	386 J. and J. Porter
343 J. B. Watters	387 C. Atherton and A. H. Renton
345 J. Lake	
349 G. Twigg	391 W. Crookes
358 E. Lindner	427 S. R. Freeman and A. Grundy
360 R. A. Brooman	
367 M. Peck	457 W. Clark
368 J. P. Lindsay	1218 W. E. Newton
374 E. Leigh	1219 W. E. Newton

Sealed August 8, 1865.

379 H. W. Hart	436 G. T. Humphris
384 D. H. Barber	449 F. A. Laurent, J. Castelaz, and N. Bassett
388 J. Hall	
395 J. Cass	
399 D. Barr, W. H. Page, and J. C. Newey	450 J. Thompson
	451 R. Smith
402 L. H. G. Ehrhardt	586 W. S. Mappin
403 J. A. Pastorello	590 W. E. Newton
405 J. G. Tongue	615 W. E. Newton
415 W. F. Batho	699 J. Atkins
416 R. J. Jones	703 J. Webb
417 G. Whitton	727 W. E. Newton
419 E. H. Newby	937 P. J. Jamet
420 J. Trotman	1594 A. Robinson

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, August 8, 1865.

853 W. Betts. Labels for bottles.
860 J. Rooke. Double-cylinder steam engines.
874 A. D. Gascon. Digestive elixir. (A communication.)
875 F. Thomas. Kitchen ranges.
881 I. L. Pulvermacher. Fastenings for pins.
894 T. W. Nordenfelt. Covered hammock. (A communication.)
896 W. M. Nielson. Shaping machines.
904 T. Cook. Safes.
910 H. A. Bonneville. Telegraphic apparatus. (A communication.)
916 T. K. Mace. Rib holders for umbrellas.
921 W. Kilby. Winding of silk.
923 R. A. Brooman. Street railways. (A communication.)
924 G. Burt. Ornamenting metal tubes.
933 J. von der Poppenburg. Projectiles and cartridges.
940 F. Brown. Kitchen ranges.
963 J. Vaughan. Steam hammers.
954 W. Moody and W. J. Hubaud. Stringing and tuning pianofortes.
960 A. Millar. Electric telegraphs.
962 J. G. N. Alleyne. Traction engines.
963 H. Simon. Washing ores. (A communication.)
964 J. Bethell. Building barges.
972 C. Eeplin. Regulating the supply of gas.
986 P. Hugon. Gas engines.
987 A. Muir. Breech-loading fire-arms.
1000 T. Skidmore. Safes.
1005 W. Weatherley. Sizing paper.
1009 V. A. Prout. Photographic cameras.
1018 R. A. Brooman. Tapered rods and bits. (A communication.)
1025 W. Clark. Horseshoes. (A communication.)
1050 W. E. Newton. Elastic binders. (A communication.)
1055 A. Westhead. Signalling on railway trains.
1068 W. Clark. A compound for use instead of indiarubber. (A communication.)
1122 R. Canham. Making cores.
1125 E. Lord. Spinning cotton.
1190 E. M'Nally. Shaping metallic articles.
1240 J. H. Johnson. Steam generators. (A communication.)
1646 G. Smith, jun. Locomotive engines.
1698 T. L. Jowett. Bricks.
1704 S. S. Bateson. Croquet mallets.
1748 W. R. Lake. Pressing clay. (A communication.)
1762 S. Wright. Axles for carriages.
1818 G. T. Livesey. Ammoniacal liquors.
1837 T. C. M'Keen. Diving apparatus.
1838 T. C. M'Keen. Elevating ships.
1858 S. Hingley. Skelps for iron or steel tubes.
1868 J. P. Wint. Cutting the soles of boots.
1877 D. M'Crummen. Seaweeds.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2187 T. G. Webb	2203 W. W. Burdon
2193 G. Coles, J. A. Jaques, and J. A. Fanshawe	2206 W. G. Valentia and F. Levick
	2209 M. A. F. Menaous
2198 J. Townsend	2227 J. Tatham
2190 J. Gray	

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1769 J. J. Russell	1799 J. Smith, jun.
1794 S. Carey	1804 J. Walker

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending August 5, 1865.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
2279	0 4	2287	0 4	2294	0 4	2301	0 4	2308	0 4	2315	0 8
2280	0 8	2288	0 8	2295	0 8	2302	1 10	2309	1 0	2316	0 8
2281	0 4	2289	0 4	2296	0 4	2303	0 8	2310	0 8	2317	0 4
2282	0 4	2290	0 6	2297	0 4	2304	0 4	2311	0 4	2318	0 4
2283	0 8	2291	0 4	2298	1 8	2305	0 10	2312	0 4	2319	0 10
2284	0 4	2292	0 4	2299	1 2	2306	1 10	2313	0 4	2320	0 4
2285	2 0	2293	0 4	2300	0 4	2307	1 4	2314	0 6	2321	0 4
2286	0 6										

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennets Woodcroft, Great Seal Patent Office, 25, Southampton buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

TIMBER, duty 1s. per load, drawback 1s.

Teak - - load	£12 0	£13 10	Archangel, yellow -	£13 10	£14 10
Quebec, red pine -	3 10	4 15	St. Petersburg, do. -	11 0	13 0
,, yellow pine -	2 15	3 15	Finland - - -	8 0	10 10
St. John, N.B., yellow	0 0	0 0	Memel - - -	10 0	15 0
Quebec oak, white -	5 5	6 0	Gothenburg, yellow	10 0	11 0
,, birch - -	3 10	4 10	,, white	9 0	9 10
,, elm - -	3 10	5 0	Gefle, yellow - -	10 10	11 10
Dantzic oak - -	3 5	6 5	Sodcrtamn - - -	9 10	11 0
,, fir - -	2 15	3 10	Christiania, per C.,		
Memel fir - - -	3 10	4 0	12ft. by 3 by 9 in.		
Riga - - - -	2 5	3 0	Yellow - - -	18 0	23 0
Swedish - - - -	2 10	2 15	Deals, 1 ask, Dantzic,		
Masts, Quebec red pine	6 10	8 10	over 40 ft. 3 in.	0 14	1 8
,, yellow pine	5 0	6 0	Puncheons per ton	5 0	8 0
Lathwood, Dantzic, fm	7 10	8 0	Oils, &c.		
,, St. Petersburg	8 10	9 10	Seal, pale per ton	40 0	0 0
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.			Sperm body - -	83 10	0 0
			Cod - - - -	50 0	0 0
			Whale, 8th Sea, pale	44 0	45 0
Quebec, white spruce	14 0	18 0	Olive, Gallipoli -	54 0	0 0
St. John, ,,	13 0	15 0	Cocoanut, Cochin	44 10	45 0
Yellow pine, per reduced C.			Palm, fine - -	36 10	36 10
			Linseed - - -	31 15	0 0
Canada, 1st quality -	18 0	20 0	Rapeseed, Eng. pale	46 0	0 0
,, 2nd ,, -	13 0	14 10	Cottonseed - -	26 0	33 10

METALS.

IRON:—		£ s. d.		£ s. d.	p.
Welsh Bars, in London-	per ton	7 15 0	to	8 0 0	5
Nail Rods - - -	do	8 10 0		0 0 0	
Hoops - - - -	do	9 15		10 5 0	
Sheets, single - -	do	10 10 0		11 0 0	
Staffordshire Bars - -	do	8 15 0		9 0 0	
Bars, in Wales - -	do	7 0 0		7 5 0	
Rails - - - - -	do	7 0 0		7 5 0	nett
Foundry Pigs, at Glasg. No 1	do	2 15 6		3 3 0	nett
Swedish Bars - - -	do	12 0 0		12 10 0	5
STEEL:—					
Swedish Keg, hammered -	do	15 0 0		0 0 0	
Swedish Faggot - -	do	16 0 0		0 0 0	
COPPER:—					
Sheet & Sheathing, & Bolts	per ton	91 0 0		0 0 0	3
Hammered Bottoms - -	do	101 0 0		0 0 0	
Flat Bottoms, not Hamrd -	do	96 0 0		0 0 0	
Cake and Tough Ingot -	do	95 0 0		0 0 0	
Best Selected - - -	do	98 0 0		99 0 0	
Fine Foreign Copper - -	do	91 0 0		0 0 0	
Yel. Metal Sheathing & Rods	per lb.	0 0 7½		0 0 8	
LEAD:—					
Pig, English - - -	per ton	19 0 0		2 15 0	5
,, Spanish Soft - -	do	18 10 0		19 0 0	
Shot, Patent - - -	do	22 10 0		0 0 0	
Sheet - - - - -	do	20 0 0		0 0 0	
White - - - - -	do	26 0 0		26 10 0	
TIN:—					
English Block - - -	per cwt.	98s 0d		0s 0d	2
do Bar - - -	do	95s 0d		0s 0d	
do Refined - - -	do	97s 0d		0s 0d	
Banca - - - - -	do	94s 0d		95s 0d	nett
Straits - - - - -	do	90s 0d		91s 0d	nett
TIN PLATES:—					
Best Charcoal, I.C. - -	per box	1 8 6		1 9 0	2
Second Quality - - -	do.	1 7 0		1 8 0	
Coke - - - - -	do.	1 5 0		1 6 0	
SPELTER:—					
On the spot - - - -	do.	22 5 0		22 10 0	nett
ZINC:—					
English Sheet - -	do	27 10 0		28 0 0	2
QUICKSILVER - - -	per btl.	8 0 0		0 0 0	

FRENCH & SMITH, Sworn Brokers Brabant-court, Philpot-lane, E.C.; and 4, Rumford-place, Liverpool.

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THE
MECHANICS' MAGAZINE.

LONDON: FRIDAY, AUGUST 18, 1865.

THE ATLANTIC TELEGRAPH.

UP to the present time—Wednesday night—more than fourteen days have elapsed since, after a successful run of 1,200 miles made by the "Great Eastern," the signals through the cable suddenly ceased. The cause of that cessation has been ascertained with certainty to arise from loss of insulation—that is to say, the gutta-percha is to some considerable extent removed or torn away from the copper conductor—and this accident would seem to exist at about 1,175 miles (of cable) from Valentia; but whether the cable is altogether severed from the ship, or whether the exposure of the conductor is unattended by a breakage of the outer wires, cannot with absolute certainty be decided, although opinion leans to the affirmative. But what has become of the "Great Eastern" and her comrades? Allowing her four days to await the effects of the disturbance of the earth's magnetism, communicated to the daily papers by the Astronomer Royal, there are yet ten days of absence unaccounted for, being amply sufficient for her own return, and twice as much as would have been needed for the return of H.M.S. "Terrible," which is a powerful vessel capable of doing ten knots per hour. Amid the maze of conjecture that has been constructed upon the subject of her absence, there are only three probable suggestions as to the reason of her non-arrival, putting out of the question any serious accident to herself, which may be very fairly done, as in that case one at least of the attendant ships would have certainly come home ere this to report. The first is, that being engaged in deep water she might have run back for several hundred miles into a depth where there was a better chance of hooking up the cable with a view to underrun it; and that she may even now be engaged in the latter process. This explanation, of course, presupposes an absolute break of the cable. The next is, that the cable not being broken, she is endeavouring to haul on board until the fault is arrived at, with a view to cut it out and go forward. In this case the distance to be picked up being about seventy miles, and the rate of picking up about an eighth of a mile per hour, her time of absence would still be accountable. A third solution of the difficulty is this. It had been arranged before starting that, if sufficient surplus cable remained after connecting Ireland with Newfoundland, it should be used in laying for the New York, Newfoundland, and London Telegraph Company a new line of communication between Placentia Bay, Newfoundland, and Cape Breton, to form a link in the main line to New York, existing lines being very deficient. It may be that, having tried all possible means to restore the fortunes of the broken Transatlantic line, it has been thought desirable to use the remaining cable to effect this object, and replace the cable so used by new cable, to be constructed on the return of the "Great Eastern." Even on this hypothesis, however, it is somewhat singular that one of the vessels should not have returned. We have no doubt, however, that one or other of these three events is the cause of the "Great Eastern's" detention.

It has been suggested that the route chosen by the Atlantic Company is in fault, and that the northern route, by Iceland, Greenland, and Labrador, with a land line of about 700 miles beyond the latter to Quebec, or the southern route, to the Azores, and thence across to the banks of Newfoundland, would escape the risks attendant upon the direct line; but really, the adoption of either of these routes, the question of which has again and again been most carefully discussed, would simply be adding unknown difficulties and unsolved problems to those already known and solved. If the difficulty be depth of water, which it has been abundantly and most practically proved not to be, then this difficulty is much increased both by the Azores route and the Greenland route. If it be that the distance between each stepping stone is less, then, deducting the 650 miles of shallow water from the old Atlantic route, in which shallow water it is admitted any engineering operation can be performed without danger, then there are 1,000 miles only of *deep* water in the direct route, which will compare favourably, even as to length, with the deep water portions of both northern and southern routes. If we add to this that the Azores are surrounded by submarine volcanoes, which are perpetually at work, and not unfrequently manifest their action in clouds of steam upon the surface of the ocean—if we add, too, that the total cost and mileage is greatly in excess of the direct route; that the direct route is British soil on both sides, while the Azores and Greenland routes are both foreign—if we consider that Greenland could, owing to ice, only be approached during six weeks in each year, the navigation even then being very difficult, and the chances of fracture to the cable enormous; and further, that if landed on the Labrador coast it would have to be connected with civilised America by a land line of 700 miles, through the most desolate and inhospitable country of the world, it may well be doubted whether it would be advisable to exchange for such a state of things a route which has once been successfully spanned, and along which three hundred messages have been transmitted, and which failed through no geographical defects, but simply from the absence of a well-constructed cable.

Since the foregoing was in type the impenetrable mystery which has for so long shrouded the fate of the Atlantic telegraph cable has been solved, as will be seen by the following copy of a telegram from Mr. Varley, on board the "Great Eastern" steamship, at Crookhaven:—

July 24.—Partial loss of insulation when seventy-four miles of cable paid out, depth 500 fathoms; recovered ten and a half miles of cable. Cut out fault, and started again next afternoon. Detention thirty-eight hours.

July 29.—Total loss of insulation when seven hundred and eight miles paid out. Picked up two and a quarter miles, cut out fault, and sailed same day; depth 2,000 fathoms. Detention eighteen hours and three quarters; insulation of submerged cable more than doubled, and conductivity considerably increased.

August 2.—Partial loss of insulation when twelve hundred and twelve miles paid out; recovered two miles, depth 1,950 fathoms; fault still overboard, when cable fouled hawser pipe and broke, in consequence of damage sustained in clearing it therefrom.

August 3 to 11.—Moored two buoys, grappled four times for cable, and hooked it three times. On each occasion after lifting it several hundred fathoms from the bottom tackle broke close to bow of vessel; all the grappling rope being lost, obliged to return; all entertain hopes that lost end of the twelve hundred miles can be recovered and the line successfully completed to Newfoundland.

We append the following copy of Reuter's telegram, which we received subsequently to the above:—The "Great Eastern" proceeds direct to Sheerness. All well on board. She reports having parted company with H.M.S. "Sphynx" a few days after starting. The weather was for the most part very calm, but often foggy and rainy. A stiff breeze blew on two days, but although the sea washed over the "Terrible," scarcely any motion was observable on board the "Great Eastern," her greatest roll being 7½ deg., and her greatest pitching 1 to 1¼ deg. The cable payed out beautifully, and owing to its diameter and lightness the strain required to prevent too rapid egress never exceeded 14 cwt. Its angle with the horizon during the paying-out rarely exceeded 9½ deg. No difficulty whatever was experienced in mooring the buoys in the deepest water, two having been left behind moored with pieces of cable that had been picked up from a depth of two miles. One of them rode out a stiff summer gale, its position after nine days being unchanged. Captain Moriarty's chronometers found the true position of the ship to within a fraction of a mile. The "Terrible" has sailed for Newfoundland to coal.

THE PATENT LAWS.

NEARLY two years and a half ago a royal commission was appointed to inquire into the working of the laws relating to letters patent for inventions. The attention of the commissioners was directed solely to this point with the view of introducing into it improvements or amendments of detail. After two years of attentive consideration the commissioners issued their report, which recommended sundry alterations in, and additions to, the present code of laws. But beyond the publication of this report and the accompanying recommendations — both of which we discussed at the time—nothing was done. The practical result of the proceedings was to establish the efficacy of the present system in general, and to show that the only thing necessary to adapt them perfectly to the wants and requirements of the present day, was to establish a more satisfactory method of trying the validity of patents. In the main the commissioners may be said to have left the patent laws just where they found them. But there was an under current at work in the minds of some of the commissioners; Lord Stanley, the chairman of the commission, being especially influenced thereby. Their inquiry was limited by prescription to the working of the laws with a view to their amendment, but the minds of some appear to have been directed to the entire abolition of the patent laws. Such in effect were the sentiments expressed by Lord Stanley last week at the Liverpool Chamber of Commerce, and these sentiments have found an echo in the daily press. Such in effect, too, are the sentiments indulged in, if not openly expressed, by certain of our wealthy manufacturers, who find it does not always agree with their businesses to recognise the rights of patentees. Lord Stanley, whilst prosecuting the inquiry set before him, appears to have taken an independent view of the case—a view peculiar to himself—and so to have arrived at the conclusion that patents for inventions in the main effect more harm than good. He therefore suggests a commission of inquiry, to examine into the broad question of the desirability of granting patents for inventions at all.

This may appear a dangerous doctrine to disseminate, but in reality it is one which we might with safety leave to find its own level, and the injustice apparent on the face of it is a sufficient guarantee that that level would be a very low one. However, we will look at the case as Lord Stanley puts it and as it really stands, for, although there may be much to be said on either side, it by no means follows that there is the same amount of equity on both. Lord Stanley would have us believe that, under the actual administration of the law, patents for inventions do more harm than good, and that no mere administrative improvement would be an effectual remedy for the "abuses" which he sees. These "abuses" consist, firstly, in a multiplicity of patents, so many being granted for trifling inventions, and next, in a monopoly of patents by reason of wealthy manufacturers buying up all the patents they can secure relating to their businesses. Then we are told of the injustice done to five men out of six who may have been working out the same idea, whilst only one can obtain a patent, by reason of which the other five are

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deprived of the fruit of their labours and are prohibited from using their own inventions. Lastly, there is the great expense attaching to the trial of patent cases, which acts as a bar to the poor inventor, whether proceeding on the offensive or defensive.

Upon the first point advanced by Lord Stanley, that there is a multiplicity of patents, we would observe that no better proof of the inventive genius of the age can be afforded, than by this very circumstance. As to the patents for trifling inventions, they are in many instances more beneficial both to the public and the patentee than those of the more ponderous and elaborate class. As a case in point we may notice Mr. Greaves's wooden thimble or washer, for securing iron spikes in railway chairs. This useful little invention has saved railway companies thousands of pounds in the aggregate, and has materially benefited the patentee. Next, as to trade monopolies, and the buying up of patents. This point is scarcely worth the trouble of refutation, for it is so self-evident that the same influence would be at work, were there no patent rights, to buy up secret inventions from which the public would never derive one atom of benefit; whereas, however extensively patents may be bought up, they must become known and be the property of the public on the expiration of their respective terms. Let us glance for a moment at the working results of secret inventions. It is now over twenty-five years since Mr. Bessemer commenced the secret manufacture of bronze powder. His machines produced the article at a cost of six shillings per pound, which by hand labour was made and sold for four pounds; and even now, nine years after the patent would have expired, the material could be sold for one third of the price he is making, and yet yield ordinary profits! The public are now entirely ignorant of his method of manufacture, the article is comparatively very little used, and the high prices are maintained. Had he taken a patent the invention would have become public property nine years ago, competition would have caused a considerable reduction of the price, and bronze powder would have been much more extensively used. As to the unfortunate five men out of six who fail to obtain a patent for an invention, all we can say is that the man who obtains it certainly deserves it. It is by no mere accident that he obtains it—he has tried for and won the prize; either in intellect or energy the other five must have been comparatively deficient. And so in every department of life, the best, as a rule, must be first. But speaking from practical experience, it is the very rarest occurrence for even two men to achieve the same invention at the same time. It is a far less frequent matter to hear five men lay claim to the invention of a sixth which, but for something or other happening, *they* would have patented, and of which, for all that they have not done so, they persist in accounting themselves the inventors. With regard to the expensive character of patent litigation, Lord Stanley only utters a complaint which applies to the general principle of legal proceedings. We agree with his lordship that the costs are heavy, not, however, in relation to patents alone, but in all cases which become matters of litigation in this and most other countries.

There cannot be a question that the repeal of the patent laws would result in a general standstill in all inventive departments. Were there no special reward in store for inventors, there would be no inducement for them to apply their energies to the development of improvements in the arts, sciences, and manufactures, and in a broad sense improvement would cease. There would be no inducement for a man to apply himself for years to the task of inventing a machine or discovering a process of manufacture, if, as soon as he had perfected his ideas, the results should become public property, and he be deprived of the benefit of his labours. Who would suppose for a moment that the late Mr. John Fowler would have spent years of time and thousands of pounds in perfecting the steam plough had he not had in view the protection of his inventions in order to realise an ultimate profit, whilst at the same time his country would be materially benefited? In conclusion, we repeat what we have ever asserted, that the grant of a patent is a fair bargain between the Crown and the inventor; he, on the one hand, enjoying the monopoly of his invention for fourteen years on the condition that at the expiration of that period the public enter into full possession thereof.

AN ANGLO-INDIAN RAILWAY.

THE practicability of a direct railway to India was discussed some ten years since, when the route suggested was from Calais, as a starting point, through Ostend to Cologne. The line was to pass thence by Augsburg, the Lombardy provinces, and the Principalities, onward to Orsova, on the borders of the Ottoman Empire. From Orsova the line was proposed to be continued to Constantinople, and thence to Bassorah. From Bassorah the course was to be through the plains near the side of the Persian Gulf, through Beloochistan, where it would enter India across branches of the Indus, which were to be bridged for the purpose. It was proposed that about nine hundred miles of the line should follow the course of the valley of the Euphrates, the length from Babylon to Bassorah being across a sandy plain, which is said to have a fall of six and a half inches per mile. Although the feasibility of this scheme was never questioned, yet, somehow or other, it did not attain any importance, and never passed beyond the stage of ideality. A few years subsequently to the time when the foregoing scheme was mooted, Mr. William Pare suggested a direct Indian railway through Europe, Turkey, and Persia to Bushire and thence to Kurrachee. This involved a bridge over the Bosphorus, and Mr. R. M. Ordish prepared a design and estimate for a wire suspension bridge capable of meeting all the requirements of the case, and which would cross the Bosphorus at a point where it is nearly half a mile wide in one main span of about two thousand five hundred feet. This scheme, however, like the previous one, never came to anything. But the attention of the public in India, and especially that of the British residents, is just now being turned very seriously to the construction of a direct railway from the Straits of Dover to Calcutta. This scheme is now propounded by Sir Macdonald Stephenson, and is over the same route as that proposed by Mr. Pare, and which, as far as Bushire, has always been considered practicable. Not so, however, that portion between Bushire and Kurrachee, the character of the country between those two points being comparatively unknown.

The circumstance which has brought the subject so strongly into notice of late is Lieutenant-Colonel Pelly's recent exploration of some portions of the route which were previously unknown. The journey was made through the district from Bunder Abbas to Cape Jask on the eastern side of the Persian Gulf, and was undertaken with the view of determining whether the route was suitable for the erection of an independent line of telegraph, for facilitating communication with Europe. On his return Lieutenant-Colonel Pelly reported the route to be more favourable for railway than for telegraphic purposes, inasmuch as the district was liable to floods which could be better withstood by a railway than by a telegraph. Some idea of the favourable character of the country may be gathered from the fact that Lieutenant-Colonel Pelly performed the whole journey on camels. This he could not have done had not the route been for the most part through dry arid plains which skirt the shore of the sea. Further inland there is higher ground, the country in such case being richer. The people met with along the route are said to be simple and inoffensive, but they would not furnish an adequate supply of labour in constructing this portion of the line. Neither would the country along the Mekran coast afford sustenance to large bodies of men engaged on works of this class. But there are alternatives in either case; labourers can be brought from a distance, and fed from stores which might be established along the sea coast. There, however, appears to be one other difficulty in the way, but as it is an engineering question we know that it is not a whit the less surmountable than the others. This is the occasional floods to which the country is subject, and which at times render it impassable for camels. These floods are due to the rush of waters from the higher lands, after heavy rains, finding their way in immense sheets to the sea. But this simply involves extra expense and care in the first instance in constructing the line, which can easily be made capable of meeting all such contingencies.

In a commercial point of view, the importance of the scheme cannot be overrated, nor can its success be questioned. That such a line would pay is certain, from the circumstance that it would unite the two richest known countries, thus developing a trade at present dwarfed and stunted from the slow and costly nature of transit. As with the through traffic so with that of a local character, most of the countries traversed by the line possess their special commercial features, and some of them are traversed by railways which would prove of advantage to the scheme in question. With regard to this last point, the trunk line might be found available for uniting the somewhat complex system of European lines. The facilities of transit offered by the proposed railway are something wonderful when compared with those at present available. The combined sea passages from Marseilles to Alexandria and from Suez to Calcutta represent a length of five thousand six hundred miles, whilst the entire length of the journey from London to Calcutta by Sir Macdonald Stephenson's route would be but little over five thousand miles. In point of time this line would bring India within a seven days' journey of London, whilst under existing arrangements the traveller from Calcutta reaches Marseilles in a month, and between Bombay and Brindisi there is a fortnight's sailing. There need be little fear entertained for the success of this project; it cannot fail to meet with the support of Government and people, both at home and abroad. Besides commercial interests there are many others which would be found ready to enlist in the cause. It would, in fact, be an object which all nations might combine in promoting.

THE NAVIGATION OF THE THAMES.

ONE of the first acts of the new Parliament will be to discuss the provisions of a bill which is proposed to be introduced by the Board of Trade, for improving the navigation of the upper portion of the Thames. A Select Committee appointed by the House of Commons has reported in favour of placing the upper and lower portions of that river under the management of the Thames Conservancy Board, and the consequent repeal of the Act of 24 George II., chap. 8, and five subsequent acts, which gave to the Commissioners jurisdiction over the Thames between Staines and Cricklade, a distance of 107 miles, but navigable only for 80 miles. To understand the change proposed, it is necessary to state that the Commissioners are at present about 800 in number, and that they comprise landowners, bondholders, the members of Parliament for Middlesex and Surrey, for the cities of London and Westminster, and the borough of Southwark, and for four counties, including their cities and boroughs. There are also rectors and incumbents of the several parishes that border on the Thames, and mayors, recorders, &c. These are the nominal Commissioners, but the working members consist of fifteen representatives of five districts,

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who are controlled by the Commissioners when they choose to call a general meeting. The Commissioners are not a corporation, and their powers are so restricted that their office is almost a misnomer. The mill and lock owners of the river exercise authority independently of them, and charge tolls too high for the public to pay, and for the support of locks that do not really exist. The navigation of the Thames is seriously impeded in several ways; the locks are in a dilapidated and dangerous condition; some portions of the river are overgrown with weeds; the banks have been in several places undermined; the sewage discharged into the river by thirty-two towns is a great impediment; embankments that have been erected by landowners for the reclamation of land have contracted the water-way; and, to close the list of evils produced by years of mismanagement, the Commissioners are in debt to the extent of £84,400, with the interest on borrowed sums. They are individually responsible for this state of things; although it is extremely improbable they will have to wipe off the debt incurred by a series of circumstances over which, for the most part, they had no control. Unless the Commissioners had greater powers given them, and the existing rights of old lockowners had been abolished, we do not see that they could have improved the navigation of the river.

In the course of the evidence given before the Select Committee, it was proved that the pound locks on the river are in such a bad state that the general surveyor is in daily fear of their falling down, and thus stopping the navigation. Mr. S. W. Leach, the engineer to the Conservators, stated that he would not answer for their maintenance for a month; and Mr. J. Castle, the general surveyor to the Navigation Commissioners, said that the gates and weirs were so leaky that they did not sufficiently store the water, many of the gates being in such a bad condition that they could not be opened. The towing-path bridges have been used for years as footways, although they are in such a rotten and insecure state that accidents might easily happen by their use. The bed of the river is not sufficiently kept open for the purposes of navigation. The part between Cricklade and Lechlade, and another part above Oxford, which was navigable five-and-twenty years ago, is now so grown up that "two persons in a flat-bottomed pleasure boat could not go up it in the summer time in consequence of the bed of the river being silted up."

It will be necessary to expend between twenty and thirty thousand pounds in putting the navigation into an efficient state. If that is done, it is expected that the traffic will be diverted to a considerable extent from the railways. It appears that under the present acts the Commissioners are obliged to levy one uniform toll upon all description of barges, which, of course, is a great impediment to the traffic of the river. It is highly desirable that a toll varying in amount according to the nature of the traffic should be charged. For instance, the traffic in coal might be largely increased by the lowering of the toll. Already the traffic is great, notwithstanding the locks are unable to carry a very large amount. The cost of transit of coal from Staines to Oxford is stated to be 4s. 1d. per ton, and the old lock tolls would bring it up to 6s. 7d. Railways, on the other hand, charge considerably less than 1d. per ton per mile. Mr. Graham, the general clerk to the Commissioners, says, "I believe that we should have a great deal more coal than is now brought up the river from the Pool (supposing the tolls were reduced) from the North-country and the Welsh and Midland districts." The principal traffic would, it appears, be from the Oxford Canal and not from London. Hitherto, a large proportion of the traffic on the Thames navigation is supplied from the collieries on the Ashby-de-la-Zouch Canal. Mr. Woodhouse, an agent for these collieries, states that, out of 4,600 vessels sent down this canal, about 600, with a total burden of 17,000 tons, passed into the Thames navigation below Oxford. It was the opinion of this witness that the railways did not afford adequate facilities for the coal traffic, and another gentleman stated that a little competition would be of advantage to the general public. Mr. Woodhouse's opinion is very favourable to the conveyance of coal by water. He states that the coal from the Moira and Gresley collieries is of a dry splint description, not at all bituminous, and as it is necessary for the purposes of the traders that it should store or stack, it has to be conveyed in large lumps. "That sort of coal is carried much easier and much better, and with less breakage, by the quiet mode of transit over the canal, where there is no bumping as there is on the railway, than it is carried by the railway. We send large quantities of coal by railway as well as by canal, but we find great inconvenience on lines of railway from the breakage arising from shunting, damaging the coal most seriously, and from the detention of waggons and want of wharf room and stacking accommodation at the railway terminals." Evidence was given showing that on most of the railways the traffic is choked at present, and that great inconvenience has resulted therefrom. From a table published in the appendix of the report we learn that the relative quantities of coal supplied by rail and canal in the neighbourhood of the Thames from the above-mentioned collieries were—in 1863, by river 18,089 tons, by rail 1,779 tons; in 1864, by river 16,298 tons, and by rail 2,826 tons. The owners of collieries do not find the detentions from delays on the canals so serious as those on railways, as they expect, at certain seasons, to have the traffic hindered, whereas on railways it is impossible to know what to expect. It was considered by Mr. Woodhouse that canals successfully compete with railways in the coal traffic. On the Oxford Canal, for instance, the cost by horses is one halfpenny per ton per mile; but by steam-tugs, which reduce the hauling power one-half, the cost is little under a farthing. It is therefore evident that there is room for both canal and railway traffic in coals.

English timber is sent downwards from Oxford and Reading and upwards from London. At one time large quantities of iron, stone, slates, corn, and groceries, were carried by the river; but in consequence of the discreditable condition of the stream the traffic has passed to the railway companies. If increased facilities were given, and reduced tolls established, there is no doubt a considerable traffic in heavy goods would be the result. Mr. Richard Gillett, the engineer and manager of the Oxford Canal, gives the only alternative which a Birmingham iron merchant is obliged to adopt in the transit of his goods to Reading:—"He does not know what he will have to pay, there being so many charges over the Thames; his only chance is to give the man who goes with his vessel a sum of money; but, as a class, these men are not to be trusted with money. The consequence is, he is compelled to send by railway. A man taking a contract cannot send his goods down by water, the Thames charges are so extremely high; and not only that, they cannot be got at—the whole system is obstructive."

Another most important question which demands attention is the prejudicial effect upon the London water supply if the navigation works are not put into immediate repair. The professional witnesses were not agreed as to this matter. It is clear that if the navigation works were abandoned the water supply would equally come through the valley of the Thames. But the question which engaged considerable attention was, whether that supply would be as sure and regular in its quantity. One witness considered that there would be more water in winter time than in summer. Mr. Leach, on the other hand, thought there would be no material difference, and that the principal prejudicial effect would be in allowing a larger growth of weeds, which are said to make the water bitter. It was a received opinion, he continued, that "the disturbance which water undergoes in falling over the weirs tends to purify it." The three water companies have the power to take 60,000,000 gallons of water per day at Hampton Wick. It has been computed that the smallest quantity which fell over Teddington Weir in the dry season of last year in one day was about 380,000,000 gallons, after the water companies had taken their supply. The Rev. J. Clutterbuck, who has made this subject his special study, considered that there was great danger of the water in the Upper Thames falling off.

The peculiar geological condition of that country (the Upper Thames) is this,—you find the oolites there, and there is an interspersing of the beds of stone and rock and gravel with clays. Wherever there is a junction there is a spring, and wherever there is this weeping the springs there are necessarily land drainage; the land drainage leads away this water at once, so that these parts of the strata are left entirely dry, and instead of weeping out gradually, as they used to do before the land drainage was in vogue, and so supplying the water to the Thames throughout the summer, it all comes away at once. I have myself seen at Cirencester, the river running bank high, perfectly clear—as clear as crystal, merely from the drainage water which comes off in such an immense quantity, whereas in the same place where the water was four or five feet deep, running in an immense volume, as at the Thames head and elsewhere, you will find at the end of the summer the river perfectly dry. I should say that it is a very important question, not only with reference to the Thames navigation, but also with reference to the water supply of London. I believe that the time will come, and that we may live to see it, when London will be distressed for want of a supply of water from the Thames. I believe that it is an important question to the London water companies, and I think that the time will come when it will be absolutely necessary to construct reservoirs in the upper part of the Thames just in the same way as reservoirs are constructed to supply the Oxford Canal. The Oxford Canal is so well supplied with water from these reservoirs that occasionally they are able to sell water to the Grand Junction Canal. The upper part of the Thames is extremely well fitted for these reservoirs, and I believe that the time will come, and that not long hence, when these reservoirs will be absolutely necessary, whether for the mills, the navigation, or the supply of water to London.

Mr. Castle, too, considers that unless steps are taken for the repair of the locks, the effect will be that the river in low-water times in the summer will be "reduced to a mere ditch in many places," whilst the navigation, if wholly abandoned, would result in the water supply of London being materially decreased. The balance of probabilities evidently lies in this direction, for, as Mr. Castle pointed out, the water would come down in a great volume in flood tide, and, of course, in dry summer the quantity would be decreased. We have very far from exhausted all the scientific details and questions introduced into this peculiarly interesting and important book. We have preferred to give facts and leave the reader to apply them. How far the sanguine anticipations of some of the witnesses examined may be realised, is a question open to consideration. There is no doubt that the navigation of the river ought at once to be put in good order; and this done, we believe the proposed new Board will ultimately find it more than self-supporting.

SMOKE CONSUMPTION.

WE have occasionally directed attention to the much-neglected question of smoke consumption, and have at the same time pointed out various methods of effecting that object. Most of the numerous appliances noticed have been tried in practice, and have been found to effect the object for which they were designed more or less efficiently. But notwithstanding the many means at hand to remedy the evil, the smoke nuisance continues with unabated vigour, as a lounge at any of our railway stations, or a visit to our manufacturing districts, will abundantly prove. It needs not even that we quit London to

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seek for proof in this respect, for there is ample evidence of the fact in all directions. Even as we write, we have on the right a railway train standing in a station the engine emitting copious wreaths of smoke, whilst on the left stretches a cloud of the same obnoxious article, the joint product of numerous factory chimneys. Now of course every reasonable being, that is, everyone save the parties most interested in the said locomotives or factories producing the above results, will exclaim that this state of things ought not to be allowed to exist. And it need not exist, for there are means enough to be had for the extinction of the race of blacks that infest our atmosphere. Legislature has done much to abolish the evil, but it has not done all that it might. It is in some respects too lenient, it imposes certain circumlocution processes culminating in a fine. Five pounds per day penalty sounds very uncomfortable to some people, but we well remember some few years since that such a fine was—and perhaps is still—paid by a manufacturing firm carrying on an extensive business not a day's journey from Lambeth. They would rather pay the fine than have their process of manufacture interfered with, by which a far greater loss would be incurred. For the protection of the public the proper treatment here would undoubtedly be that adopted in the case of little birds that can sing and won't sing; that is, provided reasonable means exist wherewith the case may be met, and no one will attempt to deny that such means do exist.

The worst portion of smoke is the superfluous carbon which is left unburnt either from the want of sufficient atmospheric air, or of a higher temperature than that present, which is insufficient for the perfect combustion of the varieties of carburetted hydrogen and the vapour of coal tar which are disengaged from heated coal. In either case the hydrogen is fired, whilst the carbon is carried forward by the draught of the chimney to be disseminated through the atmosphere and over the ground. The object of every apparatus proposing to effect a cure for this evil, must necessarily be to perfect the combustion of the superfluous carbon. If there was nothing more to be said than has already appeared upon the present subject, it would scarcely be worth while opening it up again for the sake of mere argument. We shall therefore support our position as to the perfect practicability of smoke consumption by reference to an apparatus for effecting this, and at the same time economising fuel, to which our attention has recently been directed. The invention to which we refer has been designed by Mr. E. B. Wilson, and has for its main features improvements in furnace building. This system did not emanate perfect in all points from the brain of the inventor, as did Minerva from that of Jupiter, but its development was the work of time. By dint of perseverance and careful experiments the furnace has passed through various modifications to its present perfect condition. By the internal construction of the furnace the utmost intensity of heat can be obtained, and the heat can be concentrated within a limited space or diffused over a considerable area, as may be found necessary. Mr. Wilson proceeds upon the principle laid down by Cutler some years since, which consists in carrying on combustion inversely to the usual practice. He burns the fuel from the upper surface downwards instead of from the lower surface upwards. Cutler failed from his inability to effect the introduction of fresh fuel in an efficient manner, and his plan has since been revived at various times with modifications, but with uncertain results. In carrying out his idea, Mr. Wilson dispenses with furnace bars and the ordinary door, and feeds through an aperture in the top of the furnace, where air also is admitted. The coal, supplied in small pieces, falls on a curved inclined plane, on which it rests on a sloping bank until consumed. In front of the heap of coals is a mixing chamber formed by increasing the height of the furnace roof for a short distance in a slanting direction. The coal is supplied at short intervals at the top, and the whole mass slides down the slope as combustion proceeds.

From the above arrangement it will be seen that the following consequences ensue. Assuming the furnace to be in full operation, the door would remain partially open, and through this aperture the atmospheric air necessary for combustion would be supplied. The air on entering passes first through a stratum of cold fuel, about a foot deep; below this point the coal commences to smoulder and to give off free carbon vapour and hydrogenous gas. A rapid combination of these gaseous products with oxygen takes place, an excess of oxygen being admitted to keep the solid carbon on the outside of the smouldering fuel in vigorous combustion. The result is that, before the gases emitted from the fuel can find their way into the body of the furnace, they must pass through the outer stratum of burning carbon. By this means the entire gaseous mixture is immediately raised to the highest heat obtainable from the solid fuel, to which it adds the heat obtained from its own perfect combustion. During this process the heating chamber is filled with a white flame of great intensity, and the whole of the hydrogenous compounds are effectually utilised. This is a great source of economy in the Wilson furnace, and contrasts favourably with the ordinary method of burning on fire-bars, in which the compounds and mixtures of hydrogen, as soon as formed, pass from the hottest part of the fuel through the cooler coal on the top, and thence to parts of the furnace of still lower temperature. The result is that the greater part of the most valuable element passes away into the chimney without doing its proper duty. As an instance of the completeness of combustion in the Wilson furnace, it is stated that, on a puddling furnace being drawn in which 41 cwt. of fuel had been used since the previous clearing out, the residue was found to weigh but a little more than 20lb. These furnaces have been working for some time past in Manchester, giving the best results as regards economy of fuel, perfect combustion, and entire absence of smoke. They are also in use at the works of the Gartness Iron Company, near Glasgow, where the weekly returns show a saving of one-third in fuel upon the old system. Several ordinary steam boiler furnaces in Glasgow are also being altered upon Mr. Wilson's principle, which certainly appears to fulfil the conditions of smoke consumption and economy so perfectly that the smoke nuisance really need no longer exist.

Before leaving the subject we may refer to a method of promoting the consumption of smoke in locomotives and ordinary furnaces by the use of the steam jet. This plan is known in France as Thierry's system, and in England as Wright's, being patented, we believe, in the first instance in France by M. Thierry, of Paris. It consists of a steam coil of peculiar construction, which is placed behind the fire-bridge. Steam from the boiler is led by a half-inch pipe to this coil, which is two inches diameter, and tapering at the ends to half an inch. Here it is superheated and afterwards led by a half-inch pipe to a perforated tube placed inside the furnace over the door. This apparatus is of course only used occasionally, for instance, when firing up, and greatly aids in consuming the superfluous carbon. It is governed by a cock outside the boiler, which, on being turned, admits the steam to the superheating coil, whence it passes to the perforated pipe, from which it issues in powerful jets directed into the burning fuel. It forms a very effective smoke preventer, but no particular saving of fuel results from its use. The apparatus has been applied to the locomotives on the Southern and Western railways of France, and it has been fitted to several furnaces in London. We have examined one application of the principle, which appears to answer the purpose very effectually. The stir which has been made about smoke has led to the invention of so many efficient devices for suppressing the nuisance, that we think the time has arrived for introducing compulsory measures, rather than leaving it open to smoke-producers to "try and do what they can," which often means but little more than nothing.

NOTES ON NEW DISCOVERIES AND NEW APPLICATIONS OF SCIENCE.

A New Flux for Use in Copper Smelting—American Emery—M. Becquerel's Thermo-Electric Battery—Preparation of Thermo-Electric Sulphide of Copper — The Laws Governing the Attractive Force of Electro-Magnets—Cost of Working MM. Bellet and de Rouvre's Electro-Magnetic Locomotive—Another New Light.

THE Welsh process of smelting copper is in several respects much less economical than could be desired. All the sulphur of the ore is lost, being allowed to escape into the atmosphere in the form of sulphurous acid. The value of the sulphur which is thus sent into the air by the copperworks in the neighbourhood of Swansea, to the utter destruction of all vegetation within reach of the "copper-smoke" containing it, and to the great prejudice of human and animal life, is estimated to exceed two hundred thousand pounds per annum. Converted into sulphuric acid, its annual value would exceed half a million. Besides this loss of sulphur there is also great loss of the more valuable constituent of the ores worked, the "ore-furnace slag," which is thrown away, rarely containing less than 0·5 per cent. of copper, chiefly in the form of "coarse metal." Dr. Percy remarks that "those who have seen the prodigious accumulations of this slag at the copperworks of Swansea and the neighbourhood will have an accurate conception how great the loss must be when they reflect that every hundred tons of the slag contain half a ton of copper. The green efflorescence so frequently present on the walls built of this slag bounding the road near the Hafod Works and elsewhere must often, one should think, excite unpleasant impressions in the minds of the great smelters as they travel along. Le Play estimates the loss of copper in the ore-furnace slag to be 2·8 per cent. of the total copper obtained. Admitting that about thirty thousand tons of copper are annually smelted in this country, it would follow that eight hundred and forty tons of the metal are annually thrown away, or, in value, supposing the average price to be a hundred pounds per ton, not less than £84,000 worth." M. Peter Spence, of the Pendleton Alum Works,—the largest in the world,—some few years ago patented a method of saving the sulphur evolved in copper smelting which met with the high approval of Dr. Percy, Dr. Angus Smith, and other authorities, and now the same gentleman has patented the use of a flux which he finds to have the effect of rendering the ore-furnace slag very much "cleaner," or freer from copper, than it is usually at present. This flux is simply the spent shale of the alum manufacture, being the residuum of the shale of the coal measures after it has been acted upon by sulphuric acid for the production of alum.

The world's supply of emery has hitherto been drawn almost exclusively from two localities: Cape Emeri, in the island of Naxos, and the neighbourhood of the ancient city of Smyrna. Two new sources of this commodity have recently been discovered, however, Professor Crace Calvert, of Manchester, having found a valuable deposit of it in North Wales a few years ago, and a still more valuable bed having been lighted upon, about twelve months since, near Chester, in the state of Massachusetts, U.S. The latter is of very great extent, and is so situated that the emery may be mined at a cost not exceeding two dollars per ton. The emery is said to be superior in quality to the very best hitherto known, and to be capable of doing one-third more work than the

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finest samples from Smyrna or Naxos. Moreover, "apart from its cutting properties, one quality is claimed for the Chester emery which at once distinguishes it from the Oriental variety,—the American emery is not liable to oxidation, remaining bright and clean after having been moistened and exposed to air. The damage by oxidation is not only a partial loss of hardness, but the coating of the particles by rust interferes materially with their adhesion to the wheel. Consequently, a wheel charged with the American emery best retains its charge, and accomplishes the most abrasion. That this is a well-ascertained difference between the American and the Oriental emery is apparent from the invariably rusted appearance of the crude stone coming from the East, whereas the produce of the Chester mine, and even the loose stones lying about the vicinity, betray not the slightest tendency to oxidation." Emery is a compound of alumina, or sesquioxide of aluminium, with protoxide of iron, the alumina being aggregated to the same degree of hardness as in corundum, or adamantine spar, one of the hardest minerals known. Oriental emery usually contains about 62·3 per cent. alumina and 37·7 per cent. protoxide of iron. The American emery, though less liable to oxidation than Oriental emery, contains a large proportion of protoxide of iron, its analysis yielding 40·95 per cent. of that oxide and only 59·5 of alumina.

At its sitting of July 24th M. Edmond Becquerel presented to the Academy of Sciences some "New observations on Thermo-electric Batteries," going to show that sulphide of copper is even more powerful, as the positive element for such batteries, than the alloys with which Magnus has recently obtained such good results. M. Becquerel had previously,—about six months ago,—presented a memoir, in which he had shown that sulphur modifies very powerfully the thermo-electric properties both of the metals which are thermo-positive and of those which are thermo-negative: sulphide of bismuth, for example, being much more intensely negative than metallic bismuth, and sulphide of copper much more intensely positive than metallic copper. In his new memoir he shows that a couple consisting of sulphide of copper and the alloy of nickel with copper and zinc which is known in France as "maillechort," is more than twice as powerful as a couple made of the alloys used by M. Magnus. The electro-motive force of one of M. Magnus's couples, when one end is heated to the boiling point of mercury and the other kept cool by ice, is 14·78 times that of the standard bismuth and copper couple which M. Pouillet employed in his well-known researches, but the electromotive force, under the same circumstances, of a couple composed of sulphide of copper and maillechort is 34·71 times that of the standard bismuth and copper couple. A battery composed of M. Becquerel's couples, however, will only yield effects of tension, the resistance of the couples being too great to permit of quantity effects being obtained from it.

M. Becquerel prepares his thermo-electric sulphide of copper by submitting to the action of vapour of sulphur thick plates of copper previously heated to dull redness. When a coating of sulphide has thus been formed upon the copper plates he cools them rapidly by dipping them into cold water, this rapid cooling enabling the film of sulphide to be readily detached. The sulphide thus obtained has then to be fused and cast into bars. This operation has to be conducted with very great care, inasmuch as the sulphide has its thermo-electric properties almost entirely destroyed by being raised to a temperature only very slightly above its fusing point. It fuses at between 1,030 deg. and 1,040 deg. Centigrade, and if allowed to attain 1,100 deg. before being cast is quite spoilt. A somewhat similar phenomenon has been observed by Bunsen in the case of copper pyrites, which forms when in its natural state a very powerful negative thermo-electric element, but loses nearly all its power as such by being fused and cast. In both cases the change of properties is evidently due to a change of physical condition, sulphide of copper which has been heated to only just its fusing point having a kind of fibrous structure, most perceptibly different from the structure of the same substance after having been exposed to a higher temperature, and copper pyrites in its native state being much more distinctly crystalline than after artificial fusion. At the close of his memoir M. Becquerel expresses his regret at the rarity and costliness of tellurium, since he has found that the telluride of copper is even more powerful, as a thermo-electric element, than the sulphide.

At a late meeting of the Société des Ingénieurs Civils, M. de Bruignac read an interesting communication respecting the electro-magnetic locomotive, invented by MM. Bellet and de Rouvre, of which an account was given in the MECHANICS' MAGAZINE for the 6th January last. The most remarkable statements made in it were to the effect that the gentlemen just mentioned have found that the law that the proportion between the force with which an electro-magnet attracts its armature when placed at one distance from its polar surfaces and the force with which it attracts the same armature when placed at some other distance therefrom, is in the inverse ratio of the squares of the distances, holds good only for distances within a certain limit, beyond which the attractive force is inversely as the distance, and that the amount of the attractive force communicated to an electro-magnet by the passage round it of a given current is greatly influenced by the form of the electro-magnet, and especially by the length of its branches. M. de Bruignac also states that MM. Bellet and de Rouvre's experiments abundantly confirm the observation of other physicists that there is a point, in the case of every electro-magnet, beyond which its force cannot be increased by increasing the strength of the battery current. He cites specially a little electro-magnet which they found to carry twelve kilogrammes with a current from two Bunsen-cells, fifteen kilogrammes with a current from ten cells, and only seventeen kilogrammes with a current from twenty cells. A current from twenty-five cells enabled it to carry eighteen kilogrammes, but beyond that point its power could not be increased.

M. de Bruignac indulges in some calculations with respect to the cost of working MM. Bellet and de Rouvre's locomotive. He points out that by substituting it for the ordinary steam locomotive the weight of a train at present weighing one hundred and thirty tons would be reduced to one hundred tons, and he estimates that, to enable the electro-magnetic locomotive to propel this train at the rate of fifty kilometres, or about thirty-one miles, per hour, would require two hundred and seventy Bunsen cells, each costing six centimes an hour. The cost of propelling the train would thus amount to sixteen francs twenty centimes, or about thirteen shillings, per hour, being as nearly as possible at the rate of fivepence per mile. If M. de Bruignac, however, were to try the experiment on the great scale,—say with an actual railway train,—we fancy he would find the cost per hundred tons per mile a very long way from being defrayed by fivepence.

Mr. James Wilkinson, of Chelsea, is endeavouring to rival the magnesium light, for photographic purposes, by means of a mixture of phosphorus and nitrate of potash. He recently burnt a quarter of a pound of this mixture in his garden, at night, with a view to obtaining a photograph of a wind-engine which was being erected in an adjoining garden, and he states that "the length of time from when it was first lit until it was finally burnt out was nearly six minutes. The utmost cost was a fraction over fourpence. The reflection of the light might be seen for two miles round. So bright was it that the fire-engine authorities mistook it for an ordinary conflagration, and hurried their engines to the spot. Upon finding no trace of the fire they returned, rather chagrined, not, however, without first satisfying themselves by a thorough examination of the premises. All around appeared one blaze of light, the sky looking like a mass of fire." The picture taken during this startling illumination "came out," we are told, "with great sharpness and vividness, the houses near being brought out prominently. It, in fact, equalled any picture taken on a bright day."

THE SMITHSONIAN INSTITUTION.

THE annual report of the Board of Regents of the above Institution for the year 1863, has recently been published in America. The following remarks of scientific interest are extracted therefrom. Upon the influence of the sun and moon on the magnetic needle it is observed that in some of the preceding reports an account has been given of a series of reductions of the magnetic observations made from 1840 to 1845, inclusive, at Girard College, Philadelphia, by Professor Bache. The first two of the papers of this series related to what is called the eleven-year period of the variation of the needle, which corresponds with the recurrence and frequency of the spots on the sun. The third paper relates to the influence of the moon on the variation of the needle. The fourth refers to the change in the horizontal part of the earth's magnetism coinciding with the eleven-year period of the spots on the sun. The fifth relates to the effect of the sun in producing daily and annual variations in the horizontal component of the magnetic force. The sixth relates to the lunar influence on the horizontal magnetic force. A particular account has been given of the result of all these investigations, which tend fully to corroborate the conclusions arrived at from observations in other parts of the world, that both the sun and moon are magnetic bodies, and exert an influence upon the polarity of the earth; and also that the magnetism of the sun has variations in intensity which are in some way connected with the appearance of spots on its surface, giving rise to the variations in those perturbations of the needle which have been called magnetic storms, and which present a periodical recurrence at an interval of about eleven years. The influence of the moon is much less marked than that of the sun, and appears to be more analogous to the temporary magnetism induced in soft iron. In an appendix to this paper the connection of the appearance of the aurora borealis with the disturbances of the direction and force of the earth's magnetism is discussed. From the result of this discussion it appears that there is a periodicity of about eleven years in the recurrence of the aurora, as well as in that of the great disturbances of the needle, and that these are coincident with each other and with the appearance of the spots on the sun.

Upon the subject of foretelling storms it is stated that for several years previous to the commencement of the war a large map was exhibited in the Smithsonian Institution, on which was daily represented the direction of the wind and face of the sky over the greater portion of the United States; and previous reports call attention to the fact that a properly organised system for giving daily changes of the weather in distant parts of the United States would be of great practical importance to the shipping interests of the country. It has also been observed that American meteorologists are much more favourably situated for predicting the coming weather than those of Europe. The storms in American latitudes generally move from west to east, and, since the seaboard is on the eastern side of a great continent, they can have information of the approaching storm while it is still hundreds of miles to the west of them. N t so with the meteorologists of Europe, since othey reside on the western side of a continent, and can have no telegraphic despatches from the ocean. The proposition, however, to furnish constant information of this kind could not be carried out by the limited means of the Smithsonian Institution, and, indeed, can only be rendered properly and fully serviceable under the direction and at the expense of the Government.

New and interesting features have been introduced into the daily meteorological bulletin published by the Imperial Observatory at Paris

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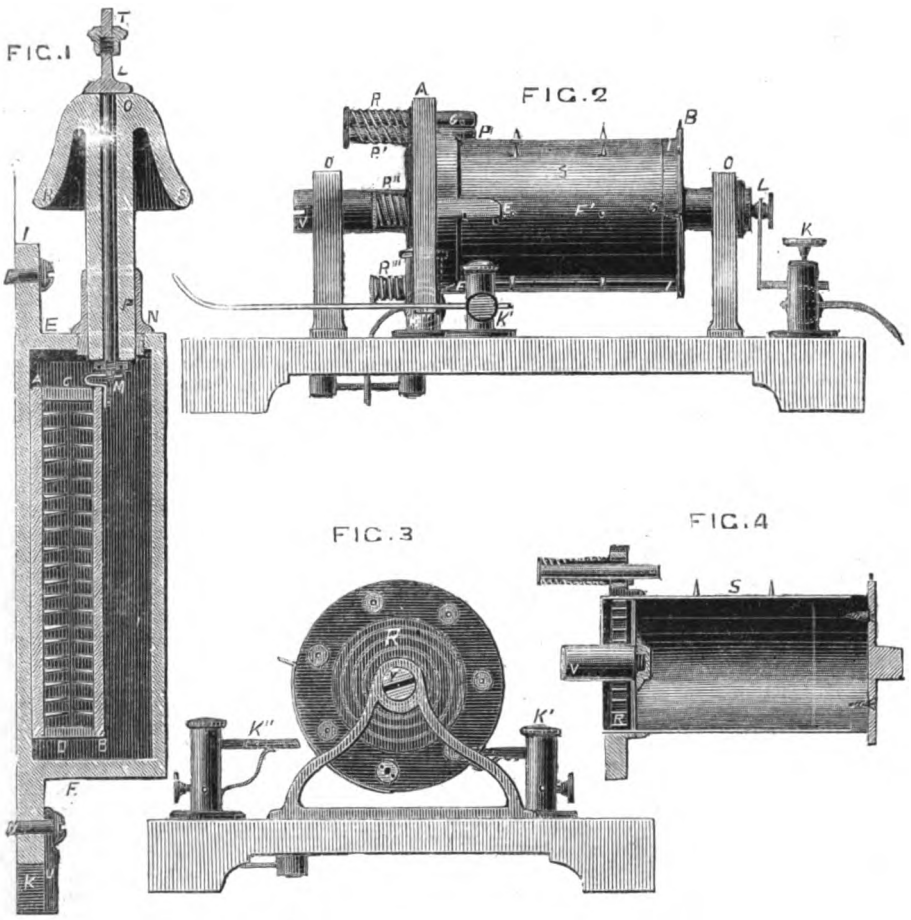
ELECTRIC TELEGRAPH PROTECTORS.



As mentioned in the last report, these bulletins are lithographed each day from records of the barometer, thermometer, wind, and face of the sky, compiled from telegraphic reports transmitted to the observatory from various parts of Europe. In addition to these, they now contain daily a small outline chart of Europe upon which are drawn diagrams showing the barometric curve of the day through the various stations, together with the temperature and direction and force of the wind. For the use of vessels about to leave port, a statement is also given of what will probably be the direction of the wind the next day. Chambers of commerce and intelligent seamen have acknowledged in strong language the benefit of these daily bulletins, thus adding to the ever-accumulating testimony in favour not only of the speculative interest but also practical benefits of meteorology. At Bordeaux, Havre, and other important ports, as soon as the bulletins are received, the telegraphic announcement of the weather and the probable direction of wind for the following day are posted in public places and furnished to the principal newspapers for publication.

ELECTRIC TELEGRAPH PROTECTORS.

M. AUGUSTE BERTSCH, engineer, No. 27, Rue Fontaine, St. George, Paris, has patented an invention which has for its object improvements in lightning conductors for preventing atmospheric electricity damaging electric telegraph instruments. For this purpose the lightning conductor is composed of two parallel copper plates retained at a distance apart, and insulated from one another by four small posts of insulating material. Each plate carries about three hundred sharp points, and these points are carried on the sides of the plates that are towards each other. A lightning conductor constructed upon this principle is shown in the accompanying engraving, in which fig. 1 is a vertical section. A B are the two metallic plates separated and insulated one from the other by posts C and D; each plate carries about three hundred sharp points made of copper, either silvered or gilt. The extremities of the points carried by the opposite plates are brought to a distance of about 1·25th or as close as 1·50th of an inch apart from each other. These plates are enclosed in a rectangular box E F of cast iron, which is cast in one piece, one side only of the box being left open; this side is afterwards closed by a thick sheet of glass G H, through which the interior of the apparatus can be seen. The plates are fixed in the rectangular cast-iron box by one of the plates A, which is furnished with points, being closely fixed to the back of the box either by screws passing through from the exterior or otherwise. The cast-iron case E F is put in communication with the earth by the copper wire U, and the metal plate B is put in connection with the line wire of the telegraph by the metallic rod L M. I K are two lugs or ears on the exterior of the box, which permit of the apparatus being securely fixed by means of screws or otherwise to telegraph posts, to walls, to the entrance of tunnels, or wherever the effects of condensation and quantity of static electricity are to be feared. The metallic rod L M passes out from the interior of the case through a tube of porcelain P, fixed by a suitable cement in a watertight manner to the interior of the tube N, which screws into an opening in the top of the case; on the top of the porcelain tube P is formed an inverted cup or bell R S which keeps off rain from the greater portion of the tube. The rod L M rises above the top of the bell, and above the bell it has formed all around it a projecting flange O which covers the top of the opening through the tube P; this flange is drawn down on to the top of the bell by a small nut screwing on to the lower end of the rod. The upper end of the rod L M is readily connected to the line wire by means of a copper wire attached to the end of the rod by the binding screw T.

Apparatus constructed in the manner above described may be manufactured at less cost than the apparatus heretofore employed for this purpose; it may also be fixed in any situation, either to the telegraph posts or to the walls of tunnels or otherwise, and by being constantly in operation it takes continuously from the line wires the slightest traces of static electricity. In order that a perfect security may be attained on account of the large amount of static electricity which has sometimes to be placed in equilibrium with the earth, the inventor prefers to employ, together with the apparatus above described, an apparatus of the sort now commonly employed, in which a fine wire is employed as the conducting wire between the line wire and the telegraph instruments, in order that if there be any discharge of static electricity through this wire the wire may be burnt and the instruments remain uninjured. This second instrument is placed on the interior of the building in which the telegraph instruments are contained. It is, however, important that this class of apparatus should be so constructed as to work continuously and independently of the will of the operatives. M. Bertsch, therefore, constructs apparatus of this description in such a manner as to remain permanently in the circuit and to operate automatically. For this purpose he arranges the apparatus in such manner that when the fine wire which connects the line wire with the instrument is burnt, the wire is immediately replaced by another fine wire. Fig. 2 shows a side view, and fig. 3 an end view, of an apparatus so constructed. The apparatus is composed of a cylinder A B terminated at one end by a disc A, and at the other end by a disc B; the disc A is connected with the earth and the disc B with the telegraph instruments. Around the disc A are placed a number of spring hooks C P E F, insulated one from the other and also from the earth. The springs R R^1 R R^{III} constantly tend to draw the hooks towards the disc. The opposite disc, which is in connection with the instruments, is also provided with an equal number of hooks, and is connected to the cylinder in such manner as to be insulated from it at the point I I for dynamic electricity. Fine wires F F^1 are stretched between the hooks on the disc A and the hooks on the disc B. Within the disc A is a helical spring R (figs. 3 and 4), which constantly tends to rotate the cylinder. The bobbin is supported between two standards O O by a central axis, the axle at one end is connected with the earth, and the other is connected with the telegraph instruments by the clips L and K. Near the opposite disc is another clip K^1, in which is held the extremity of the line wire, and which carries a contact piece against which the head of one of the spring hooks firmly rests. On the opposite side of the disc is a third clip K^{II}, communicating with the earth wire, and which may also carry a contact piece. This contact piece is not required if the cylinder communicates with the earth by the contact piece K^1 and by the foot of the standard which supports the axis V of the cylinder. In the first case the disc carries on its edge a plate of copper, which, when the last of the fine wires has been burnt, rests on this contact piece, and instantaneously establishes the communication between the line and the earth. The cylinder S is formed of a metallic tube carrying points which are retained at a very short distance from the fine wires. Atmospheric electricity has therefore always an easy path for regaining its equilibrium with the earth, and it will thus be seen that the apparatus is constantly in action as a discharger. When one of the threads is burnt, the hook which establishes the contact between the line wire and the instruments is withdrawn by its spring into the disc; the cylinder is then caused rapidly to turn by the spiral spring R, which brings the next hook up to the contact piece, which thus forms a stop to prevent the cylinder from turning further. The communication is thus re-established by the new fine wire placed in the circuit; this change is effected in the sixtieth of a second, that is to say, in so short a time as not to interrupt the working of the telegraph. When the last of the fine threads is destroyed, the communication between the line wire and the earth is instantaneously made direct by a projection from the disc, which takes the place of the last hook.

THE FRENCH EXHIBITION OF 1867.

IT is definitively arranged that the Palace for this Exhibition is to be erected on the Champ de Mars. The building, which is to be formed of two half circles, will be 547 yards in length by 437 yards in breadth. The space will be divided into a number of sectors by a series of passages radiating from the centre to the circumference, and by concentric galleries. The centre of the building will be occupied by a garden, and the first concentric gallery will be devoted to the fine arts, while the last one will be allotted to the machinery. All the machines exhibited are to be set in motion, and the motive power is to be placed outside the building. The passage which will lead the visitors from the bridge of Jena to the centre of the building will be appropriated to the geological history of the globe. There will also be, somewhere near the garden, a collection of implements illustrative of the history of labour. The Champ de Mars has

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been handed over to the Imperial Committee of the Exhibition, and the works are to be commenced immediately after the festivities of the 15th inst. The first thing done will be to cut a canal through the entire Champ de Mars with branches to the main sewer. Visitors may arrive at the Exhibition either by omnibus or boat. To facilitate the approach of visitors coming by water two subterranean passages will be made under the Quay d'Orsay—one above and the other below the bridge of Jena opposite the landing-places to be constructed for the convenience of passengers by steamboats. The committee has just appointed seven admission committees, to examine the objects specially exhibited with a view to improve the physical and moral condition of the people. Several gentlemen connected with the Paris press figure in the list.

RAILWAY TRAIN COMMUNICATION.

IT will afford some satisfaction to the travelling public, especially the timid portion thereof, to learn that the directors of the South-Western Railway are going earnestly into the question of communication between guards and passengers in the trains on their line. The system adopted is Mr. Preece's electric signals, which will be found fully described at page 212 of our issue for the 7th of April last. Several months' working of experimental trains fitted with this apparatus have given such satisfactory results that the system is now in course of general application on the above line. Coupled with the block system of electric signalling on the line, the train signalling will render the line as safe in all respects, for purposes of travel, as a railway can be under existing conditions of construction. The South-Western Company are certainly setting an example well worthy the imitation of all other companies. If, after it has been so thoroughly demonstrated that railways can practically be made safe, other companies do not proceed in the same direction, there will be manifest reason for legislative interference, and compulsory measures will be the result. We subjoin the instructions to enginemen, guards, and all parties concerned in the use of electric communication between passengers and guard, which have just been issued by the South-Western Company. They will be perfectly intelligible by a perusal of the description referred to above:—

1. In the event of something of a serious nature occurring, which urgently requires the stoppage of the train, the passenger may "break the glass," and "ring" by moving the bell handle in the direction denoted by the arrow:—Thereby a bell will ring in each guard's van in the train, and also on the engine. 2. When the guards and engineman hear the bell ring, they will at once look carefully along each side of the train, and in case any violent oscillation be seen, or a carriage be on fire, or other occurrence of a serious character be observed, the train will be stopped as speedily as possible, and, when stopped, must be protected by signals as prescribed by the rule book. 3. Should, however, the guards and engineman fail to observe anything which really necessitates an immediate stoppage of the train, their duty will be to stop the train at the next station or junction, so as to protect the train, when stopped, by fixed signals. 4. When the train is stopped the passenger who broke the glass and rang the bell will communicate with the guard; but should he fail to do so, the guard will detect the compartment from which the passenger gave the alarm by looking for the broken glass, and in case the alarm has been mischievously and wantonly given, or from insufficient cause, the names and addresses of all the passengers in that compartment will be taken, in order that the law may be enforced.

The bell signal code between guards and engineman is as follows:—One beat, acknowledgment; two beats, go on—all right; three beats, look out—something wrong; four beats, shut off steam—pull up, and stop at next station or junction; six beats, danger—stop at once. Every signal must be acknowledged.

STEAM BOILER INCRUSTATION.

THE following is a copy of an American specification, relating to an invention of a new and useful improved method of removing incrustation from boilers, which has been presented by Mr. Davis Embree, of Dayton, Ohio, United States of America, to the Government and people of the United Kingdom of Great Britain and Ireland. It was received at the office of the Commissioners of Patents 12th July, 1865. The patent was accompanied by the following memorandum:—"Dayton, Ohio, U.S.A., April 21st, 1865.—The undersigned hereby transfers or relinquishes to the Government and people of the United Kingdom of Great Britain and Ireland all his right to take out a patent in that country for the invention or discovery described in the circular hereto attached; and desires that notice of the same be filed in the Patent Office department, so that no improper person may be able to obtain a patent for the same discovery. Davis Embree."

SPECIFICATION.

The groundwork of my invention, or rather application, I conceive to be founded on sound chemical principles. That lime is the basis of all incrustation in steam boilers. That it is generally found to be carbonate of lime or limestone. That it assumes the form of crystals. That it is insoluble in water. That particles of the same kind, in the formation of crystals, unite with each other, adding to the mass first formed or fixed. Incrustation of boilers may be dissolved by an acid which has stronger affinity to lime than carbonic acid has; the lime and such acid will unite, generally forming a compound that is soluble, and cannot coat a boiler, while the carbon passes off in form of carbonic acid gas. Incrustation can also be removed by an alkali that has a stronger affinity for carbonic acid than lime has; such alkali uniting with the carbonic acid leaves the lime in a pure state, which is soluble in a sufficient quantity of water, and cannot coat a boiler; the compound of such alkali with carbon will also generally be found soluble. To prevent incrustation in steam boilers, one other mode may be resorted to,—that of thoroughly boiling the water before it enters the steam boilers. These are the only means known to accomplish the object desired.

There are but few persons aware of the exact condition in which lime is held in solution in what is called hard water. It is not carbonate of lime, for that is insoluble, and the assuming of that form causes all the difficulty. We must, therefore, look to some other combination, for every new combination of chemical atoms has different results, and these atoms, according to late authority, unite in definite proportions, and not otherwise; hence, one atom of lime united with one atom of carbonic acid will form carbonate of lime (insoluble). If one atom of lime unite with two atoms of carbonic acid, it will be supercarbonate of lime, a substance that is soluble, and which, we contend, is the true condition of lime in hard water.

Limestone is carbonate of lime. By being burned in a lime-kiln it is deprived of its carbon, and its water of crystallisation, and becomes quick-lime. It then seizes upon a certain quantity of water or carbonic acid wherever it may come in contact with them, or either of them. Now, take a small quantity of quick-lime, either dissolved in water or otherwise, and put it in common hard water, and it will immediately seize upon the surplus carbon of the supercarbonate of lime, and reduce all the lime in the water to carbonate of lime, which will be insoluble, and will immediately fall to the bottom of the vessel, leaving the water as pure as water can be; hence the impossibility of its coating a boiler. It only requires two tanks or tubs for water, that one may be settled while the other is filled, or, if the engine be supplied from a well, and worked only in the daytime, the lime may be put in the well itself of an evening, and it will be settled before morning. The quantity of lime proper to be used can be tested by litmus paper. If there be a small surplus quantity of lime it cannot injure the boiler.

To remove incrustations in a steam boiler, I have chosen still-slop, an article not heretofore used. It costs but little, and contains a large quantity of vegetable acid, which is not severe on iron. I do not claim the discovery of any new chemical principle. I have long been aware that vegetable acids would decompose carbonate of lime. I am also aware that quick-lime has been used to break what is called hard water; but I do claim the right to use or employ known materials for a purpose which is new and useful, when such appliance has never been authorised, patented, known, or published. What, therefore, I desire to secure by letters patent is the use of still-slop to prevent or remove incrustation by lime in steam boilers, and the use of quick-lime in the manner herein substantially set forth to prevent such incrustation.

HYDROSTATIC ROTARY ENGINE.

THIS invention, which has been patented by Mr. B. W. A. Sleigh, of 7, Alfred-place, Bedford-square, consists of a new mode of applying hydrostatic power, whereby a continuous rotary motion is obtained, conveying the power of propulsion, by means of which all manner of machinery may be driven, worked, and propelled. The hydraulic element used to generate, produce, and communicate the augmentation of hydrostatic power, having performed this office by pressing upon the rams which drive onwards the acquired increase of power, passes out from the ram cylinders, which become emptied by the pistons of the rams driving them to the bottom or ends of their chambers into the cylinders of pump-plungers ready to be ejected forward again. Nor is a fresh supply of water required, for when once the cylindrical mechanism of this engine is charged with the required amount, no further replenishment is necessary except to make up for evaporation or leakage, and thereby each series of rams and pump-plungers having delivered their strokes no fresh supply is required from an outside source, as the bases of the rams and pump-plungers are never while in work removed from a contact with the hydraulic element, while the cups and valves of each series of cylinders charged with water act as tanks or reservoirs for supply.

The accompanying engraving represents a plan of the hydrostatic engine. Upon a bed-plate of metal A is placed the engine. First there are bolted down upon the foundation-plate in a horizontal position four ram cylinders, Nos. 1, 2, 3, and 4, at the end of which are attached their respective series of pump-plunger cylinders 5 and 6, 7 and 8. Nos. 1 and 2 ram and pump-plunger cylinders are placed with a space between parallel to each other, as are also No. 3 and 4, only to the rear of the former. In each cylinder duly bored out for its reception is a ram of metal 9, 10, 11, 12, and each cylinder is for a space within its mouth grooved out in a recess so as to form a stuffing-box for the reception of suitable hydraulic packing, such as leather collars air and water tight, through which the rams 9, 10, 11, 12, pass outwards in giving their respective strokes, and then retire inwards after delivering the same. One set of ram cylinders 1 and 2, with their rams 9 and 10, face a main crank shaft B, revolving through four plummer boxes or bearings *c c c c*, which are cast upon bed-plate A, with caps and brasses of metal. The ends of main crank shaft B, projecting at B, outside bed-plate, and said main crank shaft in rotating works or drives machinery or wheels keyed thereon. Attached to the rams 1 and 2, 3 and 4, are screwed metal lugs 13, 14, 15, 16, through the centre of which are drilled holes, in which metal pins 17 traverse, fastening to forked levers D *d*, which stand vertically above and below surface of bed-plate, to which they are attached by suitable lugs or pins at 17. The vertical levers D, in projecting below the bed-plate, are, at their fulcrums *a a*, attached to carriages or brackets hanging beneath and bolted under surface of bed-plate. Connecting rods *c*, are pinned or jointed from *a* to bell-crank shaped levers *d*, working at *e*, on their centres or stud brackets at *e*, which form pivots, said brackets or carriages being bolted under bed-plate. The other end of bell-cranks *d*, are connected by pins at *g* to forked connecting rods *h*, the upper ends of which are connected to main B, and minor B', crank shafts by metal butts and straps.

The object of this lever adaptation is that when No. 1 ram is propelled or driven out from its cylinders it presses by means of the lug and pin fastened through the lever D upon the said lever, which being thus driven forward, the lever draws the horizontal connecting rod *e*, bell-crank lever *d*, and forked connecting rod *h* backwards the necessary distance to obtain by this movement a half throw of main crank driving shaft B, and thus causing a half revolution of said crank shaft. Instantaneously that this has been accomplished without a perceptible pause of time, ram No. 2 moves forward in like manner, and ram No. 1 begins to retire into its cylinder. The forward pressure of ram No. 2 drives the lever D, and lever attachments thereof, in like manner as described of lever arrangement of ram No. 1, and thus causes by means of its stroke the second half revolution of the main crank driving shaft B, thus completing the entire circle of revolution. On the centre of main crank shaft B, is keyed a fly-wheel E, which revolves through a

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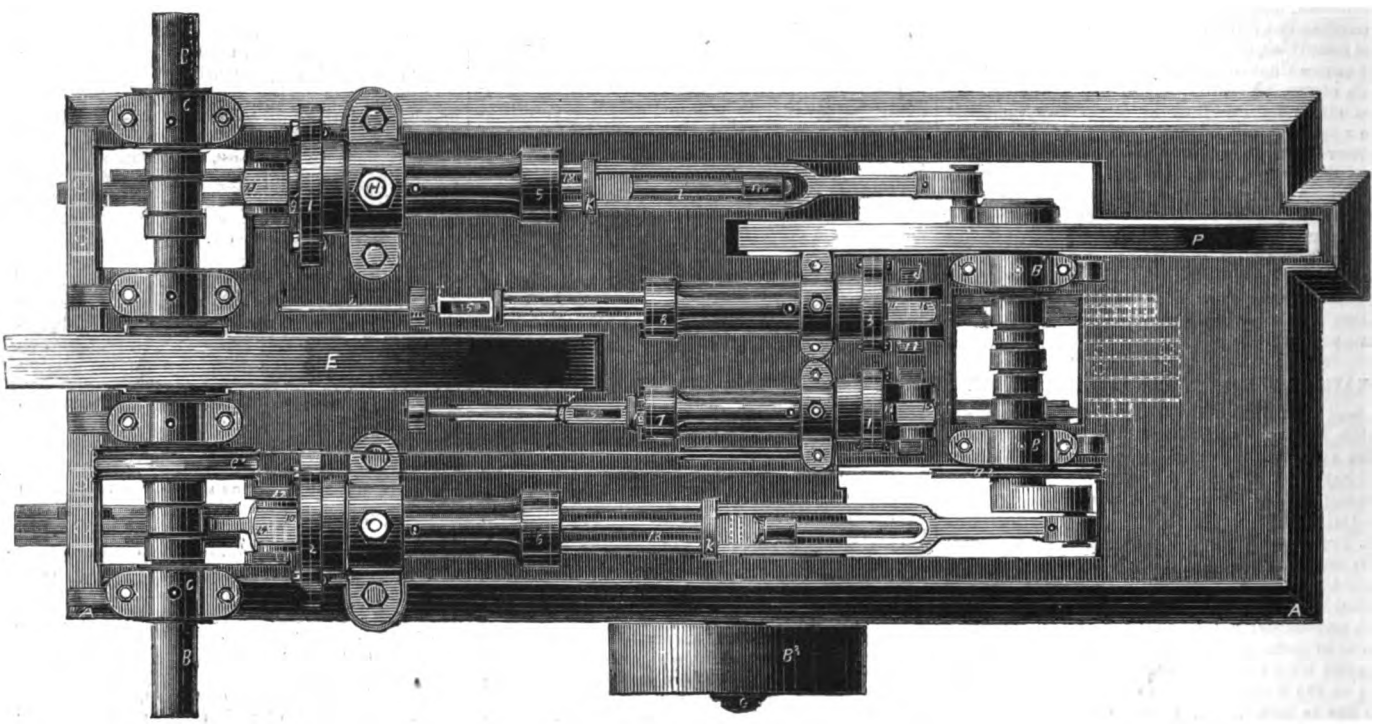
HYDROSTATIC ROTARY ENGINE.



slot in the bed-plate performing its revolutions. At the base of the ram cylinders 1 and 2, 3 and 4, are screwed in the series of pump-plunger cylinders 5 and 6, 7 and 8, before referred to, and upon the top of the ram cylinders at H are movable cup reservoirs H, which fit into screw holes drilled in the metal communicating with the interior of the cylinders. These cups at the upper ends are of glass, so as to allow the charge of water in the cylinders to be gauged, and contain self-acting valves, by which any deficiency in cylinders can be replaced. When the cylinders are filled with water, these cups are screwed in and also filled with water; a metal cap is then placed on the head. Pump-plunger cylinders 5, 6, 7, 8, consist of hollow cylindrical tubes of the necessary thickness of metal and interior diameter and bore. In those cylinders, moving through similar hydraulic stuffing-boxes as described of the rams, there work solid metal pump-plungers 18. Each series of pump-plungers are united together by metal crossheads *k*, in the centre of which are screwed guide rods *l*, which work through guides *m*, bolted to bed-plate, and are attached to forked connecting rods, which forked connecting rods are applied to the minor crank shaft B^1 by means of metal butts and straps. The revolutions of the minor crank shaft B^1 are caused by the active working and pressure of the smaller rams No. 3 and 4, as in manner hereinafter described, the pressure of these rams being communicated on the minor crank shaft B^1, by the intervention of a similar lever arrangement as described of rams Nos. 1 and 2. At each revolution of the minor crank shaft upon which is keyed the fly-wheel P, each half throw drives inwards the pump-plungers 5 and 6 of rams 1 and 2, and as the pump-plungers descend in their cylinders they press forward and eject under the base of the rams 1 and 2 the water which was contained in each, and as this water presses upon the base of the rams by the descending of the pump-plungers to the end of their stroke, so in proportion the rams press forward, upwards, and onwards, conveying the augmentation of hydrostatic power thereby generated upon the levers, causing, as before described, the rotation of the main crank shaft B, whereby wheels and machinery attached thereto are driven and worked. Parallel with the end of the pump-plungers 5 and 6 of the rams 1 and 2, and with a space intervening, are bolted down upon the bed-plate the series of pump-plunger cylinders 7 and 8, fastened into the base of the rams 3 and 4, also bolted down upon the bed-plate. At the crossheads *k*, of the pump-plunger cylinders 7 and 8 of the rams 3 and 4, there are screwed on lugs *r*, of metal, slotted out to receive the upper end of forked levers S, which oscillate upon pins at *t*, placed through the centre of the lugs *r*. The fulcrums of the forked levers work upon studs or pins fastened at the base angle of hanging brackets bolted under bed-plate. The upper forked ends of the levers by their pressure forward drive by their alternate action inwards the pump-plungers 7, 8, which in their stroke eject from their cylinders the water contained in each under the base of the rams 3 and 4, which press forward in manner as before explained upon the minor crank shaft B^1, which again performs its office as hereinbefore described. The levers S, which work in brackets fastened under bed-plate, thereby giving pressure upon the crossheads *k*, of the pump-plungers 7 and 8, are driven backwards and forwards, thus pressing and retiring after delivering each stroke by the action of two connecting rods running under bed-plate, which are fastened to the levers S, and which in pressing forward and retiring work horizontally and parallel to each other beneath the bed-plate. At the other end of the connecting rods they are attached by means of metal butts and straps to the double throws of an auxiliary crank shaft G. The end of this crank shaft, which is fastened beneath the bed-plate, projects its shaft out from beyond the bed-plate, and upon this is fastened a V-grooved wheel B^3, in which works a gut band connected with an outside foreign power, by means of which the engine is set in motion. Upon the main crank driving shaft B, is keyed a double V-grooved wheel e^1 upon the minor crank shaft B^1, and upon the auxiliary crank shaft are also keyed single V-grooved wheels, the three V pulley wheels following in vertical line with a gut band passing round each, by means of which is maintained the harmonious action and alternate movement between the double systems of rams and pump-plungers, thus also equalising and obviating loss of time between each throw of the respective cranks, and further by this application an equitable upward and downward movement is given by the working of the engine itself to the pumps, levers, and other portions without the necessity of regulating the same by hand power.

Once the engine is set in motion the inventor is enabled to multiply to any number the rams of the engine, and to construct them and the pump-plungers of whatever diameter and length is necessary for the work and size of the engine, in proportion thereto, and use only from one pump-plunger for each ram. He is further enabled to add at the crossheads of the minor set of pump-plungers the slotted lugs in which the forked levers work intervening, and these lugs screw upon another set of crossheads, to which are attached another series of pump-plungers and cylinders screwed into another series of rams, by means of which, as the return strokes of the minor rams, after causing their half-circles of rotation upon the minor crank shaft, draw backward the pump-plungers, the lever action in returning driving forward the pump-plungers of the fresh series, by which means the water contained in them is ejected under the bases of the additional rams, which forces forward through the medium of main lever and bell-crank action, the same as described respecting the throw of the major series of rams, and thus on another series of butts, and bell-straps fixed upon additional throws on the main crank, this additional power thus generated is communicated to the said main crank driving shaft. He can also on an extended bed-plate on a level with and facing the existing bed-plate and main crank shaft, bolt down and attach an entire duplicate set of rams and hydrostatic machinery attached thereto, thereby duplicating the hydrostatic power on main crank and other shafts, as also duplicate the machinery on other series of bed-plates *ad infinitum*. The power can be driven direct from the rams on to main and minor crank shafts if advisable, without the intervention of the lever arrangement for securing a longer throw. In lieu of directly conveying the hydrostatic power upon driving shafts, this can be done by attaching the pistons of the rams to cranks fixed on cut ratchet wheels, working on a lesser series, to secure thereby greater speed, and keyed on driving axletrees.

SCREW PROPELLER SHAFT THRUST.

THIS is an invention for which letters patent have been granted to Mr. Martyn John Roberts, of Pendarren, in the county of Brecknock. It relates to improvements in means or apparatus for reducing the friction now produced by the longitudinal or endlong pressure of ships' screw propeller shafts, or of any upright or inclined shafts when revolving. This invention consists in receiving the thrust or endlong pressure of propeller and other shafts upon a fluid under constant pressure, whereby the friction that would ensue between the end of such a shaft when revolving and a solid support is in a great measure avoided. If an inelastic or nearly inelastic medium, such as water, is used, the inventor then prefers combining with the apparatus whereby the fluid pressure is applied an air vessel whereby an elasticity in the medium is obtained, for without such elasticity injurious jerks and blows would be created in the shaft and between it and any solid bearings it might come into contact with. Again it is sometimes desirable that the shaft should be as it were divided in its length, so that the portion actually impinging upon the fluid bearing should be independent of the main portion of the shaft, to the end that, should the main or principal portion of the shaft sink in its bearings, it should not cause that part of the shaft supported endlong by the fluid medium to press too severely on the sides of the box or cylinder, hereafter described, which contains it. The apparatus for effecting these three ends consists of a cylindrical vessel open at one end, into which the end of the shaft or

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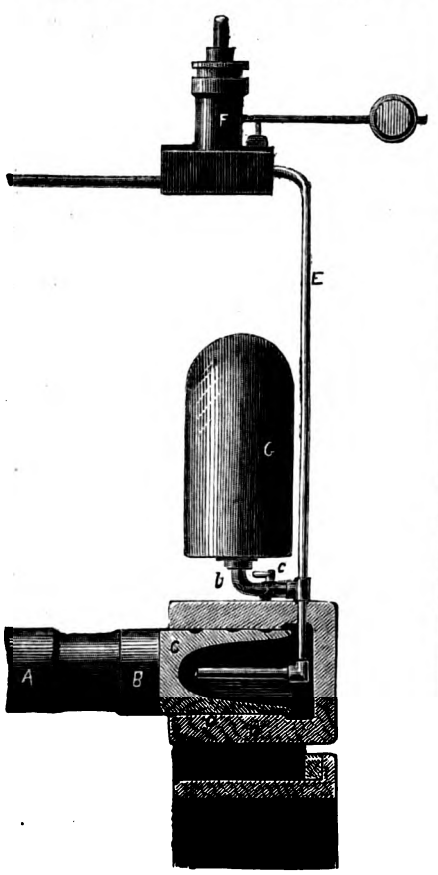
the detached end or "plunger" is placed. It is preferable to make the plunger hollow for the purpose not only of keeping it cool by the mass of fluid within it, but also that the points of pressure may be as near each other as is possible. This plunger fits pretty closely the cylinder, and sometimes has annular grooves at its surface for the purpose of restraining or checking the flow or waste of the supporting fluid between the side of the plunger and its containing cylinder. From this cylinder a pipe leads to an air vessel, and from this to a pump of sufficient size to force the water or other fluid into the cylinder at the desired pressure, and also to keep up the supply, that is, to compensate for any waste of liquid between the sides of the plunger and the cylinder. Sometimes a stuffing-box is placed at the mouth of the cylinder still further to retard the waste of water. The force pump, being actuated by proper machinery, is made to work continually, and any excess of water the pump throws in beyond what escapes between the sides of the plunger and the cylinder or through the stuffing-box, is permitted to escape through a proper valve weighted to the required pressure, or the liquid may rise in a tube below a piston, and by this means throw the force pump out of gear and stop it. But the inventor prefers the



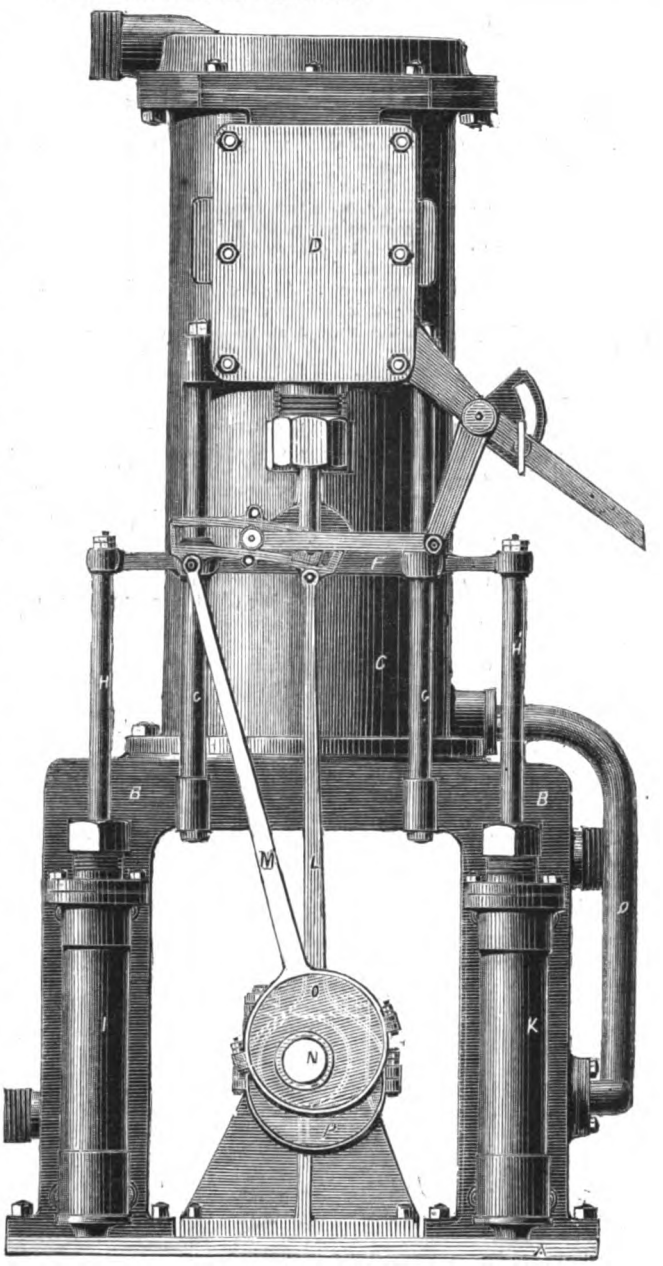
constant action of the pump as being more simple, and also because the escape of a small portion of water between the plunger and its cylinder in a measure lubricates the moving parts. A tap or stop-cock is sometimes placed between the air vessel and the cylinder for the purpose of instantly shutting off the pressure by closing the stop-cock when required, as, for instance, when backing or going astern.

The accompanying engraving shows the manner in which this invention is carried into effect. A is a screw propeller shaft, B the inboard end, C is a plunger which may be in a piece with, or preferably in a separate piece from the shaft, D is a cylinder or case in which the plunger is free to revolve and play. The plunger is shown hollowed at back for the purpose hereinbefore mentioned. *a a* are annular recesses in the outside of the plunger, E is a pipe communicating with a force pump F, and also by the pipe *b* fitted with a stop-cook *c* with an air vessel G.

In the Thames district, at Auckland, a native has produced 2lb. of gold, said to be discovered in that neighbourhood; but he wishes, very wisely, to make the reward of £2,000 offered by the Government secure before revealing the precise whereabouts.

LUNGLEY'S STEAM ENGINE.

MR. CHARLES LUNGLEY, of Deptford, in the county of Kent, shipbuilder, has patented some improvements in steam engines applicable to such as are in part worked at high pressure and are fixed to the boiler on a separate bedplate and with a condenser attached so as to constitute part of the bed-plate, the shaft being solid so as to form the eccentrics for working the air pumps and such other parts of the engines as may be required. The intermediate or other parts of the shaft of oscillating and other engines are forged with solid eccentrics on the shaft, and thus the expense and risk of cranks on shafts are avoided. This is applicable to all kinds of engines, and is intended to dispense with the cranks, which are so liable to break. The air pumps are also worked from the piston rod, and supply the boiler direct from the condenser, thereby diminishing all the before-named working parts, and simplifying the general working of the engines. For this purpose a cross-head is fitted to the end of the connecting rod extending to the outside of the guides, and to this is attached the air pump on one side and the circulating pump on the other. The air pump in this case acts as a feed pump, and pumps direct from the condenser to the boiler.



The accompanying engraving shows the manner in which this invention is carried into effect. A is a bed-plate fixed upon a steam boiler, B B is a framing on which the cylinder, condenser, and parts connected with them are supported, C is the condenser, D is the cylinder, E is the piston rod, F is the cross-head, working up and down on the guide rods G G. This cross-head is carried out on each side beyond the guide rods, and has fixed to it the piston rods H H¹ of the air pump I, and feed pump K. L is a rod connected to the eccentric P, and M is a rod connected to the eccentric O. N is the shaft showing the eccentrics O and P, which are forged solid therewith. Q is the pipe from the condenser to the feed pump K.

PARAFFINE LAMP BURNERS.

THE object of this invention is to dispense with the draught chimney usually required for lamps in which camphine, paraffine, and other volatile oils are consumed. In performing this invention, a patent for which has been granted to Mr. Isaac Watts, jun., of Manchester, the tube for the wick and the apparatus for raising the wick are made as usual, but the wick tube is surrounded by a perforated casing; it is circular below and connected to the wick tube. The upper part is tapered and terminates in a flat slot with overhanging lips and open sides. This casing supplies the requisite air to the wick for the combustion of the volatile oil, and gives also the desired protection to the flame. In the annexed engraving fig. 1 is a front view of the improved burner, fig. 2 is a transverse section, fig. 3 a plan, and fig. 4 a longitudinal section of the same.

In these views *a* is the tube for the wick, and *b* is a cross shaft with two small catch wheels and a milled button, forming the apparatus for raising the wick in the usual manner, *c* is a perforated casing surrounding the wick tube. The perforations are to admit air for effecting the perfect combustion of the camphine, paraffine,

FIG. 1 FIG. 2

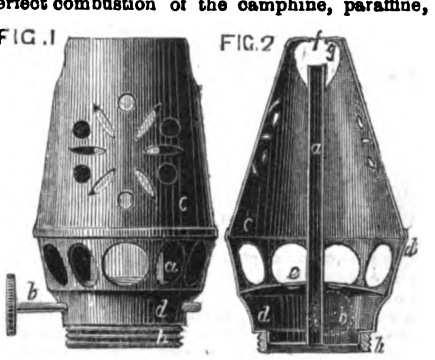
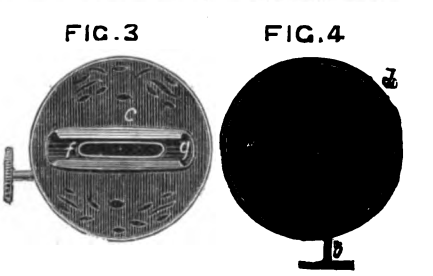


FIG. 3 FIG. 4



or other volatile oil to be consumed. These perforations may be made as shown, or in any other convenient manner. The lower end of the

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casing C is circular, and it is soldered or otherwise secured to the lower casing *d*, which is also perforated to admit air to the flame, and the lower casing *d* is connected to the wick tube by the disc *e*. The upper part of the casing *c* is gradually tapered, and terminates in a flat slot with overhanging lips *f* and open sides *g*. The top of the wick tube is rather below the top of the casing *c*, and consequently the lips *f* protect the flame from the surrounding air, while the peculiar shape of the open sides *g*, with the perforations in the upper and lower casings *c* and *d*, supply sufficient air to the flame to create the draught and to support combustion, thus rendering the draught chimney unnecessary. To the lower end of the lower casing *d* is soldered or secured the ring *h*, by which the burner is connected to the lamp.

POLISHING METALS.

Mr. George Printy Whittle, of Abinghall, Gloucester, engineer, and Mr. John Fox Gloyn, of Manchester, have patented an invention for improvements in the preparation and application of certain materials for the purpose of cleaning and polishing the surfaces of metals, which are also applicable to other purposes. In carrying out this invention the patentees take the slag, dross, or cinder produced from the smelting of iron, copper, and silver, and subject it to a suitable action of crushing, grinding, or pulverising by machinery, and when it is sufficiently crushed or pulverised, it is sifted into suitable degrees of fineness to suit the various purposes to which it is to be applied. The material thus produced is suitable for cleaning and polishing metals, sharpening knives, razors, and other cutting instruments, and may be used in the same manner as sand, emery, and similar materials are now used for the said purposes, and will be found very superior and more economical than sand, emery, or similar articles. This material is also applicable to filtering machines, as it makes an excellent filtering medium, and will supersede the use of charcoal, felt, and similar articles used for filtering water and other liquids. It also makes an excellent cement for covering the outsides of buildings, covering the surfaces of roads or streets, either used alone or mixed with other cements. As a cement for the foundations of houses or other buildings, roads, walks, or similar purposes, the powder is mixed with lime or other suitable material. It may also be used alone or otherwise as a tooth powder. This powder mixed with soap makes an excellent material for scouring floors, decks of ships, or other places; and it also makes an excellent hand soap, which may be used as a substitute for the ordinary sand soap.

PUBLIC TELEGRAPHS AND RAILWAY COMPANIES.

The recent increase in the charges for the transmission of telegraphic messages has led to the appearance of the following article in the *Scotsman* of Monday last:—It is matter of satisfaction and hope that influential representative bodies—such as the Edinburgh Chamber of Commerce—should cease to regard our public telegraph system with comparative indifference. The enlightened opinion, the vigilance, and the activity of those bodies, have not unfrequently been productive of great benefit, by overthrowing gigantic railway and other combinations against the public interest, and by giving a stimulus to reform in much that concerns the national welfare. Little attention has, however, been paid to the progress and condition of telegraphy, the management of which, less under the influence of public opinion than that of a railway company, has been permitted to take its own course unchecked; and thus has resulted that unsatisfactory performance of the public service which induced Mr. George Harrison to suggest the formation of a committee of the Chamber of Commerce with the object of stimulating telegraphic reform. That committee has already received ample evidence of the existence of a widespread feeling of dissatisfaction throughout the country, at once conclusively proving the necessity for taking active steps to remedy the evils complained of. What may be the result remains to be seen; but, so far as we are aware, the committee have not directed their attention towards, if indeed they know, the chief cause of that combination of the telegraph companies which has been justly pronounced to be in some respects worse than a monopoly. That cause is the extraordinary nature of the relations which subsist between most of the railway and the two oldest telegraph companies. Let full information be acquired as to the nature and extent of those relations; let railway boards and managers be taught and convinced that in connection with this matter their real interests are the public interests, and monopolistic combination will gradually become impossible; a fair field will be presented to public and to private enterprise, valuable inventions now unused will be utilised, and telegraphy will receive that powerful stimulus which is so desirable, and which will tend towards that full and unfettered development which is simply impossible under the existing arrangements.

Before stating the nature of some of those agreements which railway companies have entered into—in many cases to their own and to the public loss and inconvenience—a brief statement of the causes which have led to the present combination may not be uninteresting. The Electric and International Company were in possession of a legalised monopoly for several years. Evidence having been laid, however, before a Parliamentary committee, which conclusively proved that public business was performed in a most unsatisfactory way, a continuation of the monopoly was refused. The British and Irish and the Magnetic Companies were then formed, and subsequently amalgamated, thus leading to a considerable reduction of rates. On the establishment of the United Kingdom Telegraph, the older companies agreed to divide a certain portion of their business and profits, and not to oppose each other in certain places. Meanwhile, the United Kingdom Company, proclaiming loudly their intention of establishing and maintaining a uniform shilling rate, were received everywhere with satisfaction. No mention was made of the fact that their act left them at liberty to raise their tariff; and with the utmost confidence in the professions made by the agents of the company, merchants, manufacturers, and joint-stock associations, advanced sums of money sufficiently large to enable the company to extend lines from England to Scotland, without encroaching on the capital. No sooner, however, did the company attain the *ultima thule* of their extensions—Aberdeen—than they turned round and solemnly intimated that the shilling rate did not pay, and that the price for long distances must be doubled. It is not to be wondered at, therefore, that some of those bondholders, whose too great confidence made the company what it is, should now endeavour to resent the unfair dealing by instituting law-suits. With judicious management and fair encouragement, the shilling rate will pay, and pay well. The dividend of one of the companies, which, for ten years, continued stationary at 7 per cent., rose on the introduction of the shilling rate till it reached 9 per cent., and this, too, with additional competition in all the leading towns of England and Scotland. We assert, and we do so advisedly, that the United Kingdom Company have irreparably lost a splendid opportunity of success, chiefly from causes within their own control. The public and the press were in their favour, and by judicious management that favour could have been retained and increased. Take one case out of many. The introduction of the shilling rate led to the transmission of special news telegrams, which frequently contained many thousand words. The amount of money paid for those telegrams alone not unfrequently exceeded the whole week's income from private sources of any one of the companies in Edinburgh. Here was a new and a daily widening field, which in enterprising hands would have been most assiduously cultivated and extended, being more productive and less expensive and troublesome than the ordinary sources of revenue. But the telegraph company would not be guided by the principles of ordinary mercantile transactions. Those who would use their lines to the extent of twenty thousand words a week were charged at a rate practically a half higher than he who would use them to the extent of twenty words in a lifetime. If a railway company ignored season and return tickets, excursions, fêtes, and reviews, and demanded that every ton of coals and of heavy goods should be paid for at as proportionately high a rate or even higher as a parcel weighing one pound, no one would be surprised if the dividend were *nil*.

The proximate cause, however, of the increased tariff lies in the fact that a few months ago the older companies hired the United Kingdom Company to transmit all public intelligence north of Manchester; and the latter being thus "kept," could not in gratitude fail to resist the importunities of her protectors, and accordingly the rates were raised. The shilling tariff had popularised telegraphy to a certain extent—had rendered it a kind of necessity; and the question, in one quarter at least, was not whether the low rate would pay, but simply one of this nature:—Even if there is a falling-off of forty-nine per cent. in the number of messages, which cannot take place now that the public are accustomed to telegraphy, is it not clearly better to transmit fifty-one messages at two shillings, than one hundred at one shilling? The skilfully contrived subsidising of the United Kingdom Company has thus led to that powerful combination, carelessness, and delay complained of by the Chamber of Commerce. Instead of transmitting public despatches directly from London to the whole country as formerly, one company undertakes transmission to Manchester, and the other from Manchester northwards, so that the risk of error and delay is now doubled, and in some respects worse than doubled. The one company occupy the roads, whilst the others occupy every railway between Edinburgh, Glasgow, and all the leading English towns, to the absolute exclusion of all and sundry. Most of the leading railway companies have not only paid for the erection and maintenance of their own telegraphs, but have sacrificed their own rights in many cases, and granted to one or other of the older companies privileges which are absolutely incredible. What board of directors would pay a locomotive builder full prices to construct locomotives, and, without a shadow of reason, enter into an agreement with him under a penalty of thousands of pounds to employ him and him alone to build and repair all engines; to suffer him to run engines and trains of his own—to empower him to prevent those of any other builder or other company from appearing on the line—to convey himself, all his workmen and apprentices, all his materials, stores, parcels, and correspondence, free of charge, and to empower him to dictate who and what should be conveyed by any train?—and all this for half a century. And yet, such an agreement would not be a whit more absurd than some which exist between railway and telegraph companies. The North British have found that an agreement of the Edinburgh, Perth, and Dundee line absolutely precludes them till the year 1894 from erecting a single mile of wire on their own poles, from introducing or using any electrical apparatus whatever, from fixing a single insulator on any inch of their own ground or property, from erecting a pole, and from permitting any person or association of persons to erect, control, and maintain telegraphs, save only the telegraph company. In addition, sundry incredible privileges are conceded to that company. Hence the reason why such places as St. Andrews and other quarters in Fifeshire are wholly deprived of electric communication; and many towns throughout the country are in the same disagreeable position. The telegraph company know their advantage, and will not extend lines to those places save on their own terms. Thus the public are not only deprived of the use of an invaluable invention, but they are deprived of all hope of competition. Thus, the county of Caithness, to which communication during the herring fishery would be invaluable, has entirely failed to obtain the benefit of that communication, although offers have been made to pay the cost of extension by public subscription. Hence, year by year, a great interest is seriously injured by isolation from the markets of the south and of the Continent, simply because the arrangements of the Inverness and Perth Junction Railway prevented competition when competition was in the field. £1,500 would have covered the cost of extension. £3,000 were demanded, with a guarantee that if the revenue in Wick fell short of a stipulated sum, the fish-curers and dealers would meet the deficiency for a period of twenty-one years. And what were the advantages held out to them in return? The privilege of sending messages over a line which they had much more than paid for, at four times the price which prevailed in the larger towns! Is a system of this nature—a system which thus holds one half of the country at its mercy, and cripples industry by depriving it of one of its most valuable auxiliaries—deserving of aught else at the hands of business men than of every legitimate effort to complete its overthrow?

Railway boards have utterly failed to see that by means of some of their agreements they have not only sacrificed public and private interest extensively—have not only cut off whole towns, parishes, and counties, from all hope of communication for years to come, but have sacrificed their own interests to an extraordinary extent. They have failed to see that their policy tends to stifle competition; that it is for their own as well as for the public interest that competition should be encouraged; that competition would give them superior instruments, superior lines, superior workmanship, superior maintenance, lower prices, better attendance, and, above all, absolutely complete use of, and control over, their own wires—what many boards have not at present. In the trial of a collision case, would the excuse avail them that their wires could not be used at the moment, in consequence of their being occupied with private messages; or that they could not use such and such an apparatus to prevent the collision, because they had sacrificed their rights to purchase any electrical apparatus save from one company? Is it not a fact that in many cases public safety has been endangered, and traffic interfered with, not for hours or for days, but for whole years, as on the Edinburgh, Perth, and Dundee line, solely because certain boards had bound themselves hand and foot so helplessly that they could not obtain the use of their own wires, at any moment? What guarantee have they against that progress of electrical science which may, and assuredly can, render collisions a thing of the past, and increase the value of their lines by rendering it perfectly

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safe to convey ten times the existing traffic? What pledge have they that they could secure the use of inventions which would attain those objects? Is it not a fact that some of our companies have rendered themselves so helpless that they must fall back on a signalling apparatus abandoned by its inventor twenty years ago as frequently useless, and even dangerous? But, what is more to the point, most railway boards have utterly failed to see that, instead of paying telegraph companies and conveying officials, &c., free, that telegraph companies should pay them—that the mere right of way is of great value, and that that right of way could be let advantageously to public companies and private persons alike. If a pound or two pounds per mile were charged for rental, some great railway companies would derive an income of thousands of pounds a year without trouble or outlay. No telegraph company would take the road under any circumstances if a railway were open to them even at a higher rental than we have stated. The South-Eastern and Dover Company have persistently retained their wires in their own hands under intelligent supervision, and, as was lately shown, with the result of an immunity from accidents such as no line in Europe can show. In some cases there are twenty, thirty, and forty wires converging towards one quarter. Here would be a fair source of revenue on a line of several hundreds of miles—an income instead of an outlay of thousands of pounds. The iron trade of Glasgow, Liverpool, Manchester, and London, have expended from £15,000 to £20,000 a year on telegrams alone. And yet, if the railway poles were open to their use, the trade could have had a line of their own—absolutely devoted to their own use, and much better worked—for a merely preliminary outlay of less than £5,000. So that not merely national, but great vested interests are seriously injured by the existing arrangements. The merchant, the manufacturer, the ironmaster, and the coalmaster alike suffer from difficulties in communicating with their distant places of business.

If the Chamber of Commerce could succeed in placing the whole matter in its true light before every railway board in the kingdom—urging those whose agreements are about to expire to leave their lines free, and those whose agreements will continue in force for years to exercise a judicious revision, they will not only gradually break down the existing combination, but confer a lasting and really incalculable benefit on the whole country. The fact of the chief lines being open would be half the battle won to a new company, as it is the closing of those lines alone which prevents immediate competition. The Bonelli instrument—one of the most philosophical and remarkable inventions of our time, although susceptible of improvement—was howled and brayed down by an interested opposition. Yet there is reason to believe that, had its promoters at first seen their way to traverse the railways, it would ere now have been flashing its sixpenny messages between Edinburgh, Glasgow, and London, and wearying us at our breakfast tables with its daily budget of ten columns of the "latest news." Nay, more: under the existing system, invention is completely fettered, if not absolutely stifled. In most cases there is no field for it. The public are thus deprived of the benefits of instruments greatly superior to those in use. What progress can invention be expected to make if there is absolutely no market? An eminent electrician justly remarked—"It is idle to bring forward anything new, however useful or perfect. The market is effectually closed against us. Two telegraph companies monopolise most of the railway connection, and it is for their interest to sell their own apparatus, to the exclusion, wherever possible, of all others." Could improvement be expected in any department of industry, more especially in one essential to the welfare of the whole country, if that department were absolutely in the hands of one capitalist, who found it for his interest to use his own antiquated engines, and manufacture his own antiquated goods, absolutely uncontrolled by public opinion or by Parliamentary legislation? Would we now enjoy such great facilities of communication had the whole railway and steamship system of the empire been in the hands of one or at most of two companies? Unless something is done to break down the existing railway arrangements, telegraphic reform will be impossible for the next half century; and the country of free trade—the country where commerce and manufactures are being developed with daily accelerating velocity—the country in which the telegraph itself was invented, will be deprived of the full benefits of an invention the great uses and powers of which can only be developed to a fractional extent under the existing system. The Chamber of Commerce can accomplish much; it has accomplished more than telegraphic reform; and it will be strange, indeed, if acting separately, as well as in conjunction with kindred bodies throughout the country, it does not give such a stimulus to electric communication as will lead to that full and free development which is so necessary to every class of the people.

IMPROVEMENTS IN RAILWAY CARRIAGES.

CAPTAIN CLAXTON, of Park-road, Brompton, the floater of the great tubular bridge, has evinced his interest in the question of railway intercommunication by patenting an invention having for its object improvements in railway carriages by which the security of passengers against personal assaults and other insults will be rendered more perfect, and by means of which evidence against offenders would be easily obtained. For these purposes he makes an opening in each of the partitions which separates one compartment from another, and fills the same with wire gauze. The whole is made of sufficient size to allow sound to pass with sufficient facility to allow any loud noise to be heard freely from one compartment to the next through the gauze, and also when the gauze is forcibly removed to enable a person to see freely from compartment to compartment, but it is not made sufficiently large to allow of a person passing through it. The gauze is sufficiently fine to prevent its being seen through, and, to prevent ordinary conversation being heard through it, it may be used double if required. In the engraving fig. 1 shows a tranverse section, and fig. 2 a longitudinal section of a compartment of a railway carriage. *a a* are two holes or openings formed through the partition *b b* which divides two compartments of a railway carriage one from the other. These openings or holes are shown to be above the ordinary netting, but this is not essential, as they may be lower down when desired. The drawings show the shape of the openings to be rectangular, but this may be varied. In each opening or hole a frame is hinged to admit of its being opened from either side by a suitable handle and catch; or the one may be arranged to open into one compartment, and the other into the other compartment. The frames have wire gauze in them which will admit of sound passing from one compartment of a carriage to another, so that, in the event of any person making any unusual or extra noise in one compartment, it would be heard by passengers in the next or other compartment of the same carriage, whilst ordinary conversation would not readily or at all be heard from one compartment to another.

FIG. 1

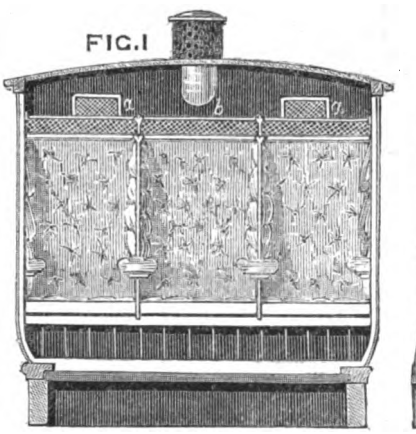
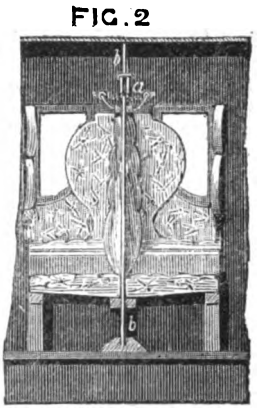


FIG. 2



INVISIBLE PHOTOGRAPHIC IMAGES.*

By MR. M. CAREY LEA.

SOME experiments in which I have lately been engaged seem to me to finally settle the long-contested question as to the nature of the invisible photographic image, and I hasten to send a very brief description of them, hoping it will be in time for your July number. The view that the change which takes place in an iodo-bromised plate in the camera, is a purely physical one; that no chemical decomposition takes place, and neither liberation of iodine nor reduction of silver, has obtained a pretty general acceptance. But latterly it has been opposed by two distinguished photographers, Dr. Vogel and Major Russel. The former affirms that iodid of silver is never sensitive unless there is a body present capable of taking iodine from it under the influence of light. And Russel believes that the developed image is chiefly produced at the expense of the silver haloid in the film. The following experiments seem to me to decisively close this controversy in favour of the physical theory:—

Experiment 1.—If the iodid or bromid of silver in the film undergoes decomposition in the camera, and still more, if the developed image is formed at its expense, the film of iodo-bromid must necessarily be greatly consumed in the development under the dense portions of the negative, which it has contributed to form. To settle this point, I exposed and developed an iodo-bromised plate in the ordinary manner. Then, instead of removing the unchanged iodid and bromid by fixing in the ordinary manner, I took measures to remove the developed image without affecting the iodid and bromid. This I succeeded in doing with the aid of a very weak solution of acid per-nitrate of mercury. Now, if the iodid, or bromid, or both, had been in any way decomposed, to form, or aid in forming, the developed negative image, when this came to be removed, there should have been left a more or less distinct positive image, depending upon varying thicknesses of iodid and bromid in the film, much like a fixed negative that has been completely iodised. Nothing of this sort was visible, the film was perfectly uniform, just as dense where an intense sky had been, as in those parts which had scarcely received any actinic impression, and looking exactly as it did when it first left the camera, and before any developer had been applied. This experiment seems sufficiently decisive. But the following is far stronger:—

Experiment 2.—A plate was treated in all respects as in No. 1, except that the application of the nitrate of mercury for removing the developed image was made by yellow light. The plate, now showing nothing but a uniform yellow film, was carefully washed, and an iron developer, to which nitrate of silver and citric acid had been added, was applied. In this way the original image was reproduced, and came out quite clearly with all its details. Now as every trace of a picture and all reduced silver had been removed by the nitrate of mercury, it is by this experiment absolutely demonstrated that the image is a purely physical one, and that after having served to produce one picture, that picture may be dissolved off, and the same physical impression may be made to produce a second picture by a simple application of a developing agent.

Since the above was written, I have repeated the experiment with a pyrogallic development with similar results. Both the first and second developments may be made with an iron developer, or both with a pyrogallic. The experiment succeeds without the least difficulty in either way.

* Communicated to the "American Journal of Science and Art" for July, 1865.

TO CORRESPONDENTS.

The MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post-office orders made payable to Mr. R. A. Brooman, of 166, Fleet-street, E.C.

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All communications should be addressed to the EDITOR, 166, Fleet-street.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith.—ED. M. M.

RECEIVED.—R. P. E.—J. N.—G. S.—R. P. E.—W. R. W. W.—G. S.—J. H. T.—W. B.—W. H. P.—W. L. W.—J. S.—T. C. C.

R. MARSTON.—The quantity of water required for a turbine depends upon the fall of the water. A 1-horse power turbine will require 40,000 cubic feet per hour for 1ft. fall, or 4,000 for a 10ft. fall.

Miscellanea.

Seventy despatches from different parts of Europe, and which contain meteorological observations, arrive at M. Le Verrier's bureau in Paris, between 9 and 11·30 a.m., every day. The observations in these are immediately reduced, the weather forecasts drawn, and between 12 and 1 they are telegraphed to all parts of France and various European capitals. At 2·30 p.m., the daily bulletin is issued, and circulated to all correspondents for the cost of the paper and printing. M. Le Verrier suggests the formation of a central and European bureau for contracting the international part of the service.

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Orders have been received at Woolwich Arsenal that all carriages and slides for ship guns of six tons weight and upwards are to be of wrought iron. A considerable number of wooden gun-carriages and slides were made before it was discovered that wood was unfit for that purpose. A considerable time must therefore elapse before the requisite machinery can be got ready, and the men accustomed to making iron gun-carriages.

New carriages of a luxurious kind are about to placed on the Nicholas Railway between St. Petersburg and Moscow. In addition to a handsomely furnished saloon and smoking chamber, each carriage comprises a series of smaller apartments opening on both sides of a corridor. The sofas, ottomans, and cushions of the daytime are at night converted into beds, mattresses, pillows, &c., so that the passengers can sleep with all the comforts of home. These improvements are not confined to the first-class carriages, but are extended to those of the second and third-class. Our railway directors and managers would do well to follow this example. Of course a slight additional charge is made to passengers using these conveniences.

It appears, by an official document, that in the year ending March 31st last, the duty paid on patent medicines produced as much as £55,333 0s. 4½d.

The following statement gives an idea of the cost of keeping Paris clean:—The sweeping of the macadamised roads costs £33,680 a year; the cleaning of the paved ways £91,000, of which £3,120 goes for materials, £20,400 for carting away the dirt, and the rest in paying the sweepers, who consist of women as well as men. The expenses of management and superintendence are £10,400. Total expenditure, £135,080.

A heavy fall of rain took place at Kingston, Jamaica, on the 19th ult., which was estimated as equal to two inches, or about 45,000 gallons to the acre, in one hour and twenty minutes. During last year the fall of rain on the 24th of May in twenty-four hours was equal to 43,000 gallons, and on the 27th of May of the same year within the same space 45,000 gallons. In proportion, Kingston has not had a similar fall of water since the year 1848.

Oaken barrels may be prevented from colouring spirit by dissolving one part of ammonia alum and two parts of sulphate of iron in one hundred parts. Well wash the casks with this solution boiling hot, and allow them to stand for twenty-four hours. Then rinse out the casks well, dry them, and finally give them a washing with a thin solution of silicate of soda.

From New York we learn that a project has been started for a line of steamers between that port and Bristol, to be called the Transatlantic Express and Passenger Steamship Company. The idea is to apply the European hotel system to ocean steamers by charging only for the berth occupied, and allowing each passenger to pay separately for meals. The company are to construct several iron steamers after an improved pattern, large, roomy, and of light draught, and with a height small in proportion to the length (590ft.) and width, so as to prevent rolling and pitching.

We learn from a Rouen paper that Messieurs Gouverneur, De Butter, and Eichelbremer, of Nogent-le-Retrou, in the department of the Eure-et-Loire, have succeeded in perfecting a method of obtaining a cheap gas for lighting purposes. They simply use the refuse of apples and pears after the manufacture of cyder and perry. The apparatus consists of a portable furnace and still head, an additional piece which performs the functions of condenser, washer, and purifier of the gas, and a gasometer. Each charge yields 500 litres, or half a cubic metre of gas, or at the rate of 170 metres per ton of the refuse. The heat required for the distillation is said to be 200 deg. Cent., or about one-sixth of that required for coals. The advantages of this gas are said to be that it does not contain sulphur, burns without any odour, has no effect on paint or gilt work, and possesses more illuminating power than coal gas. Several manufacturers in the district are said to have availed themselves of the invention, and farmers are delighted with the prospects of converting useless refuse into gas or money.

The iron screw steam ram corvette "Pallas," is ordered to carry the following armament:—Four 300 and two 100-pounder Armstrong guns in the midship batteries, four 40-pounders on the upper deck, one in the captain's cabin, and one abaft, and two pivot guns forward and aft on the weather deck. She is rapidly approaching completion, and will be undocked on the 30th of November next.

The great Chicago Lake tunnel is being pushed forward very successfully. The mammoth crib, which is to be the terminus in the Lake, has just been sunk about two miles from the shore, from which distance the water to supply the city will be taken. The work advances at the rate of 17ft. a day, and the workmen have already bored it out from the shore at a distance of 3,206ft. When completed the cost of the tunnel will not be less than 2,000,000 dol.

Trials were made last week on board her Majesty's ship "Excellent," of Mr. Cunningham's training winch for traversing heavy guns on board ships and in batteries. This simple and efficient method of training heavy guns is fitted to a 300-pounder or 12 ton gun on board the above ship, and its working was very successful. Two men traversed the gun from extreme right to extreme left, and *vice versa* (40 deg.) in nine seconds, and one man could easily train the gun for ordinary range firing. The training winch involves no fittings about the carriage or deck, and so simple is the application of it that it was fitted to the gun on board the "Excellent" in less than one hour, and the gun was at once manned and worked. The training winch can be attached to any description of traversing carriage without alteration to the carriage. It is admirably adapted for guns in batteries, as it enables them to be trained from positions of safety to the gunner, and also with more precision and greater rapidity than by the ordinary means. This consideration also particularly refers to iron-clad ships, as the training winches are placed between the quarters and quite out of way of shot entering the ports.

We understand that Captain Colomb and Captain Bolton's arrangements for signalling are being used in conjunction in the British army, and that the two officers are still engaged in perfecting, with the results of their joint experience, the system and apparatus for all purposes.

The works of the Pneumatic Despatch Company from the North-Western Railway terminus, Euston-square, to the central depôt at the Bull and Gate, Holborn, are very nearly completed, and the line is expected to be in working order within a few days. Under the direction of the company's engineer, Mr. Rammell, a carriage has been passed backwards and forwards in the tube. The actual terminus of the trunk line, apart from that between Holborn and Euston-square, is intended to be constructed in St. Martin's-le-Grand, and to this spot the tube will be eventually carried, having already reached the brow of Holborn-hill, about half a mile eastward of the central depôt. The present line may be regarded as the trunk of a future extensive pneumatic system, the branches of which will intersect the principal districts of the metropolis.

During the year 1864, out of nearly 27,000 persons who were engaged in raising upwards of ten million tons of coal during the time, 119 were killed and 218 injured by 95 accidents which occurred.

A correspondent of the *Times* calls attention to the fact that, while a telegram can be sent from London to Paris, and thence to Lisbon, for 9s. 2d. (namely, 5s. to Paris and 4s. 2d. from Paris to Lisbon), the charge from London to Lisbon direct is 16s. This difference in favour of France is said to be in consequence of a convention between France, Spain, and Portugal on the subject; but it is fair to suppose that, upon the necessary measures being taken, England might be placed on an equal footing, and, as the number of telegrams is rapidly increasing with the progress of our commercial relations with Rio de Janeiro and Buenos Ayres, the question seems to demand attention.

It is stated in France that the miniature railway which is to connect Enghien with Montmorency is to be opened to the public towards the end of the year.

The following are the principal dimensions of the new iron-cased frigate Hercules, of 1,100 horse power (nominal), which is about to be commenced at Chatham:—Length between perpendiculars, 305ft.; extreme breadth, 59ft; depth of hold, 20ft. 7in.; burden in tons 4,813 14-94. Her sides are proposed to be constructed of a thickness greater than any vessel now afloat, in order to render her as nearly as possible invulnerable to the heaviest description of ordnance she may be called upon to face. For this purpose the Hercules will be plated with a thickness of no less than 11½in. of iron, in addition to 32in. of timber backing at the waterline, and in immediate contiguity to her gun battery. Her armour-plates will be composed of the best description of rolled iron, 9in. thick, in addition to which a double skin of iron-plating, composed of plates 1½in. in thickness, will be worked behind the 10-inch teak backing, to which the armour-plates will be bolted. Behind these again will be 22in. of timber, and, finally, the ordinary ¾-inch inner plating, or skin of the frigate.

A conference of members of council, secretaries of science committees, and science teachers, of the Lancashire and Cheshire Union of Mechanics' Institutes, was held at the Manchester Institute, on Saturday last, for the purpose of considering the fees paid by pupils, the examinations and prizes awarded by the Government, and other matters relating to science teaching. Dr. Watts occupied the chair. Mr. J. C. Buckmaster, from the Science and Art Department, stated the results of the last examination. He said the first examinations were held in 1861, when there were only seven certificated science teachers in the two counties and six classes with 137 pupils. Now there were forty-seven certificated teachers, thirty-seven classes, and 2,063 pupils in the district embraced by the association.

The *Hamilton* (Canada) *Times* states that on the 18th ult., Leslie, the American Blondin, crossed the Niagara at the Falls on a rope 961ft. in length. He started from the American side wearing about his waist a broad band of thin iron, and from this chains led to his wrists and to bands encircling his legs about the knees. The irons were *bona fide*, not of the description provided for a previous performance of the kind, and weighed about 28lb., which, with the balancing pole, made a load of nearly 80lb., which was carried over the rope. A high wind was blowing at the time. When he arrived at the Canadian shore, his appearance indicated that the feat had been a trying one. He speedily recovered his composure, and in five minutes started on his return, on this occasion relieved of his shackles, and performing several ventures on the way, such as hanging from the rope by his feet, the violent gusts of wind sometimes rendering his position one of extreme peril.

Among the numerous plans for rendering the bottoms of iron ships proof against fouling, is one by Mr. Mulley, Lloyd's surveyor at Plymouth. It consists in completely encasing the ship's bottom with wood to a considerable height above the deep load-line, and then covering the wood with a sheathing of yellow metal in the same way as the bottom of a wood ship is sheathed. This method of treatment he applied to the "Iron Gem," which is now in the Clarence Graving Dock for inspection, she having just returned from a voyage to the Brazils. The outer metal sheathing is smooth and clean, not exhibiting even a wrinkle, while, by the ingenious yet simple mode in which the wood casing is secured to the hull, no metallic contact is possible between the iron of the ship and the yellow metal or any of its fastenings, and by this arrangement galvanic action is completely prevented.

It is stated that the inspectors appointed to carry on the works of Messrs. Levick and Simpson, of the Blaina, Coalbrookdale, and Cwmcelyn Works, on behalf of the creditors, will, in all probability, receive an offer to take the works off their hands at once, and to pay the creditors in full, an offer which, it is believed, will be readily accepted by the creditors, for although the assets apparently show a large surplus, yet if the iron trade happened to get depressed the value of the works would be materially decreased.

The *Building News* states that the annual meetings of the British Association will be held next month, at Birmingham. Excursions into the Black Country are being planned, and invitations have been sent in greater numbers than can possibly be accepted. Reports on the iron trade of the district are being prepared by a local committee, and similar reports on the coal fields, and various manufactures peculiar to South Staffordshire, are in course of preparation. It has been arranged to inspect the iron, fire-clay, and glass works of Stourbridge; to visit and examine the geological features of Dudley and its neighbourhood; to inspect the numerous interesting works at Wednesbury; and other excursions to Wolverhampton, Oldbury, Spon Lane Works, have also been decided upon. Advantage will be taken of the first day's visit to Birmingham to open the Central Lending and Reference Library, in Ratcliff-place, attached to the Midland Institute.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgement:—

BOILERS AND FURNACES,—219, 224, 240, 243
BUILDINGS AND BUILDING MATERIALS,—220, 223, 232
CHEMISTRY AND PHOTOGRAPHY—218, 244
CULTIVATION OF THE SOIL, including agricultural implements and machines.—202, 204
ELECTRICAL APPARATUS,—206
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c.,—212, 231, 236, 248, 251, 255
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals,—205, 207, 211, 221, 246, 249
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.,—203, 214, 230, 258
GENERAL MACHINERY,—208, 237, 238, 241, 252, 257
LIGHTING, HEATING, AND VENTILATING,—256
METALS, including apparatus for their manufacture,—209, 229, 259
MISCELLANEOUS—222, 226, 227, 234, 235, 245, 250
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.,—215, 216, 239
SHIPS AND BOATS, including their fittings,—210, 225, 228, 233, 242
STEAM ENGINES, &c.,—217, 260
WARFARE.—213, 247, 253, 254

202 B. KING. *Improvements in the manufacture of manure* Dated January 23, 1865.

In the manufacture of manure according to this inven-

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tion the patentee uses the following ingredients in the proportions hereinafter stated, which may, however, be modified if desired. He first takes four tons of animal excrement or dung, which has been previously placed in heaps for some five or six months in order that it may become well decomposed; this dung he sifts through a half inch sieve to render it suitable for drilling; he steeps from two to four tons of bones in water, by preference dilute urine, for from twelve to twenty-four hours; he then mixes and entirely covers with sulphuric acid and allows it to stand until the bones become a jelly. In this state the softened bones are mixed with the excrement, together with about from eight to sixteen cwt. of sulphate of lime. The whole of the ingredients are mixed in a boiling state, and again placed in heaps until the manure becomes decomposed, which will require at least a month before it will be ready for use, and may with advantage be kept for a much longer period. *Patent completed.*

203 A. C. F. DEROCQUIGNY and D. GANCE. *Improvements in sewing machines.* Dated January 24, 1865.

This invention consists in certain improvements in sewing machines, by which the patentees work buttonholes, and that kind of embroidery known as scalloping, and the loop tambours, zigzag, whip, and any other kind of stitches. The specification of the invention is too elaborate to be quoted here in detail. *Patent completed.*

204 C. T. WELDS. *Improvements in ground vineries or glass ridges for the cultivation of grapes or other fruit.* Dated January 24, 1865.

The length of ground vineries or glass ridges varies according to circumstances, and they have a cross section which resembles a triangle, one of whose sides is removed. As these ground vineries or glass ridges are now constructed, their sides and ends are permanently united together. The present patentee, on the contrary, unites the two sides together by hinges at the apex of the angle formed by them, which allows of one side being turned over and laid upon the other side, and thus easy access can be gained to the grapes or other fruit underneath them. He also unites each to one of the sides by hinges, so that, when not in use, the sides and ends can be folded upon one another, and the said vineries or glass ridges can then be stowed away in a small space, or carried from place to place with great facility. *Patent completed.*

205 R. R. RICHES and C. J. WATTS. *Improvements in mills for grinding corn and other substances.* Dated January 24, 1865

This invention relates to mills in which the grinding surfaces are composed of a horizontal corrugated cylinder, combined with a similarly corrugated concave or under grinding surface, and consists, in the first place, in forming the teeth or corrugations in the concave with an extended grinding surface. The invention consists, in the second place, in dividing the concave into two or more separate parts lengthwise (but by preference into three parts), for the purpose of adjusting each of such parts separately to the proper distance from the convex grinding surface of the cylinder, as required, instead of adjusting the concave formed in one piece as usual. The invention consists, in the third place, in the combination with mills of the construction referred to of a flour dressing machine, so as to constitute together a portable grinding and dressing machine, such combined machine being mounted either on a carriage or on a portable frame. The invention consists, in the fourth place, in arranging the interior of the hopper and feeding apparatus of such mills in such manner that two or more kinds of grain or other substance may be mixed and afterwards operated upon together in any required relative proportions. The invention consists, in the last place, in forming the concave and the cap in one casting, and fixing the same to the frame, combined with a mode of mounting the cylinder so as to admit of its being moved lengthwise, in order to adjust the grinding surfaces to their required distance apart. *Patent completed.*

206 J. ROVERE and H. A. B. HUGUET. *A new electric pile.* Dated January 24, 1865.

In performing this invention the inventors obtain electricity from the atmosphere by means of a metal rod terminating in a sharp point, and erected in an upright position at the top of a house or building, or of a mast or pole. They obtain electricity from the earth by means of a metal bar set in an upright position in the ground (preferring damp soil), or in a well or the like. This bar terminates at top in a sharp point. If this point be placed near to the lower end of the rod erected in the atmosphere, an electric current will set in from the atmosphere to the earth, or from the earth to the atmosphere, whereby an electric pile is formed. When the circuit of this pile is closed, that is to say, when in the space between the rod or point fixed in the ground or well, and the bottom of the rod erected in the atmosphere, there be placed a body or an electro-magnet, the various effects obtained from voltaic piles will be obtained from this arrangement, as for example, light, heat, and motive power. Several of such piles combined will form a battery. *Patent abandoned.*

207 G. HASELTINE. *Improvements in the mode of, and means for, preserving fruit and other eatables.* (A communication.) Dated January 24, 1865.

This invention cannot be described without reference to the drawings. *Patent completed.*

208 J. BAILEY. *Improvements in fly or embossing presses.* Dated January 24, 1865.

The stand or frame of this fly or embossing press has a hole formed in it which is bored out at its lower end to fit a ram, and at its upper end it is tapped to receive a screw nut, bush, or collar. The screw shaft which actuates the ram is made to screw into the ram, which is tapped to receive it, and the ram is prevented from rotating with the screw shaft, and is kept steady by means of a V-formed part, which is adjustable to a V-formed groove extending lengthways in the direction of the movement of the ram. The upper end of the screw shaft passes through the screw nut or collar, and fits so that a collar formed upon the screw shaft comes against the under side of the screw nut, which thus receives and resists the pressure when the ram acts. A loose collar is fixed upon the screw shaft above the screw nut, so that, by means of these two collars upon the screw shaft, it is prevented from moving endways. In presses arranged according to this invention the ram alone has end movement, and the screw shaft has simple rotary movement. *Patent abandoned.*

209 W., R., and J. WOODWARD and A. WOODWARD, jun. *Improvements in furnaces for melting metals and smelting ores.* Dated January 24, 1865.

This invention consists, firstly, in arranging and combining furnaces for melting metals and smelting ores so that air may be supplied thereto by applying and using in furnaces so arranged and combined one or more jets of steam in the flue, funnel, chimney, or chimneys leading from the furnace, thereby creating a partial vacuum above the fire or fuel in a state of combustion, the required air to support the combustion entering at proper orifices arranged at the lower part of the furnace. The invention consists, secondly, in the construction of furnaces for melting metals and smelting ores according to the first part of the invention by arranging and combining therewith steam boilers, and applying the waste heat of the furnace to generate steam for creating the partial vacuum above the fire, the sides of the furnaces, or the flues or chimneys of such, being formed wholly or partially of a hollow vessel or hollow vessels to contain water, these vessels forming steam boilers. *Patent completed.*

210 T. STEEL. *Improvements in apparatus for lowering boats and disengaging them from their tackle.* Dated January 25, 1865.

This invention has for its object the combination and arrangement of apparatus by means of which boats may be lowered from the decks of ships or other vessels simultaneously at both ends by means of a rope passed from the blocks on each davit, such two ropes being brought together and passed round a cleat fixed to the deck or other convenient part of the ship. Then the boat is disengaged from its tackle by the simultaneous opening of a connector at each end, caused by the pull of chains of suitable length, which become in a state of tension when the boat has been lowered to the required extent. *Patent completed.*

211 A. STEVENSON. *An improvement in the construction of mills for grinding and pulverising grain and other substances.* Dated January 25, 1865.

This invention relates to the "ventilation" of those mills in which one stone is made to rotate or rub over or in near contact with another and stationary stone. To accomplish this the inventor attaches to the inside of the said mill-stone case one or more pieces of metal or other material which project inwards therefrom, preferably at an angle near to the surface of the running stone, so as to intercept the heated air and steam or moisture; and, by connecting into the mill-stone case at the side of each of the projecting or intercepting pieces a pipe or spout, he carries the same to a chamber, if it contain "stive," or otherwise to the outside of the building. The mill-stone case, instead of having projecting pieces attached thereto, may itself be made of angular or other form to intercept the heated air. *Patent abandoned.*

212 R. A. BROOMAN. *The manufacture of a new thread for weaving and other uses.* (A communication.) Dated January 25, 1865.

This invention consists in a particular method of producing spotted or speckled threads, and is based on the irregular winding of one or several threads round one or several threads of the same or of different nature and of different colours. Suppose, for example, a thread is unwound from a bobbin and passes through another bobbin from which a thread of a different colour is being unwound at the same time so as to surround the first thread in an irregular manner, spots or specks are produced the variety of which depends on the advance of the first thread and the winding or rotary movement of the second. The spots will, for example, be very decided if the first thread moves and stops at regular or irregular periods while the winding of the second thread is continued. It will be understood that when the first thread advances, while the second thread of a different colour winds round it, the latter forms round the first thread spirals which are plainly separated from each other; but if the motion of the first thread be stopped or slackened, and the second thread continues to wind round it, the spirals of the second thread become superposed or laid one against another round the first thread without leaving spaces between the spirals, and form a spot or speck thereon. If the first thread be then again caused to advance without the winding of the second thread being stopped, the latter will again form distinct spirals until the advance of the first thread is again stopped or slackened to form superposed or close spirals, and so on. *Patent abandoned.*

213 J. MARSHALL and H. MILLS. *Improvements in manufacturing ordnance and gun barrels of cast steel or of homogeneous iron.* Dated January 25, 1865.

In carrying out this invention the inventors form, by the process of casting, hollow cylindrical ingots of cast steel, or homogeneous iron, which hollow cylindrical ingots are, when required, elongated and reduced in diameter by the process of rolling, drawing, tilting, or hammering, until they are reduced to the required size. They are then made into ordnance or gun barrels in the ordinary manner. *Patent abandoned.*

214 C. ROQUES. *Improvements in the construction of brushes and in the apparatus or means connected therewith.* Dated January 25, 1865.

This invention is more particularly applicable to brushing long hair, such as that grown upon the heads of females. The apparatus consists of a rod or shaft upon which a pulley is rotated by means of a driving belt, the shaft or rod being furnished with handles by which the operator holds the brushing apparatus against the head of the person to whom it is applied. Upon the rod or shaft there is also fixed a frame of metal or other suitable material, at each end of which a roller is fixed; upon this frame the brush is stretched, and is caused to travel upon the rollers by means of a belt passing from a pulley connected and driven by the driving pulley on to one of the rollers which carry the brush. When stretched, the brush is in the form of an oblong with rounded ends, and in travelling one of its sides is applied to the head of the person. *Patent completed.*

215 S. L. and A. FULLER and C. MARTIN. *Improvements in the construction of carriages, parts of which improvements are also applicable to other purposes.* Dated January 25, 1865.

This invention is applicable to the carriages which are called or known as landaus, and other carriages provided with removable fronts, consisting of framing and glass plates or lights arranged therein. In such carriages, when constructed in the ordinary way, great inconvenience is occasioned by the great difficulty in raising and lowering or removing the framing and lights contained therein, and by which the fronts of such carriages are formed in consequence of such parts being disconnected and entirely independent of each other. By means of these improvements the said operations can be easily performed by one person. The framing of which the front portion of the carriage head is formed is provided with hinges or joints at the angles thereof, so that the frame immediately behind and parallel with the driving seat shall be capable of falling towards the same in a sloping position. The top part of the carriage front, which is usually covered with leather, is jointed to the said last-mentioned frame, and is capable of falling and resting upon the same, thus protecting the glass, while those portions of the frames which form the front sides of the door-framing hold down in a horizontal or nearly horizontal position upon the sides of the body of the carriage. The last-mentioned portions of the framing or door pillars are so constructed that the glass plates or lights at the sides of the front portion of the carriage can be slid behind or through the door pillars (which may be constructed with suitable slots therein for such purpose), and lowered into the door casings, the latter being made of sufficient capacity to contain the same. When the framing is raised and placed in its upright position, the side windows or lights are raised from the door casings, and slid behind or through the door pillars, as before mentioned, into the other portions of the framing, which are suitably grooved to retain them, so as entirely to close the front part of the carriage. *Patent completed.*

216 O. GÖSSELL. *Improved apparatus for adjusting the weight of railway carriages and engines.* (A communication.) Dated January 25, 1865.

This invention cannot be described without reference to the drawings. *Patent completed.*

217 W. PATON. *Improvements in packing for steam joints, stuffing-boxes, pistons, and the like.* Dated January 26, 1865.

In making the packing for a circular steam joint, for example, a tube formed by plaiting flax or other suitable yarns or threads is cut to length about double that of the ring for the joint when opened. This tube is doubled over upon its ends, so that the loose yarn ends are turned inside, this being done with both ends of the tube, so that the two sets of loose ends meet each other. The outer butt ends formed by this means are then stitched together, and the packing is worked into the form of a flat ring, and is saturated with red lead or other substance suitable for making the joint tight. This packing may, of course, be made square or of other forms according to the shape of the steam joint to be packed. *Patent abandoned.*

218 D. GAY. *Improvements in photo-sculpture, and in apparatus to be employed therein.* Dated January 26, 1865.

This invention relates to an improved method of treating photographic portraits when intended to be employed for obtaining sculptured models therefrom. We cannot here give space to the details of this invention. *Patent abandoned.*

219 C. D. ABEL. *A new or improved apparatus, applicable to steam boilers, for preventing deposits therein.* (A communication.) Dated January 26, 1865.

This apparatus consists of a hollow closed vessel, by preference of a spherical form, situated above the boiler and made of equal strength with the same, which vessel is connected at its lowest extremity with the boiler by means of a pipe provided with a stop-cock or valve. At its upper end the vessel carries a funnel, also provided with a cock or valve, through which the chemical or other fluid or compounds are introduced into the vessel, such introduction of the fluids or compounds being facilitated by the escape of the air from the vessel through an escape pipe attached to the top of the vessel, and provided with a cock or valve. Another pipe provided with a cock or valve establishes a communication between the steam space of the boiler and the top of the vessel, so that the said fluids or compounds being introduced into the vessel through the before-mentioned funnel, and the cock of the latter and of the escape pipe being then closed, the cock in the steam pipe is opened so as to cause the steam to pass from the boiler into the vessel and heat or act upon and dissolve the fluid or compound contained therein, after which the cock in the pipe connecting the lower extremity of the vessel with the boiler is opened, and the fluid contained in the vessel is enabled to pass down into the boiler on account of the pressure of steam being the same in the vessel as in the boiler. *Patent abandoned.*

220 W. SMITH. *Improvements in machinery for compressing coal dust and other materials fit for burning, also clay into bricks, tiles, pipes, and other like articles.* Dated January 26, 1865.

This improved machinery comprises a cylindrical multiple mould, the moulds being formed round the periphery of the said cylinder or wheel, which is caused to rotate upon a shaft in the centre. Each mould is fitted with a sliding and hinged lid, which is moved, opened, and closed by self-acting guides, and, when closed and acted upon by the rollers in the manner described, presses the materials into the mould. The materials are fed into the machine at one side and delivered at the other when compressed. *Patent abandoned.*

221 G. HASELTINE. *A new process of manufacturing syrup and sugar from maize and other cereal grains.* (A communication.) Dated January 26, 1865.

We cannot here give space to the details of this invention. *Patent completed.*

222 J. H. PEPPER and T. W. TOBIN. *Apparatus for illusory exhibitions.* Dated January 26, 1865.

This invention cannot be described without reference to the drawings. *Patent completed.*

223 S. SHARP and D. SMITH. *An elastic valve and high pressure and general tap.* Dated January 26, 1865.

This tap is made of metal, with the exception of the seat or cushion of the valve or plug or plunger, which valve is made of metal, resting on and passing through an elastic seat or cushion; the seat or cushion is made of vulcanised india-rubber, or of cork and india-rubber, or of cork, india-rubber, and canvas combined. The tap is made in two parts, which screw one into the other, between which two parts the elastic seat or cushion is placed, so that by turning one part it screws up and compresses the elastic, which is forced forward so as to meet the valve, thus renewing the joint at any time when it may become in any way deficient. The valve plug or plunger worked by means of a screw crank or eccentric in connection with the handle as may best suit the size and purpose to which each tap is to be applied. *Patent abandoned.*

224 R. MUSHET. *Improvements in lining the sides and bottoms of puddling furnaces employed in the manufacture of iron or steel, and in mending, repairing, and fettling the sides and bottoms of the said puddling and other said furnaces.* Dated January 26, 1865.

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This invention consists, first, in employing that compound ore of platinum and iron called Ilmenite when crushed, stamped, or otherwise pulverised and mixed with refractory substances, such, for instance, as sand, silica, kaolin, calcined iron, slag, or hematite iron ore, for the purpose of lining the sides or bottoms or the sides and bottoms of puddling furnaces and other furnaces used in the manufacture of iron or steel; and, secondly, the invention consists in employing the said crushed, stamped, or otherwise pulverised Ilmenite when mixed with refractory substances for mending, repairing, or fettling the sides or bottoms or the sides and bottoms of puddling furnaces, balling furnaces, hollow fires, gas furnaces, and other furnaces or converters employed in the manufacture of iron or steel. *Patent completed.*

225 J. HARRISON. *Improvements in cleansing ships' bottoms at sea, and in the machinery, apparatus, or means connected therewith.* Dated January 26, 1865.

This invention relates to the arrangement and construction of machinery employed in cleansing the bottoms of ships or vessels when at sea, and it essentially consists of a knife or scraper fixed to the end of a cranked or straight rod or bar, and movable in a frame, which frame is held close against the ship's bottom by guide ropes which pass from one side of the ship below the keel and up to the other side. The frame work carrying the scraper is movable on the guide ropes, and is furnished with anti-friction sheaves, so that it may be the more easily moved. On the side of the ship opposite to that being scraped a guide apparatus is placed, which bears against the keel. By this apparatus the guide ropes are kept at the required distance apart, and the outer or working rope is also kept from rubbing against the keel. When the apparatus is employed for cleansing a ship's bottom, it is placed in the water and passed between the guide ropes and the ship. A man or men or winding apparatus situate at the side of the ship opposite to that being scraped hauls or haul the scraper down to the keel. When in this position, if the ropes attached to the scraper be hauled, the scraper by the peculiarity of its formation acts across the plates of the hull, cleansing them in its course. *Patent completed.*

226 A. A. CROLL. *Improvements in the purification of coal gas.* Dated January 26, 1865.

This invention relates to the use of sulphurous acid, wood, saw-dust, or other suitable open or porous substance, and sulphate of lime, in the purification of coal gas. *Patent completed.*

227 H. W. RIPLEY. *Improvements in colouring kempy wool and hair.* Dated January 26, 1865.

This invention consists in applying colour to such hemps or hempy wool and hair by printing them all over or solid when in the state of sliver or fleece, and then setting or fixing the colour by steaming the sliver or fleece in like manner to that in which printed yarns are steamed. *Patent abandoned.*

228 J. HAMILTON, jun. *Improvements in machinery for propelling vessels.* Dated January 26, 1865.

This machinery is applicable for propelling vessels where stern wheels are used. The invention consists in certain arrangements of machinery for driving and for lifting and regulating the dip of the float-boards. We cannot here quote the details. *Patent completed.*

229 J. G. WILLANS. *Improvements in the manufacture of iron and steel.* Dated January 26, 1865.

This invention relates, first, to the treatment in the blast furnace of such iron ores from the green sand and oolitic formations, hematite ores, and iron cinder, as may contain four times as much silica as other earths, not including lime. These, when smelted without the addition of as much alumina as would bring down the silica present in the furnace to within three times the amount of the other earths the ein, not including lime, would have the tendency when partially deprived of oxygen to fuse and descend more rapidly than desirable. In such case, as a corrective, also as a flux, the patentee adds, in place of entirely or in part of ordinary limestone, a mineral chiefly composed of carbonate of magnesia and carbonate of lime, in the raw or calcined state, containing at least as much magnesia to lime as exists in the proportion of 21 carbonate of magnesia to 77 carbonate of lime, or as 3 of the former to 11 of the latter. Should the magnesia exist in larger proportion, or this ore or fuel contain magnesia, or the slag be preferred to contain more lime, ordinary limestone may be added along with the magnesia mineral. The quantity of the latter required to produce a satisfactory slag will depend upon the amount and chemical nature of the earthy contents in the furnace, and may be arrived at in the usual way by furnace magnesia. The invention relates, secondly, to the production of steel and iron by decarburetting divided cast or refined metal to the required point in a more certain manner than heretofore by enclosing or encasing it in contact with malleable iron (such as small scrap or crushed puddle-ball), or with substance containing oxygen (such as iron ores, iron cinder, &c.), so that, when subjected together to heat, the enwrapping material or case may impede the action of the carbonaceous matter in the furnace upon their contents, and that, when the metal be partially or entirely deprived of carbon, the cases or enwrapping material may be melted or welded along with the contents. *Patent completed.*

230 C. FALCK. *Improvements in apparatus called "ice safes."* Dated January 26, 1865.

In constructing an ice-safe according to this invention, the ice-safe may be of any desired external form or shape, but by preference of a cylindrical form. The patentee constructs these safes double, leaving a space between the inner and outer cylinders, into which charcoal or other suitable nonconductor of heat is placed. Each safe is made to receive any desired number of shelves, on to which the articles to be cooled are placed. In front of each safe is a door which is double, and is filled with a non-conductor of heat, as described above. At the back the safe is divided off by a vertical partition, in the front of which the shelves and articles to be cooled are situated; at the back of this partition is a chamber for receiving the ice. This chamber may extend from top to bottom of the safe, but the patentee prefers that it should not descend lower than the bottom shelf. At the bottom of the safe a hollow chamber is formed, communicating with the ice chamber by a pipe or tube, so that the water from the ice may descend freely into this bottom chamber, and from time to time be drawn off therefrom by a suitable cock or tap. It is preferred to make these safes of sheet metal, such as iron coated or covered with zinc or tin. *Patent completed.*

231 W. CREASY. *Improvements in machinery for threshing, beating, and dressing flax.* Dated January 26, 1865.

For the purposes of this invention a cylinder, the surface of which is (by preference) of wood, is used, on to which the heads of flax straw are placed, whilst the straw is held by hand; above the cylinder is a beater having a curved hollow under surface corresponding with the radius of the cylinder. The beater has a rod which moves, or rods which move, through brackets or guides, by which the beater is caused to rise and fall correctly. The beater is raised and allowed to fall by any convenient means, such as tappets or lifters on a shaft or shafts, to which motion is given to steam engine or other power. The cylinder is caused to make a partial rotation at each time of lifting the beater by means of a ratchet or driver, or otherwise, actuated by the power which works the machine. The heads of the flax straw are placed on the cylinder below the beater by which the heads will be thrashed, and the seed and chaff separated will, by the partial rotation of the cylinder, be carried from under the beater, and will fall off the surface of the cylinder into a receiver, from which they are raised by an elevator in order to be dressed by passing over a sieve, and by being acted on by a succession of blasts. The seed is then again lifted by an elevator and delivered into sacks, or into other receivers, in like manner to that in which like processes have been performed in other thrashing machines. *Patent completed.*

232 G. DIBLEY. *Improvements in preparing for fixing and in fixing plates or sheets of metal such as are used for roofing and other similar purposes.* Dated January 26, 1865.

This invention has for its object to form the requisite holes in such a manner that they may be closed in a more or less perfectly watertight manner without a washer being requisite for that purpose, and consists in raising the metal surrounding the hole in the plate in such a manner that the edge of the hole projects up from the face of the plate or sheet, whereby the nail or screw, on being driven down through the hole, is made to fit with the underside of its head firmly against the projecting edge of the hole, so as to form a more or less watertight joint, and this joint will be all the more perfect the firmer the nail or screw is forced down upon the edge; in addition to which the extent to which the edge of the hole is raised above the surface of the plate or sheet will alone be sufficient in most cases to prevent the water from passing into the hole. *Patent completed.*

233 J. E. MASSEY. *Improvements applicable to ships logs and sounding machines.* Dated January 26, 1865.

This invention consists in causing the tube, with its vanes, trains of wheels, and indices, to revolve round a stationary worm shaft geared into the first motion or worm wheel of the train of wheels which carry the pointers, motion being imparted to the train of wheels by rotation round the stationary worm shaft. *Patent completed.*

234 W. CLARK. *Improvements in pencil-cases usually termed "ever-pointed pencils."* (A communication.) Dated January 26, 1865.

This invention consists in facilitating the application of the lead without the necessity of removing the stump, which always remains in the holder; in fact, by these improvements, it is almost impossible for any portion to remain, as the inventor applies an internal rod, which pushes up the lead until it is entirely used; the lead is also introduced at the same end as that from which it is emerges, consequently, the nose or point never requires unscrewing, and so ensures increased strength, economy in the manufacture, and facility in the use of the pencil case. *Patent completed.*

235 J. E. F. LUDEKE. *Improvements in mathematical compasses for ascertaining the utmost correctness of the contents and square of any circle.* Dated January 27, 1865.

This invention consists in the use of a wheel which is attached to one point of a compass, the periphery of which is divided into measures, and marked by lines and figures on the sides thereof, and five short pins are fixed on the periphery, so that by turning the compass the wheel will revolve and describe and mark the exact measurements of the circle lines. Fine cuts on the periphery will prevent the wheel from slipping. *Patent abandoned.*

236 C. D. ABEL. *Improvements in throstle spinning frames.* (A communication.) Dated January 27, 1865.

This invention has reference to a description of throstle spinning frame, for which letters patent were granted to S. Dreyfous, dated 18th January, 1862 (No. 137). One of the present improvements has reference to the form of the flyers. The present improved form of flyer consists of a cylindrical tube having collars at its upper and lower ends, at which points it is supported by and revolves in two bearings formed in two transverse bars or plates attached to the framework. This tube has projecting upwards from its upper end a forked arm, the union of the fork being situated centrally over the tube, where it is provided with a loop, whilst at its lowest extremity the tube is provided with two arms or prongs projecting downwards, similar to those of the ordinary flyer, and made to taper towards their extremities, where they are provided with loops or eyelets. The yarn or roving is conducted from the drawing rollers through the loop or eyelet at the end of the before-mentioned forked arm; it then passes through a second loop fixed at the upper end inside the tube, whence it is conducted down through the tube, and, after being twisted once or twice round one of the lower arms, it passes through the loop or eyelet at the end of such arm on to the cop spindle. For imparting motion to the flyer a whirl is fixed to the tube between its two bearings, round which whirl a gut passes from the main drum, as in the arrangement described in the specification of the before-mentioned letters patent. *Patent completed.*

237 J. HIND. *Improvements in the construction of pumps for lifting and forcing liquids.* Dated January 27, 1865.

This invention cannot be described without reference to the drawings. *Patent completed.*

238 R. HELSHAM. *A new or improved method of removing dirt from the inside of the barrels of keys.* Dated January 27, 1865.

We cannot here give space to the details of this invention. *Patent completed.*

239 J. SOUTHALL, jun., and H. SOUTHALL. *Improvements in the manufacture of saddle trees and in the spring bars of saddle trees.* Dated January 27, 1865.

This invention consists, firstly, in manufacturing saddle-trees of papier-mache, or any other vegetable substance, combined with horsehair, instead of making the saddle-trees of wood, as is usual. The invention consists, secondly, in an improvement in the spring bars, which are situated on opposite sides of the saddle-tree, and to which the straps of the stirrups are connected. *Patent completed.*

240 C. DE BERGUE. *Improvements in furnaces.* Dated January 27, 1865.

This invention consists in constructing furnaces with two or more fuel chambers, each with a moderate span or extent of roof bridge adapted to the same operating chamber, and in so arranging and distributing the separate fuel chambers around or partly around the operating chamber, or (in the case of very long heating furnaces for bars or tubes of iron to be welded, or for other purposes), along either or both sides of the operating chamber, so as the more uniformly, and consequently economically, to distribute or diffuse the heat over or throughout the extent of the operating chamber. Also the invention comprises the construction of the said roof bridge of these fuel chambers of or with hollow fire-clay tubes of suitable shape arranged to admit a circulation of cold air, to increase the durability under intense heat, and the construction of the part or parts of the furnace situate about or at the roof bridge or bridges of the fuel chambers, so that, when burnt or destroyed, the said roof bridge or bridges may be readily replaced. *Patent abandoned.*

241 J. COMBE. *Improvements in the action and arrangement of drilling machines, turning lathes, and other machine tools in which a variable speed is required.* Dated January 27, 1865.

This invention cannot be described without reference to the drawings. *Patent completed.*

242 H. MOORE. *Improvements in applying power to the working of ships' windlasses, winches, capstans, pumps, and other ships' gear.* Dated January 27, 1865.

Provisional protection has not been allowed for this invention.

243 J. TWIBILL. *Improvements in steam generators or steam boilers and furnaces, part of which is also applicable to other heat generating apparatus.* Dated January 27, 1865.

We cannot here give space to the details of this invention. *Patent completed.*

244 J. H. JOHNSON. *Improvements in the treatment of oils obtained from the distillation of tar, and in the application of the same to the purposes for which ordinary drying oils are applicable.* (A communication.) Dated January 27, 1865.

The patentee claims, first, the manufacture or production of drying oil by the admixture, in suitable proportions, of linseed or other oil previously rendered highly siccative with tar oil, substantially as described. Second, the application and use of siccative tar oil, prepared substantially in the manner described, in substitution for linseed and other drying oils heretofore employed in various branches of the arts and manufactures. *Patent completed.*

245 A. H. BRANDON. *Improvements in the treatment of tar oils for the purpose of employing the same as paint.* (A communication.) Dated January 27, 1865.

This invention relates to the manufacture of paint fit for house work, carriages, cloths, and other objects, according to two different processes, in both of which tar oil constitutes the principal ingredient. The first process consists in the manufacture of paint formed of tar or mineral oil, vegetable oil, and drying ingredients, in the following proportion: tar oil from 55 to 80 per cent., vegetable oil, such as linseed oil, poppy oil, nut oil, and other similar products, 20 to 45 per cent. drying ingredients, such as sub-carbonate of iron, oxide of lead, sulphate of lead, sulphate of zinc, manganese, and other similar chemical ingredients, equal to about one-tenth in weight of the vegetable oil, which two latter ingredients are boiled together until they are of a proper consistency; the tar oil is added subsequently and the whole agitated to ensure proper mixture and allowed to cool; the requisite colouring materials being added, it can be employed in the same manner as the usual paints. The second process consists in manufacturing paint with tar oil, vegetable oil, and Norway tar, in the following proportions by weight:—Tar oil about 16, vegetable oil about 10, and Norway tar about 4. For this purpose the vegetable oil is boiled down to the requisite consistency, after which the two other ingredients are added to it, either before or after cooling, and the whole agitated; the desired colouring material being added it is then fit for use. *Patent abandoned.*

246 G. HASELTINE. *An improved process of manufacturing syrup and sugar from maize, starch, and other cereal grain starch.* (A communication.) Dated January 28, 1865.

We cannot here give space to the details of this invention. *Patent completed.*

247 S., R., and W. TRULOCK. *Improvements in breech-loading fire-arms.* Dated January 28, 1865.

This invention consists in the application of two bolts to the ordinary Lefaucheux breech-loading gun, one locking into a projecting piece of iron or undergrip at the under side of the barrel or barrels, the other locking into a recess at the top of them. These bolts are actuated by a single external lever, which is attached to a cross pin carrying an internal double lever, which works into them, and a spring of sufficient strength acting on this double lever keeps the bolts always pressed home (or locked) unless when the external lever is depressed, which motion unlocks the gun, and the barrel or barrels will then be thrown up by their own weight. In locking the gun it is merely necessary to close the barrel or barrels against the stock, and which action, pressing back the top bolt, also causes the bottom bolt to move forward, clearing the way for the under-grip, into which and the top recess the bolts shoot as soon as the barrel or barrels are home. On the external lever, and at the far end of the cross pin, cams or small projections are wrought which raise the hammers to half cock simultaneously with unloading the gun, and the position and form of the external lever permit of the gun being unlocked without removing the hand from the trigger guard. *Patent completed.*

248 B. DOBSON and W. SLATER. *Improvements in cotton gins.* Dated January 28, 1865.

This invention consists, first, in forming the grate and the vibrating knife in one casting, the edge of which may be chilled or hardened; to this casting are connected the ordinary rocking shaft, the table, and the radius rods, the edge of the said grate forming the knife or working edge which acts upon the seed cotton. Secondly, in making the grate as above described but without being hardened,

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and with a strip or knife of steel, or other hard metal screwed or otherwise attached to that edge of the grate next to the roller. Attached to the under side of the grate coating are the usual connecting rods which communicate or impart to the grate, and consequently to the table attached to it, a vibrating motion, which, in combination with the inclination given to the table, causes the seed cotton to move towards the roller or rollers. *Patent abandoned.*

249 V. BURG. *Improvements in filtering apparatuses.* Dated January 28, 1865.

This invention relates to improvements in apparatus for filtering, by means of natural or artificial porous stones, slabs, or diaphragms, water, urine, vinegar, beer, oils, saccharine solutions, aqueous salts of indigo, paper pulp, ceramic slips, or other suitable liquids or semi-liquids, either in the cold or warm state, and in a more certain and perfect manner, particularly in much larger quantities, comparatively to the bulk of the apparatus, than by the filtering apparatus hitherto in use, the filtering in this apparatus taking place partly on the same principle as that of the filtering through filtering paper—that is to say, through very thin filtering media of sufficient porosity for allowing an easy and rapid percolating of the liquid through them, the required rigidity and resisting power being given to the said porous slabs or diaphragms by special means (as described), and for allowing the filtering to take place from either side or surface of the said filtering media towards the opposite side or surface, and thus permit of an easy and effectual cleansing of them. *Patent completed.*

250 W. E. NEWTON. *Improvements in the rectification of alcohol, and in the apparatus to be employed therein.* (A communication.) Dated January 28, 1865.

The patentee claims the separation of the vapours and their elimination or condensation in special and distinct vessels, the object of which is to preserve the column, and all the parts which are intended to receive pure vapours, from all the impure odours which may injure the valuable rectified products, and also the substitution for all ordinary condensers and analysers composed of cylindrical tubes of channels with annular surfaces or rectilinear sides, and other forms, having for their object the division of the vapours into thin streams or layers. *Patent completed.*

251 J. PETRIE, jun. *Improvements in machinery or apparatus for washing wool and other fibrous materials.* Dated January 28, 1865.

This invention relates to machinery for washing, in which wool or other fibrous materials are conveyed to squeezing or delivering rollers by feed aprons, and consists in so arranging the said aprons with reference to the rollers that, should the material fall from the former, it will drop into the surface or surfaces of one or both of the latter, and thus be presented to their bite. This the inventor accomplishes by placing the top roller (if they be vertically arranged) on one side of the under roller, and adopting the guide roller of the feed apron above and over the surface thereof; or he disposes the squeezing or delivering rollers horizontally, and in like manner carries the feed apron above and over one of them. *Patent abandoned.*

252 J. RAINES. *Improvements in mortar mills, applicable also to grinding other substances.* Dated January 28, 1865.

This invention consists, firstly, in causing the runners of mortar or other such mills to be pressed upon the bed thereof by a spring or springs. Secondly, in mounting the mill upon a framework, which also carries a hoisting apparatus and an engine for driving the same, the whole constituting an apparatus complete in itself. *Patent completed.*

253 W. CLARK. *Improvements in breech-loading fire-arms and cartridges.* (A communication.) Dated January 28, 1865.

This invention cannot be described without reference to the drawings. *Patent completed.*

254 E. BLAKESLEE. *An improvement in cartridge boxes for fire-arms.* Dated January 28, 1865.

This invention cannot be described without reference to the drawings. *Patent completed.*

255 E. T. HUGHES. *An improved system of drying wool, cotton, and other fibrous materials, and in the machinery or apparatus connected therewith.* (A communication.) Dated January 28, 1865.

We cannot here give space to the details of this invention. *Patent completed.*

256 A. S. MACRAE. *Improvements in lanterns for burning hydrocarbon fluids.* Dated January 28, 1865.

This invention consists in an improved arrangement of lantern for enabling petroleum, paraffine, and other hydrocarbon fluids to be burned efficiently without the use of a glass chimney. At the lower part of the lantern there are perforated plates for the admission of air, and at the top a mock chimney or draughting medium, which chimney is part of the lantern, and is made of various heights and diameters according to the size of the burner, and by its use there is sufficient draught to burn the fluid without emitting smoke, and, as before said, without the glass chimney. *Patent abandoned.*

257 W. FOSTER. *Improvements in screw taps, more especially designed for cutting threads in the fittings and connections for gas, steam, and water pipes.* Dated January 28, 1865.

This invention consists in so constructing and arranging the parts of screw taps that the cutters may be withdrawn from their work without reversing or stopping the tap or machine in which the said tap is used. We cannot here quote the details. *Patent completed.*

258 W. H. HIGGINS. *Improved machinery for shaping hat and bonnet blocks.* Dated January 28, 1865.

We cannot here quote the details of this invention. *Patent abandoned.*

259 J. M'INNES. *A metallic anticorrosive varnish for protecting the surfaces of metals from oxidation.* Dated January 30, 1865.

The object of this invention is to protect the surface of metals from oxidation by means of a metallic anticorrosive varnish consisting of a metallic soap formed by decomposing an alkaline soap by a metallic salt, by preference the sulphate of zinc. The metallic soap thus formed is then purified by washing or other means, after which about 10 per cent. of tallow is added; the whole is then thinned to the consistency of varnish by adding petroleum or other volatile spirit, in which the metallic soap will dissolve. The whole is then passed through a filter and refiltered until perfectly clear and bright, and free from all insoluble matter, when it is stored in close vessels to prevent evaporation ready for use. *Patent abandoned.*

260 G. DAVIES. *Improvements in the construction of steam engines.* (A communication.) Dated January 30, 1865.

This invention relates to the combination of arrangement of an engine constructed so as to obtain the greatest amount of useful effect possible. The steam which actuates the piston passes directly from the boiler to a circular slide valve, which presents only one direct opening. The steam is not divided by a throttle valve, nor by the large extent of the valve box, as occurs in ordinary engines. The cylinder has no ends, but is provided with two pistons and a partition in the centre of its length, and the steam is admitted direct into one or other of the compartments thus formed, that is to say, there are no steam passages. The stuffing-boxes of the piston rods are dispensed with, and it is very easy to remedy any leakage of the pistons, because it will be perceived immediately, and a handy workman might even rectify the same while the engine is in motion by simply turning two screws, the heads of which project, and which screws serve to expand the packing. *Patent abandoned.*

261 W. TEALL and A. NAYLOR. *Improvements in means or apparatus for extracting or expressing oil or grease from the greasy waste of fibrous substances, or other substances containing oil or grease.* Dated January 30, 1865.

This invention relates to that kind of apparatus in which a perforated cylindrical vessel is placed within another cylindrical vessel capable of holding water or other liquid, and the substances or materials to be operated upon are put into bags and placed in the perforated vessel, and a piston or cam is caused to press thereon. Now these improvements consist in constructing this perforated vessel of either cylindrical or other suitable form, and in two or more parts longitudinally, which parts are held together by belts or hoops placed around them. The hoops are jointed in one or more places, and connected by rollers, wedges, or other suitable means, so as to be made tight thereon, and readily disconnected to allow the parts of the vessel to open or expand. The patentees also employ within this vessel another vessel of finer perforations, or with smaller holes therein, which is also in two or more parts longitudinally, and lined within with finely perforated zinc, or other metal or material, or wire gauze, or woven fabric. The substances to be operated upon are placed in this vessel (instead of being placed in bags as heretofore), and pressed by a piston or cam in the usual manner, and to prevent injury to the lining by the action of the piston they place longitudinal rods or slips of iron or other material at suitable distances apart on the face of the lining. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated April 11, 1865.

1036 R. Turner, Deptford. An improved chain or iron cable shackle.

Dated April 12, 1865.

1037 G. W. Rothleb, Soho. A new apparatus or mechanism for flying through the air.

Dated April 28, 1865.

1188 E. Moore, Tewkesbury, Gloucestershire. Improvements in the manufacture of dress shirts and dresses made by means of the stocking frame.

Dated May 9, 1865.

1288 C. S. Baker, Fleet-street. Improvements in paddle wheels. (A communication.)

Dated May 20, 1865.

1398 J. Armstrong, Brinsworth Ironworks, Masbro', Yorkshire, engineer. Improvements in the manufacture of crossings for the permanent way of railways, and also in tyres for wheels.

Dated June 3, 1865.

1524 T. Forster, Manchester-road, engineer and millwright, and J. Eckersley, Kirk-street, Bolton, Lancashire. Improvements in looms for weaving.

Dated June 5, 1865.

1537 J. A. Woodbury, Southampton-buildings, Chancery-lane. Improvements in paper or cloth lined paper collars, and in the machinery for manufacturing the same.

Dated June 17, 1865.

1640 E. Byerley, Bristol. Improvements in the means of communication between passengers and guards of railway trains.

1641 G. Haseltine, Southampton-buildings, Chancery-lane, civil engineer. Improved sewing machinery and stitch formed by the same. (A communication.)

1642 V. Baker, Col. H.M. 10th Hussars, Dublin. Improvements in hydraulic motive power machinery.

Dated June 20, 1865.

1654 I. Baggs, Chancery-lane, electrical engineer. Improvements in electric telegraph instruments and relays.

Dated June 24, 1865.

1692 G. Turton, Sheffield, commercial traveller. Improvements in floating docks.

1694 F. G. David, Fetter-lane. An improved composition for the manufacture of printers' rollers.

Dated July 11, 1865.

1830 F. Massey, Tysoe-street, Clerkenwell, ship log manufacturer. Improvements in ships' logs.

Dated July 14, 1865.

1854 G. Clark, Napier-street, Dover-road. An improved drawing instrument. (A communication.)

Dated July 18, 1865.

1866 J. P. B. le Patourel, Piette House, Guernsey, H.M.S. Hon. Company's Marine. Improvements in ventilators.

Dated July 19, 1865.

1874 J. E. F. Lüdeke, Stonefield-street, Islington. Improvements in motive power by capillary attraction.

1880 J. G. Rowe, Queen-square, Westminster. Improvements in signal and alarm apparatus for railway and railway trains.

Dated July 20, 1865.

1818 C. Rosson, Birmingham, gun manufacturer. Improvements in portable charge holders for breech-loading guns whether single or double barrelled, as also in the means of manufacturing the said holders and in exploding the charge.

1889 W. Tranter, Birmingham, gun maker. Improvements in fire-arms and in cartridges for the same.

1890 C. H. Simpson, Bexhill, Sussex, Com. R.N. Improvements in apparatus for propelling vessels.

1891 H. A. Clum, Fleet-street, prof. natural science. An improved instrument for indicating atmospheric changes.

1892 T. Swinburne, South-square, Gray's-inn. Improved mechanism for propelling, driving, and forcing purposes.

1895 R. Smyth, Hastings, Ret. Lieut.-Col. H.M. Indian Army, and W. E. Evans, Market-place, Great Portland-street. Improvements in organs and harmoniums and similar keyed instruments.

1897 M. L. Parry, St. Paul's Churchyard. Improvements in condensing apparatus for steam engines.

Dated July 21, 1865.

1899 St. J. V. Day, civil engineer, Buchanan-street, Glasgow. Improvements in the propulsion of ships, and in the machinery or apparatus connected therewith. (A communication.)

1900 L. A. M. Chaulin, Rue de l'Echiquier, Paris. An improved process for rendering wood incombustible.

1901 G. Taylor, Heywood, and J. Crossley, Bury, Lancashire. Improvements in covers for rollers used in spinning cotton.

1902 J. Walton, Willenhall, Staffordshire, lock manufacturer. Improvements in locks and in latch bolts for locks and latches.

1903 R. M. Wanzer, Cheapside. Improvements in sewing machines. (A communication.)

1906 E. Schaub, Manchester, merchant. An improved sizing material to be employed for sizing or dressing yarns preparatory to weaving. (A communication.)

1907 C. Gardner, Dover. Improvements in apparatus for cleaning windows.

1909 W. S. Yates, Leeds, and A. Freeman, Manchester. Improvements in machinery or apparatus for folding fabrics on to cardboards or metallic plates for the purpose of hot pressing.

Dated July 22, 1865.

1910 E. Perré, Manchester, engineer. Certain improvements in the method of obtaining motive power, and in apparatus connected therewith.

1911 W. Diaper, Tabernacle-walk, Finsbury. Improvements in the construction of safes or strong receptacles for the protection of property.

1912 G. Wilson and J. Goodfellow, Glasgow. Improvements in bedsteads, sofas, and chairs.

1913 W. E. Newton, Chancery-lane, civil engineer. Improvements in the construction of valves for steam and other engines. (A communication.)

1914 J. P. Gillard, Paris, civil engineer. Improvements in the manufacture of soda and carbonate of soda.

1915 M. P. W. Boulton, Tew Park, Oxfordshire. Improvements in obtaining motive power when heated air or aëriform fluid is employed.

Dated July 24, 1865.

1919 J. M'G. Croft, M.D., Abbey-road, St. John's Wood. Improvements in rudders for steering ships or vessels.

1921 R. A. Brooman, Fleet-street, patent agent. A new or improved instrument to be employed in examining and facilitating operations in the throat. (A communication.)

Dated July 25, 1865.

1923 M. B. Schumann, Manchester, merchant. An improved portable chamber or receptacle to contain aërated liquids, and the apparatus connected therewith, by which the flow of such liquid is regulated and measured.

1924 J. Rigg, Crewe, Cheshire, assistant locomotive superintendent. Improvements in the construction of railway carriages.

1925 L. Petré and E. S. Tucker, Stamford-street, silvered glass manufacturers. Improvements in ornamental tables and table stands, such as cruet frames, liqueur frames, flower, egg, and other stands.

1926 T. J. Mayall, Red Lion-court, Fleet-street. Improvements in parts of military and other outfits.

1927 M. J. Roberts, Pendarren, near Crickhowell, Brecknockshire. Improvements in means or apparatus for producing friction or adhesion between pulleys, rollers, and the like, and cords, bands, belts, or chains passed over or round them.

1929 J. Jukes, jun., Armagh-road South, Old Ford, Bow, and J. Swinburne, Wenlock street, City-road. Improvements in locomotive boiler furnaces.

1930 H. Wright, Goodge street, Tottenham-court-road, jeweller. An improved shank for buttons, studs, and solitaires.

1931 J. H. Johnson, Lincoln's-inn-fields. An improved mode of lacing boots, shoes, and other articles united by laces. (A communication.)

1933 A. P. Price, Lincoln's-inn-fields, consulting chemist. Improvements in the manufacture of carbonate of ammonia, and in the utilisation of the product obtained in such manufacture. (A communication.)

Dated July 26, 1865.

1936 W. and J. Richards, Oldbury, Worcestershire, engineers. Certain improvements in the manufacture of salammoniac.

1937 J. Bélicard, jun., Manchester. Improvements in the manufacture of velvets, plushes, and other pile fabrics, and in the machinery or apparatus connected therewith.

1938 G. T. Bousfield, Loughborough Park, Brixton. Improvements in apparatus for burning combustible and volatile liquids for generating steam and similar purposes. (A communication.)

1939 E. Spicer, New Bridge-street, Blackfriars. Improvements in compositions similar to gunpowder for blasting, for use in ordnance and fire arms, and for other purposes. (A communication.)

1940 S. Lusty, Walworth, machinist. Improvements in fluid meters.

1941 A. V. Newton, Chancery-lane, mechanical draftsman. Certain improvements in sewing machinery. (A communication.)

1942 W. E. Newton, Chancery-lane, civil engineer. Improvements in machinery for planing metals. (A communication.)

1943 F. Pulman, Whitehall-yard, Westminster, modeller, and R. Ginman, Woolwich, iron and brass founder. An improved composition for coating ships' bottoms and the surfaces of other vessels or structures which are exposed to the action of sea water.

1944 W. Barton, Boston, Lincolnshire, ironmonger. Improvements in the construction of cooking stoves and ranges.

1945 J. Jaques, S. Wenk, and A. A. Mathieu, Quai de Valmy, Paris. Improvements in apparatus for preventing accidents on railways.

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Dated July 27, 1865.

1948 R. Mortimer, Bush-lane, London, wholesale shipping ironmonger and merchant. Improvements in instruments for marking or impressing railway tickets.

1949 W. E. Newton, Chancery-lane, civil engineer. Improvements in bolt screwing machines. (A communication.)

1951 A. Cheffins, Randolph-street, Camden Town, mechanical draftsman. Improvements in the construction of omnibuses.

Dated July 28, 1865.

1955 I. Greggory, Chorlton Hall, Victoria Park, Manchester, F.R.G.S. Improved means of communication by signals between passengers, guards, and drivers of railway trains.

1957 W. E. Newton, Chancery-lane, civil engineer. An improved process for applying air-proof solutions to the interior of casks and barrels. (A communication.)

1958 W. E. Newton, Chancery-lane, civil engineer. An improved water meter which may be employed as a water, steam, or gas engine. (A communication.)

1959 R. B. Mitchell, Bakewell, Derby. An improved brake for railway and other wheeled carriages.

1960 W. Cockburn, Paisley, weaver. Improvements in weaving ornamental fabrics.

Dated July 29, 1865.

1961 R. Clayton, Pudsey, engineer, and J. Raper and J. Goulding, Tong, near Bradford, machinists. Certain improvements in looms for weaving.

1962 F. A. Abel, Royal Arsenal, Woolwich. Improvements in compounds for waterproofing and insulating purposes.

1965 A. A. Larmuth, Salford, Lancashire, dentist. Improvements in machinery or apparatus for cutting the edges of paper hangings.

1966 R. Worsnop, Bradford, overlooker. An improvement in "cap frames."

1967 V. Baker, Col. H.M. 16th Hussars, Dublin. Improvements in applying and utilising water power.

1969 J. Swinburne, Wenlock-street, City-road, and J. Laming, Lauderdale-buildings, Aldersgate-street, City, engineers. Improvements in means or apparatus for stopping or retarding railway carriages.

Dated July 31, 1865.

1974 A. Y. Rehm, Rue Saussure, Paris. Certain improvements in crinolines.

1976 E. Sabel, Moorgate-street. Improvements in the manufacture of iron rails and girders. (A communication.)

1977 J. Lawson and E. G. Fitton, Leeds, machinists. Improvements in preparing machinery for flax, tow, jute, and other fibrous materials.

1979 A. V. Newton, Chancery-lane, mechanical draftsman. An improved method of obtaining induced currents of electricity from magnets and induction oils. (A communication.)

1980 A. V. Newton, Chancery-lane, mechanical drafts man. An improvement in refining petroleum and other hydrocarbon oils. (A communication.)

1981 A. V. Newton, Chancery-lane, mechanical draftsman. An improvement in ejectors for discharging bilge water and for other purposes. (A communication.)

1982 W. Clark, Chancery-lane, engineer. Improvements in apparatus to be used in swimming. (A communication.)

Dated August 1, 1865.

1985 T. B. Paton, Montrose, Forfarshire. Improvements in machinery for the manufacture of linen or other yarns or threads.

1986 W. la Penotière, Essex-street, Strand. An improved composition for coating the bottoms of iron and wooden ships, by which the same are preserved from fouling and the iron from corrosion, whether internally or externally, by sea or other water or moisture, which is applicable to iron of any kind exposed to the action of moisture.

1990 L. E. C. Martin, Adam-street, Adelphi. Improvements in locomotive and other tubular boilers.

1992 M. P. W. Boulton, Tew Park, Oxfordshire. Improvements in obtaining motive power by heat.

Dated August 2, 1865.

1993 A. Ford, Arthur-street West, City. An improved method of forming india-rubber, gutta-percha, or such like balls.

1994 H. Levy, Glasgow. Improved means for testing alloys of gold.

1995 T. Andrew and J. W. Taylor, Commercial-street, Spitalfields. Improved mechanical arrangements or fastenings applicable to the doors and cases of safes and strong rooms, for the purpose of preventing the opening thereof by wedges or levers.

1997 J. G. Teal, Leeds, draper. Improved apparatus for communication between passengers and guards in railway trains.

1998 J. Crean, East-road, City-road, and C. J. Barr, Chapel-street, Shoreditch. Improvements in apparatus and means for giving alarm in cases of fire.

1999 F. O. Dear, Hertford. Improvements in the means of communication between the passengers and guard and driver of a railway train.

2002 W. W. Burdon, Newcastle-upon-Tyne, coal owner. Improvements in reducing vegetable fibre to pulp, and in machinery employed therein.

2003 R. Bailey, Hoxton, engineer, and J. Eagland, Hatton Garden, brass finisher. An improved fastening or lock.

2004 C. Hodgson, Portarlington, Queen's County. Improvements in and apparatus for treating peat in bogs and obtaining it therefrom, also applicable to tilling and cultivating land.

2005 W. H. Petitjean and E. M'Nally, engineer, Manchester. Improvements in the construction of railway carriages, and in railway brakes and signals, part of which is applicable to marine purposes.

2006 H. Allman, Ampthill-square, engineer. Improvements in burglar proof safes.

2007 J. H. Tyler, Bermondsey, engineer. Improvements in apparatus used in rolling leather.

LIST OF SEALED PATENTS.

Sealed August 11, 1865.

418 A. Fryer
423 R. P. Barrett
429 W. C. Ridings, sen.
431 W. H. Brown
432 M. Lane
433 C. Langley
437 R. H. Emerson
441 W. Kirrage
462 P. E. Bidaux
489 J. Keighley and R. Shephard
654 W. Clay
1028 R. A. Brooman
1146 J. F. C. Carle

Sealed August 15, 1865.

442 R. A. Brooman
444 H. J. Pickard
448 J. F. Hearsey
452 R. Hill and R. Tushingham
465 C. Brakell, W. Hoehl, and W. Günther
470 W. Robinson
472 L. W. G. Rowe and A. Baab
477 W. E. Gedge
478 J. Cliff
479 J. D. Nichol
497 T. G. Webb
517 W. E. Gedge
561 W. Clark
583 S. Brooks
594 W. Clark
598 Sir J. C. Lillie
603 H. A. Bonneville
604 H. A. Bonneville
606 J. H. Johnson
607 J. H. Johnson
618 E. Pettitt
743 A. V. Newton
1319 H. Ransford
1418 H. Nunn
1568 G. Haseltine
1572 G. Haseltine
1678 G. Haseltine

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, August 15, 1865.

951 R. Baynes. Force pumps.
966 W. Teall, L. Lepaige, and E. T. Simpson. Lubricating oil. (A communication.)
967 J. I. Darribat. Seats for waterclosets.
969 C. W. Lancaster. Fire-arms.
970 E. Rithedon. Protecting ships from oxidation.
971 F. R. Ensor. Lace.
976 E. H. Newby. Pointing the ends of metallic rods. (A communication.)
989 E. Welch. Fireplaces.
991 S. Smith and J. W. Jackson. Governors.
995 H. Edmonds. Ventilating ships.
1012 S. Moore. Electro-magnetic engines.
1013 T. Turton. Cutting files.
1020 W. Brookes. Heating files.
1023 C. Vaughan. Iron and steel.
1029 J. H. Johnson. Steam generators. (A communication.)
1030 J. H. Johnson. Communication in railway trains. (A communication.)
1032 A. Turner. Looms.
1039 H. Bridson. Clamps.
1043 J. Walker. Door locks.
1046 T. J. Mayall. Fire-arms.
1061 C. Turner and T. Room. Looms.
1062 R. A. Brooman. Raising water. (A communication.)
1085 T. Whitehead and N. Nussey Drawing wool.
1087 R. A. Brooman. Lace. (A communication.)
1113 E. Wilson. Lamp.
1144 W. Clark. Bleaching textile materials. (A communication.)
1147 W. E. Newton. Penholders. (A communication.)
1151 G. Davies. Securing buttons to fabrics. (A communication.)
1176 J. Tangye. Hydraulic pulling jacks.
1201 W. Clark. Locks. (A communication.)
1228 W. E. Newton. Folding beds. (A communication.)
1254 G. Peel, jun. Hydraulic presses.
1358 W. Montgomerie. Locomotive engines.
1387 A. V. Newton. Screw drivers. (A communication.)
1445 W. Clark. Knitting machines. (A communication.)
1544 J. Kennedy. Submerging telegraphic cables.
1641 G. Haseltine. Sewing machinery. (A communication.)
1776 J. Johson and J. F. Dickson. Converting wrought iron into steel.
1781 T. S. Prideaux. Draught beer.
1804 J. George. Coffins.
1834 N. Jenkins. Water valves.
1835 B. Fothergill. Sewing machines.
1889 W. Tranter. Fire-arms.
1892 T. Swinburne. Forcing purposes.
1895 R. Smyth and W. E. Evans. Organs.
1897 M. L. Parry. Condensing apparatus.
1899 St. J. V. Day. Propelling ships. (A communication.)
1909 W. S. Yates and A. Freeman. Folding fabrics.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2226 E. Humphreys
2244 J. Lancelot
2247 J. Combe and J. H. Smalpage
2257 A. Delrue
2258 C. M. Westmacott
2280 A. Walker
2285 W. Beatson
2380 W. E. Newton
2413 J. Nickson and T. Waddingham, jun.
2509 T. Molineux
2877 W. Clark

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1839 A. J. Paterson
1851 T. Worth and H. Spencer
1868 L. A. and E. I. E. Herrmann

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending August 12, 1865.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
2007	0 4	2327	0 6	2333	0 10	2339	0 10	2345	1 4	2351	1 6
2322	0 4	2328	0 8	2334	0 4	2340	0 4	2346	0 4	2352	0 4
2323	1 0	2329	1 4	2335	1 6	2341	0 8	2347	0 4	2353	0 10
2324	0 4	2330	0 4	2336	0 6	2342	0 4	2348	0 4	2354	0 4
2325	0 4	2331	1 0	2337	1 0	2343	0 10	2349	0 6	2355	1 6
2326	0 4	2332	0 4	2338	0 4	2344	0 10	2350	0 4	2356	0 4

NOTE.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennets Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date.	Nos.	Names	Subjects of Designs
1865			
June 15,	4724	H. Young	Lighting and extinguishing lamps
,, 24,	4725	T. J. Croggon and Co.	Double action syringe
,, 27,	4726	T. Turner	A croquet stand
,, 30,	4727	J. Ellis, jun.	A stay fastener
July 3,	4728	J. Whitehouse and Sons	Rose for door knobs
,, 4,	4729	C. Topham	Music or reading stand
,, 6,	4730	A. and D. Baumann	Hat brim
,, 21,	4731	J. Castle	A lady's cart
,, 24,	4732	A. Bell	Printers' inking roller
,, 25,	4733	T. H. P. Dennis	Conical roller blind ends
,, 25,	4734	R. and G. Walsham	Waist buckle
August 11,	4735	F. Heeley	Bottle tap and cork screw

PROVISIONAL REGISTRATIONS.

1865			
June 1,	1623	T. Parnell	Side lantern for ships
,, 1,	1624	F. W. Russell	Cask trial tube
,, 12,	1625	R. Sill, jun.	Umbrellaholder
,, 14,	1626	T. Pope	Tobacco pipe
,, 20,	1627	F. Stephens	Sewing machine
,, 23,	1628	J. G. Blake and Son	Oil feeder
,, 23,	1629	C. Crouch	A purse
,, 24,	1630	J. Cheshire	Bottle tap and screw
,, 28,	1631	J. Brock	Lock furniture
,, 28,	1632	G. Mills and Son	Spear pump
July 3,	1633	J. J. Balleine	Sash fastener
,, 8,	1634	W. Keen	Safety fastener for safes
,, 14,	1635	H. Edwards	Door fastening
,, 27,	1636	J. S. Tucker	Telegraph cable
August 8,	1637	Mackenzie and Crosbie	Wine buffet

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

TIMBER, duty 1s. per load, drawback 1s.

Teak - -	load	£12 0	£13 10	Archangel, yellow -	£13	10	£14 10
Quebec, red pine -		3 10	4 15	St. Petersburg, do. -	11	0	13 0
,, yellow pine -		2 15	3 15	Finland - - -	8	0	10 10
St. John, N.B., yellow		0 0	0 0	Memel - - -	10	0	15 0
Quebec oak, white -		5 5	6 0	Gothenburg, yellow	10	0	11 0
,, birch - -		3 10	4 10	,, white	9	0	9 10
,, elm - -		3 10	5 0	Gefle, yellow - -	10	10	11 10
Dantzic oak - -		3 5	6 5	Soderhamn - -	9	10	11 0
,, fir - -		2 15	3 10	Christiania, per C., 12ft. by 3 by 9 in.			
Memel fir - -		3 10	4 0	yard - - -	18	0	23 0
Riga - - -		3 5	3 10	Dezal lank, Dantzic, or 40 ft. 3 in. -	0	14	1 8
Swedish - - -		2 10	2 15	PUMICESTONE per ton	5	0	8 0
Masts, Quebec red pine		6 10	8 10	OILS, &c.			
yellow pine		5 0	6 0	Seal, pale per tun	39	0	40 0
Lathwood, Dantzic, fm		7 10	8 0	Spermbody - -	89	0	90 0
,, St. Petersburg		8 10	9 10	Cod - - -	50	0	0 0
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.				Whale, 8th Sea, pale	41	0	45 0
Quebec, white spruce	14	0 18	0	Olive, Gallipoli -	53	0	54 0
St. John, ,,	13	0 15	0	Cocoanut, Cochin -	44	10	45 0
Yellow pine, per reduced C.				Palm, fine - -	36	10	37 0
Canada, 1st quality -	18	0 20	0	Linseed - - -	31	15	32 0
,, 2nd ,, -	13	0 14	10	Rapeseed, Eng. pale	46	0	0 0
				Cottonseed - -	26	10	33 10

METALS.

IRON:—		£ s. d.		£ s. d.	p. ct.
Welsh Bars, in London -	per ton	7 15 0	to	8 0 0	2½
Nail Rods - - - -	do	8 10 0		0 0 0	
Hoops - - - -	do	9 15 0		0 0 0	
Sheets, single - - -	do	10 10 0		10 15 0	
Staffordshire Bars - -	do	8 10 0		8 15 0	
Bars, in Wales - - -	do	7 0 0		7 5 0	
Rails - - - - -	do	7 0 0		7 5 0	nets
Foundry Pigs, at Glasg, No 1	do	2 15 0		0 0 0	nett
Swedish Bars - - -	do	11 15 0		12 0 0	2½
STEEL:—					
Swedish Keg, hammered -	do	15 0 0		0 0 0	
Swedish Faggot - -	do	16 0 0		0 0 0	
COPPER:—					
Sheet & Sheathing, & Bolts	per ton	91 0 0		0 0 0	3
Hammered Bottoms - -	do	101 0 0		0 0 0	
Flat Bottoms, not Hamrd -	do	96 0 0		0 0 0	
Cake and Tough Ingot -	do	86 0 0		0 0 0	
Best Selected - - -	do	87 0 0		89 0 0	
Fine Foreign Copper - -	do	90 0 0		0 0 0	
Yel. Metal Sheathing & Rods	per lb.	0 0 7½		0 0 8½	
LEAD:—					
Pig, English - - -	per ton	19 0 0		19 5 0	2½
,, Spanish Soft - -	do	18 15 0		19 0 0	
Shot, Patent - - -	do	22 10 0		0 0 0	
Sheet - - - - -	do	20 0 0		21 5 0	
White - - - - -	do	26 0 0		0 0 0	
TIN:—					
English Block - - -	per cwt.	93s 0d		94s 0d	2½
,, Bar - - -	do	94s 0d		95s 0d	
do Refined - - -	do	96s 0d		0s 0d	
Banca - - - - -	do	93s 0d		94s 0d	nett
Straits - - - - -	do	89s 0d		0s 0d	nett
TIN PLATES:—					
Best Charcoal, I.C. -	per box	1 9 0		1 10 0	
Second Quality - -	do.	1 7 0		1 8 2	
Coke - - - - -	do.	1 3 0		1 4 0	
SPELTER:—					
On the spot - - - -	do.	22 5 0		0 0 0	nett
ZINC:—					
English Sheet - -	do	27 10 0		28 0 0	2½
QUICKSILVER - -	per btl.	7 18 6		8 0 0	3

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THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, AUGUST 25, 1865.

THE ATLANTIC TELEGRAPH.

THE PAST.

IT was truly said by one of our most eminent engineers that no one could boast of successes who could not also recount some failures. He could himself look back upon times of doubt and darkness which were as nights to so many days of hope. But then he could also see that such times were as stepping stones to ultimate success, and, toilsome though the way was, it was nevertheless necessary to the end in view. And so with all the great concerns of life, and sometimes with the small ones too, capital and labour must be expended, and time absorbed by the month, or even, it may be, by the year, ere a scheme can be pronounced practically perfect. However clear the way may have appeared from the first, or however feasible and correct in principle the plan may be, it is invariably found that, in practical development, obstacles and imperfections such as no foresight can guard against or precaution obviate, will present themselves. Thus has it fared with the great engineering scheme of the day—the laying of the third Atlantic telegraph cable—in which the whole earth has an interest more or less direct. Feeling this interest too, each nation, as a man, held its breath during the suspense to which all were subjected by the recent accident to the cable. And now that the worst is known the sway of hope is universally re-asserted, and a consentaneous approval is accorded by men to all that has been, and all that is proposed to be done by those who have invested not only their money but their reputation in the undertaking. It is true we might qualify these observations by referring to the grumblers and croakers of society, who always crop out here and there to have a say upon matters in which they have had no earthly experience. But we can afford to exclude such from consideration, as they only cease to be ridiculous when they cease to be remembered. They are, too, in such an infinitesimal minority that their opinions are soon lost in the cloud of witnesses that trained experience, or even common sense, can and does array against them. But, as an ounce of fact is said to be worth sixteen of argument, we will deal with the former commodity, of which we have a good stock on hand.

We have already, in previous numbers, followed the Atlantic telegraph cable through its manufacture, shipment, and—in outline—laying, down to the time when, with 1,200 miles of cable successfully submerged, the signals through the wires suddenly ceased. Then followed a dead blank, a fortnight long, in the history of the enterprise, during which period conjecture was exhausted, and men waited anxiously yet silently for the worst. At length the worst came, and infinitely worse it might have been had not everything, except the contingency of picking up the cable in 2,000 fathoms of water, been provided for in the most ample manner. It appears that a partial loss of insulation occurred when 84 miles of the cable had been paid out. This was on the 24th of July. Ten miles and a half were recovered by the 25th, and the fault was cut out. The cause of all the anxiety and delay proved to be a piece of iron wire about two inches long, which is presumed to have found its way into the tank by accident, and having adhered to the cable was forced into its core when passing through the wheels of the paying-out machinery. This fault being remedied, the "Great Eastern" sped on her way rejoicing. Later in the day, however, the ardour on board was checked by a failure of signals from the shore. But suspense did not last long, for soon the exchange of currents between the ship and shore became strong and regular; and so the voyage was continued for that day and the next, the average rate of paying out being about 5·87 miles per hour of cable. The total loss of cable in direction from a straight line was 9·32 per cent.; on the whole distance, 8·3 per cent. The cable continued to run with the most perfect regularity in a depth of 2,000 fathoms, striking the water about 213ft. from the stern of the vessel. Thus things went on until the 29th, when, after 716·4 miles of cable had been payed out, matters were brought to a standstill by the discovery of "dead earth," which was far worse than the previous fault. The tedious process of picking up again commenced, and in about nine hours' time the portion of the cable where the mischief existed had been reached and the mishap remedied. The nature of these defects created suspicions in the minds of some that all was not going on quite so fairly as it should be. On the 30th the cable was once more running out into 2,000 fathoms of water, all things going on most satisfactorily.

By Monday, July 31st, the cable had been nearly all payed out of the after tank, and at 3 a.m., the screw engines were stopped and the paddles slowed, to allow the last coil in the after tank to run out, and the paying out to be transferred to the fore tank. This operation was easily effected, and the "Great Eastern" steamed ahead again. An examination was then made of the length of cable cut out on the 29th, in which the "dead earth" was known to exist. The result was the discovery of a piece of wire of the same gauge as that forming the outer casing of the cable, and which had apparently been pointed at one end and driven clean through the cable, the wire being in length just equal to the diameter of the cable. The conviction was that the act was that of either wilful malice or malicious sport; the cablemen themselves admitted that the mischief could not have occurred accidentally. The same gang were on duty in the tank on each occasion of fault, so an arrangement was made to watch the tank. The 1st of August passed away without anything occurring worthy of note except the very satisfactory progress made. The 2nd, however, was destined to be a sad and memorable day in the annals of Atlantic telegraphy; about 8 a.m., Greenwich time, the galvanometer detected a flow of electricity indicative of a serious fault, which was generally believed to be not far from the stern of the ship. This was soon proved by experiments to be the case; so once more the weary task of picking up was resorted to, and at 9·58, after 1,186 miles had been payed out, the tedious process commenced. The situation of the vessel was assumed to be over a gentle elevation, on the top of which there were nearly 2,000 fathoms of water. According to the dynamometer the strain on the cable was from 50 to 55 cwt., although the latter figure represents the maximum only reached on one occasion. Not until one hour and forty-six minutes had elapsed had one mile of cable been recovered, and then, as if further to retard operations, the eccentric gear of one of the engines got out of order, so that manual assistance had to be rendered to enable it to continue working. Presently steam failed, and after that water got low in the boilers, so that the picking-up was stopped, and the ship began to forge ahead and chafe against the cable. At this juncture the great misfortune occurred, and this was directly due to the hawse-pipes which project some distance beyond the bows of the "Great Eastern." So long as a strain was kept on the cable it was prevented getting under the bows of the ship, and the hawse-pipes were not in the way. But on the picking-up machinery failing, it became necessary to stop the ship, for she could not go ahead without running over the cable, nor turn astern without snapping it. So the "Great Eastern" was left to the mercy of the wind, which drifted her broadside on, until at last an oblique strain was brought on the cable, all that Captain Anderson's skilful seamanship could do notwithstanding. So, unhappily, the cable chafed and strained until at last it became visibly damaged in two places. All the protective measures that could be devised were adopted, but with very little saving result. The machinery was once more in motion, and the cable coming slowly inboard, the first damaged part being in fact on deck; suddenly a jar caused the dynamometer to fly up from 60 cwt.—the highest point marked—with a sudden jerk 3½ inches. The chain shackle and wire rope attached to the cable got out of the groove of one V wheel, and falling on another below it, caused a severe shock to the cable, which just afterwards parted at the dynamometer and the end disappeared in the sea. The "Great Eastern" had then accomplished more than two-thirds of her journey, she being 1,062·4 miles from Valentia and 601·6 miles from Heart's Content. After a very brief consideration, Mr. Canning came to the conclusion to seek for the cable away down at the bottom of the Atlantic, two miles vertically beneath him. Out, then, went the grapnels and wire rope, the ship drifting down across the track in which the cable was supposed to be lying. At 15,000ft. the grapnel reached the bed of the Atlantic, and at once set to work on the first task of recovery.

On the 3rd of August, at eight a.m., 300 fathoms of the wire rope, with the grapnel at the end, were hauled in, and from the strain on the dynamometer, there could be no doubt that the cable had been seized and was being hauled up with it. But soon the spur wheel of the wretched picking-up apparatus broke, and hauling in became both a difficult and dangerous operation. 700 fathoms had been secured, and there appeared no doubt that the cable was coming up, when one of the iron swivels in the wire rope yielded under the strain, and hope was once more ended for the time. Although the trial had been brought to an abrupt conclusion, yet an important fact had been established: it was demonstrated that the grapnel could pick up in more than 2,000 fathoms of water. The only question was, whether the wire rope on the cable itself would bear the purchase and weight of hauling up from such depths? However, no time was lost in useless speculation, and as there was wire rope enough left to make another attempt to recover the cable, it was resolved to proceed two miles to westward of the last fishing point and then commence anew. On the 4th, soundings showed a depth of 2,300 fathoms, and, after drifting about awhile in fog, a buoy was dropped surmounted by a red flag and having two miles and a half of the cable attached, terminating with a mushroom anchor, to denote the bearings. Two days of drifting through fog followed, but on the 7th inst. the "Great Eastern" was able to commence another grappling experiment. At 1.47 p.m. the grapnel with 2,500 fathoms of cable was hove over, and, owing to the improvements which had been made in the machinery, it was at the bottom in half the time of the previous one. Soon after six o'clock the strain gradually increased from 45 cwt. to 60 cwt., and the cable was once more hooked. Two hours later the picking-up machinery again gave way, but without injuring the cable, and the capstan was brought into use in the operation. On the 8th August the dynamometer rose to 87 cwt., and it was calculated that the grapnel with the cable was then rising from the bottom. Soon a mile of rope had been hauled in, the rate having been steadily kept at 150 fathoms per hour, the cable being then suspended in the ocean 1,500 fathoms below the ship. The strain increased to 90 cwt., when suddenly the head of the pin in one of the shackles and swivels used in joining the lengths of wire rope together gave way, and all was again over; the cable with the grapnel and 1,500 fathoms of wire rope rapidly returned to the

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bottom of the sea. A second buoy attached to 2,500 fathoms of cable, with a broken spur wheel for a mooring, was then lowered as near as possible to the spot where the grapnel had just disappeared.

A third attempt was then determined on, and the diameter of the capstan was increased by 4ft. so as to obviate the evils arising from the failing of the picking-up machinery. The swivels of the wire rope, too, were replaced by a new system of bolts. Preparations occupied the time until the 10th, when the grapnel was again lowered, and at 10.30 touched the bottom. This attempt, however, proved futile: the "Great Eastern" drifted over the line of the cable without the grapnel having made a bite, so it was hauled in again, and when, at 5.20 next morning, it reached the deck, it was discovered to be entangled with the wire rope, so that it could not catch on the bottom. The resources were now nearly exhausted as regards what we may call fishing tackle, but a final effort was made with a line composed of 1,600 fathoms of wire rope, 220 fathoms of hemp rope, and 510 fathoms of manilla. This fourth line was lowered at 1.56. The "Great Eastern" drifted across the line of the cable, presently the strain rose to 60 cwt., soon it reached 80, and later on, for a short time, 105 cwt. At 9.40 p.m., Greenwich time, just as 765 fathoms had been got in, a shackle on the hemp hawser passed through the machinery, and a moment afterwards the rope parted near the capstan, and the last hope of those who had worked so nobly vanished, as the tail of the rope rushed over the bow whistling like a round shot. The "Great Eastern" then bade farewell to her faithful companion, the "Terrible," and turned her head eastward, the "Terrible" going west to St. John's to coal. The "Sphynx" parted company from the other two a few days after starting from Valentia.

THE FUTURE.

To pass at one bound from a retrospective to a prospective view of matters is, in this instance, admissible, inasmuch as the past and future of the Atlantic telegraph cable are connected by a present which consists now of only a single link; that link being the fact that 1,200 miles of cable lie stretched across the bed of the Atlantic. But its future commences now, nay, it commenced as soon as the "Great Eastern" had recounted her history; so to that future let us turn. As a starting point, we will take the conclusions which may be legitimately drawn from the foregoing narrative. The perfect adaptability of the "Great Eastern" for the work of laying down the cable is evidenced by the fact that in a stiff breeze, when the sea was washing over the "Terrible," scarcely any motion was perceptible in the "Great Eastern," her greatest roll being 7½ degs., and her greatest pitching 1 to 1¼ deg. The big ship, therefore, by her wonderful steadiness at sea, and from the facilities for steering which her screw and paddle engines afford, is proved to be eminently adapted for cable-laying. But, to render her fit for future service, she unquestionably requires careful overhauling and repair. Improvements will have to be made in the arrangement of her tanks and coils, whereby she may carry her full complement of boilers, for it can be imagined she must labour under a disadvantage when working *minus* two boilers. Amongst other things requiring attention to the end that she may be made truly serviceable, are certain points of construction which at the present time appear rather weak. The strengthening is proposed by Mr. Fairbairn to be effected by placing additional stringer plates on the upper deck, and probably a short way down the sides, so as to increase the ship's powers of resistance to strain with a heavy cargo on board, such as she had from the Nore to Valentia. This being done the "Great Eastern" may, with safety, be trusted on any sea and in any weather. It may be that the future of this vessel will become entirely identified with the pursuits to which she has been so appropriately appointed, and for which she is so admirably fitted.

With regard to the machinery for laying the cable, nothing that can be said in its favour appears too strong praise; whilst the reverse of this holds with respect to the hauling-in apparatus and tackle. But it must in fairness be said that such a contingency as having to pick up the lost cable from a depth of two miles and a half was never anticipated; hence the failure—the grappling gear was inefficient. The remedy will be to have an engine fitted to the paying-out apparatus, so that, in case of need, its action can be reversed and the machine used for hauling in. This would enable a fault—if such occurred—to be recovered very soon after it had left the ship, immense time also being saved by avoiding the operation of shifting the cable from stern to head. Machinery will also be fitted in the bows of the vessel for the purpose of fishing up the present cable. All these of course are simple matters of detail, the best methods of arranging which will be determined by the experiences recently gained. The picking-up apparatus, too, will of course be constructed consistently with the duty it has to perform in recovering the cable, which duty has been well ascertained, so that no excuse is left for mechanical failure in this respect. The question had not been practically dealt with before, and so was unprovided for, or we should probably now be recording congratulatory messages carried by the subtle fluid from President Johnson to Queen Victoria.

The cable itself has all the requisites of strength and the right specific gravity; it never went over the stern at a greater angle than 7 deg., and never showed a greater strain than 14 cwt. upon the dynamometer. Its insulation improved daily as the cable became influenced by the lower temperature of the deep ocean. Its present failure is due principally to one of its own wires having penetrated the gutta-percha core, and this cause has been so far fatal only because it was not anticipated. Every kind of experiment had been previously resorted to, but the wire never before penetrated the core. This, taken in connection with other circumstances, appears to have directed some of the leading minds to the conclusion that the faults were the result of malice, although Captain Anderson inclines to a contrary opinion, believing them to be the result of accident. But whichever way the truth may lie, it certainly follows that such appliances only should be used as would prevent the recurrence of such fatal results. In order to afford additional security, Captain Anderson suggests that the outer protecting wires should be formed of a number of smaller ones, so that no single wire would be sufficiently strong to penetrate the core; or if necessary, the core might be covered with canvas or wire gauze to make it still more secure. The cable is perfect in its insulation; it possesses the right specific gravity, the right strength, and fails only in one respect—that of being capable of wounding itself. But there is enough of experience now to check its suicidal tendencies, or if not to prevent, at any rate to remedy at once any wound that may be inflicted whether by itself or by Mr. Russell's "cable assassin."

In the ordinary course of things, and had there being no let or hindrance on the part of the vessel herself, the "Great Eastern" would probably be despatched on the voyage of recovery a few weeks hence, armed with efficient picking-up tackle. But as the necessary repairs will occupy some two months the expedition could not leave early enough for useful effect. Winter gales would probably drive the ship from her work, and without the sun the locality of the cable could not be discovered. It has, therefore, been concurrently determined by all interested in the question that the better plan will be to delay the voyage until May next year. In the meantime a new cable will be manufactured, which will be sent out in the "Great Eastern" when she goes to recover the other one. This cable will be of the same character as the last, with the exception perhaps of a slight addition to its outer covering, but which will in no way interfere with its specific gravity, or any other condition already proved to be satisfactory. The process of picking up the cable will, doubtless, be on this wise:—The "Great Eastern" will proceed to within ten miles of the extremity of the cable so as to keep clear of the grapnels and tackle now resting on it. She will then drag until the grapnel bites, when she will commence hauling in. Another vessel—say the "Terrible"—will be going through the same operation a mile to the east of the "Great Eastern." The latter vessel having obtained a hold will probably break the cable in the lift, and will then proceed eastward on the course of the cable about half a mile astern of the "Terrible," where she will again grapple for, and no doubt lay hold of, the cable, which, with the bight thus formed, will be comparatively easy of recovery. The recent deliberations of the boards of the several companies interested in the Atlantic telegraph cable have been distinguished by a spirit of the utmost confidence in the realisation of a great success next year. Not the slightest doubt is entertained as to finding, with the greatest precision, the position of the broken end by solar observation, and of eventually raising and repairing the cable. The animating principle is a determination to perfect the telegraphic communication between England and America, which object, we doubt not, will ultimately be effected.

THE FAILURE OF THE ATLANTIC TELEGRAPH CABLE.

WHEN the "Great Eastern" commenced laying the Atlantic cable the probabilities in the mind of the general public were three to one that England and America would be united in less than a month by an electric line. The public were far too sanguine, as the return of the "Great Eastern" has shown. The difficulties to be contended with in laying so fine a thread between the Old and New World were and still are immense, but not greater than can be overcome by practical men possessing a sound knowledge of natural philosophy, and who are, therefore, men of common sense. It was stated that all the faults in the manufacture and the laying of the old cable had been carefully avoided. This was not so, for the principal and most important fault was evidently not seen, for if it had been seen it is hard to understand how it should have been so heedlessly repeated. The great mistake was in having the outside wires spirally wound round the straight copper core, thus making a cable, as it were, of fine straight wires and spiral springs, the spiral springs to take all strains and the centre wires none. This is a thing impossible, for how could the spiral extend, as it naturally would, in proportion to the strain upon it, without extending the central and weak core? We can easily imagine the extension of the spiral spring being so great as to break and completely separate the copper core before it had one-fourth of its own breaking strain on; and not only that, but it would also open the insulated covering sufficiently to admit the water, and thus indicate "dead earth," when electrical tests were applied. The strengthening outside wires being arranged as spiral springs were evidently the cause of failure. Theory shows clearly that such an arranged cable would fail with a much less strain than would be required to break the sustaining wires. We have no data to prove that the failure arose from any other cause.

On Monday, July 24th, when eighty-four miles of cable had been payed out, it became apparent to the electricians that there was a fault somewhere in the cable. This fault is said not to have been found until more than ten miles of cable had been picked up, and that the fault was caused by a piece of wire 2in. long having been driven into the core in

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passing through the paying-out machinery. This may or may not have been the cause of loss of insulation. If it was the cause, how came it that the electricians did not notice it immediately the faulty part fell into the sea? Most certainly if a piece of wire was thrust through to the core it would act immediately on passing into the water, and would not take one hour and a half, equal to ten miles of cable payed out, before destroying the insulation. Is it possible that ten miles of cable were payed out without any test? One hour and a half, and no proof that "all is well?" we can scarcely believe it. Either the electricians were very negligent in allowing such a length of cable to pass out, or the failure was from some other cause. The depth of water when the fault was observed was 400 fathoms. Now, this length of cable would offer immense resistance to being dragged through the water at the rate of six miles per hour, and the slightest hitch in the paying-out machinery would at once put such a strain on the cable as to extend it sufficiently to break the copper core, or separate the insulating material enough to admit the water. The fault may have been but a short distance overboard, but in hauling in, fresh accidents were likely to occur by over-straining the "spiral spring" of the cable, and injuring the core, and thus it was necessary to pick up ten miles before all came right. It is admitted that much of this ten miles of cable was a good deal strained. Even in paying out the strain might have been more than was desirable at any one moment of time. What may it have been very often when hauling in? Certainly, the chances of overstraining were far greater, and faults may have occurred very often from sudden strains, and ten miles had to be picked up before the remaining immersed portion of cable showed perfect insulation.

Mr. W. H. Russell, in his diary, says :—

"Saturday, July 29. In the night we had passed over 2,400 fathoms deep, and at 9 a.m. were in 2,000 fathoms only; distance from Valentia, 686 miles: miles of cable paid out 797; distance to run, 1,028 miles. About ten minutes past one o'clock (ship's time) there was a slight commotion and excitement in the neighbourhood of the testing-room, and soon afterwards, with great quickness indeed, the engines were stopped, and the ship ceased to move. Up swarmed, at the ominous quiet, all the lazy life of the floating city, and buzzed about the deck. And soon the cause was known—this time no 'fault;' far worse—'dead earth,' total and complete destruction to the insulated channel." A portion of the cable was "picked up," and on Monday, July 31, "an examination was made of the portion of cable in which the 'dead earth' was known to exist by a series of exhausted electrical tests. Slowly but surely the defective portion of the cable was reached and cut out. A very painful discovery was then made. An incision was visible in one strand of the hemp covering an external wire, and on unravelling the strands, so as to expose the insulated wires, a piece of broken iron wire was found driven through the gutta-percha covering, so as to project beyond it on each side to the extent of the diameter of the cable. One end was sharp, as if cut with nippers; the other was broken off abruptly; and the diameter, on the gauge being applied, corresponded with that of the wire covering the cable. It was impossible to resist the irritating and sorrowful conviction that such an injury was the work of some hired cable assassin or some purposeless malefactor. Mr. Canning showed the cable and the steel to the cablemen, who admitted that the mischief could not have occurred accidentally."

No "fault;" far worse, "dead earth." If in the first fault the wire two inches long touched the core as this last piece of wire is supposed to have done, why was not the first "fault" "dead earth"? Again, the probabilities are in favour of assuming that there was some sudden and accidental strain on the cable extending the "spiral spring" sufficiently to break the copper core and open the insulating material. But how comes the piece of wire driven through the core? Far more likely it occurred during the process of hauling in than paying out. Considering how many times the cable was cut at this point it is natural to suppose that stray pieces of wire would not be wanting in the neighbourhood of the incoming coil. This stray piece of wire, which made it impossible "to resist the irritating and sorrowful conviction that such an injury was the work of some hired cable assassin," was, of course, of the same diameter, by gauge, as the wire covering of the cable. When could a hired cable assassin quietly drive in a piece of wire? not easily into the part that was moving from the tank to the sea at the rate of six miles per hour, and the portion in the tanks was assumed to be in water. If, therefore, the wire was driven into that portion, why was not the "fault" discovered at once by the electricians? There is nothing to prove that this fault was not caused by excessive strain on, perhaps, a weak part of the cable when overboard, and that the wire was not accidentally driven into the cable at the time of hauling in. On the 2nd of August the cable parted and went overboard in nearly 2,000 fathoms water, 1,062 miles from Valentia. The cause of this sad accident arose from the discovery of a fault and consequent hauling in of the cable, and the very imperfect engine used for the purpose. Who would have supposed that an engine specially provided to perform that very important work would be in such a disgraceful state?—"Eccentric gear out of order, so that a man had to stand by with a handspike, aided by a wedge of wood, and an elastic band to aid the wretched engine. Next, the supply of steam failed, and when the steam was got up it was found that there was not water enough in the boilers, and so the picking-up ceased altogether for some time, during which the ship forged ahead, and *chafed* against the cable. Then occurred the great misfortune." Of course it did; it would require a most wonderful cable to withstand such playing with in 2,000 fathoms water with one end held fast to the bow of a vessel that was continually rising and falling and chafing against it. We wonder it did not part sooner and fly overboard. Whatever distance the bow of the "Great Eastern" rose and fell when the cable was fixed at the bow, and not being hauled in, that same length was allowed for by the cable *stretching*, for it was impossible that it could be absolutely lifted, in the time of the rise, from the bottom, or for a length of 2,000 fathoms. We almost question if the strain was felt at a distance of 1,000 fathoms, for the friction of 1,000 fathoms of cable in water, when moved with the same speed as the rise of the bow of the vessel, would be enormous.

It is almost certain that the main "faults" were caused by the *stretching* of the spiral spring, and consequent opening of the insulating material and disruption of the copper core. Hauling-in ought never to be required, for it is a most dangerous operation with any cable in great depth of water, and where the surface is not as smooth as a millpond. Such hauling in would *not* have been required had the cable been made with the sustaining wires parallel with the axis, and therefore parallel with the copper core, then the copper wire, being the most ductile, would always have accommodated itself to the extension from strain of the iron covering wires; they, being straight and of iron, would naturally break before the copper core could be injured in the slightest degree. Thin wires wound round the straight sustaining wires would bind them together on the insulating material as perfectly as could be desired. The arrangement for hauling in from the bows of the vessel was a great mistake. What an amount of hazard and care would have been avoided had the hauling-in apparatus been fixed at the stern—either by itself and parallel to the paying-out machinery, so that the cable would simply have required lifting out of the groove of one wheel into the other, or, as Captain Anderson recommends, having an engine applied to the paying-out gear, so as to reverse and haul in at once, while the fault was being located. Such an arrangement would have greatly reduced the risk of completely losing the cable—not, however, with such a faulty engine as was used at the bows of the vessel.

As to fishing up the cable from a depth of two miles and a half, or two miles of water, the chances are very vague. If in a distance of nine hundred and forty-eight miles only one thousand and eighty-one miles of cable were payed out, there is not much slack left for the successful picking up. Presuming that the cable was laid hold of at a depth of 2,000 fathoms, and presuming the fishing tackle to be amply strong for any strain put upon it—what would be the consequence to the cable? Why, it would break long before it was brought to the surface. When it is considered that it is laid in nearly a straight line, there being so little slack, the strain on itself from its own weight would be very great when lifted only one mile from its present resting place. Assuming that in a length of about four miles of cable the length of slack is half a mile, the centre of the length of four miles and a half being lifted up one mile, the strain on the cable at the highest point would be equal to three miles of its own weight on either side of the fishing tackle; beyond this strain, there is the strain due to the friction of pulling it through the water. If it is strong enough to withstand the above strains, how much higher could it be lifted? In lifting it higher the cable must either stretch, or be dragged along the bottom of the ocean beyond the distance of two miles on either side. Even supposing the curve of the catenary to be flatter than we have assumed, the consequence would be a proportionately increased strain on itself at its highest point, due to an increased length suspended at a more acute angle with the horizon. It thus appears impossible to lift the cable safely out of this great depth of water—especially when we consider that experiments have been made which gave a result showing that, in great depths of water, the strain with equal velocity is increased to four times when the length is doubled; and, in addition to this, it must be remembered that the friction is increased as the square of the velocity.

Our only hope of regaining a portion of the cable is by fishing it up in shallow water, and carefully, and slowly, underrunning it in very calm weather. No doubt there are many enterprising men who would undertake to underrun it at a certain sum per mile, and it might be to the interest of the company to accept any reasonable offer to that effect. We regret, however, that nothing more can be done towards picking it up and completing it this year. Early next year we hope to see this cable underrun for a considerable distance, a connection safely made, and a complete cable in perfect working order, resting safely on the bed of the wide Atlantic. It may be advisable at the same time to lay another cable of such specific gravity that it would slowly sink to the bottom of the ocean. Such a cable would have but little strength, and must therefore be of such a quality that it would by no chance whatever require hauling in. It will be a proud day for Englishmen when this important work is successfully completed.

W. T. C.

INJECTION CONDENSERS.

ACCORDING to history the first steam cylinder was also a condenser—the steam acted on the under side of the piston and the atmosphere on the upper. On the piston completing the up stroke a jet of water produced condensation and a vacuum simultaneously, the atmosphere causing the down stroke. Primitive as this mode of applying a powerful agent was, the principle still remains the same, and the condensing engines of the present day are as those of the past. The cylinders now in use are closed at each end, and the steam operates on each side of the piston; but the cause and effect of the vacuum remains unalterable. There are two systems of condensation which are commonly known as injection and surface; the former may be said to be the most universal, owing perhaps to the economy of the outlay in proportion to that required for

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the latter system. The condenser and air pumps for land engines are usually alike, the condenser being cylindrical and the air pump vertical in action and arrangement, it being well known that space in this case is not of much importance, also that high-pressure steam is more often employed at present than it was formerly. The field for condensation and improvements in the same can be truthfully said to be on board our commercial and war ships; space is there of the utmost importance, and economy of fuel a matter of consideration. In the present day each maker prefers to adopt a certain class of engine, and at the same time to arrange the condenser and air pumps to suit his ideas. To form a just opinion of the qualities of the injection and surface systems when applied to marine engines, it will be necessary to analyse each arrangement applicable for the particular kind of engine adopted. Commencing with the injection condenser, for paddle and screw-engines. Air pumps with vertical action are similar in general arrangement; the piston forms a suction and delivery valve alternately, while the remaining valves are located at the top and bottom of the air-pump barrel. The air pump is not in all cases perpendicular; for large engines, and in vessels of moderate beam, an angular arrangement is preferred. The suction valves are at the bottom of the pump, which is situated outside the condenser. The discharge valves are at the top of the pump, outside or clear of the cover, the air vessel being secured above the valves last alluded to. This description will apply to most arrangements for paddle-wheel engines.

Our next type of condenser and air pumps will be that for screw engines. In this case we cannot confine ourselves to two or three examples for comparison, as the number of arrangements for the screw engines greatly exceeds that for the paddles. Marine engines for the screw may be said to be of two kinds as regards the principle, viz., direct and return actions. The condensers and air pumps applicable for direct-acting engines are as follows:—The air pumps are as near the base line as practice will admit, the condenser being situated between the pumps. The suction and delivery valves are under and over the barrel, at each end. The discharge chamber extends on each side of the condenser and at the end of the same, so that actually the discharge water may be said to surround the condensing chamber during its exit. The means for obtaining access to the valves are by doors, those relating to the suction valves at the side, while the doors for the delivery valves are on the top of the same. Now it will be obvious that both discharge and condensing chambers must be within the inner lines of the air pumps. The external shape of the condenser in question is that of an hemisphere on a parallelogram; for the end view, the form in plan being square; also the same may be said of the side elevation. Our next example consists of the condensing and discharge chambers being situated over the pumps; these latter are located as close together and near the base line as the peripheries of the cylinders will admit. The discharge chamber is at the sides and end of the condenser, the latter extends over the top of the former for a given height, thus forming the termination of the chamber, for condensation. The suction valves are located in the bottom of the condenser, distributed the entire length of the pump; it is almost needless to add that these valves are inverted. The discharge valves are on the same level as those last alluded to, located at the bottom of the discharge chamber on each side of the condenser, but contrary in action to those for the supply. The doors for gaining access to the discharge and supply valves are respectively secured at the sides of the discharge chamber and the top of that for condensing. The exterior form is as follows, in plan and side elevation square, the end elevation being flat at the top but angular at the sides below the discharge valves. The sides intersect the bottom in bold curves, whose radii are struck from those of the air pump's diameter.

The next arrangement is as follows:—The air pumps and valves are located similarly to the last example, with the exception that the suction valves are situated lower than those for the discharge; consequently, the bottom of the latter chamber is higher than that for condensing. The discharge chamber in the present example extends to the top and sides of the condenser, instead of being under the same at the sides, as in the previous arrangements. The exterior shape is much the same as that of the last. The exhaust steam pipe in the three examples enters the condenser at the front end below the top line. The discharge water pipe is opposite that for the steam. The injection pipes enter the condenser at the back end and extend along the sides till nearly reaching the exhaust steam, when the splash plate or rose completes the requirement. In some cases one injection pipe only is used, which is situated at the back end centrally under the discharge water pipe. The example we next select for comparison has the discharge chamber centrally located over the air pumps. The condensing chambers are situated on the same level on each side of that for the discharge. The suction and delivering valves are secured on the bottoms of their respective chambers over the air pumps. These valves are reverse in action, as in the two last examples. In the present case the condensed steam enters on the top of the condenser, two steam pipes being thus required. The doors for gaining access to the valves are at the ends and top of the condensing and discharge chambers. Those relating to the condenser are, of course, below the same. The injection pipe is situated at the side of each condenser, in a line with the exhaust steam pipe.

We have thus far treated of examples relating to direct-acting engines. We propose next to describe the arrangements of condensers and air pumps for return-acting engines, commonly known as double piston rods return connecting rod engines. Our first selection is arranged as follows:—The condensers are placed between the air pumps, rising centrally above the same to attain cubical capacity. The discharge chamber is located outside the pumps, and is similar in shape to that for condensing. The suction and delivering valves are under and over the pumps at the outsides of the same, access to the valves being attained by doors at the sides of the discharge chambers and pump barrels. The exhaust steam enters the condenser at the top and the injection at the back end of each condenser. The discharge water pipe is secured at the back end of the chamber in the ordinary manner. The space between the condensing and discharge chambers is occupied by the piston and connecting rods, guides, &c.; hence the cause for the arrangement alluded to. The form of the exterior of the present example will be similar to ɯ, the bottom portion being flat. This relates to the end views, the shape in plan and side elevation being square. In some cases the same exterior of condenser, &c., is preserved, but reverse in arrangement. The condensers in this case would be outside the air pumps, while the discharge chamber would be between the same. The suction valves are inverted at the bottom of the condenser so as to effectually drain the same. The discharge valves are at the sides of the air pumps, extending the entire width and length of the bottom of the discharge chamber. The exhaust steam, discharge, and injection pipes are all respectively located as in the last examples. In the next arrangement the air pumps are raised from the base line as much as the crank shaft will admit. The condenser is raised at the front end and extends below for the entire length of the pumps and valve chambers. The suction valves are outside the pumps beyond the guides of the piston rods. The discharge valves are above the pumps, also the chamber above the former. It will be readily understood that in this case the suction valves are greatly below and beyond the air pump, a fact to which we shall hereafter allude. The shape of the exterior of the example under notice can be more easily conceived than illustrated descriptively; suffice it to say, the discharge chamber is raised centrally above the condenser and pumps, which latter form the base for the former, the plan and side elevation being as in those previously alluded to.

We now come to a compact arrangement separately located outside the guides of each engine. The condenser is over the pump, and outside the same. The discharge chamber extends the entire length at the side of the condenser, over the pump. The suction and discharge valves are respectively situated in the bottoms of the chambers, reverse in position and action. The shape of the exterior in this case is so readily understood that further description is needless. Our last selection consists of an arrangement where the condenser is situated above the pumps, the discharge chamber being below the former and at the side of and between the latter. Thus it will be seen that the suction valves are located above the pumps, while the discharge valves are at the side of them, the location of the valves being at right angles with each other. It may be added that, in the case of the last three examples, the exhaust steam enters the condenser at the front end near the top. The injection and discharge water pipes are connected at the back end of the condenser and discharge chamber.

We have now alluded to twelve different arrangements, all of which are in actual work. Before further alluding to the examples noticed, it will not be out of place to explain the true principles of injection condensation. When steam enters the condensing chamber it is in the form of a vapour; on coming in contact with the cooling fluid in the shape of water it condenses; the two amalgamate, or rather reunite, forming a body of water of a higher temperature than that used for injection. Now, it is obvious that the greater the space occupied by the condensed steam the less room for the process of condensation. Hence, it is practically consistent with natural laws to drain the condenser at the same speed as the injection water and steam amalgamate. When the condenser is below the air pump or at the side of the same, a vacuum must be caused by the bucket, piston, or plunger before the water will rise in the barrel; at the same time a cessation of flow or exit from the condenser must ensue. The present remarks, of course, refer to single and double acting pumps similarly situated. Above the pump is the correct position for the condenser, irrespective of action. The motion of falling bodies causes a vacuum; hence, in the case of gravitation of water, and the same being applied to condensers, a better vacuum is attained than with the ordinary kind. The arrangement we propose for land condensers and pumps, and also for vertical action on board vessels, is as follows:—The condenser should be on the top of the pump, in fact, the top of the latter should be the bottom of the former, the suction valves being inverted so as to effectually drain the condenser. The discharge valves should be at the side of the pump at the top, access being attained to each set of valves by doors suitably arranged. The bottom of the air-pump barrel might be open to the atmosphere or closed, or inserted in a body of water. By this arrangement a perfect action would be attained, owing to the fact that, on the suction valves opening, the gravity of the water would greatly assist its exit, it being remembered that a vacuum is caused above and below the water in all cases. The injection also causes a better vacuum by falling direct rather than rising to fall again within the condenser or beyond the rose or splash plate.

With reference to the examples for screw engines to which we have alluded, it may be observed that the air pumps are all of hori-

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zontal double-action type. The two classes of arrangement of marine screw engines greatly affect the condensers, &c., while at the same time correct action can be maintained in each example. The adoption of the suction and delivering valves under and over the pump (as in two of the examples to which we have alluded) is rather primitive, and in no case whatever, with valves so arranged, have we known good results at sea for a lengthened time. Now, when the condenser is over the air pump, the former can drain effectually, as we have explained. The exterior of the condenser can also be of a more uniform shape, it being remembered that by having castings a plain surface can be moulded with perfect accuracy, whilst, with an uneven surface, joints, &c., are necessary. These practical matters form a reason for alluding to the exterior forms of the examples under notice. The positions of the valves of air pumps are of great importance, and in no case whatever should those relating to suction be located below and beyond the side of the pump. It will be remembered we have alluded to an example of this kind before now, and at the same time noted it for further remark; hence our present allusion to this error of arrangement. To produce a quick and perfect drainage of the condenser and discharge of the condensed steam and water, both suction and delivering valves should be close to the pump, or at least as near as practice will admit.

Our ideas of what an arrangement for direct and return-action engines should be, are as follow:—For the former class we should prefer the discharge chamber to be centrally situated over the pumps; the condenser located on each side and in front of the discharge chamber. By this arrangement compactness of the valves and pumps would be obtained, while the discharge chamber would be above and between the pumps; hence an air vessel of great capacity would be attained, a matter not to be disregarded. With reference to the arrangements requisite for return-action engines, it must be remembered that in the present examples the piston and connecting rods, with the requisite guides, greatly impair the compact form of the pumps and condensers. We say this remembering that cubical capacity in the hold of the vessel is of great importance. It next becomes necessary to consider which is the most valuable, height or area, in plan. Should the two last examples for return-action engines be adopted, the results would be equal, owing to the different arrangements being alike in principle of action, with the exception that in the latter case the whole is situated between the guides, which perhaps is the better arrangement for accessibility to the working portions requiring adjustment.

ATLANTIC CABLE GOSSIP.

ADVICES from New York state that the steam sloop of war "Sphynx" arrived at Heart's Content, under canvas, on the 6th inst., having exhausted her coal on the 4th. She parted with the "Great Eastern" and "Terrible" on the 27th ult. in lat. 52·43, long. 20·2, during a very heavy sea and a stormy gale from the westward; everything was working well. When the "Sphynx" was sighted in Trinity Bay the entire cable fleet was reported as arrived, and great excitement prevailed. Two steamers proceeded down the bay early in the morning to meet the "Great Eastern," with a large party of prominent persons on board. Their disappointment was great. About noon of the same day three guns were fired down the bay, and it was again reported that the "Great Eastern" had arrived. The firing was occasioned by the steam sloop of war "Royalist" mistaking the "Sphynx" and the "Stevenson" for the cable fleet.

On the continent the failure of the Atlantic cable, which is lamented in the whole continental press, from Odessa to Lisbon, has given rise to scientific controversy. Herr Siemens, a partner of the telegraph manufacturing firm of Siemens and Halske in Berlin, in an article inserted in *Dingler's Polytechnisches Journal*, contends that gutta-percha is an elastic, but not a porous substance, and that the water cannot possiblyhave found its way to the wire while the cable remained undamaged. To this argument Dr. Moor objects in the *Cologne Gazette*, stating that gas will escape from a gutta-percha bag, and inferring from this fact that, though gutta-percha may ordinarily be impermeable to water, it is not so when subjected to a pressure equal to 400 atmospheres. He recommends that a cable of some 30,000ft. should be sunk to a great depth, being partly suspended in the water and partly disposed on the bottom of the sea, and that the ship employed for this purpose should try to keep over the same place as long as possible, maintaining its connection with the cable, and making telegraphic experiments of every kind, and that the results of these experiments and the condition of the cable when wound up at length, will supply many useful hints as to the difficulties to be encountered and the defects to be remedied. Dr. Moor is, however, not very sanguine as to the ultimate success of the enterprise, and rather inclines to think that no efficient cable will be thrown across the Atlantic, while we have failed to discover a substance which is light, elastic, non-conducting, and waterproof, under a pressure of 400 atmospheres. In France, Mr. Russell's account of the voyage of the "Great Eastern" with the Atlantic cable has given so great an interest to the enterprise that most of the French papers have begun the translation of his log.

Literature was not neglected in the big ship during the expedition, a lithographer being specially retained on board. His duty it was to lithograph and print the previous day's diary of events, as written by Mr. Russell and copied out by Mr. J. C. Deane. Envelopes addressed to the editors of twenty-five American journals, and to the editors of sixty-five published in England, Scotland, and Ireland, were kept in readiness, and as each day's news was told off it was added to the stock already folded for posting. By this means the letters were sent off simultaneously, and without a moment's unnecessary delay. The "Terrible" took the American bag, and would forward it from Newfoundland. A form, showing the number of miles paid out and the number run, was drawn out and signed by Mr. Canning, which was also lithographed and a number struck off, with blank spaces for the figures. This bulletin was issued every day, and stuck up in a conspicuous part of the deck, informing all of the position of the ship and the quantity of cable run. Nor was this all; a publication of high literary and artistic pretensions was issued every week from the lithographic press. From inspection we are able to pronounce the *Atlantic Telegraph*, edited by Mr. Henry O'Neil, A.R.A., illustrated by Mr. R. Dudley and the editor, to be the most highly-finished production ever published at sea. The frontispiece is composed of well-executed portraits of the leading men engaged in the expedition: the Atlantic telegraph flag, with its combination of stars and union jack, floats in the background; the "Great Eastern" and her guard of honour are in the front, and the whole is enclosed in a neat framework of cable. The sketches are full of humour, especially one by Mr. Dudley, of Mr. Cyrus Field taking his turn of duty as watchman in the tank. Under the head of "Births" we find the following:—"August 2nd. On board the 'Great Eastern,' Sir Optimus Cable; his unfortunate father dying at the same moment." "On the 8th inst., Mr. Varley of a Formula, stillborn." The last page is occupied by a song entitled "The buoy I left behind me," air "The girl I left behind me;" a portrait of the said buoy being prefixed. We reprint the following lay as a sample of the contributions when all was going on satisfactorily:—

THE LAY OF THE ELECTRICIANS.

Air—"Over the Sea."

Under the sea! under the sea! Here's what De Sauty is saying to me.
Such testing as this is the perfectest bliss! Insulation is coming it strong,
So we'll test! test! test! with coils and rhiometers! keys, galvanometers!
Test! test! test! Test each minute all night and day long.

Chorus.

Copper and zinc! acid and stink! tink-a-tank, tink-a-tank, tink-a-tank-tink,
Copper and zinc! acid and stink! success to con-tin-u-i-ty.

* * * *

From shore-end to sea! shore-end and sea! See what Valentia is saying to me.
Mark May's strong relay in units B.A. of millions and trillions again,
It's so grand I can hardly trust Thomson or Varley to test! test! test!
Such a lovely con-tin-u-i-ty.
Chorus—Copper and zinc, &c.

It may not be out of place at the present time to notice the following instance of the wear and tear of telegraphic cables as stated in an American contemporary. "The expedition sent from New York to repair the cable across the Bay of St. Lawrence has begun its labours. By underrunning the cable it was found that part of the coating had rusted off about three miles from shore. Other breaks will no doubt be discovered, as the cable still refuses to work; but it will probably be in order by the time the 'Great Eastern' reaches Heart's Content." As matters stand it probably will.

COMPETITIVE ENGINE TRIAL.

A TRIAL of marine engines is about to be carried out in New York under peculiar circumstances. The competitors are the authorities of the engineering department of the American Navy, and Mr. E. N. Dickerson, between whom for some years past a warm discussion has been carried on. The case in brief stands thus:—The machinery of the "Algonquin," a double-ended naval vessel, which was constructed by a Mr. Dickerson, was not accepted by the Government for causes not made public, and Mr. Dickerson thereupon issued a challenge to the Navy Department to try the speed of the "Algonquin" and the economy of her machinery by a race. The conditions of this trial were that each steamer was to have an equal amount of coal weighed into her and run until the same was exhausted; after this the steamer giving out was to be towed back by the other to the starting point. This challenge was not accepted under these conditions, but the Navy Department offered to try the engines of their design at the dock against those of Mr. Dickerson, on condition that both vessels should be tied to the wharf, and minute observations should be taken of the amount of coal burned, and the number of revolutions made by the machinery of each vessel, the decision being left to engineers of note in New York. This novel experiment is to be made in New York, and will continue for ninety-six consecutive hours.

SCOTTISH SHIPBUILDERS' ASSOCIATION.

AT a meeting held April 3rd, 1865, James Rodger, Esq., President, in the chair, the proposed amalgamation with the Institution of Engineers in Scotland was discussed. The committee appointed to confer with the committee of the Institution of Engineers in Scotland gave in no formal report; but Mr. Mansel stated that they had met the committee of the engineers, who informed them that the Institution of Engineers had agreed to change their name, and suggested that the title of the united body should be "The Institution of Engineers in Scotland incorporated with the Scottish Shipbuilders' Association." The committee of this Association unanimously recommended that this name should be agreed to by this Association. The President thought it would better meet the views of the Engineers if the name were "The Institution of Engineers in Scotland, with which is incorporated the Scottish Shipbuilders' Association." However, if the Engineers had no objection to the other name, they need have none. Mr. J. G. Lawrie moved—"That the committee of this Association be authorised to proceed with the amalgamation with that of the Institution of Engineers in Scotland, in accordance with previous reports, and that it be left to them either to adopt the name proposed by the committee of the Engineers or that suggested by the chairman." Mr. A. Gilchrist seconded the motion, which was carried unanimously.

The foundation stone of two new lighthouses, at Buddonness, on the Tay, was laid on Saturday last. The new lighthouses—the plans of which were prepared by Messrs. Stevenson, Edinburgh, the engineers to the Northern Lights Commissioners, as well as to the Dundee Seamen Fraternity—are to be considerably higher than the present ones, by which, of course, the lights will be seen at a greater distance at sea. The height of the largest of the two is to be 101ft. above high water, and will be seen at a distance of fifteen miles; while the present is 71ft. in height, and is seen at thirteen miles. The lower light will be 61ft. above high water, and will be seen at twelve miles and a half; while the present is 48ft., and is seen at eleven miles and a half. At present the two lights blend into one at three miles distance; but the new lights will blend at six miles and a half from Buddonness.—*Building News.*

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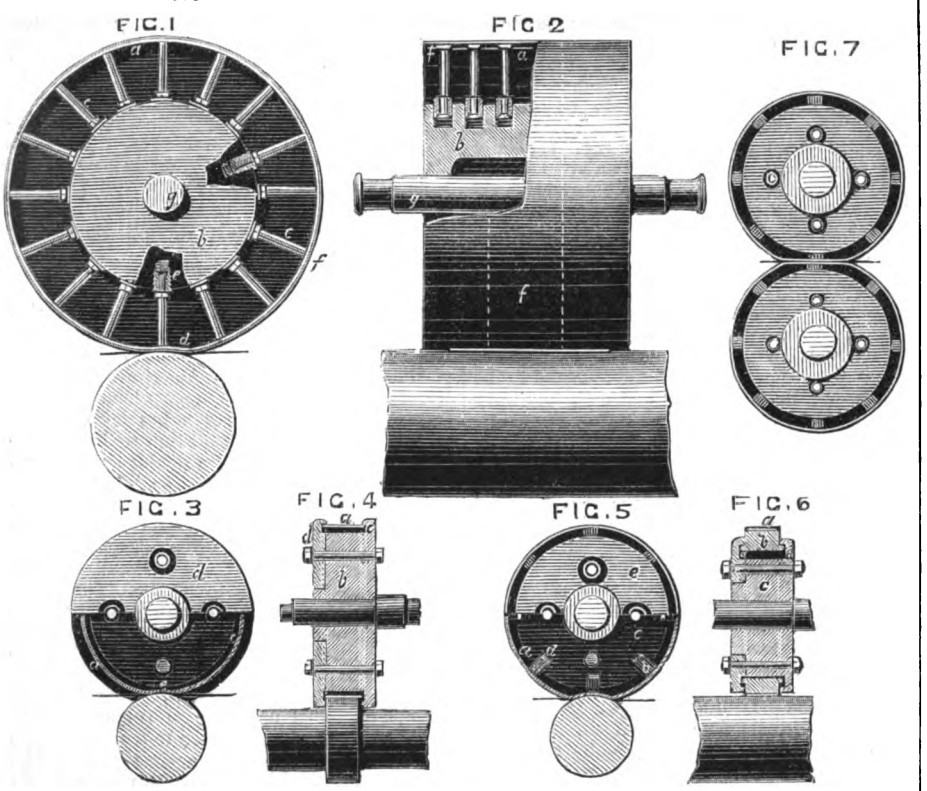
ROLLERS FOR DRAWING FIBROUS MATERIALS.



ROLLERS FOR DRAWING FIBROUS MATERIALS.

MR. HENRY A. O. MACKENZIE, of Grasmere Lodge, Uckfield, Sussex, civil engineer, has patented improvements in the construction and manufacture of rollers and wheels for drawing fibrous materials, and for other purposes, which consist in the construction of rollers and wheels with an elastic or flexible rim connected by spokes or rods to a central boss or nave in such a manner as to allow the said rim to yield to pressure inwards and become flattened, thereby increasing the pressing or drawing surface thereof, but to cause it to resist pressure outwards. It is preferred that the said rim, when required to be elastic, should be composed of steel, also that the spokes or rods should be composed of wrought iron or steel, and the boss or nave of wrought or cast iron. For some purposes the rim may be covered with leather, india-rubber, or gutta-percha; but the metals and covering materials may be varied.

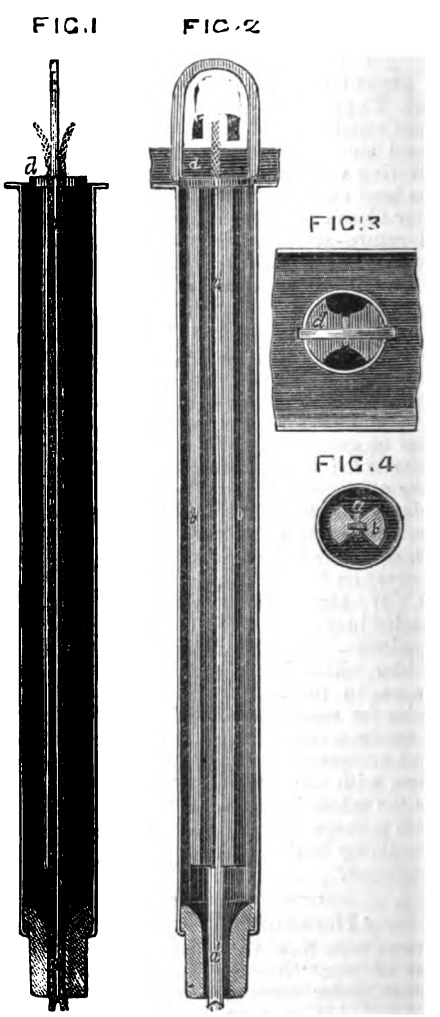
In the engraving fig. 1 is a side view of a roller constructed according to the invention; fig. 2 is an edge view of the same, a portion of the roller being shown in section; fig. 3 is a half side view and half section of another form of roller; fig. 4 is a vertical section of the same; figs. 5 and 6 are similar views of another form of roller. In these several figures the top roller only is shown as constructed according to the invention. Fig. 7 represents both the top and bottom roller as so constructed. *a a*, figs. 1 and 2, is a rim of steel or other suitable metal; *b b* is the boss or nave, to which the rim is connected by spokes *c c* by means of screw plugs *e e*, in such a manner as to admit of the spokes sliding inwards on pressure being applied to the outside of the rim, as shown at *d*, but to resist the drawing of the spokes outwards. This is effected, as shown, by a space being formed in the boss beyond the head of each spoke in the direction towards the centre of the boss, into which the head of the spoke can pass, and by the head of the spoke being made of such a size that it cannot pass outwards through the hole in the plug. But the mode of connecting the spokes to the boss or nave so as to effect the double purpose referred to may be varied. *f f* is a covering of leather, india-rubber, gutta-percha, or other suitable material, which covering is principally required when the roller is composed of two or more rings arranged laterally in order to cover the junctions of the rings, and thereby prevent any portion of the material under operation from passing between them; *g* is a wrought-iron spindle forming the axis of the roller.

In the form of roller shown in figs. 3 and 4 there are no spokes, but the rim *a* is fitted into grooves *c c* on each side, one of such grooves being formed in the boss *b*, and the other in the disc *d* bolted to the boss; the grooves *c c*, in the boss *b* and disc *d*, are respectively formed so as to allow a sufficient space for the rim, so that when pressed on the outside it may be capable of bulging inwards or becoming flattened as required, and as shown at *e*, but the rim is prevented from bulging outwards by the outer parts of the boss *b* and disc *d* outside the grooves *c c*, as shown in the upper part of fig. 4. Figs. 5 and 6 are similar views of another form of roller made according to the invention. *a* is the rim of steel or other suitable material similar to that shown in figs. 3 and 4; *b b* are pieces of metal which are riveted to the rim, such pieces of metal being inserted in cavities *d d*, formed in the boss *c*, such cavities being of sufficient depth to leave a space for the pieces of metal *d d* to pass inwards on pressure being applied to the outer surface of the rim *a*, but the said pieces of metal *d d* are prevented from moving outwards by the outer parts of the boss *c* and the disc *e*, against which respectively the small flanges on the pieces *d d* come in contact, as shown in fig. 6. By this means the rim *a* is susceptible of yielding to external pressure, and becoming flattened or bulging inwards in the manner shown in fig. 5, but is prevented from bulging outwards.

MANUFACTURE OF CANDLES.

HERETOFORE in the manufacture of candles having two wicks, it has been usual when making the candles to keep the wicks separated from each other by means of a wire, which was introduced into the mould together with the wicks; and in order to keep the wicks at an even distance from each other the wicks were placed on opposite sides of the wire, and were usually held there by being dipped together with the wire into melted candle stuff, and a coating of the candle stuff allowed to cool upon them. When the mould had been filled with melted candle material and the material had cooled the wire was withdrawn from the candle, and the space occupied by the wire was afterwards filled with melted candle stuff, and the candle so made solid. The wires hitherto employed have for the most part been circular in section, and when using such wires, not only was it difficult to retain the two wicks at an even distance apart, but the wicks could not be brought sufficiently near together or so near together as it is desired, for if the wires were made of small diameter so as to bring the wicks closer together, the wires could not be made of sufficient strength to keep the wicks straight in their length.

Now, according to an invention which has been patented by Mr. William Palmer, jun., of Southweald, Essex, flat wires or narrow strips of thin metal are employed for dividing the wicks, so that when desired the wicks may be brought much closer together than heretofore. In order to give the requisite strength to these wires or strips to retain them straight, the two opposite edges of the strips are connected to stronger wires or ribs, which may be of a circular or other section. Or, in place of the strip being strengthened by a rib on both edges, it may be strengthened on one side only; the narrow strip for dividing the wicks may also be made in one piece with the strengthening rib or ribs, in place of their being connected together. The lower end of the flat strip is caused to project somewhat beyond the lower end or ends of the supporting wire or wires or ribs, so that it may enter the nozzle of the mould and so be kept central. The upper end of the wire is kept central as heretofore by projections at its upper end that enter the top of the mould. In using these wires for retaining the wicks in position in the mould, the wick is doubled over the end of the flat strip that is to enter the nozzle of the mould,



and the two ends of the wicks are led up one on each side of the flat strip; the wicks and wire are then introduced into the mould, and the melted candle material is poured in. When the material has cooled the wire is withdrawn, as hitherto, and a hollow space on one or both sides of the wick will thus be formed, which may afterwards be filled up with candle material, which may be of a different quality to the material of which the exterior of the candle is composed.

In the accompanying engraving fig. 1 is a longitudinal section, fig. 2 a side view, partly in section, fig. 3 a plan, and fig. 4 a transverse section of a candle mould, having within it a wire, constructed according to this invention for supporting the wicks. *a a* is the flat strip of metal by which the wicks are separated, and by which the two wicks are kept only a very small distance apart, and such as will cause them when burning to present only one flame. On each side of the flat strip is a rib *b*; these ribs are by preference of a section such as is shown at fig. 4, though other forms of ribs for giving strength may be employed; but whatever be the section of the

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strengthening ribs, it is desirable that they should offer considerable area, in order to produce holes of considerable size in the candles, to be afterwards filled in with a candle material of different quality to the material of which the exterior of the candle is composed; when, however, this is not desired the ribs may be made of less sectional area. The peculiarity of the invention is, that the wicks are brought nearer together than could be the case if ordinary wires were employed, whilst the use of the strengthening ribs offers a favourable opportunity of employing a more or less considerable quantity of candle stuff in the centre of the candle different from that used for the exterior of the candle.

The flat strip *a* projects beyond the ribs *b*, as is shown at a^1, and enters the nozzle of the mould; the upper end of the wire has projections *d d* upon it, the lower portions of which enter the top of the mould and so keep the wire central as is usual; the upper portions of the projections *d* project over the top of the mould and prevent the wire entering too far into the mould; the ends of the two wicks which are to be at the nozzle end of the mould are bound with thread. The lower end of the strip *a* has a notch formed in it to receive the wicks, as shown. When the wicks have thus been placed on the wire, the wire is inserted into a mould, into which melted candle material is then poured; when this has cooled the wire is to be withdrawn from the mould, leaving the wicks in the candle; afterwards the holes in the candle, formerly occupied by the ribs *b b*, are to be filled with candle material of a different or like quality to that of which the outer portion of the candle is formed, thus completing the candle.

THE CHICAGO TUNNEL.

THE immense crib for the east end of the Chicago Lake tunnel was successfully launched on the 26th of July last. It is 40ft. 6in. high, and built in pentagonal form, in a circumscribing circle of 98½ft. in diameter. It is built of logs one foot square, and consists of three walls, at a distance of 11ft. from each other, leaving a central pentagonal space having an inscribed circle of 25ft., within which will be fixed the iron cylinder, 9ft. in diameter, to run from the water line to the tunnel, 64ft. below the surface and 31ft. below the bed of the lake. The crib is thoroughly braced in every direction, so that it might be tumbled over without injury. It contains 750,000ft. of lumber, board measure, and 150 tons of iron bolts; it weighs about 1,800 tons. The outside is thoroughly caulked. It was towed to its position, two miles from the shore, on the same day, and the process of sinking begun by opening sluices and placing some 600 tons of stone in the bulkheads. The crib will hold 4,500 tons of stones when filled, giving an extra weight of 3,900 tons for steadying against the waves. The crib as now built will stand about 7ft. above the water line, but when filled in, another 5ft. will be added. It is expected that the excavation will be commenced at the lake end about the middle of September, when the work will be prosecuted from both ends and probably finished in twelve months from the present date. Exactly one third of the whole length is already finished. A house is to be built over the crib, to enable the men to work in all weathers.

EROSION OF LEAD.

THE erosion of lead, and even of type metal, by certain species of insects, is not generally known, and may be extremely mischievous. Not long ago it attracted the attention of the French Academy of Sciences, and several communications respecting it have been published with their proceedings in the *Comptes Rendus*. Of these the following is a *resume*:—In 1858 Marshal Vaillant exhibited to the Academy leaden bullets brought back from the Crimea, in some of which the larvæ of insects had excavated circular passages three or four millimetres in diameter, and in others superficial grooves. Inquiry was made through the Russian Ambassador, M. de Kisselef, whether similar erosion had been observed in Russia. M. V. de Motschulsky replied that nothing of the kind had been detected in the cartridges of the Russian army in the Crimea, and that the insect which had caused the injury appeared to be very rare in Russia, not having been discovered by Russian entomologists in the Crimea. It is stated to be very common in England, Sweden, and Germany, and to occur in the Jura in France. It attacks silver firs and pines. The insect which damaged the French cartridges was imported from France in the wood of the cases in which they were packed. All the excavated passages were originally circular in section, and those that were semicircular in section, that is, superficially grooved, were only segments, of which the other half was in the contiguous surface of other bullets or of the wood forming the sides of the cases. The passages were always open at both ends. Excavation was effected by the mandibles of the insect, the apparatus consisting of a saw toothed, and cut like a file. The insects do not eat the lead, but simply bore it out; and it was observed that their remains, after metamorphosis, had been carried downwards by the particles of the metal, reduced to powders, and dispersed on the outside through the cracks in the bottom of the packing case. The perfect insects did not attack the lead, but died in the passages, even immediately after their complete metamorphosis, as very often occurs with insects in general.

In 1833 Audouin exhibited to the Entomological Society of Paris, sheet lead from the roof of a building deeply grooved by insects. In 1844 Desmarest mentioned erosions and perforations of sheet lead by a species of Bostriche, and illustrated the fact by cartridges from the arsenal at Turin. Mr. Westwood, the well-known British entomologist, has recorded observations by himself on the perforation of lead by insects. M. Bouteille, curator of the Museum of Natural History at Grenoble, sent to the French Academy of Sciences, from the collection under his charge, specimens of cartridges gnawed by insects, which were found *in situ*, and the following report upon the subject was made by Marshall Vaillant, deQuatrefages, and Milne Edwards; the insect *Sirex gigas*, a large hymenopterous species, which, in the larva state, lives in the interior of old trees or pieces of wood, and which, after the completion of its metamorphosis, quits its retreat for the purpose of reproduction. As previously stated it cuts its way by its mandibles, gnawing the woody substance or other hard bodies which it meets with in its course. Analogous perforations are made by the mandibles of the *Callidium sanguineum*. The reporters add:—"If it is probable that it is always with their mandibles that coleopterous as well as hymenopterous insects thus attack lead or other hard bodies, it is not well established that it is always the desire of liberty which prompts them so to act. Indeed, in some cases, coleopterous insects have been seen to gnaw the exterior of similar bodies." Reference was made to a paper by Antonio Berti on the perforation of leaden pipes by an insect named *Apate humeralis*.

Scheurer-Kestner, in 1861, communicated to the French Academy a notice of the erosion by an insect of the sheet lead of a new sulphuric acid chamber. The creature was caught in the act of escaping through the lead, having been imprisoned between it and a wooden support. Perhaps the most interesting and important case of insect erosion is that of stereotype metal, which was communicated in 1843, by M. du Boys, to the Agricultural Society of Limoges. Specimens riddled were also exhibited.

SPIRAL RAILWAYS.

AT the recent Parisian *fetes* of August 15, there was exhibited in the Avenue de la Motte Piquet, a miniature circular railway, round which an engine was conveying no less than ten carriages, in each of which about twelve persons were seated; the travellers, chiefly consisting of soldiers, bronzed and weather-beaten invalids, mostly *minus* an arm or a leg. The Paris correspondent of the *Star* thus graphically describes the railway and alludes to the history of its inventor:—The train whizzed round at the rate of five-eighths of an English mile in 50 seconds, and so accurate have been the calculations taken for the construction of the wheels that eminent engineers have pronounced this marvellous contrivance to be safe from the usual danger of getting off the rails. I had never seen anything like this, and inquired its history. A young mechanician, scarcely twenty-two years of age, M. Michaud by name, is the talented inventor of this system, which, applied to spiral ascensions of mountains, will prove of inestimable value. M. Michaud, young, poor, and unknown, has spent £1,500 (35,000f.) on his fairy train, of which the engine, which has three-horse power, cost £320 (8,000f.). I had a long talk with him; I asked him what he had done to attract the notice of Government, and why he was reduced to exhibit this marvellous application of the highest scientific principle at a low fair, and why he had not applied his discovery to some higher purpose. He replied abruptly, "Did you know Sauvage?" I said I had heard the name. "Ah!" he said, "that is all; he was my father's friend. Here is his story: On June 21, 1843, the population of Havre assembled on the quays to witness the entrance into port of the first screw steamer 'Le Napoleon.' The excitement and enthusiasm were tremendous, but the originator of the idea, the first on whom it had dawned, who had worked it out in poverty and privation during thirteen weary years, was lying in the Havre Debtors' Prison for a petty sum he owed in consequence of an effort to realise his dream. My father went to see him that very day. On the window of his cell was a miniature dock in zinc. Floating on it was a vessel, constructed with a penknife, the perfect model of a screw steamer. The only murmur Sauvage uttered was that the 'Napoleon' did not quite come up to his expectations." Young Michaud added that on the Emperor's accession to the throne he had attempted to make amends for the ingratitude of the late Government; but his generous anxiety came too late; Sauvage died mad. Referring to his own discovery, he told me that, having no fortune, he despaired of being able to struggle against the jealousy of prospering engineers, and therefore he decided on making it into a mere toy, in the hope of slowly amassing sufficient money to carry out his idea on a larger scale. Michaud told me that last year, at the fair of St. Cloud, he had taken two hundred college boys of the town gratuitously, and that the Prince Imperial, who happened to pass by at the time, accompanied by General Fleury, not only insisted on a drive, but got on the engine and inspected its construction with minute attention, making most intelligent inquiries and remarks on the explanations given by Michaud.

LEAD POISONING.

POISONING by drinking water which has acted on lead happens far more frequently than is often suspected, and the mode in which the water is rendered poisonous is frequently difficult of discovery. A correspondent of the *Times* states that, from a rural parish where the drinking water is got from draw-wells, and there are neither leaden pumps nor leaden pipes to contaminate the water, several of the peasantry went lately to the neighbouring county infirmary suffering from lead poisoning. Careful investigation led to the discovery of the source of the evil—the so-called "tinned" kettles in which the water used for tea and for cooking was boiled. It was ascertained that the "tin" with which the kettles were lined was an amalgam of tin and lead. The adulteration of tin with lead is one of the most common frauds. It is of very great importance to public health that some way of escaping from poisoning by leaded tin should be discovered, and it would be desirable that we should know whether there is any coating for iron which would resist heat and the ordinary action of water, and which could be substituted for what is called "tin." About a year ago a French patent was taken out for such a coating, and the coating is said to have stood very severe tests of heat and acids. Such a coating has also been discovered lately in England. Anyone giving accurate information respecting such coatings would confer a boon upon the public. A very ready test for lead in water consists in taking two tumblers and filling one with water which is known not to have been in contact with lead; the other being filled with the suspected water. Dissolve in each about as much bichromate of potash as will stand on a groat. By daylight the water in each tumbler will be of the colour of pale sherry and water. Cover the tumblers so as to keep out dust, and let them stand in a warm place in a room with a fire in it for twenty-four hours. If the suspected water be free from lead, it will still have the same colour as the other, but if there be lead in the water it will have a more or less opalescent tint, as if a drop or more of milk had been put into it. If there be a great quantity of lead in the water a very slight film of lead will be deposited on the glass.

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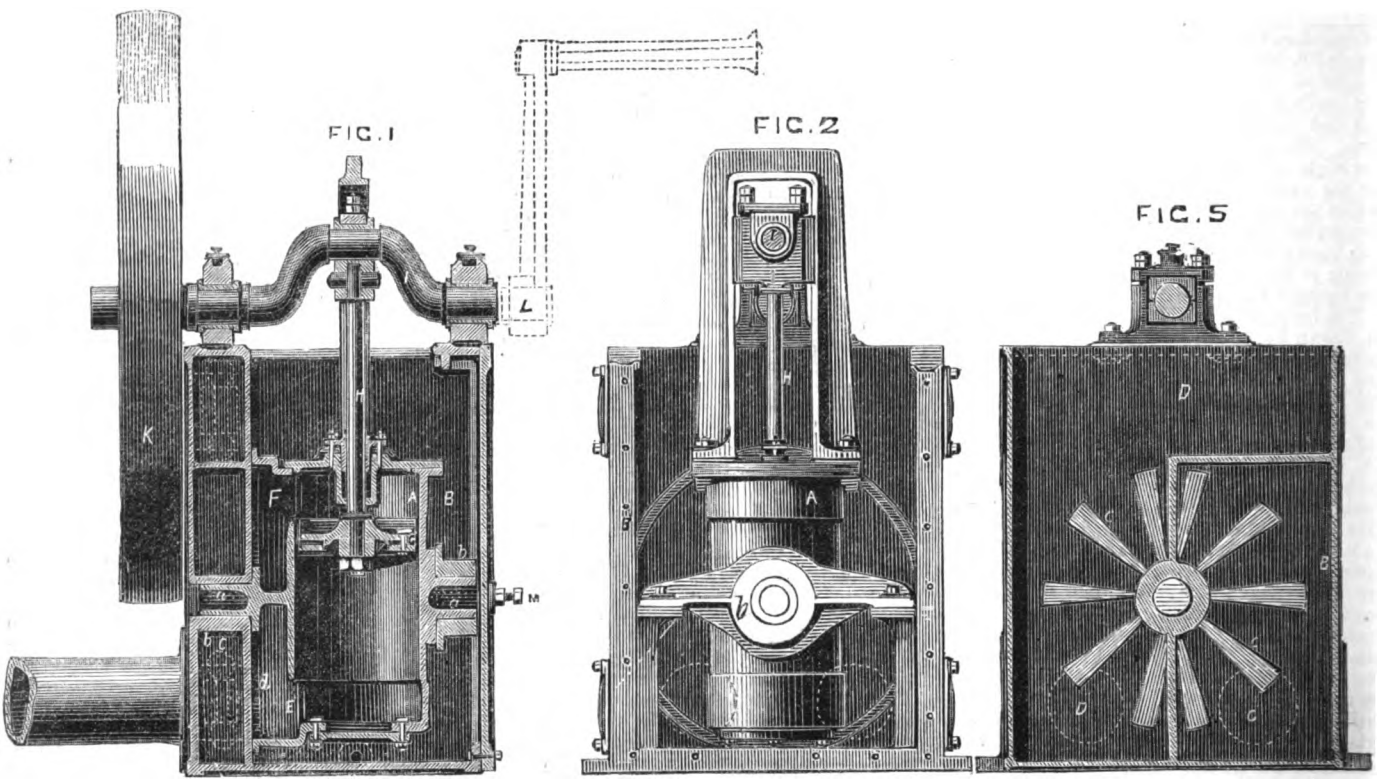
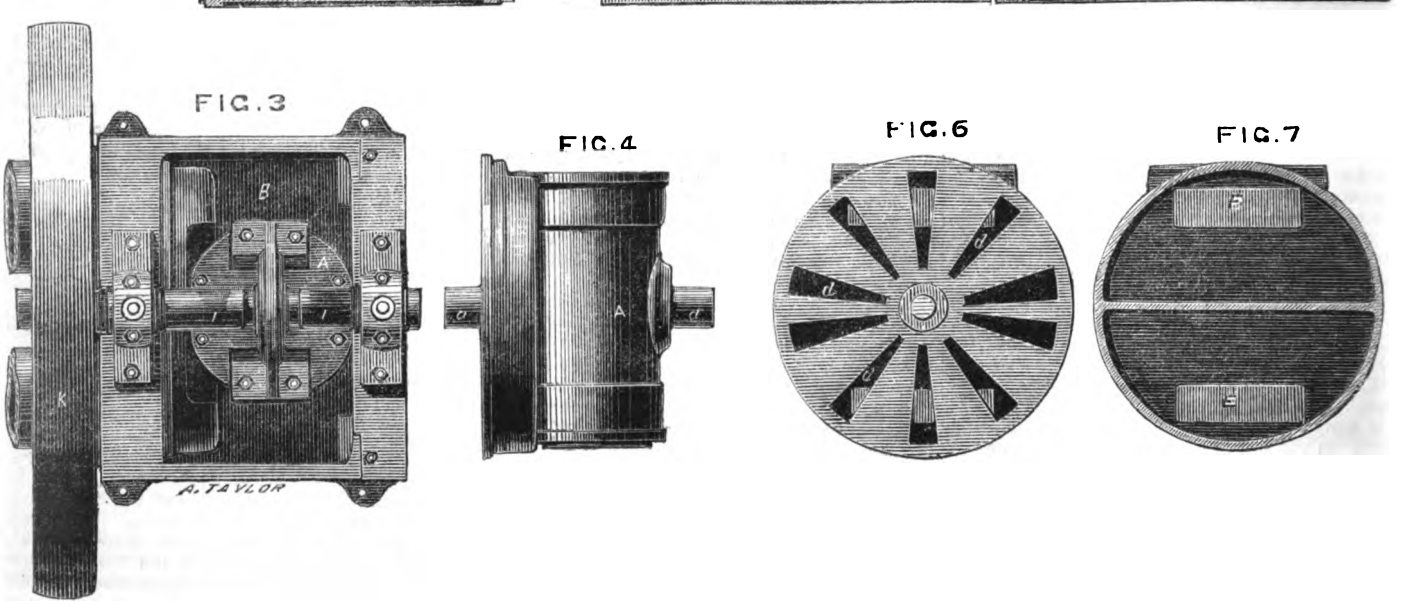
IMPROVEMENT IN PUMPS.





IMPROVEMENT IN PUMPS.

THIS invention consists in a new construction of pump, whereby the admission and emission of the fluid to be pumped is regulated without the use of valves, that is, of apparatus acted upon by the vacuum or pressure within the pump. It has been patented by Mr. J. C. Wilson, of East India House, Lime-street, London, civil engineer. The working barrel of the pump is constructed in the usual manner, in the form of a cylinder, with a piston working up and down within it, but instead of this cylinder being made a fixture as hitherto it oscillates upon trunnions, in a similar manner to the cylinder of an oscillating steam engine. On one side of this cylinder a working face is fixed which contains ports or openings which communicate with the interior of the cylinder by means of suitable passages. This cylinder is placed in the interior of a cistern or tank in such a manner as to cause its working face and ports to work against a corresponding face fixed on the side of the tank; the ports in the latter communicating on one side with the suction pipe or source of supply, and on the other with the delivery pipe or place of discharge.

Fig. 1 of the accompanying engraving is a section, fig. 2, an elevation, and fig. 3 a plan showing the manner in which these pumps are constructed. A is a cylinder or working barrel shown detached, and in elevation at fig 4. It is formed with trunnions *a a*, in which it is free to oscillate. The trunnions work in bearings *b b*, provided on the inside of the tank B. This tank is separated at one side or end into a suction chamber C and a discharge chamber D, and the side or face of the chamber next the cylinder or working barrel A is pierced with holes or ports *c c*, as shown in the sectional view, fig. 5. Fig. 6 is a view showing the ports *d d*, on the side of the cylinder A, and fig. 7 is a section through the water passages in the cylinder A; E is a suction pipe; F, a discharge trough; G, the piston working in the cylinder A connected by the piston rod H to the crank I; K is a fly-wheel, and L a crank handle for giving motion to the pump; M is a screw for keeping the working face of the cylinder A in contact with the side of the chambers C and D. On setting the pump to work, and commencing with (say) the piston at the top of the cylinder A, the suction ports on the cylinder face communicating with the top of the cylinder are brought opposite to the ports in the suction chamber C, and water is drawn into the cylinder on the top side of the piston; at the same time the oscillation of the cylinder causes the suction ports communicating with the bottom of the cylinder to be closed, and the discharge ports to be opened, and the descent of the piston forces the water out on that side into the discharge chamber D. This action is reversed as the piston ascends from the bottom to the top of the cylinder. Instead of being worked by hand, these pumps may be driven by steam or other power, a pulley, or toothed wheel, or friction gear being fastened to the crank shaft. It is not essential that the barrel should work in a cistern, as a simple framing provided with similar ports to those hereinbefore described in the cistern, and communicating with a supply and discharge, may be substituted.

ENGINE GOVERNORS.

LETTERS PATENT have been granted to Messrs. John and William Weems, of Johnstone, in the county of Renfrew, North Britain, engineers, for an invention which relates, firstly, to improvements in apparatus for governing and controlling the working speed of both land and marine engines, air, water, and gas engines, as well as water wheels, and other such generally similar mechanism. The second part consists of improvements in apparatus for regulating, measuring, and registering the flow of liquids and fluids. In the engraving fig. 1 represents a sectional elevation of one form of the improved apparatus for governing and controlling the speed of land and marine engines, air, water, and gas engines, and water wheels, and the dotted lines show the application for regulating the flow of steam or other fluids or liquids from a higher to a lower pressure; fig. 2 represents a sectional elevation of the improvements in apparatus for regulating, indicating, measuring, and registering the flow of fluids and liquids, fig. 3 being an end elevation of the same with cover removed.

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ENGINE GOVERNORS.

FIG. 1

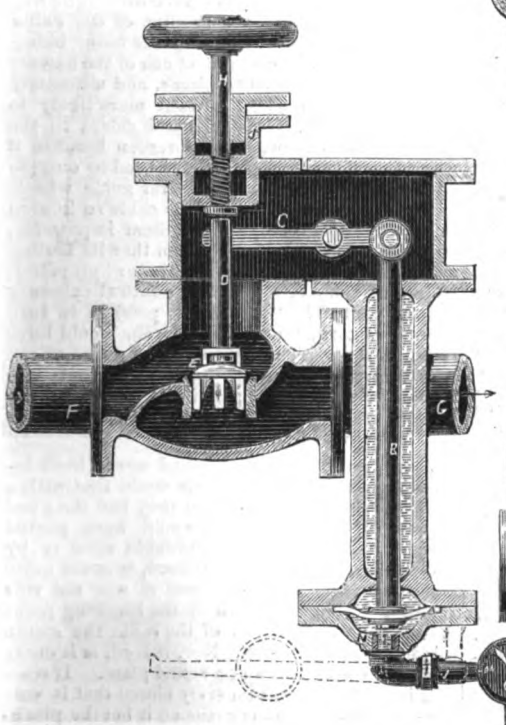


FIG. 2

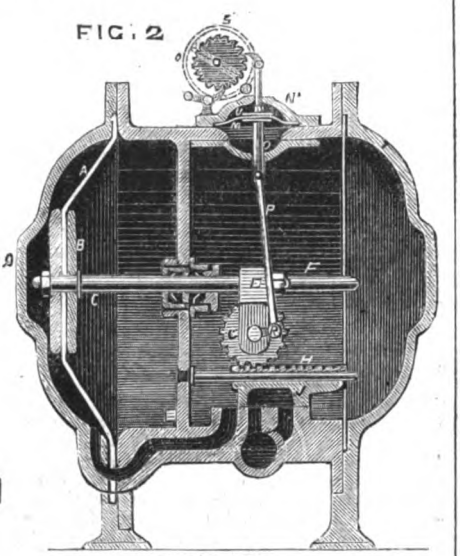
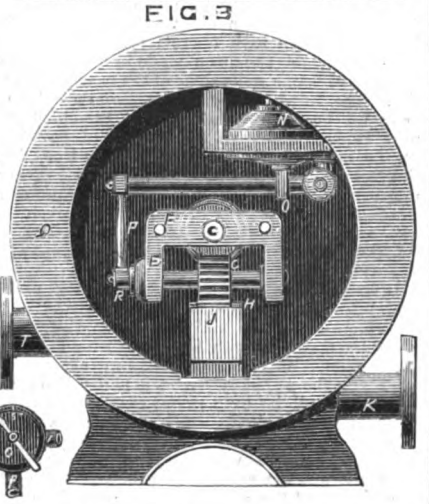


FIG. 3



In fig. 1 is a chamber within which is fixed a diaphragm A of india-rubber, metal, or other flexible material, and resting on or connected to that side of the diaphragm which is exposed to the pressure of the steam or other fluid or liquid is the spindle or rod B, connected by the lever C to the spindle or rod D of an equilibrium, conical, throttle, or other valve E, situated between the boiler and engine. The opposite side of this diaphragm or flexible partition A is connected by the pipe I to a pump or pumps or other contrivance for forcing fluids or liquids. A crane or cock O, with an indicating pointer and handle or other opening capable of being regulated, is placed between the diaphragm A and the pumps or other contrivance for forcing fluids or liquids. The screwed spindle H passes through a stuffing-box J. The inlet F of steam or other fluid or liquid is shown by the arrow near the pipe F, and the discharge or outlet by the arrow at G. When the pump or other similar machine is set in motion the fluid or liquid is forced against the diaphragm A on the one side, while the pressure of the steam or other fluid or liquid is exerting its power on the other side, and when the engine has attained its required speed the crane or cock O is regulated to allow the excess of the fluid or liquid to escape at P, and on the slightest increase of speed the power of the pump is also increased, which forces a greater quantity of the fluid or liquid that cannot escape at the regulated opening P; a greater pressure is consequently exerted on the diaphragm A, which yields, thus imparting a forward movement to the rod B, communicating with the valve E by the lever C and spindle or rod D, thereby regulating the valve E so as only to admit the necessary supply of steam or other fluid or liquid for the desired speed, and, on the engine slowing, the speed of the pumps or other contrivance is reduced, the pressure on the under side of the diaphragm A is lessened, whilst the pressure of the steam or other fluid or liquid on the opposite side causes it to recede, and by means of the rods B and D and the lever C the valve E is opened, and a sufficiency of steam or other fluid or liquid is admitted to raise the engine to its former speed. The throw of the valve may be regulated or it may be entirely closed by turning the handle or wheel of the second spindle H, thus answering the purpose of a stop valve.

Fig. 1 also represents the arrangement and construction of apparatus for regulating the flow of steam or other fluid or liquid from a higher to a lower pressure, and maintaining a uniform pressure therein, and also acting as a stop valve, the only difference being the removal of the pipe I and the substitution of an adjustable weighted lever, as shown by the dotted lines. The steam or other fluid or liquid enters from the high pressure at F, as shown by the arrow, and passes through the valve E into the low-pressure receiver or pipe G, the weight on the lever being adjusted to suit the desired pressure. When the low pressure of the steam or other fluid exceeds the required pressure, it exerts its power on the diaphragm, which recedes, and by means of the rods B and D and lever C regulates the valve so as only to admit a sufficiency of steam or other fluid to maintain the proper pressure, and when the pressure falls too low the lever and weight press the diaphragm downwards, thus opening the valve so as to admit a sufficiency of steam or other fluid to raise the desired pressure. The screwed spindle H, fitted with a handle or wheel, serves to regulate the throw of the valve, and when screwed down acts as a stop valve and prevents the passage of the steam or other fluid when desired. Within the chamber Q, fig. 2 and 3 (bolted together in parts), is fixed a diaphragm A, of india-rubber, leather, metal, or other flexible material, to which is attached a piston or pistons B and rod C, on the end of which is fixed the crosshead E, travelling on two guide rods F, within which is a toothed wheel G working in a toothed rack H fixed on a valve J sliding on three ports. The small flexible diaphragm M within the chamber N is open on one side to the pressure of the fluid or liquid, and on the other to the atmosphere, and to which is attached a piston or pistons U and rod O, one end of which is connected by the rod P to the crank R of the toothed wheel G. The water or other fluid or liquid is introduced at the pipe T, fig. 3, and presses the diaphragm A to one side, carrying with it the rod C, the toothed wheel G travelling in the toothed rack H, and when the diaphragm A has arrived at its extremity, the crank pin R of the toothed wheel G has been carried beyond the centre, and the small diaphragm M being at all times acted on by the pressure of the fluid or liquid gives the toothed wheel G a sudden half turn, carrying with it the toothed rack H, and instantaneously reverses the ports of the valve or valves, and the pressure of the fluid or liquid now acting on the opposite side of the diaphragm A; it recedes and brings back the crank pin R of the toothed wheel G beyond the centre, which being held in a state of tension by the diaphragm M springs up and again reverses the ports, the fluid or liquid in the opposite side of the diaphragm A being meanwhile discharged through the discharge pipe K. By means of this reciprocating movement of the diaphragm M motion is given to the index, whereby the flow of the fluid or liquid is regulated.

BUFFER SPRINGS.

SPRINGS are frequently constructed by rolling or winding a flat, parallel, or tapered steel bar into a conical spiral form; the pressure is applied in such manner as to flatten the cone by causing its apex to approach its base. Springs have also been made of a flat steel bar wound into a flat, spiral, or volute form, in which case the application of pressure tended to force the centre away from the outer coil, and thus cause the spring to assume the form of a cone; these springs, when overstrained, are apt to break near the centre or in some of the inner coils. In an invention which has been patented by Mr. William F. Henson, of 15, New Cavendish-street, Portland-place, civil engineer, springs are constructed of a conical, conoidal, or oval form, with tapered bars of steel of various sections applicable for railway carriage buffer and other springs, which may be constructed of any section of steel other than tapered, such as oval or half oval, of hollow or half hollow bar steel, which may be tapered or otherwise. The chief feature of this invention is the formation of a spring made in a conical form, having two or more of its coils sunk or inverted from the apex of the spring to the inner cone or coils of the conical spring, so as to form an elastic base or cushion, to prevent breakage, or from being overstrained or overworked at any time when acted upon; the spring will also be increased in power by the inner cone or coils of steel forming an elastic conical base to the outer conical spring. The springs may be constructed of twisted steel bars or wires of any convenient sizes, and thus form a bar suitable for coiling. The inverted cone of the conical spring may be constructed of flat or oblong bar steel so as to form an inner volute spring to the outer conical spring. The springs may also be made parallel, having an inner conical spring of tapered bar steel or otherwise. The springs are constructed in the usual way by taking a bar of steel of any convenient length, size, or section, and winding the said bar of steel upon a mandrel, causing each coil to wind upon the preceding one. The coils separate a little when removed from the mandrel, which allows them freedom of action. They are then inserted into a cast conical-shaped box suitable to receive the spring, which is then forced into an inverted conical form having, as before stated, two or more of its coils inverted from the apex. This steel inverted conical spring is hardened and tempered in the usual way. The method of constructing the spring may be varied as found most convenient. The parallel inverted conical spring, or, in other words, a conical spring having parallel sides, is constructed in the usual way that parallel springs are now made; but with the addition of an inverted cone, which is made as before described, or varied in such manner as may be most desirable, with tapered bars of steel, of oval or other form. The springs are fitted into a cast or wrought-iron box suitably formed, thus forming springs of an improved class and adapted for railway waggons and carriage buffers as well as other purposes by giving a great power of resistance when acted upon.

At the Duncyvan Ironworks a furnace of elliptical section, of 20ft. by 12ft. diameter, and 60ft. in height, has been erected, which is stated to give extraordinary results.

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ON UNDERSUNK FOUNDATIONS.*

TIMBER piles are eminently unsuited for India, as they are soon destroyed by white ants. Iron, until very lately, has never been much used on a large scale, but undersunk foundations of brickwork have been in use for a very great length of time. The natives were in the habit of making them in a very primitive way. The ground was cleared and excavated as deep as possible without using shoring. The curbs consisted of a ring of basket work, or rough timber in some cases; on these masonry cylinders were built ordinarily of splayed bricks laid in liquid clay mortar. When this reached a convenient height it was bound together with hay ropes. The well sinker then got inside and excavated the earth from under the curb until the cylinder sunk to its whole depth; a further portion of cylindrical wall was then built and sunk in the same manner, divers being used when the curb descended below the surface of the water; sometimes a contrivance called a jham is used, by which the earth is lifted, but it is of little use in any but sand foundation. When the wells were sunk to the necessary depth they were slabbed or planked over, according to the material to be procured. In the Madras Presidency wells for foundations have been constantly used. The Vellore Annicut was so founded, as also St. Andrew's Church, built, we believe, in 1818.

When the East Indian Railway was being constructed it was found necessary, or rather advantageous, to use these brick cylinder foundations; European engineering skill made the following improvements on the native method of making and sinking. The curb was carefully made of strong timber bound together with iron, the section showing a wedge edge downwards vertical iron ties joined it to the brickwork and prevented a separation. At certain heights rings of iron were built into the brickwork, and vertical ties passed through them, thus binding the whole together and preventing one portion of the brickwork from falling away from the rest, a disaster likely to occur without this precaution in quick and shifting sands. Again where the iron rings were placed, cross horizontal ties keep the brickwork together and prevent the wells from bursting; when these had been sunk to the full depth required they were domed over or corbelled out and in, to squares, arched over and arched over also from one to the other.

In the Jumna Bridge the wells were partly filled with concrete and then built in with masonry, and not arched over at all, but we prefer the latter system, but it is often advantageous to fill the wells with concrete; thus each forms a solid column—but in all cases we recommend that this filling should not be built upon, preferring to arch over from the brickwork. The brickwork of the wells should always be of the very best, carefully moulded, and well-burnt splayed bricks laid in the best hydraulic mortar. To clear out the soil from the interior, dredging machines are used with success, and can be seen at the Armenian Ghat, where Mr. Denham, the district engineer of the East Indian Railway, is sinking some wells for the new pier; these are sometimes worked by steam power. A spoon and clay cutter are also occasionally used. A new sand pump has been patented in England, and one on the same principle is now being made by Messrs. Marillier and Edwardes, the Indian agents for the patentee. The best means, in our opinion, of getting out the subsoil to lower the wells is by means of divers. These men work with much more accuracy and economy than any machinery can; wells are apt to get out of the perpendicular, and require careful excavation to get them straight again. Mr. Denham had great trouble on this account, we believe, with well No. 1 on the Howrah side, but overcame it. Indeed, this well is now sunk to a depth of 87ft. below rail level—perhaps the greatest known depth in the world—and great skill and engineering knowledge were displayed in overcoming the many difficulties. We recommend those of our readers within reach to watch the works going on at the railway jetties, as they are most interesting.

We now proceed to make a few remarks upon the different considerations which guide us in designing bridges upon well foundations; the heads of which we enumerated in a former number, viz.:—1st. To sink the wells until they rest upon rock or other good substratum. 2nd. To sink the wells to such a depth that there is scarcely any fear of danger from scour, and 3rd. To make a continuous barrier above and below with a platform between, through which the wells (on which rest the piers) are sunk. With respect to bridges built on the first principle we would premise that the following general rule holds good, when practicable, with wells as well as other foundations, viz., that when founding upon rock, no matter how hard, your masonry should be sunk at least six inches into the rock at the shallowest part, and at least two feet into the most tenacious clay. When a good soil is found within a reasonable distance of the surface of a river bed, cofferdams are generally made use of, as in the case of the bridge over the River Adjai, one of the principal rivers of Lower Bengal, which was built in 1854-5 by Mr. Sibley, now chief engineer of the East Indian Railway in the North-Western Provinces. The cofferdam was in this case made in three bays for each pier, and was composed of brickwork blocks with two pockets each, which were filled with puddled clay; between the blocks also it was made watertight. The only instance we know of a bridge built on this first principle were the land piers of the Kankan Bridge at Kamptee, of which we will speak more hereafter. Here the wells were sunk through sand until they rested on sandstone rock, which shelved down at an angle of 30 deg. We fear these were not allowed to bite into the rock, as the appurtenances for assisting in doing this, viz., Siebe's diving dresses, were handed over to the Barrakur Bridge, where the late Mr. Powell told us they proved most useful, indeed necessary.

The second principle of designing well foundations, viz., sinking them to such depth as to obviate danger from scour, is the one which has been most extensively used on the East Indian Railway. Amongst the principal bridges may be enumerated the Soane, which is completed, and the Jumna, which is in progress. In the former the wells were, some of them, sunk to a depth of 60ft. and in the latter they are being sunk to a depth of 43ft. We believe that in sinking one of the wells of the Jumna the ruins of an old well were found which interfered much with operations. It is probable that an attempt had been made in former years to build a bridge on wells somewhere near the present site. The third system of building on wells may be called the Madras system, as it has chiefly been used in that country. It consists of building a barrier or annicut across the river by a line of continuous blocks above and below. In some cases the upper blocks have been only sunk some four or five feet, and the lower ones little more; between these two curtains is laid on platform of stone, and below the lower an apron is laid to prevent scour, a most needful precaution.

It is evident that at least one, and if possible both lines of barriers should be completed in one season. We believe that the Kankan Bridge at Kamptee failed through this precaution not having been taken. We are of opinion that the two barriers and the platform between and the apron below, should all be built in one season, and be completed before a single well for the piers is commenced upon. In designing a bridge of this description care should be taken to ascertain that the banks are determined at the line of your barriers, and that the water will not possibly turn the flank of your continuous wall. In the Kankan Bridge above referred to, it was intended to sink the upper barrier 10ft. and the lower one 20ft.; the wells under piers also 20ft. We have not been able to obtain any reliable information regarding the failure of this bridge. We think it a pity, as these things should have thorough ventilation, as a beacon for the future.

* From the Calcutta *Engineer's Journal.*

Correspondence.

THE ATLANTIC CABLE AND ITS FAILURE.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—The Atlantic telegraph cable is another instance that, though an enterprise may be conducted by the first talent of the country, it is not given to man to reach perfection except through stages of progress, accompanied often with failures. But this process may be greatly shortened, and the things taught by experience be anticipated by forethought, if only publicity be given to the proceedings, and many minds be invited, from the many aspects in which the subject will be viewed, to detect faults and suggest remedies. But the Telegraph Company have always been averse to publicity, and accordingly they have had to buy their experience, and at a price which one would have thought would have made them wiser, even on the first failure, and induced them to collect information from every quarter.

It seems that this second expedition, though failing through errors in mere matters of detail, has successfully resolved the following all important points—that the present cable possesses that combination of strength and buoyancy which renders it possible to recover it, at a reasonable rate of hauling in, from a depth of 4,000 yards; that it is possible to grapple with a cable at that depth, and that it is highly probable it can be brought to the surface. These are points which could only be determined by an experiment, which, however, ought, as a matter of wisdom and prudence, to have been a preliminary one, in which case deficiencies and faults of arrangement would have been observed, and failure would not have been as now a ruinous disaster. In this want of caution have been evinced the same self-sufficiency and go-ahead energy which brought the first cable to grief.

Evidently an error has been committed in placing the hauling-in machinery at the bow instead of the stern of the vessel. It would be doing an injustice, doubtless, to the directors of the engineering department to suppose that they thought the cable was to be hauled in at the same catenarian curve at which it was payed out; but they did think it best, it seems, to take it up perpendicularly over the bow of the vessel. This was a mistake in several points of view, and was the direct cause of the loss of the cable in the process of hauling in. As I understand Mr. Russell's narrative, the vessel was with her head to the east, but she could not, with the little or no way upon her, be kept truly in the line of the cable as so far laid, and consequently the latter being obliquely hauled in got foul of one of the hawser pipes, was injured in two places, and ultimately ran off the guide wheel. What more likely to happen than this, from the first incident to the last, and yet they were not foreseen because it was deemed needless to be influenced by outside advice. Even if swinging lateral guide wheels had also been provided, and the cable so housed in as to render escape from them impossible, still, what more likely to happen than its fouling either with the paddle wheels or propeller, under the same or some other nautical exigency beyond control? "It was not possible to turn the ship astern, for in that case she would have snapped the cable; nor could she go on ahead without running over the cable." What was more likely to happen, even habitually, in the process of hauling in from the bow, than this predicament of affairs?

Again, even if the cable had never been injured or fouled, I can scarcely doubt that with a little more sea on than what they had the good fortune to encounter, it would have parted through the sudden strains brought upon it by the pitching of the ship. Indeed, it is not quite clear from the narrative that it was not this pitching which increased to the breaking point at the weakened parts of the cable the strain which it had to endure. Nor, indeed, is it clear that it was not broken at a sound place. If so—and it appears to be obscurely hinted that it was so—what could have occasioned it but the pitching of the vessel? for the dynamometer showed a strain of only 60 cwt., and subsequently the cable did not part at a steady strain of 87 cwt., nor even when mounting at starts to 90 cwt. and 105 cwt. It is to be remarked, too, that "after midnight the wind rose and increased to a strong gale," and although "about daybreak the wind fell to a light breeze," it is not to be supposed that there was not a swell on when the cable broke about noon. However that may be, the pitching of such a ship as the "Great Eastern" is a dangerous thing to encounter in the hauling-in of a telegraph cable, for, though the angle should not exceed the 1½ deg. observed, yet the great length of the vessel will make the rise and fall at the bow somewhere about 15ft. Now by hauling in the cable perpendicularly at the bow, this tug of 15ft., of irresistible force and unmodified velocity, is withstood by the entire resistance of the cable from the surface to the bottom of the sea. Something, therefore, must inevitably break except for the elasticity of the cable itself. No wonder it came up in a greatly strained condition. Now, if the hauling in is effected at the stern, with a long length of cable out, not only is it free from fouling anywhere, but the length and velocity of the tug produced by the pitching, together with the resistance depending on that velocity, ruled as it is by the square thereof, are all modified according to the angle at which the cable is recovered, and may be practically considered as wholly nullified. If we can only get rid of the excessive and unknown amount of strain which these tugs are capable of producing, we can cope with all other strains with a certainty that they will be adequately and safely encountered; for as to that which results from lifting the weight of the cable, it is a quantity which can be calculated and due provision made; and as to that which results from lifting it against the resistance of the water, although it is of unknown amount, yet we can make it just what we please, according to the velocity with which we choose to effect the lifting. The raising of the cable ought, therefore, to be a perfectly safe operation, because we can eliminate by practical expedients all dangerous uncertainty from the problem.

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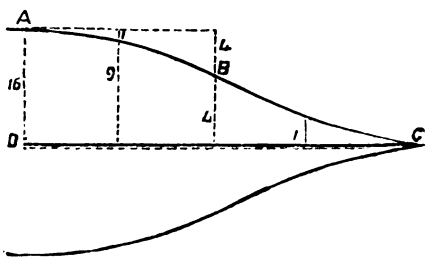
As to any danger arising from the ship being allowed to forge ahead, it would come under the class of gross negligences not to be anticipated; but if an accident of the kind did occur the pull would not be met by a very rigid resistance, but by a flattening of the curve formed by the cable near the surface of the water, and concave towards the ship, the action being that of an immense retarding frictional gear. I admit that the formation of this curve would increase the amount of resistance during the steady work of hauling in, but only to a small amount, and it is not a consideration to be for a moment compared with the advantage of getting rid of the dangerous sudden pulls produced by the pitching of the vessel. I am not aware whether there was any compensating apparatus, other than the dynamometer, in connection with the hauling-in machine, to counteract in some measure the pitching movements; but if there were, I do not perceive how it could be made to act efficiently except on a scale too large to be worked without danger.

As to the picking-up arrangements, everything seems to have been sadly mis-estimated as to strength and efficiency; even the donkey engine and its boiler having failed alike with cog wheels and the swivels of the wire rope. Had these appliances been preliminarily put to the proof against a resistance equivalent to what it could have been calculated they might have to meet, the cable would in all probability have been successfully picked up; but pushing eager haste, with want of forethought, and a *malapropos* American spirit for going ahead imported into matters of science, and into practical matters demanding the most cautious and deliberate steps, have once more been the ruin of this grand undertaking. On the other hand, the executive officers appear to have done their duty nobly and intelligently.

Yours, &c.,
August 21. BENJ. CHEVERTON.

THE WAVE-LINE THEORY.

SIR,—I am not aware whether anyone has pointed out the errors in the theory by which Mr. Scott Russell sought to establish the validity of the wave-line principle for naval construction, in a paper to be found in the Proceedings of the Institution of Naval Architects, for the year 1863. Mr. Scott Russell's theory is to the effect that, if the section of the bow by a horizontal plane be bounded by parabolic curves arranged as shown in the annexed sketch, the resistance of the water will be the least



possible. D C represents the central line of the ship; AB, BC, are cusps of parabolic curves, of which one of the distinctive features is that the ordinates are to one another as the squares of the abscissæ. Mr. Russell's proposition is that a particle of water coming in contact with the ship at C, will be pushed out of the way of the advancing bow with the least possible exertion of force if it be curved as described, for the motion of the particles to one side and out of the way will then be that produced by a constant force, and similar, for instance, to that of gravity till it reaches the point B, when sufficient velocity having been generated to ensure removal of the particle altogether out of the way of the bow, it is only necessary that the remainder of the curve AB should be so formed that advantage may be taken of the sideways velocity already given to the particle, without pressing to increase it, and that thus after passage of the bow, the particle may be found at rest at A, no force having been unnecessarily expended. This seems to be the theory on which the sectional form referred to is based, and by which it is sought to establish its validity.

But in the first place no correct form can be contrived on the basis of assumption of atoms of water as "independent particles."

In the second place there is an obvious inconsistency in the above theory, which treats of the passage of the water over the first curve of the bow CB as for independent particles; while it argues for the form of the second curve BA as if the particle were not independent but were checked out of already acquired motion by the action of a constant force, which we may suppose is considered to exist in the ordinary hydrostatic pressure of the water on the particle referred to. For, the particle having been given velocity, unless some force is in action to check such velocity and stop its motion, this will continue, according to the dynamical law that "a body in motion will continue in motion until acted on by retarding force, &c., external to itself." It seems an inconsistency to assume such force in existence at one period and not at another; whilst, when taken into consideration, we have no reason to take for granted that its action must, as here presumed, be necessarily that of a constant force.

In the third place it has been omitted from consideration that pressure of a plane is normal to its surface, and consequently that the tendency of the bow will not be to force the particle in a direction at right angles to the keel line, but in a varying direction shown by the perpendicular to the plane at point of contact with the particle.

In the fourth place, the important element in such a problem of friction has not been taken into consideration. This necessitates other modification in the form of such a curve. Perhaps sufficient exact experience does not exist to assume certainly the best form of bow. The problem, like all of the kind concerning fluid resistance, is perhaps beyond the range for anything but approximation, of mathematical theory. The other curve, that of "versed sines," for which Mr. S. Russell advances a theory, does not seem to be sufficiently supported by it to render its advantages theoretically prominent, however successful it may be practically.

Your obedient servant,
August, 17. F. DENBY.

SAFETY GUNPOWDER.

SIR,—Permit me to point out that in your article on safety gunpowder you omitted, in your comparative statement in connection with the transport of gunpowder, to take into account the enormous amount of extra expense which will be incurred in extra packages. You say, "the maximum proportions Mr. Gale observes are three of protective powder to one of gunpowder, so that, for four tons of protected or safety powder, there would only be one ton of gunpowder, which would, therefore, cost £2 for transport, but this would be as against £7 10s., which would give a saving of no less than £5 10s. per ton for carriage." But, Sr, i you omitted to say that to store or hold one ton of gunpowder mixed with three tons of another material, making four tons, would require 86 Government service barrels, at a cost of 15s. 10½d. each = £68 5s. 3d., each barrel weighing 30lb., or 2,580lb. for packages. Now to store or hold one ton of gunpowder perfectly secure in cases that have neither seams, or joinings, and cannot be broken, and are water, air, and dust proof, and which protect the powder from damp and the possibility of explosion (unless wilful) requires 22 cases weighing but 99lb., or 99lb., which, at a cost of 10s. each, would be £11, which, deducted from the above, shows an excess for non-explosive of £57 5s. 3d. Now, Sir, I think both political and domestic economists will stand aghast at the enormous extra expense which will be incurred, if the non-explosive system is adopted by the Government. But I have not taken into account the expense of three tons of foreign matter which have to be mixed with the gunpowder, and the mixing and unmixing. I do not in the least wish to speak slightingly of the discovery, but as a practical economist and one who has devoted much time to the question of preventing gunpowder explosions, my opinion is, that gunpowder, if put into proper packages, will be less liable to accident than when mixed with such enormous quantities of foreign material, besides depending upon so many operations before it can be used, which to some extent destroy its granular or other properties.

The late experiments on powder cases at the Royal Arsenal, Woolwich, by order of the Secretary of State for War, fully prove that non-destructible and safety cases can be had. The cases in question under the most severe test smashed both the service wooden barrel bound with copper hoops, and likewise the copper case covered with a wooden case, at the same time saving in weight over the present cases used by Government, 95,000lb. in 3,000 cases.

I am, Sir,
Your obedient servant,
August 17. C.

THE ATLANTIC TELEGRAPH CABLE.

SIR,—We were informed on the return of the "Great Eastern" from her unsuccessful attempt, that most, if not all, the fractures of the rope and cable which occurred took place in the machinery and inboard of the vessel. Perhaps if an arrangement for retaining the end of the rope or cable on fracture, similar to that mentioned in my letter which appeared in your number of the 11th inst., had been used, the disastrous result of these casualties might have been avoided. Although the greatest strain on the cable will necessarily be inboard, it does not of course follow that the fracture will be situated quite at the *locus* of maximum strain—its position will be modified by casual defect in the cable or rope, and the disaster will take place at a weak part of the cable in the vicinity of the point of greatest strain, unless some method be adopted to ensure the strain being so much greater on the brake than at any other place that, if fracture, occur it must necessarily occur there. This seems to have been done accidentally with the wire rope, perhaps also with the cable. If it were so arranged, and the contrivance above referred to proved effective, as I daresay it would, a great deal of time and money might be saved, to the advantage of international telegraphic communication.

Your obedient servant,
August 20. F. DENBY.

TO CORRESPONDENTS.

The MECHANICS' MAGAZINE is sent post-free to subscribers of £1 1s. 8d. yearly, or 10s. 10d. half-yearly, payable in advance. Post-office orders made payable to Mr. R. A. Brooman, of 166, Fleet-street, E.C.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5½d. per line for 6 insertions, 5d. per line for 13 insertions, 4½d. for 26 insertions; and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

All communications should be addressed to the EDITOR, 166, Fleet-street.

To insure insertion in the following number, advertisements should reach the office not later than 5 o'clock on Thursday evening.

We must absolutely decline attending to communications unaccompanied by the name and address of the writer, not necessarily for insertion, but as a proof of good faith.—ED. M. M.

RECEIVED.—W. W.—G. S.—G. P.—R. W.—T. R.—T. H.—M. and Co.—B. C.—H. P.—W. H. H.—F. D.—J. F. M.—H. P.—J. N.—C. C. and Co.—T. S.—R. H.—G. D.

Miscellanea.

The Waterloo and Whitehall Railway, the proposed works of which were recently described by us, is progressing favourably towards construction. The act was one of the latest sanctioned by the expiring parliament, and the works are in course of being let to responsible contractors. The working plans of the line are completed, and the schedule of prices nearly so. It has been erroneously reported that the line is to be worked on the atmospheric principle; it will be worked on the low-pressure principle. In the present case it is proposed to work the railway on the low-pressure principle. The atmospheric line is worked with a pressure of 20in. of mercury, but the Whitehall company do not propose to work with more than 6in. The question of leakage is a matter of comparatively little importance, as an absolutely tight fit is not necessary.

Mr. James Wilkinson has written us with reference to the paragraph in our "Notes" of last week, in which we describe his proposal to rival the magnesium light for photographic purposes. He observes that the statement in question would lead to the supposition that nitrate of potash and phosphorus, are the only ingredients he uses in producing the light; whereas, there are five other powders included in the composition, which are quite as important as the above.

Can anyone inform us the maximum price land in or near the metropolis may be expected ultimately to realise? The following sale by auction, which took place on the 11th inst., renders a guess tolerably impossible. The land in question was a small freehold estate of about 244 acres, having frontages to the public roads, and adjoining the Morden Station on the Croydon and Wimbledon Railway, in the parish of Merton, Surrey, and about ten miles from the metropolis. It was sold for the extraordinarily high price of £60,000, being at the rate of nearly £250 per acre.

Bernard Palissy's furnace has just been discovered beneath that portion of the gallery of the Louvre which joined the Tuileries on the river side, and which is now being rebuilt. On the 27th July last the workmen came upon a large potter's furnace, which was found to contain a number of moulds for the production of statues. A letter is in existence in which Bernard Palissy proposed to Catherine de Medicis to construct, in the garden which then adjoined the Tuileries, a monumental grotto decorated with extraordinary figures, of which the writer gives a minute description. The moulds are said to agree precisely with those descriptions, and it is therefore conjectured that Palissy set up his kiln in the immediate neighbourhood of the grotto about to be constructed. The discovery would have passed without much notice had it not been for an archæologist, M. Berty, who traced the furnace to the celebrated Palissy.

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The number of passengers conveyed upon and over the metropolitan extensions of the London, Chatham, and Dover Railway, were for the half-year ending June 30, 1864, 2,202,005; half-year ending December 31, 1864, 3,349,536; half-year ending June 30, 1865, 3,322,009. Total, 8,873,550. These large numbers of passengers have happily been carried without accident of any consequence, or the loss of a single life. The rapid growth of this traffic, and of the suburban traffic of the Brighton company, to and from the Victoria Station, has long since proved the utter inadequacy of two lines of rails to accommodate and develop it properly. It is expected that early in the coming year the company will be in possession of an independent access to Victoria by three new lines of railway now in rapid course of construction, and that about the same time the two additional lines from Herne-hill to Blackfriars will be available; so that with four lines through to the City, they will be enabled to separate the suburban from the through traffic, and to increase the number and punctuality of the trains to such an extent as will meet the requirements and efficiently serve the district traversed.

The railway from Cordova to Malaga has been opened with great ceremony by the Minister of Public Works, the civil governors of the two provinces, and other officials, in presence of a large number of spectators. The benediction was given by the Bishop of Cordova.

The balance sheet of the South London Working Classes Industrial Exhibition shows the entire sum realised during the forty-four days this most successful enterprise was open to be £1,429 2s. 1d. The profit realised was over £286, of which £281 12s. was expended in prizes for exhibitors. The balance will go toward the getting up of a memorial catalogue which will contain a *resume* of the entire proceedings, viz.: the prefatory statement giving an account of the formation of these exhibitions in March, 1864, at Lambeth; the reports of the opening and closing ceremonies; the visit of his Royal Highness the Prince of Wales; the distribution of prizes by Lord Palmerston, and much other information calculated to be of interest to those who have taken an active part in the undertaking.

We regret being unable to give so satisfactory an account as the foregoing of the West London Exhibition, opened some months since in the Floral Hall, Covent Garden, and which was finally closed last Monday night. The exhibition has been an unmistakable failure, and, instead of any profits, the guarantors have been called upon to contribute.

The story of Foley the fiddler, and founder of the Foley family, who introduced into Staffordshire the machinery for making split rods, which, previous to this, had been of the rudest description, is thus graphically narrated in *Once a Week*:—"The observant fiddler, having heard that Sweden contained appliances suited to this branch of the trade, played his way to Hull and across to Sweden, where he speedily became a favourite with the workmen in the iron districts. As soon as he had primed himself with the information he wanted, he suddenly disappeared, and turned up again in Staffordshire, where he persuaded a capitalist to put up the requisite machinery for split rods according to the Swedish pattern. But when the mill was put up it would not work, and off went the fiddler again, as most people thought, to drown himself for very shame, but in reality back to Sweden, where he and his instrument were welcomed as only an old favourite can be. There he stayed until he had not only corrected the error in his calculations, but also taken furtive drawings of all the ins and outs of the mill, after which the treacherous musician reappeared in the same sudden manner, and set the Staffordshire mill going, to his ultimate enrichment.

It is rumoured that Garibaldi's second son, Richiotti, is about to become the pupil of Mr. Benjamin Piercy, C.E., and will probably take his first lessons in railway making on the Whitchurch, Wrexham, and Connah's Quay line.

A correspondence of our Ministers in Persia to the Foreign Office, printed in the *Gazette*, shows that, for the present at least, the only telegraphic line to India that can be relied upon is the Indo-European one, by Constantinople, Bagdad, Persia, or Bassorah, and the Persian Gulf. The messages sent from England *via* the Hague and Russia, are received in a hopeless state of mutilation, averaging three weeks or a month old.

According to existing orders the "Bellerophon," 16, 1,000-horse power (nominal), is to be ready for undocking by the 16th of September, when she will immediately make her first official trial of her machinery. There is comparatively little remaining to be effected in the way of plating the "Bellerophon" with her six-inch and other armour plates, nearly the whole of which have been fixed, and the principal efforts are now directed to the completion of the ponderous reconnoitring tower now being erected amidships, immediately abaft the mainmast, the eight-inch plates, with which it will be covered, being now in the factory undergoing the bending process, to fit them for the exterior surface of the tower.

It is now definitely settled that the Great Western carriage works will go to Oxford, the company having communicated to the mayor that their resolution for moving them to that city, agreed to in April, will be carried out. The Cripley meadow, which underwent an examination as to its subsoil, &c., having been reported by the company's engineers as an eligible site, they instructed their solicitor at Oxford to get the necessary conveyance from the town clerk, in order that the same may be signed, sealed, and delivered.

The Council of the National Rifle Association announce that the annual competitive trial of rifles will take place at Woolwich, on the 23rd of November next. Each competitor shall furnish six rifles, complete and finished in every respect, and of precisely similar description. The conditions as to bore, weight, length of barrel, pull of trigger, stocks, sights, shall be as follows:—A. Bore.—Minimum, ·451. B. Weight.—Maximum, 10lb. The barrels and stocks not to be weighed separately. C. Length of barrel.—Any. D. Pull of trigger.—Minimum, 6lb. E. Stocks.—Half-stocked. All the barrels of any one set of rifles may be fired from the same stock. F. Sights.—Regulation Enfield, but so arranged as to admit of any other sights being subsequently fitted to the rifles. Any person intending to compete shall, on or before the 23rd of October next, pay an entrance of £10 and sign a letter accepting the conditions of competition. Each competitor may enter more than one description of rifle, subject to the payment of an additional entrance fee of £10 for each additional set of rifles. The detail regulations and conditions, twenty-seven in number, have already appeared in the daily press.

A lunar rainbow was seen at Neath, Glamorganshire, about 11.35 p.m. on the 11th inst. The arch was perfect and well defined throughout, and was of a dull colour, much the same as the yellow portions of the clouds near it.

New iron mines have been discovered in the neighbourhood of Irun, Spain, for the working of which a special line of railway is to be constructed. The product of the mines will, it is essimated, reach 100,000 tons per annum.

Amongst the most recent American patents is an invention by Mr. Henry Gerner, which consists in arranging the steam dome or reservoir of a steamboat in the interior of its shell and of the water space, in such a manner that the shell of the boiler can be filled up with water nearly to the top and the fire made to strike the same around its entire circumference; and, furthermore, the steam reservoir of the boiler is surrounded by the heated water and the radiation of heat from the same, and the condensation and loss of steam, consequent upon such radiation, are avoided.

A bill for making permanent provision for the establishment of the Sydney Mint has passed through the Colonial Parliament. The object of the measure is to enable the gold coin of the colony to be made a legal tender in the United Kingdom, this concession having been promised by the Home Government upon permanent provision being made by the Sydney Mint. In the course of the debate on the second reading of the bill in the Assembly, doubts were expressed as to the advantage of the colonial sovereign having a currency in England, as, being of greater intrinsic value than the English sovereign, they were, on reaching London, melted and transmitted to the Bank of England in bullion.

There has been a discovery of petroleum in a new form in Philadelphia. It is stated that a hard black substance, supposed to be coal, has been discovered on some lands in West Virginia. Upon chemical analysis the supposed coal turned out to be solidified petroleum, crystallised upon the outside of the vein and granulated inside. It lay in a stratified form, and the vein was from 55in. deep to 250ft. thick. So far as traced the lode is about a mile in length. The discoverers put their acquisition to the test, and found it possible to distil from the substance a pure oil at the rate of from 160 to 170 gallons to the ton. The location of this petroleum mine is ten miles from Cairo, and thirty-one miles east of Parkersburg, Virginia.

An American has recently invented a hydrocarbon blower, which consists in the use of a current of hydrocarbon vapours formed by the action of steam, and mixed therewith and with a suitable percentage of atmospheric air in combination with a furnace, in such a manner that an artificial draught is obtained without incurring any loss of heat; and, furthermore, a quantity of inflammable gases are introduced into the furnace, and thereby the heat is increased and the consumption of fuel in furnaces is reduced.

The last New Zealand mail brings accounts from the Hokitika gold fields which lead to the belief that, for at least 100 miles, that portion of the west coast of the Middle Island is auriferous.

We understand that the Dublin International Exhibition is likely to prove a failure in a commercial point of view. Fears are entertained that a call will be made upon the guarantors to meet the deficiencies.

During the revolution of 1848, the Hungarians are said to have seasoned a million of green-cut gun-stocks in four days, thus:—They put them in a close chamber, with escape ports, steam was injected for 48 hours among the green wood, the stocks were then plunged into tanks of iced water for six hours; after which they were kept for 36 hours in an ordinary stove-heated apartment, which sufficed to make a perfect seasoning.

Railway construction is proceeding favourably and at a rapid pace in Russia. The first section of the Odessa and Balta Railway, 93 wrests long, is now opened for the corn traffic, and a limited number of passengers forwarded by each train. The whole line will soon be opened, probably this month. The rails are being laid on the remaining section, and the arches of the last bridge are now being turned. Nine locomotives for this line have been ordered in the Mechanical Factory at Elslingen. The preliminary surveys for the Taganrog and Charkow line have given the most favourable results, and even exceeded the most sanguine expectations. The landed proprietors have everywhere declared their willingness to give up the land required for the railway without any compensation whatever, and their generous example has been followed by many of the towns, villages, and communes on the line.

The Enfield Small Arms Factory balance sheet, for the year ending March 31, 1864, has just been issued, and shows a production account to the amount of £120,548. The principal items are 24,074 rifles, pattern 1863, at 37s. 9½d. each; 14,700 artillery carbines, at 51s. 4d. each; and 3,180 Whitworth rifles, with steel barrels, at 88s. 8½d. each. There were also produced 1,504 short Enfield rifles, at 53s. each, and 2,280 naval rifles at 52s. 10½d. each, besides nipple wrenches, muzzle stoppers, snap caps and chains, brass jags for cavalry carbines, and other minor articles.

Mr. C. L. Daboll, of New London, Connecticut, has practically introduced the means by which sound may be made a substitute for lighthouse purposes. A signal of this kind, called Daboll's Fog Trumpet, to be worked by a small caloric engine, is now being placed at the Cumbrae Lighthouse. It is similar in construction, though not so large, as one recently erected by Mr. Daboll, at Dungeness. The engine requires very little attention, consumes but little coal or coke, and as no water or steam is used it is as safe as an ordinary house or cooking stove; but, nevertheless, it is capable of condensing air sufficiently powerful to sound a loud blast upon the trumpet, which, by means of an ingenious automatic arrangement of machinery, is made to rotate in any arc of the circle required.

From New York we learn that coffins for preserving the bodies of the dead for an indefinite length of time, by means of ice, are now sold in New York City. The bodies are preserved in a dry and frozen condition, so that little change takes place. Persons who desire to be preserved after death should so specify in their wills and bequeath funds to keep up the supply of ice as long as they wish the preservation to be maintained.

American railways are gradually recovering from the disorder into which they were thrown by the late war. The Memphis and Charleston Railway is soon to be taken possession of by the Company, and the road reconstructed. No other road in the South has suffered more during the war. It has been in possession of both armies at different times, and nearly every mile of it has been fought over. All the bridges and trestles have been destroyed, the track mostly torn up, and station houses and ties burned.

Patents for Inventions.

ABRIDGED SPECIFICATIONS OF PATENTS.

The Abridged Specifications of Patents given below are classified, according to the subjects to which the respective inventions refer, in the following Table. By the system of classification adopted, the numerical and chronological order of the specifications is preserved, and combined with all the advantages of a division into classes. It should be understood that these abridgements are prepared exclusively for this Magazine from official copies supplied by the Government, and are therefore the property of the Proprietors of this Magazine. Other papers are hereby warned not to produce them without an acknowledgement:—

Boilers and Furnaces,—305, 311
Buildings and Building Materials.—264, 276, 285, 326
Chemistry and Photography—263, 307, 320
Cultivation of the Soil, including agricultural implements and machines.—279
Electrical Apparatus,—269, 273
Fibrous Fabrics, including machinery for treating fibres, pulp, paper, &c.,—277, 278, 281, 293, 297, 313, 223, 329, 336
Food and Beverages, including apparatus for preparing food for men and animals.—282, 297, 306, 333, 340
Furniture and Apparel, including household utensils, time-keepers, jewellery, musical instruments, &c.—267, 268, 280, 283, 288, 291, 298, 301, 304, 308, 316, 317, 322, 323, 334, 339, 341, 343
General Machinery,—262, 294, 300, 314, 321, 324, 327, 328
Lighting, Heating, and Ventilating,—266, 319, 332, 342
Metals, including apparatus for their manufacture,—None

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MISCELLANEOUS—270, 310, 312, 330
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.,—271, 272, 275, 289, 290, 318, 335
SHIPS AND BOATS, including their fittings,—284, 286, 292, 296, 303, 315, 337
STEAM ENGINES, &c.,—271, 331, 338
WARFARE.—265, 295, 299, 302, 309

262 J. GIBSON. *Improvements in apparatus for relieving wire ropes from strain when used in lifting and lowering weights.* Dated January 30, 1865.

This invention relates, principally, to the lifting of weights in coal mines, and consists in the application to the bearings of the lifting pulley of laminated springs resting on elastic beds or cushions, such springs being of sufficient reactionary power to take the usual strain off the lifting wire rope, and thereby to relieve it from all strain, except that of tension. *Patent completed.*

263 F. A. LAURENT and J. CASTHELAZ. *Improvements in the manufacture of benzoic acid.* Dated January 30, 1865.

For this purpose the patentees decompose a salt of phthalic acid by means of heat acting in conjunction with a suitable base. We cannot quote the details. *Patent completed.*

264 G. CARTER. *Improvements in the construction of caps or pots for the chimneys of dwellinghouses and public buildings.* Dated January 30, 1865.

The object of this invention is to cause an upward current of air in all the flues of a stack of chimneys, notwithstanding there may be a fire in only one of the fireplaces of such said several flues. The patentee proposes to effect this object by the following means, that is to say, supposing a stack of chimneys to contain nine flues, each fitted with a chimney pot, he proposes to cover every three of such said pots with another cap or pot, which he calls a covering cap or pot, inasmuch as all three of the flues leading thereinto discharge their smoke into the air by one main outlet in the converging cap, so that, supposing one of the flues only to be in use, the smoke therefrom will not descend either of the other flues. He does not intend to limit himself to the use of one main outlet at the top of the aforesaid converging cap or pot, but, if desirable, he forms openings at one or more of the sides of same. In this case he proposes to employ either metal or brickwork to enclose the upper part of the flues of the chimney stack. *Patent completed.*

265 C. H. RUSSELL and J. NEEDHAM. *Improvements in breech-loading guns and in priming and capping the same.* Dated January 30, 1865.

This invention consists in adapting the nose of the breech-plug or part by which the breech of the gun is closed to receive the priming cap by which the charge of the gun is exploded, the cap at the same time acting as a packing to prevent the gas escaping from the rear of the barrel. *Patent abandoned.*

266 R. A. BROOMAN. *An improvement in shades or globes for lamps and other lights.* (A communication.) Dated January 30, 1865.

This invention is particularly intended for the use of invalids and their attendants, for travellers, and for others requiring to know the time, or to be awoke at certain times during the night. The invention consists in combining with a lamp or other light a dial plate for indicating the time, and when required an alarum or striking mechanism. The inventor fits to the globe of the lamp a dial plate of opal, crystal, or other transparent material, of the same, or of different nature and colour to those of the globe. Behind the dial-plate the patentee applies a watch or pendulum movement with or without striking mechanism. The lamp will thus indicate the hour at any time of the night, and when provided with an alarum will arouse a person at any time at which it may be set. *Patent abandoned.*

267 M. CARTWRIGHT. *Improved apparatus and means for giving alarm in case of fire, applicable in part as improvements in alarms or alarums generally.* Dated January 31, 1865.

In performing this invention the inventor carries round the rooms, by preference near the ceiling, or inserted in the walls, wires, or gutta-percha cords, which, at the corners, are united to bell crank levers, or carried over pulleys, and, supposing the apparatus to be applied to a house or warehouse, he carries these cords or wires round each room or compartment terminating at an alarm, placed by preference at the lower part of the building, and in a conspicuous position. The wires or cords are held in tension at certain points in each room or compartment by being inserted in a vessel or case filled with a flexible substance, composition, or mixture, alloyed so as to make it more or less sensitive to heat, such for instance as tallow, or other fatty substance mixed with wax, gutta-percha mixed with pitch, or any substance, composition, or mixture, which will hold the end of the wire or cord securely; so long as the wires are so retained the alarm cannot go off or work, but, upon a fire taking place, or on a given degree of heat being generated in the room or compartment, the composition retaining the wires or cords softens, and the cords thus losing their holding power, release a lever or levers in connection with the alarm and set it into action. *Patent abandoned.*

268 J. W. GILL. *An improved clothes fastener that may also be used as a letter clip.* Dated January 31, 1865.

This clothes fastener is composed of two pieces of sheet iron or other metal formed and united together in such manner that, by means of a spring and other parts, the fastener closes tightly over the rope or line. *Patent abandoned.*

269 R. A. BROOMAN. *Improvements in rail and tramways, in laying electric telegraph wires, and in compositions for insulating the same.* (A communication.) Dated January 31, 1864.

This invention mainly consists in what may be called a telegraphic rail, composed of a tube of circular or other shaped section, filled with an insulating bituminous composition formed by preference as hereafter described. The patentee leaves a passage or channel about one-third of an inch in diameter through the centre of the bituminous composition to receive a telegraph wire. The rails may be formed of any convenient length. The object of the bituminous composition with which the rails are filled is not only to insulate the telegraph wire but to give the rail sufficient solidity or strength to bear the rolling stock. The tubes are laid end to end, one against another, in two parallel lines at the required distance, and rest on blocks of mastic or wood, to which the tubes are secured by collars or otherwise. The telegraph wire may be passed through the central passage of several tubes at a time. Where a joint or connection is necessary, say every five yards, for example, the contact from one section of the wire to the following may be obtained by several methods. *Patent abandoned.*

270 W. H. COX. *Improvements in tanning hides and skins, and in apparatus employed therein.* Dated January 31, 1865.

We cannot here give space to the details of this invention. *Patent completed.*

271 M. HENRY. *Improvements in apparatus for effecting locomotion or propelling on land.* (A communication.) Dated January 31, 1865.

This invention refers to engines, carriages, and machinery to be propelled on land, such as locomotives, traction engines, portable engines, steam cultivators, and similar apparatus. Heretofore such apparatus have been propelled by applying power to the wheels on which they run. According to the present invention the propulsion of the engine, carriage, machine, or apparatus is effected by means of levers, legs, or feet, which have an alternating or rising and falling motion imparted to them by steam or other power, and are so fitted and worked that, at their down stroke, they apply their lower ends against the ground or surface to be travelled over, and thereby move the apparatus in the required direction. These levers, legs, or feet work in a manner somewhat similar to the propulsive action of the legs of a horse; they may be jointed and curved, or inclined, as required. *Patent completed.*

272 T. HALL and S. BONSER. *Improved mechanism for giving intermittent or continuous revolving motion of different velocities without the use of change wheels.* Dated January 31, 1865.

We cannot here give space to the details of this invention. *Patent completed.*

273 J. FLETCHER and D. HAMER. *The application of hydro-electricity to steam for the purpose of increasing its expansion and power, and the machinery or apparatus connected therewith, and also the application of galvano or frictional electricity for the same purpose.* Dated January 31, 1865.

In one arrangement for the application of hydro-electricity in connection with steam for working steam engines, the inventors place between the cylinder and boiler a steam chest divided by a partition into two compartments, and form in the partition a number of holes, in each of which is placed a tube of iron. The steam from the boiler passes from the first compartment through these tubes, and comes in contact with steel points on a number of insulated steel bars in the second compartment, the effect of which is to set free a quantity of electricity, which combines with and expands the steam as it is passing onwards to the valve-box and cylinder of the engine. After this combination of steam and electricity has passed through the cylinder, it is exhausted through a number of tubes into a pipe or chamber, in which there are steel points and insulated steel bars for setting free more electricity, which is returned by conducting wires to the before-mentioned steam chest, and combines with the next supply of steam, and the elasticity evolved therefrom; then the combination with increased power passes to the cylinder, thence to the exhaust, with its tubes, points, and bars, from which the electricity is again returned to the steam chest, and so on continually, thereby obtaining an increase of power. *Patent abandoned.*

274 E. P. COLQUHOUN and J. P. FERRIS. *A lubricating apparatus by condensation under pressure of steam.* Dated January 31, 1865.

This invention cannot be described without reference to the drawings. *Patent completed.*

275 E. P. COLQUHOUN and J. P. FERRIS. *Improvements in the permanent way of railways.* Dated January 31, 1865.

The object of this invention is to make a road at once elastic and durable, and this the patentees effect in the following manner:—The sleepers or blocks are of cast iron, of a form and size best suited to the soil in which they are to be placed. In the centre of the sleeper or block is a recess or chamber, in which the lower portion of the chair works. The sleepers or blocks are connected transversely by tie rods. The chair is also of cast iron, the foot of the jaws for holding the rails terminating in a plate, having on the under side a projecting rim which works up and down freely in the recess or chambered part of the sleeper. On the upper surface of the plate, which forms the base of the chair, are cast the jaws of an ordinary chair to carry the rail in the usual manner. Between the sleeper and the chair, and surrounding the projecting rim on the under side of the chair, is an india-rubber ring or washer, which acts as a spring, and produces the desired elasticity. *Patent completed.*

276 J. MEAKIN. *A new mode of placing china, stone, and earthenware in seggars, ovens, and kilns or other receptacles for firing the same.* Dated February 1, 1865.

In carrying out this invention the inventor constructs and uses a saddle pin or rib of clay or other material, with projecting lateral teeth made of various sizes. He places the articles of china, stone, and earthenware which are about to be fired, between the teeth of the saddle-pin or rib, which is placed upright in the seggars, ovens, or kilns. By this means marks or indentations upon the face and edge of such articles of china, stone, or earthenware are avoided, and the inconveniences of the modes now in use are obviated, a great saving of labour and expense is effected, and a much larger quantity of ware can be placed in such seggars, ovens, and kilns than the present modes allow of. *Patent abandoned.*

277 J. GRAY. *Improvements in apparatus for breaking and scutching flax or similar fibrous materials.* Dated February 1, 1865.

This invention has, principally, for its object the improvement of the action of apparatus for breaking and scutching flax and similar fibrous materials. In the breaking apparatus the improvement is obtained by a novel and more convenient arrangement of the parts than heretofore, wherein six grooved or fluted rollers are arranged around and in gear with a larger central grooved or fluted roller. Adjustable springs or levers are provided for pressing the outer rollers towards the centre, one to compress more or less the flax passing them; an endless travelling web or stage is provided to receive the flax and feed it to the rollers, and a similar one may also be provided for delivering it after it has passed the rollers. The improvements in the scutching apparatus are such as to save the ends of the flax from the thinning action to which they are liable in ordinary scutching apparatus, any they consist in forming the hand-board or stock against which the flax is beat by the scutching blades or wipers, with an inclination such that its lower part recedes from the plane of the scutching blades. The whole of the stock may be inclined in this way, or its upper part may be less inclined to or parallel with the plane of the scutching blades. *Patent abandoned.*

278 A. FREEMAN. *Improvements in machinery or apparatus for folding fabrics on to cardboards for the purpose of hot pressing.* Dated February 1, 1865.

The fabric passes from a roller to the centre of a frame, having at each side a layer of cardboards on a platform or table, to which is given an ascending motion by means of a drum or shaft encircled by chains attached to the bottom of the platform, the drum being turned by a ratchet wheel and ratchet worked from the driving shaft of the machine. The cards at each side are seized by fingers closed by a spring, and having to-and-fro motion imparted to them by a vibrating arm worked by a crank. The top card at one side of the fabric is seized by the fingers and carried to the fabric and folds it, and then the fingers are opened by an incline or cam, and leave the card in the fold of the fabric; the fingers now pass to the other side and seize the top card on that side, and when the vibrating armis reversed, it brings the card forward and folds the fabric by the card itself, after which the fingers are opened to allow the card to be retained in the fold; the further movement of the arm carries the fingers to the side first mentioned, where they again seize a card, which is carried to the fabric and folds it, and so the operations are continuously repeated. The folds as they are completed are held on a central table or platform having a descending motion in proportion to the thickness of the cards and the fabric, the said motion being given by a ratchet wheel drum and chains *Patent abandoned.*

279 J. SAINTY. *An improvement in lever horse hoes and lever corn drills for the hoeing and sowing of wheat and turnips and all other seed and root crops.* Dated February 1, 1865.

This invention relates to an improved arrangement of machinery for hoeing and sowing wheat, barley, oats, turnips, and mangold wurzel, by means of which, in the case of a lever horse hoe, the sand is more evenly hoed because the lifting of the hoe is prevented in stony or thistly ground; and in the case of the lever-sowing drill, by the same even pressure the coulters are kept at an equal depth from the surface; and, in both instances, the weight (and, consequently, the draught) of the implement, is materially decreased. These advantages are attained by adapting to the levers of both hoes and drills sear springs in place of weights, which springs work through guards carried by a guard bar, and may be regulated, as to the pressure they shall put upon their respective levers, by means of split spring bolts which fit into holes pierced in the guards. By shifting these spring bolts in the holes in the guard a pressure may be produced according to the requirements of the work equal to one or seven or more pounds weight, without employing weights which are now used in all horse hoes and drilling machines. The invention also affords, incidentally, the following advantages, viz:—First, a light lift, there being no dead weight in the form of pendent weights to raise when the hoes or coulters are required to be lifted clear of the ground; second, the use of chains and a barrel is not required for this light lift; third, the end levers do not require to be cranked as in the ordinary implement to enable the hoes or coulters to act on the whole width of land covered by the running wheels of the implement. *Patent completed.*

280 W. E. GEDGE. *An improved portable folding arm chair or seat.* (A communication.) Dated February 1, 1865.

This seat or chair is intended especially for the use of travellers by boat or railway, and is composed of four movable parts united by hinges, and so arranged as to form at will, and instantaneously, a seat or chair, and be afterwards folded back the one in the other into the shape of a box, enclosing all the parts which are calculated not to exceed the space usually allowed to a second or third class railway passenger. The four parts are, firstly, the actual seat, that is to say, the part on which the traveller seats himself; secondly, a frame forming the back, both of these parts being comfortably stuffed; thirdly, two other frames, one to the left and the other to the right forming chair arms. All the parts may be of wood, metal, or other suitable material, and be covered with any sort of stuff, leather, or other material according to taste. When the traveller by boat or rail no longer requires the apparatus as a seat or chair, he folds the four parts the one in the other, so as to form a box, which is closed by a couple of catches, or otherwise, and may be carried in the hand by a leather handle like a carpet bag. *Patent abandoned.*

281 J. M'NAUGHT and W. M'NAUGHT, jun. *Improvements in machinery for washing and drying wool and other fibrous materials.* Dated February 1, 1865.

We cannot here give space to the details of this invention. *Patent completed.*

282 G. J. VERTUE. *Improvements in the manufacture of oil cake and food for animals.* Dated February 1, 1865.

This invention consists in manufacturing cakes and food for animals compounded of linseed and cotton seed, with or without other vegetable matters suitable for the food of animals. *Patent abandoned.*

283 J. ROPER. *Improvements in corkscrews.* Dated February 1, 1865..

In carrying out this invention the inventor forms the screw and pin as usual in one piece, secured as in the ordinary way to the head. He forms a barrel with a long tubular neck, through which barrel and neck the screw and pin are passed before being secured to the head. A tube is also attached to the head, which tube conceals the pin; into this tube the neck slides, as the screw is inserted into the cork. The cork is drawn by continuing to turn the screw in the same direction as that employed for inserting it into the cork, this action forcing the cork up the worm of the screw, and out of the neck of the bottle. Once drawn, the cork is released from the screw by turning the head in the contrary direction, during which operation the cork bears upon the shoulder or dome of the barrel whilst the screw is being drawn through it. *Patent abandoned.*

284 J. MOYSEY. *Improvements in coating the bottoms and sides of ships and other submerged structures to prevent fouling and decay.* Dated February 1, 1865.

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This invention consists in applying to the bottoms and sides of iron ships, or to iron plates used on wooden or iron ships, or to other submerged structures, an amalgam formed of mercury and lead alone, mercury and tin alone, or of mercury and tin, or lead and any other metal. The inventor first tins or galvanises the iron plates, either before or after the ship or other structure is built, and he afterwards applies the amalgam by hand, or by a pad of wash-leather, or in any other mechanical manner. The inventor does not limit himself to any particular proportions of the materials of which the amalgam is composed, but that formed of the following materials in or about the proportions stated answers well, viz.:—Mercury, three parts by weight; tin, one part; lead one part. *Patent abandoned.*

285 G. H. PIERCE. *An improved socket for pipes and method of joining the same.* Dated February 1, 1865.

This invention consists in forming one end of pipes with a tapered socket to receive a spigot on the end of the next following pipe, which spigot is also tapered to fit into the tapered socket. The inventor forms the spigot with a flange round its base or largest circumference, to prevent the lead or other material used for packing from being forced out by the pressure in the pipes. The base or smallest circumference of the socket is provided with a corresponding flange or shoulder, in order that for heavy work, or where the joint is likely to get injured by the shaking of the machinery or otherwise, a cramp iron may be placed on each side to clip or hold the flange on the spigot, and the flange or shoulder on the socket. The cramp irons may be secured by a ring driven tightly over them. *Patent abandoned.*

286 J. HUGHES. *Improvements in the construction of armour plated ships, forts, and other like structures.* Dated February 1, 1865.

This invention relates to the construction of ships of war by strengthening them with hollow stringers or girders running longitudinally, vertically, or otherwise. These stringers are riveted to the skin and frames of the vessel, and form the backing for the armour plates. The spaces between the stringers, and also the hollow in the stringers, may be filled with wood or any composition that may be found suitable. The invention applies also to forts, turrets, cupolas, and other structures to be protected by armour plating. *Patent abandoned.*

287 C. A. WHEELER. *Improvements in fixing frost screen awnings and netting for protecting wall fruit trees, in fixing trellis for training fruit and other trees to walls, and in bricks therefor.* Dated February 1, 1865.

This invention cannot be described without reference to the drawings. *Patent completed.*

288 A. S. STOCKER. *Improvements appertaining to reflectors.* Dated February 2, 1865.

This invention has reference to the construction and combination of reflecting mirrors to be used in place of ordinary toilet looking-glasses. The patentee joins or unites together in such a manner the various parts and limbs which he employs, that when united he obtains novel movements and configurations in the apparatus which he intends to construct, affording thereby many advantages which are the enabling of several persons to be using the peculiar toilet glass at the same time, and the capability of momentary adjustment, so as to render a steady, fixed, and comprehensive view of those parts of the person so desirable to be seen when dressing or performing other operations of the toilet. *Patent completed.*

289 J. W. GRAY. *An apparatus for effecting communication between the passengers, guards, and engine drivers of railway trains by night or by day.* Dated February 2, 1865.

We cannot here give space to the details of this invention. *Patent abandoned.*

290 E. WHITTAKER. *Enabling the passengers in railway carriages to give certain signals to the guard and engine driver in case of danger or necessity.* Dated February 2, 1865.

In carrying out this invention the inventor places in the interior of each carriage a rod or wire having at one end a handle or tassel within the reach of any passenger. The rod or wire extends through the top or one of the sides of the carriage, and is attached to a bell crank connected by another rod or wire to a lever, cam, or eccentric in connection with a hammer and bell or gong, so that, when the wire or rod in the interior of the carriage is pulled, the lever, cam, or eccentric releases the hammer and enables it to strike the bell or gong, and thereby give the necessary signal to the guard or engine driver. *Patent abandoned.*

291 A. MURRAY. *Improvements in the manufacture of boots and shoes.* Dated February 2, 1865.

This invention consists in the employment of heel-plates made of malleable iron, copper, brass, steel, wrought or cast iron, zinc, or lead, nailed or screwed on wooden lasts of all sizes, on which to make men's, women's, and children's boots and shoes. *Patent completed.*

292 C. LUNGLEY. *Improvements in armour-plated ships, forts, gun carriages, and works of defence, and in fastenings to be employed therein.* Dated February 2, 1865.

In carrying out this invention the patentee uses as backing to the protecting plating bars of iron, which may be rolled or forged of dimensions sufficient to be punched or drilled through for fastening with bolts to the frame or backing of the ships, forts, or other structures. The bars may then be fitted in with wood or such other suitable substance for ships or forts as may be found desirable; and in the case of forts he makes the frames and stays of this or similar description of bars, so as to be strong enough to admit much larger fastenings than heretofore. The object of this plan is to enable the fastenings to be equal to the thickness and strength of the protecting armour parts. The connection in this manner will enable the bars to be fastened edgeways, although they may be wider or deeper, and they may also be rolled or forged thicker where fastenings go through them so that they may be drilled if thought advisable. He also makes the bars in two or more parts so that they may be secured together by rivets or bolts, clasping studs or fastenings in ships or forts. The iron may be rolled thinner in the middle so as to make it as light as possible. This iron he proposes to apply to strengthening such parts of the fortifications as may require it, such as diagonal, vertical, or longitudinal ribs or stays, and also to gun carriages. The fastenings are in the form of bolts, which he makes hollow, with a conical part at the head or outer end; the inner ends in this case he upsets by opening them out so as to form a conical part, and he clinches the opened end over. *Patent completed.*

293 J. MAYNES. *Certain improvements in looms for weaving.* Dated February 2, 1865.

The patentee claims, first, the removal of the shuttle containing the broken or spent cop, and supplying and substituting a shuttle having a perfect cop in place thereof, without stopping the loom, by means of the apparatus or mechanism described. Secondly, the interposition of levers and pauls between the weft hammer and the ordinary weft holder lever for the purpose of actuating the apparatus for changing the shuttles. Lastly, the adaptation of mechanism for stopping the taking-up motion during the changing of the weft, as described. *Patent completed.*

294 J. BALL. *Improvements in the manufacture of sheep shears.* Dated February 2, 1865.

These shears are made entirely of the best cast or shear steel, which is rolled into sheets of suitable thickness, and rolled to the required form. All that is requisite then is to bend up the edge of the steel so as to form a back to the blades, and also give the required shape to the handles, which may be done with the hammer in a few minutes, and at a low heat; or it may be bent up into the requisite form by machinery without the use of the hammer. The shears being then ground up and polished are ready for use. *Patent completed.*

295 J. H. JOHNSON. *Improvements in the manufacture of ordnance and other like castings, and in the apparatus employed therein, also in carriages or moulds for the same.* (A communication.) Dated February 2, 1865.

The patentee claims, first, the system or mode of making and strengthening guns, mortars, hydraulic cylinders, and other heavy hollow castings, by casting the metal in successive layers upon each other whilst such layers are in a glowing hot state, and then forging each newly-cast layer so soon as it is set, substantially as and for the purpose described. Secondly, the peculiar construction of moulds for carrying out the improved system of casting, substantially as and for the purpose specified. Thirdly, the connecting of the trunnions of ordnance with the breech of a gun in lieu of shrinking them on to the middle thereof, as described. Fourthly, the mode of mounting guns and of elevating and depressing them by means of a roller and lever arm operated by a screw spindle, and acting against the under surface of the gun, as described. *Patent completed.*

296 J. S. JEFFREYS. *Improvements in armour-plated and other ships or vessels, also applicable to fortifications generally.* Dated February 2, 1865.

This invention consists in constructing armour-plated vessels by placing a number of tubes of sufficient diameter that projectiles can pass through them across the vessel, such tubes being made trumpet-mouthed so as to open out at either side of the vessel. The surface of the vessel intervening between the openings of two such tubes is by this means formed convex, so that a projectile, on striking such convex part, will glance off and pass into one of the said tubes. The tubes and convex surfaces may either be formed rounded or angular. *Patent abandoned.*

297 T. ROUTLEDGE. *Improvements in treating spent or used leys resulting from the preparation of fibrous substances used in the manufacture of paper stock.* Dated February 2, 1865.

This invention consists in the economic evaporation of the spent leys or waste liquors resulting from the treatment of fibrous materials in the manufacture of paper and half stuff or paper stock, and the subsequent recovery of the alkali therefrom. The details of this invention are too voluminous to be quoted here in detail. *Patent completed.*

298 W. VALE. *Certain improvements in the manufacture of pencilcases.* Dated February 3, 1865.

Pencil cases constructed according to this invention are so made that the head or upper end unscrews in the usual manner, as well understood. The watch key is attached thereto, and, a sufficient space being reserved for the same inside the barrel, the head is screwed on in the ordinary way. *Patent completed.*

299 T. JOYCE. *Improvements in breech-loading fire-arms.* Dated February 3, 1865.

This invention consists in the improvements hereinafter described, by which the fire-arms may be rapidly loaded and discharged, and may be used as muzzle-loading as well as breech-loading fire-arms. The inventor makes the barrel open at its breech, and fixes it firmly in the body of the gun by screws or otherwise. That part of the body at which the open breech is situated is provided with two projections, the inner curved sides of which serve to guide the cartridge into the open breech of the barrel. To one of the said projections a strong plate or closer is jointed, which said plate or closer is capable of turning in a vertical plane upon its point. When the said plate or closer is raised, the open breech end of the barrel is clear for the introduction of a cartridge, but when the plate or closer is shut down, it closes the breech-end of the barrel, and is supported firmly by the two projections described against the end of the barrel. A strong spring acts on the heel of the plates and forces it home, either into its raised or depressed position, when it has been partially brought into the required position by hand. The action of the said spring upon the said plate resembles that of the spring of a clasp knife upon the blade of the said knife. The free end of the said plate or closer is provided with a thumb plate by which it can be raised or lowered. The plate or closer may either be jointed on the right or left hand side of the gun, but the inventor prefers to joint it to the left hand side. Breech-loading fire-arms made according to this invention may be provided with a nipple, and be discharged by a percussion cap, and used either as breech-loading or muzzle-loading fire-arms; or they may be made without a nipple, and the hammer be made to strike the pin or rim of a pin or rim cartridge. They may also be made to use central fire cartridges. *Patent abandoned.*

300 G. and D. HURN. *Improvements in the manufacture of driving bands or belts for machinery and other purposes.* Dated February 3, 1865.

This invention has reference to an improved description of driving band or belt applicable to machinery or other useful purposes, whereby greater strength and durability are obtained, thereby rendering the same less subject to wear and tear from the cutting of the selvage over the drum than at present, and consists in the employment of a woven combination of longitudinal threads or warp composed of vegetable or other fibres held or bound together through the medium of a transversal shaft or shute of leather, hide, or other like material, interwoven between the said longitudinal warp, so as to form a hard and durable selvage, the said combination admitting of other modifications in the external facings being employed, such as the interlacing of strips or strands above and below the fabric placed either diagonally, crosswise, or in any other suitable manner at alternate or intermediate intervals or spaces, either through, over, or along the same, and woven to any width or texture required. *Patent completed.*

301 B. L. MOSELY. *A new or improved tooth powder.* Dated February 3, 1865.

This invention relates to a new compound of tooth powder which consists of the following ingredients, viz.: Powered orris root, about one-sixth part; permangate of potassa, about ten grains; powdered chalk, about two-sixth parts; powdered cuttle fish, about one-sixth part. These ingredients are to be mixed under a slow heat, and by degrees about one-sixth part of powdered wheat starch is to be added, after which the powder may be scented or perfumed at pleasure. *Patent completed.*

302 W. BARTRAM. *A self-adjusting lever powder and shot charger for fire-arms.* Dated February 3, 1865.

This invention consists in constructing the powder and shot charger of a cylindrical tube, at the lower part of which is a rim, below which an exterior male screw is cut for the purpose of fixing the cylinder to the neck of the flask; a cutter or stopper slides under the rim by means of a lever actuated by the finger, such lever being fixed to the cylinder by a fulcrum projecting therefrom. The upper part of the lever is grooved or slotted to receive a screw fixed to an upper cutter or stopper, which draws along at pleasure to suit the measure required for the charge, the sliding motion being regulated (according to the charge required) by means of a flat spring at the back of the lever. A sliding outer tube encloses the cylinder. This tube has a vertical groove cut in the lower part to admit of its moving past the projecting fulcrum on the cylinder, and a horizontal groove is cut at the upper part to permit of the passage of the upper stopper. There is also a small vertical slot below in which a thumb screw works to secure the regulator to any point in the groove. The charger is thus accurately regulated to measure drachms and grains by an index cut on the cylinder. *Patent abandoned.*

303 M. BLANK. *Improvements in working ships' pumps.* Dated February 3, 1865.

The objects of this invention are to work the pumps with greater ease and facility than heretofore, and also to work them from the upper deck or decks, so as to obviate the necessity of going below for this purpose, as is now the case. To this end the patentee transmits the power to the pumps from the capstan by means of endless chains, racks, bands, or by shafting and cog-wheels, instead of working them by hand with cranks or levers in the ordinary manner. *Patent completed.*

304 W. CLARK. *Improvements in sewing machines.* (A communication.) Dated February 3, 1865.

This invention relates to improvements in sewing machines, in which the needle carrier has the ordinary vertical motion and a lateral movement which produces the rise and descent of the needle alternately in different lines at a certain distance apart for the purpose of forming what is termed the "whip-stitch," produced by interlacing the two threads, one of which is furnished by a shuttle from a ball or reel, and the other by a bobbin serving to feed the needle. The invention consists, first, in the production of what is termed the whip stitch with two threads by means of a lateral movement and serving more especially for sewing or uniting cloth or other fabric, or even leather, the threads being much stronger than those hitherto performed. Secondly, in an improved means of feeding the fabric with the object of preventing the resistance due to the weight or adhesion of large pieces of fabrics (such as sail-cloth, awnings, tarpaulins, or leather), interfering with the feed. Thirdly, in the application of two needles having the eye near the point in combination with two shuttles, each double-pointed, for the purpose of forming a series of stitches or seams in two parallel lines at a given distance apart. Fourthly, in an improved mode of driving the shuttle without the aid of the ordinary guides fixed or otherwise. *Patent completed.*

305 J. WESTERBY. *Improved apparatus for preventing the explosion of steam boilers.* Dated February 3, 1865.

An important feature in this invention consists in fixing the whole of the apparatus within the boiler, whereby it is placed entirely out of reach, which the inventor is enabled to do by adopting the following construction and arrangement of the apparatus:—At any suitable place in the upper part of a boiler an opening is made of such a diameter (according to the size or capacity of the boiler) as to allow of a sufficiently rapid escape of steam in case of danger (from the lowering of the water level below the ordinary working point) to prevent all fear of explosion. Beneath this orifice or opening is bolted (or otherwise attached, an elbow pipe of similar dimensions, the horizontal arm of which is furnished with a valve box having an opening into the steam space above the water level. Inside the valve box works a double equilibrium valve, which is connected by a rod to a lever, one end of which lever is attached by a rod to a float submerged in the water, and the other end carries a counterbalance weight, the fulcrum of the said lever being between the point of attachment of the valve and the end which is connected to the float. Hence it will be evident that, upon the falling of the water level, the descent of the float will cause the lever to open the valve and allow of the escape of the steam, so that all danger of explosion from want of water will be obviated. *Patent abandoned.*

306 J. R. WEBB. *A new or improved method or process and apparatus for obtaining the concentrated extract of hops and for preserving the same from deterioration.* (A communication.) Dated February 4, 1865.

This invention consists in heating the hops inside an air-tight vessel or vessels from which the air is exhausted with steam or water heated to a low degree, with or without the admixture of alkali or alkaline salts, and in subsequently concentrating the watery extract of hops thus obtained by evaporation in vacuo, at the same time mixing therewith a certain proportion of molasses, saccharine matter, or the extracted liquor of grain, which serves to hold in suspension the essential oils of the extract, thereby preserving them from oxidation and fermentation. *Patent completed.*

307 F. ROW. *Improvements in the manufacture of citric and tartaric acids, and in the manufacture and treatment of citrate and tartrate of lime and analogous basic compounds,*

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and in apparatus employed therefor. Dated February 4, 1865.

The patentee claims, first, the separation of the colouring matter from the concentrated lemon juice by dilution with water, as described. Secondly, the removal of the iron held in solution in lemon juice, and solutions of tartar by means of ferro-cyanide of potassium, as set forth. Thirdly, the construction, combination, and arrangement of the apparatus for washing citrate and tartrate of lime or other base, as described. *Patent completed.*

308 J. PARK. *An improvement in clarinets.* Dated February 4, 1865.

This invention consists in the employment of a key which covers the A natural hole, and which is kept raised by its own spring, and is shut by pressing down the thumb of the left hand over the G natural hole, and so that the A natural hole is closed when the fingers and thumb of the left hand are off the instrument. To produce the note A natural the inventor keeps the first finger of the left hand on its proper hole, and raises the thumb of the same hand from off the G natural hole, by which he allows the key covering the A natural hole to open by its own spring. By this means the note A natural is produced, and the fingering is facilitated when this note is required in certain combinations. *Patent abandoned.*

309 S. W. WOOD. *Certain improvements in revolving fire-arms.* Dated February 4, 1865.

We cannot here give space to the details of this invention. *Patent completed.*

310 J. A. PHILLIPS. *Improvements in the purification of lead to be employed for the manufacture of white lead, red lead, and litharge.* Dated February 4, 1865.

The patentee claims, firstly, the purification of desilverised lead, or lead which does not contain an available amount of silver, by adding thereto zinc, and removing the scum or dross rising to the surface. Secondly, the removal of the last traces of zinc from lead so prepared by subjecting it to a high temperature in a furnace, in the bottom of which it forms a bath covered by small coal or other carbonaceous matter. *Patent completed.*

311 F. C. HILLS. *Improvements in effecting the combustion of fuel in the furnaces of steam boilers, and the fireplaces of stoves and of gas in gas burners, and in apparatus connected therewith.* Dated February 4, 1865.

The patentee claims, firstly, the adaptation and application to steam boilers and their furnaces of apparatus for the purpose of heating atmospheric air by means of what is ordinarily waste heat, and introducing such air in a heated state into the closed ashpits of such furnaces in the manner described. Secondly, the construction of stoves in the manner described, for the purpose of effecting the combustion of fuel in the fireplaces thereof by the use of heated air introduced into the closed ashpits of such stoves. Lastly, effecting the combustion of gas by means of heated air, heated and limited in its quantity, as generally described. *Patent completed.*

312 R. S. BAKER. *Improvements in vermin and other traps.* Dated February 4, 1865.

This invention has reference to that class of traps denominated teeth traps, and consists in placing upon the jaws (or those parts of the trapwhich by closing upon each other grasp and secure the animal between them) pads, cushions, or coverings of vulcanised caoutchouc, or any other soft elastic material, whereby the animal is clasped and securely held, but is not torn or lacerated, and, consequently, subjected to unnecessary suffering. *Patent abandoned.*

313 E. HOTTIN. *Certain improvements in rendering uninflammable cotton, silk, and other textile fabrics.* Dated February 4, 1865.

In carrying out this invention the patentee prepares the "hottine" in the following manner:—He makes a solution of phosphate of lime, into which he pours by parts an excess of ammonia to precipitate the phosphoric acid combined with the ammonia; he filters this liquor to separate it from the phosphate of lime, and the liquor is bleached by means of animal charcoal. He causes it to evaporate for one hour to concentrate the solution, and then adds to it 15 per cent. of silicic acid in a gelatinous state; he puts the whole to boil until the solution has evaporated to a suitable consistence to form a crystallised mass, which he causes to dry, and afterwards reduces to powder. He employs gum, starch, and other like substances as a dressing. To apply the new composition to the articles to be rendered fireproof, he forms a solution composed of about 30 parts per 100 of hottine, 35 parts per 100 of gum, and 35 parts per 100 of starch. *Patent completed.*

314 W. CLARK. *An improved combustion pump.* (A communication.) Dated February 4, 1865

This invention is an improvement on that class of pumps or water elevators in which by the combustion of the hydrocarbon liquid a vacuum is produced, whereby the water or other liquid is caused to rise through the suction pipe, and to discharge at the desired point. The invention consists in the use of steam combined with the hydrocarbon liquid in the interior of the reservoir or chamber in which the vacuum is to be produced, in such a manner that by the condensation of the steam the intensity of the vacuum is considerably increased, and the raising or elevating of the water is materially facilitated. *Patent completed.*

315 R. A. BROOMAN. *An improved varnish for preserving wood and for protecting iron ships and other metalwork from oxidation and from fouling.* (A communication.) Dated February 4, 1865.

This invention consists in compounding this protecting varnish of the ingredients, and in or about the proportions following:—Mix 25 parts by weight of galipol, 25 parts by weight of common resin, and 50 parts by weight of essence of turpentine; to 80 parts of this mixture add 18 parts of sulphate of copper reduced to an impalpable powder and 2 parts of regulus of antimony also in the state of impalpable powder. Method of preparing the varnish.—Dissolve the galipol and the resin in a pan or other vessel, and stir the mixture, withdraw the liquid mixture, pour in the essence of turpentine, and stir the whole. Pour this mixture into another vessel, introduce the sulphate of copper and the regulus of antimony, and stir the mass. The varnish is poured into jars, bottles, or other receptacles, and is ready for use. The inventor sometimes substitutes for the turpentine petroleum, benzine, or other mineral and vegetable oils. *Patent completed.*

316 J. L. HANCOCK. *Improvements in cushions for billiard and other like tables.* Dated February 4, 1865.

This invention consists in manufacturing cushions of vulcanised india-rubber by the introduction of a tube or tubular vessel or core formed of previously-vulcanised india-rubber into a mass of india-rubber which is afterwards moulded into the form required for the cushion, and the whole vulcanised. In some cases the inventor introduces a strip of previously-vulcanised india-rubber to form the face or that part of the cushion with which the balls come in contact. Again, in some cases, in lieu of a vulcanised india-rubber tube, he inserts a thin steel tube or tubular spring into the mass of india rubber before being moulded and vulcanised. *Patent abandoned.*

317 A. H. ROBINSON. *Improvements applicable to air cushions, mattresses, portable baths, and other like air-inflated articles.* Dated February 4, 1865.

In constructing a mattress according to this invention, the inventor makes it of a number of tubular chambers, being composed of a series of rings or a coil of india-rubber tubing. One of the air inlets communicates with the tubes, and the other air inlet or inlets communicate with the interior of the chambers. In order to inflate these articles, it is simply necessary to fill with air the tubes and hollow spaces forming the sides of the article, whereupon the expansion of the sides and ends will cause air to rush in and fill the enclosed internal cavity or space by its own pressure, thus making the main portion of the article self-inflating. *Patent abandoned.*

318 R. RICHARDSON. *Improvements in railway chairs, fastenings, and sleepers.* Dated February 4, 1865.

This invention cannot be described without reference to the drawings. *Patent completed.*

319 R. M. ALLOWAY. *Improvements in treating or manufacturing peat for fuel, and in apparatus for the same.* Dated February 4, 1865

We cannot here give space to the details of this invention. *Patent completed.*

320 W. E. NEWTON. *Improvements in the preparation of superphosphate of lime.* (A communication.) Dated February 4, 1865.

The object of this invention is to make a dry superphosphate of lime from guano by adding sulphuric acid in small portions at a time, keeping the batch agitated or stirred with such rapidity as to prevent as much as possible the mass from heating. *Patent completed.*

321 C. R. MARKHAM. *A new method for removing or destroying the momentum of heavy bodies by means of an elastic machine or machines, so as to prevent injury and damage from concussion, applicable to ship cables, ship and fort armour, railway trains, fenders to pier heads and floating piers, gangways, breakwaters, and other similar structures, also as a motive power.* (A communication.) Dated February 6, 1865.

This invention cannot be described without reference to the drawings. *Patent completed.*

322 J. BOOTH. *Improvements in the manufacture of paper hangings.* Dated February 6, 1865.

This invention cannot be described without reference to the drawings. *Patent completed.*

323 E. and T. WILLIAMS. *Improvements applicable to spinning mules and throstles.* Dated February 6, 1865.

The patentees claim the use and application to spinning wheels and throstles of a revolving band, composed of strands of cotton, wool, or other suitable fibrous material, or of an iron, brass, or other suitable metallic rod or hollow tube, by preference covered with fibrous material, mounted in suitable bearings in front of and parallel with the crows, under clearers or gatherers, by preference rather lower than, and about half-an-inch or more from the said crows, under clearers or gatherers, for the purpose described. *Patent completed.*

324 W. H. and F. C. W. LATHAM. *Trimming or cutting the edges of books, magazines, and such like, where the folded parts are to be left uncut, comprised in one machine.* Dated February 6, 1865.

This invention consists of a circular knife fastened in a suitable manner upon a spindle which revolves in two bearings, with a pulley upon the spindle, by which the circular knife may be actuated, either by a pulley driven by a handle, treadle, or in any other manner. At that end of the spindle to which the knife is attached is a movable table sliding at right angles with the axes of the knife. The material to be trimmed or cut is placed on this table with the parts of the edges requiring to be cut overhanging the same. The table slides across the face of the knife, the knife at the same time rotating rapidly; the edges of the paper requiring cutting are cut away in a much more expeditious and regular manner than by the method at present employed. *Patent completed.*

325 R. A. BROOMAN. *Improvements in hairpins.* (A communication.) Dated February 6, 1865.

This invention consists in forming one or both of the legs of hair pins with a spiral twist whereby the pin more effectually retains its position in the hair of the wearer, the spiral, where each leg of the pin is twisted, being, so to speak, around a common central line. *Patent completed.*

326 R. SHAW. *Improvements in window safes for the protection of property.* Dated February 6, 1865.

This invention consists in fixing to the inside of the window frame a framework of iron or steel, or iron and steel with grooves in the sides, and one or two recesses at the top or bottom, and having one or two sliding doors which can be below the floor or above the ceiling, or at the side or sides, when the window is not required to be secured, but brought into the grooves and recess or recesses when the window has to be made fast and secure. *Patent completed.*

327 G. DUNCAN. *Improvements in machinery or apparatus for forming certain parts of metallic casks and drums.* Dated February 6, 1865.

To stiffen and strengthen the ends of metallic casks and drums concentric rings and other devices are embossed or formed thereon. The present inventor attaches on or to the outer end of a hydraulic ram, fixed in framework of the usual kind, a stamp or die, and connects a pipe from a hydraulic pump to the ram, so that, by water pressure, the ram and stamp, or die, may be made to travel forwards and backwards. Opposite the said stamp or die there is a corresponding one kept stationary by strong frame work. By placing a sheet or several sheets of metal between the dies and moving the hydraulic ram and the die thereto attached, the sheets are formed in accordance with the designs on the dies in the matrix between them. *Patent abandoned.*

328 A. STEVEN. *Improvements in hydraulic lifting or hoisting apparatus.* Dated February 6, 1865.

This invention cannot be described without reference to the drawings. *Patent completed.*

329 W. COCKBURN. *Improvements in and connected with jacquard apparatus for weaving.* Dated February 6, 1865.

The patentee claims, first, the weaving of two faced ornamental fabrics, of or similar to the "Paisley shawl" class, by means of jacquard apparatus, the lift board or lift boards of which have different portions of their holes formed with reversed saw-draughts. Secondly, the weaving of two-faced ornamental fabrics of or similar to the Paisley shawl class, by means of double-lift jacquard apparatus combined with two leaves of heddles for the upper-face warps. *Patent completed.*

330 A. A. HULOT. *A new typographic ink.* Dated February 26, 1865.

This improved typographic ink is composed of pure honey and neutral glycerine, mixed with vegetable or mineral colouring matter in certain proportions. *Patent completed.*

331 J. I. WATTS. *Improvements in obtaining motive power.* Dated February 6, 1865.

This invention relates to a peculiar construction and arrangement of machinery or apparatus to be worked by compressed air for the obtainment of motive power, and consists in the employment of two cylinders of equal length and area, the one serving as the working cylinder, and the other as an air compresser, each cylinder being provided with a piston working airtight therein. Between these two cylinders are situate two compressed air reservoirs, which are made to communicate by means of pipes with the top and bottom respectively of the compressing cylinder, and also communicate by means of a slide valve, or other convenient or well-known arrangement of valves, with the two ends of the working cylinder. *Patent abandoned.*

332 C. BEARD. *Improvements in apparatus for ventilating horticultural and other buildings.* Dated February 6, 1865.

For these purposes, in constructing glazed ventilating apparatus for the tops of greenhouses and other buildings, the patentee employs along the ridge or upper angle of the glazed roof, glazed frames which are hinged at their upper ends or parts to the ridge or upper part of the roof. To the glazed frames constituting the ventilating apparatus he applies stretchers or connecting rods, one or more to each; these are pin-jointed at one end to the lower parts of the glazed frames of the ventilating apparatus, and at their other ends to a bar running from end to end of the ventilating apparatus. This bar is connected to rings or slides which slide on uprights or supports fixed at intervals along the greenhouse or building under the ridge or angle of the roof. These rings or slides are connected by rods or otherwise with other rings or slides on the same upright, and these are weighted to counterbalance the frames of the ventilating apparatus. Over the ridge or upper part of the roof, he applies a cap, in order that the rain may be thrown off. *Patent completed.*

333 W. P. WILKINS. *Improvements in mills for grinding wheat and other grain.* Dated February 6, 1865.

We cannot here give space to the details of this invention. *Patent completed.*

334 H. MASTERS. *Improvements in connection with sewing and other machines.* Dated February 7, 1865.

This invention consists in the use of two or more rollers attached to or connected with a peddle or lever, such rollers acting or pressing upon straps, cords, or bands by means of which a spindle may be set in motion, and the velocity ratio may be varied. *Patent completed.*

335 C. HENDERSON. *Improvements in the construction of roadways, pavements, and iron girders, specially applicable for the purpose of constructing roads, pavements, bridges, and all descriptions of buildings.* Dated February 7, 1865.

In carrying out this invention the patentee proposes in the construction of roadways to remove the soil so far as may be necessary, and at suitable distances to build solid footings or dwarf walls in the usual way, and upon these walls or footings he places iron girders of two thicknesses, the lesser thickness being formed to the slope of an arch, the radius being regulated according to the width of the road; the extra thickness he carries down to a small flange, and at the extreme ends of each girder he leaves a given portion of the double thickness the entire depth of the girder. He cuts the inner portion of this extra thickness to form a shoulder to receive hollow or solid iron bars or stretchers passing from girder to girder, these stretchers being regulated in size and strength to the occasion and requirements, and cut on the inner side to an angle suitable to the radius of the proposed arch, and securely fixed by bolts, bands, or otherwise to the girders at each end. Where the distances of the said girders are of any considerable extent, or where greater strength is required, he secures one or more iron tie rods, which pass through the entire thickness of the side stretchers, and on either side secures the same by nuts and screws. Having erected proper cradling to construct an arch of the desired form, he throws an arch across the width of the road, in stone, brick, iron, or other suitable material, abutting upon the stretchers as prepared, and as hereinbefore referred to. When he applies iron for the arch, he perforates the same in various forms, and when he uses stone or other materials he provides openings or inlets in the bars or stretchers for the rain or other moisture to pass from the surface to the main drains. *Patent completed,*

336 H. B. BARLOW. *Improvements in machinery for breaking the stems of and preparing flax, hemp, and other fibrous substances.* (A communication.) Dated February 7, 1865.

This invention consists in an improved combination and arrangement of fluted and toothed rollers between which the flax, hemp, or other fibrous substances, after having been macerated in the usual manner, are passed, in order to break and strip the rind or stem, and separate it from the fibres. The flax, hemp, or other fibrous substances, are first passed between a pair of fluted or grooved rollers, by which the stems are broken; they then pass between a pair of toothed rollers, which have a lateral to-and-fro motion in the direction of their axes, in addition to the rotary motion; the action of these toothed rollers separates the rind or stem from the fibres; the rind or stem falls on the floor, and the fibres which are thus prepared for the subsequent operations are carried forward and deposited in a suitable receptacle. The toothed rollers are made by inserting serrated steel blades in a grooved cylinder, or in any other suitable manner. *Patent completed.*

337 R. BRASSENS and F. A. LE MAT. *Improvements in ships and vessels.* Dated February 7, 1865.

This invention consists in constructing the after part of ships and vessels as hereafter described, also in construct-

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ing ships and vessels with three keels, whereby great stability is ensured. The after part of the ship is constructed to receive two sternposts, each of which is provided with a screw propeller, and carries a rudder worked by one tiller. The central keel extends from the bow and runs aft parallel with the other two keels, which extend from the stem to the two sternposts, and the central keel terminates in the tunnel or arch formed between the two sternposts. *Patent abandoned.*

339 A. I. L. Gordon. *Improvements in candlesticks and candle holders.* Dated February 7, 1865.

This invention consists, principally, in the employment of two circular plates, discs, or blocks, one of which is capable of turning while the other is stationary. One of the plates, discs, or blocks has three (or any other convenient number) slots cut or formed through it in a radial direction, whilst the other plate, disc, or block has a similar number of slots formed through it in a spiral direction. These plates, discs, or blocks are placed one over the other so that one can turn on a central pin attached to the other, and three vertical pins being passed respectively through the slots in both plates, it will be evident that, upon turning one of the plates, discs, or blocks round, the action of the spiral slots will cause the three pins to approach the centre, or recede from it, simultaneously, the pins moving inwards or outwards in the radial slots, according to the direction in which the circular motion is given to the plate, disc, or block which is turned. *Patent completed.*

340 J. Cornes and W. Simpson. *Improved machinery for cutting, sifting, separating, bruising, sacking, and preparing straw and other vegetable fibrous substances to be employed in the manufacture of various kinds of paper, and also for preparing food for cattle.* Dated February 7, 1865.

We cannot here give space to the details of this invention. *Patent abandoned.*

341 C. Kilburn. *Improvements in the construction of life belts, swimming belts, jackets, and buoys, and in the employment and utilisation of certain materials in the manufacture of the same.* Dated February 7, 1865.

In carrying out this invention the inventor takes old corks, by preference old wine corks, and according to the width he requires to make the belt, jacket, or buoy, so he forms a frame in which he lays and compresses the said corks, whether they be whole or in parts. The corks are then united by twine or other material, so that when removed from the frame they retain the form or shape of the same. The corks thus united are then laid or inserted into compartments formed in a belt, jacket, or buoy, made of canvas, or other suitable material, and when so inserted the ends are stitched up. *Patent abandoned.*

342 R. de Bray. *A set of apparatus for gas lighting.* Dated February 7, 1865.

This invention cannot be described without reference to the drawings. *Patent completed.*

343 J. B. Walters. *Improvements in machinery or apparatus for brushing the hair.* Dated February 7, 1865.

This invention cannot be described without reference to the drawings. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated April 8, 1865.

1003 W. E. Gedge, Wellington-street, Strand. An improved application of steam power to locomotion on ordinary roads. (A communication.)

Dated June 30, 1865.

1746 L. Faure, Passages des Petites Ecuries, Paris. Improvements in railway carriages, which improvements are intended to neutralise the destructive effects arising from the collision of trains.

Dated July 21, 1865.

1904 A. Smith, Hackney, engineer. Improvements in sewing machines.

1905 J. H. Chaudet, Rue des Emmurées, Rouen, working chemist. An improved system of manufacturing salts, sulphates, and acetates of chrome, and of applying them as mordants in dyeing and printing textile substances, both animal and vegetable.

Dated July 22, 1865.

1918 W. E. Gedge, Wellington-street, Strand. Improvements in the means of, and apparatus for, raising water for agricultural and other useful and ornamental purposes. (A communication.)

Dated July 26, 1865.

1934 M. Kenny, Herbert-place, Irishtown, Dublin. Improvements in the construction of sliding or rolling bridges.

Dated July 31, 1865.

1978 A. Applegath, Dartford, engineer. Improvements in machinery for printing in colours.

Dated August 2, 1865.

2000 J. Pickin and R. Bailey, Congleton, Cheshire. An improved method of, and apparatus for, signalling and giving alarm on railways.

2001 H. Frankenburg, Snow-hill, City, leather bag manufacturer. Improvements in the construction of travelling and other bags.

Dated August 3, 1865.

2009 E. S. Horridge, Cheltenham. Improvements in signals for railways.

2011 W. H. Brookes, Rock Ferry, Cheshire, musical instrument maker. Improvements in the means of fastening or securing the tongues or reeds of fog horns.

2013 W. Morgans, Brendon-hills, Somersetshire, engineer. Improvements in coke ovens and in the manufacture of coke.

2015 E. L. Ransome, Ipswich. Improvements in paints or preparations for coating surfaces.

2017 L. Anderson, Newtown, Worcestershire, engineer. Improvements in machinery to be used in the manufacture of horseshoes, shoe heel and toe tips, and other similar articles.

Dated August 4, 1865.

2019 P. Robertson, Jeffrey square, St. Mary Axe. Improvements in brewing and distilling, also in drying yeast, and in the apparatus employed.

2021 W. Clark, Chancery-lane, engineer. Improvements in apparatus applicable as a motive power engine, a pump, or fluid engine. (A communication.)

2023 J. A. Leon, Liverpool, and G. Tessimond and J. Kissack, engineers and ironfounders, Liverpool. Improvements in apparatus for filtering sugar and other liquid solutions.

2025 F. G. Mullholland, Swan-street, Dover-road, civil and mechanical engineer. Improvements in the mode or method of preparing materials for, and in the manufacture of, submarine telegraph cables, the same being generally applicable for other purposes.

2027 H. A. Bonneville, Porchester-terrace, Bayswater. Improvements in revolver pistols. (A communication.)

2031 A. V. Newton, Chancery-lane, mechanical draftsman. An improvement in gun wipers. (A communication.)

2033 G. B. Woodruffe, Cheapside, mechanical engineer. Improvements in the construction of binders for sewing machines.

Dated August 5, 1865.

2035 S. Buxton, Leeds. An improved numerical registering machine.

2037 T. Smith and J. Brook, Rodley, near Leeds. A self-acting coupling for railway carriages and waggons.

2041 C. H. Simpson, Bexhill, Sussex, Com. R.N. Improvements in apparatus for sustaining and lowering ships' boats.

Dated August 7, 1865.

2045 J. Mead, Abridge, Essex. Improved means or apparatus for retarding or stopping railway carriages and trains.

2047 L. J. Crossley, Halifax, carpet manufacturer. Improvements in electric telegraphic apparatus. (A communication.)

2049 A. V. Newton, Chancery-lane, mechanical draftsman. An improved mode of, and apparatus for, facilitating the transportation and delivery of letters, newspapers, and other freight. (A communication.)

2051 M. P. W. Boulton, Tew Park, Oxfordshire. Improvements in generating steam, and in heating steam and aëriform liquids.

Dated August 8, 1865.

2053 J. Buchanan, jun., chemist, Barrhead, Renfrewshire, and R. Boyd, calico printer, Glasgow. Improvements in printing and dyeing yarns and fabrics of cotton or other vegetable materials.

2055 T. G. Messenger, High-street, Loughborough, Leicester, hydraulic engineer. A new portable machine or apparatus for the cutting of screw threads on pipes or on solid materials, and for the cutting of pipes asunder.

2057 J. Gale, jun., Devonshire-terrace, Plymouth, electrician. Improvements in preparing and treating gunpowder in order to render the same inexplosive, and to protect it from damp.

Dated August 9, 1865.

2061 T. R. Shaw, Peadleton, Lancashire, manager. Certain improvements in looms for weaving.

2063 S. and J. Law, Wolverhampton, gun makers. Improvements in breech-loading fire-arms.

2067 B. Russ and E. Gandell, jun., Lambeth. Improvements in the construction of sewing machines, particularly adapted for sewing sacks and bags.

2069 J. W. Longstaff, Stratford, engine fitter. An improved mode of relieving slide valves of back pressure.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

Dated August 14, 1865.

2098 W. Bünger, Southampton-buildings, Chancery-lane, civil engineer. Apparatus or means for ascertaining the quality and condition of grain and seed. (A communication.)

LIST OF SEALED PATENTS.

Sealed August 18, 1865.

484 C. Baulch	511 S. Savill
493 J. Hulley	523 S. W. Worssam
494 J. Dodgeon, J. Gaukroger, and W. Shackleton	526 J. Hundy
	529 J. Badcock
498 J. Carter	534 F. Claudet
499 G. N. Shore	569 J. B. Toussaint
500 J. Nicholas	657 R. Mushet
501 M. P. W. Boulton	658 E. Carchon
502 D. Barr	1318 G. Haseltine
510 J. G. Hughes	1422 C. T. Müller
516 J. Jacob and R. Pilzinger	1499 W. E. Newton
	1595 G. Haseltine
	1609 A. E. Brae

Sealed August 22, 1865.

504 G. Sinclair	543 M. B. Nairn
518 C. W. Lancaster	551 R. Barclay
524 J. Shortridge	559 J. M. Hart
525 C. J. Rowe	569 T. S. Hall
531 E. P. H. Gonlounin	581 J. Park
532 T. Routledge and T. Richardson	663 W. J. Dorning
	690 T. and H. W. Whitehead
533 J. H. Rawlins and J. Chappell	692 E. B. Wilson
537 J. Askew	708 F. A. Braendlin
541 R. Smyth	736 J. Ramsbottom
542 C. Whiting	1282 R. H. Tweddell
550 T. W. Roys and G. A. Lilliendahl	1631 J. H. Johnson
	1677 W. E. Newton

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the *London Gazette*, August 22, 1865.

994 J. Brown. Nail.

1002 W. E. Gedge. Steam locomotion on roads. (A communication.)

1011 A. G. Hunter. Soda.

1026 D. Payne. Printing machine.

1038 J. Haworth. Rotating brushes.

1041 F. P. Warren. Cooking utensil.

1042 H. Sikes and G. Jarmain. Wool.

1044 G. A. Montenat. Spreading liquids.

1047 F. Bapty and E. B. Sayers. Guide.

1049 J. S. Bickford. Safety fuse.

1053 G. Roselet. Water as a motive power.

1063 T. Bennett. Narrow strip iron.

1070 M. Smith. Looms.

1074 L. de St. Céran. Gas ammoniacal engine.

1075 E. and G. H. Morgan. Covering railway trucks.

1077 A. W. Hale. Mincing meat.

1079 F. C. Bakewell. Cushions. (A communication.)

1083 W. Bedder. Ships.

1085 J. Gardner, R. Lee, G. H. Wain, and S., C., and S. Hargrove. Iron sheaves.

1086 J. F. H. Audrew. Looms.

1099 M. Houssepian. Pumps. (A communication.)

1103 W. Hale. Rockets.

1108 J. Y. Botts. Baking bread.

1157 W. Elder. Steering ships.

1161 W. Clark. Soluble superphosphates of lime. (A communication.)

1186 D. Simpson. Furnaces.

1227 F. Wise. Obtaining decoctions. (A communication.)

1411 E. M'Nally. Screws.

1412 H. Wilde. Electricity.

1554 A. C. Henderson. Tanning hides. (A communication.)

1570 H. B. Fox. Necks of bottles.

1620 W. A. Little. Power of steam.

1836 M. H. Keene. Traction engines. (A communication.)

1670 T. W. Wood. Sluices or dams.

1874 J. E. F. Lüdeke. Motive power.

1941 A. V. Newton. Sewing machinery. (A communication.)

1958 W. E. Newton. Water meter. (A communication.)

1962 F. A. Abel. Insulating.

The full titles of the patents in the above list can be ascertained by referring back to their numbers in the list of provisional protections previously published.

Opposition can be entered to the granting of a patent to any of the parties in the above list who have given notice of their intention to proceed, within twenty-one days from the date of the *Gazette* in which the notice appears, by leaving at the Commissioners' office particulars in writing of the objection to the application.

PATENTS ON WHICH THE STAMP DUTY OF £10 HAS BEEN PAID.

2305 J. H. Johnson	2327 W. Whittle
2307 H. Garside	2344 W. Barrett
2326 J. G. Tongue	2357 M. K. Angelo
2331 J. Standish and J. Gooden	2393 J. Davis

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending August 19, 1865.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
	s. d.		s. d.		s. d.		s. d.		s. d.		s. d.
2357	0 8	2367	0 4	2377	0 6	2386	0 8	2395	0 10	2404	0 8
2358	0 4	2368	0 8	2378	0 4	2387	0 4	2398	0 10	2405	0 4
2359	0 4	2369	0 6	2379	0 8	2388	0 8	2397	0 8	2406	0 8
2360	0 4	2370	0 6	2380	1 2	2389	0 4	2398	1 4	2407	0 4
2361	0 8	2371	0 4	2381	0 6	2390	0 4	2399	0 10	2408	0 4
2362	0 8	2372	0 4	2382	0 4	2391	0 8	2400	0 8	2409	0 4
2363	0 8	2373	0 10	2383	0 8	2392	0 4	2401	0 4	2410	0 10
2364	0 8	2374	0 10	2384	1 0	2393	0 4	2402	0 4	2411	0 4
2365	0 4	2375	0 8	2385	0 8	2394	0 4	2403	0 4	2412	0 4
2366	1 10	2376	1 4								

Notes.—Specifications will be forwarded by post from the Great Seal Patent Office (publishing department) on receipt of the amount of price and postage. Sums exceeding 5s. must be remitted by Post Office Order, made payable at the Post Office, High Holborn, to Mr. Bennett Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

Timber, duty 1s. per load, drawback 1s.

Teak - - load	£12 0	£13 10	Archangel, yellow -	£11	10	£14	10
Quebec, red pine -	3 10	4 15	St. Petersburg, do. -	11	0	13	0
,, yellow pine -	2 15	3 15	Finland - - -	8	0	10	12
St. John, N.B., yellow	0 0	0 0	Memel - - -	10	0	12	0
Quebec oak, white -	5 5	6 0	Gothenburg, yellow	10	0	11	0
,, birch -	3 10	4 10	,, white	9	0	9	10
,, elm -	3 10	5 0	Gefle, yellow -	10	10	11	10
Dantzic oak -	5 5	6 0	Soderhamn -	9	10	11	0
,, fir -	2 15	3 10	Christiania, per C., 1st, by 3 by 9 in.				
Memel fir -	3 10	4 0	,, yard - -	16	0	23	0
Riga - - -	3 5	3 10	Deal fank, Dantzic, 9 to 40 fr. 3 in. -	0	14	1	8
Swedish - -	2 10	2 15	Petersburg, 9 to 40 fr. 3 in. -	0	14	1	8
Masts, Quebec red pine	6 10	8 10	Pontick Stone per ton	5	0	6	0
,, yellow pine	5 0	6 0	Oils, &c.				
Lathwood, Dantzic, fm	7 10	8 0	Seal, pale - per tun	39	0	40	0
,, St. Petersburg	8 10	9 10	Sperm, body - -	90	0	0	0
Deals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 2s.			Cod - - -	47	0	0	0
			Whale, S. fish, pale	41	0	43	0
Quebec, white spruce	14 0	18 0	Olive, Gallipoli -	53	0	54	0
St. John, ,,	13 0	15 0	Cocoanut, Ceylon -	44	10	45	0
Yellow pine, per reduced C.			Palm, fine - -	37	0	37	10
Canada, 1st quality -	18 0	20 0	Linseed - - -	31	15	32	0
,, 2nd ,, -	13 0	14 10	Rapeseed, Eng. pale	45	0	47	10
			Cottonseed - -	26	10	28	0

Metals.

Iron:—

		£	s.	d.		£	s.	d.	per
Welsh Bars, in London	per ton	7	15	0	to	8	0	0	2½
Nail Rods - - - -	do	8	15	0		0	0	0	
Hoops - - - -	do	9	15	0		0	0	0	
Sheets, single - - -	do	10	10	0		10	15	0	
Staffordshire Bars - -	do	8	10	0		8	15	0	
Bars, in Wales - - -	do	7	15	0		7	5	0	
Rails - - - - -	do	7	0	0		7	5	0	nett
Foundry Pigs, at Glasg., No 1	do	2	15	0		0	0	0	nett
Swedish Bars - - -	do	11	15	0		12	0	0	0

Steel.—

Swedish Keg, hammered -	do	15	0	0		0	0
Swedish Faggot - -	do	16	0	0		0	0

Copper:—

Sheet & Sheathing, & Bolts	per ton	91	0	0		0	0
Hammered Bottoms - -	do	101	0	0		0	0
Flat Bottoms, not Hamrd -	do	95	0	0		0	0
Cake and Tough Ingot -	do	85	0	0		86	0
Best Selected - - -	do	87	0	0		88	0
Fine Foreign Copper - -	do	93	0	0		0	0
Yel. Metal Sheathing & Rods	per lb.	0	0	7½		0	0

Lead:—

Pig, English - - -	per ton	19	0	0		19	5
,, Spanish - - -	do	18	15	0		0	0
Shot, Patent - - -	do	24	10	0		0	0
Sheet - - - - -	do	20	0	0		21	5
White - - - - -	do	26	0	0		0	0

Spelter:—

On the spot - - -	do.	22	5	0		0	0

Zinc:—

English Sheet - -	do	27	12	0		28	0
Quicksilver - -	per btl.	7	18	6		8	0

FRENCH & SMITH, Sworn Brokers
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THE

MECHANICS' MAGAZINE.

LONDON: FRIDAY, SEPTEMBER 1, 1865.

THE INDIAN TELEGRAPH.

PUBLIC indignation has recently been excited and a great outcry raised at the loose and inefficient manner in which telegraphic communication with India is conducted. The grievous disappointments and annoyances which are constantly arising have been laid to the account of Turkish mal-administration, and hitherto with considerable show of reason. But recent disclosures abroad throw a new light upon the subject, and open up some facts which show that whatever amount of blame may attach to the Turkish and other Governments, they do not stand alone in the matter, nor are perhaps so seriously to be blamed as our own Government. However much we at home may reproach other States for the mutilated, tardy, and useless manner in which the majority of messages arrive, there is reason to believe that abroad an equal, if not a greater amount of obloquy attaches to the manner in which the business is carried on in our own territory. The report of the Kurrachee Chamber of Commerce, presented in June last, animadverts strongly upon the virtual failure of the Indo-European Telegraph line through the mismanagement that characterises every part of it, and especially the lamentable and utter inefficiency of that portion situated between Kurrachee and Bombay. It is an absolute fact that it often takes longer for a telegram to travel between Kurrachee and Bombay than it does to come to London, and mutilations, and even total loss of messages, are looked upon as common occurrences. But what the commercial eye of the chamber gazes upon with the utmost suspicion and distrust is the fact that when intimation of the crisis in the cotton market was first received at Galle, then occurred the graver delays. Kurrachee, in point of fact, appears to be the *pons asinorum* of telegraphic despatches, for, whether outward or inward, when once they arrive there, there they stop, generally for a long time, often altogether. Mr. Mansfield, the commissioner in Scinde, has addressed the Government of Bombay upon the subject, and his observations certainly tend to the conclusion that, if fault is to be found with the Turkish administration, that of the Indian Government is even more reprehensible.

We may form a tolerably correct idea of what the contingencies must be with a system so radically defective as the one in question from the showing of Mr. Mansfield. A number of startling facts are disclosed from which it appears that between Kurrachee and Bombay there is but a single wire, which is the one put up some six years since, at the time of the construction of the telegraph, and this notwithstanding the opening of the Anglo-Indian (Persian Gulf) line. The detention of messages at Kurrachee, too, is a growing evil, for in May last there were numerous occasions on which messages were detained in that office from thirty to sixty hours before being sent on to the first repeating station on the Bombay line. By the Persian Gulf line between Fao and Kurrachee, 1,189 miles, the longest time occupied in transmitting a message is two hours, whilst the average time between Kurrachee and Bombay is two days. Previously to the opening of the Gulf line there were more signallers on the Indian line than there are at the present time. In fact, so utterly inadequate is the establishment to public requirement, and so inefficient for carrying on its own business, that at some stations two and even three instruments are under the charge of one operator, he having to attend to them for eight and even twelve hours at a time. Now the result of this is of course an accumulation of arrears, and so we find that on one particular day there were no less than 200 messages from Europe awaiting onward transmission. The number of messages sent in one month to and from India through the Kurrachee office was 2,104, the average price of these being £7 10s. each, making a total earning of £15,780. Taking these facts as they stand, they afford abundant proof that this department reflects serious discredit on its administrators. Not only is there an unpardonable amount of inefficiency manifested, but the experience of every India merchant goes directly to prove that beyond this there is corruption and chicanery among the subordinate officers employed. Against such a system, individuals have long and loudly remonstrated, but such a course appears futile, and it is high time active steps were taken in another direction.

The course that naturally suggests itself under such circumstances is the formation of an independent and better system through the agency of a public company constituted for the purpose. But Mr. Crawford, one of our leading India merchants, tells us that this line of action is closed to the public, and they are prevented taking the law into their own hands, however desirable, or even necessary, such a course may be. It appears that for some time past the railway companies have been allowed to convey public messages, but having no connecting lines between them, and no means of forwarding messages beyond their own stations, no great amount of benefit has been derived from them by the public. A project for establishing independent communication was set on foot not very long since by several gentlemen connected with practical telegraphy, who commenced the formation of a company for the purpose. The railway companies whose lines offered the best route for the telegraph were communicated with and came to the unanimous conclusion that the business of public telegraphy was so distinct from their own that it would be right to afford assistance to a responsible and well-regulated telegraph company formed for the purpose of supplying a public want. The subject was well discussed, and when the scheme was matured mutually satisfactory arrangements were entered into both by the railway companies and the Oriental Telegraph Company, for so was it named. These terms were, as a matter of course, submitted by the railway companies to the Secretary of State for India, and in September last the companies were informed of that functionary's conclusion, which was to the effect that it was not desirable to let the railway companies' public telegraph business to a separate company. Hence the reason why the public do not take the law into their own hands, and, following examples elsewhere, establish a better system than that which they abominate and yet must of necessity patronise. The decision arrived at by the Secretary of State is just one of those unaccountable things which it is not given to ordinary mortals to understand. The only key to it is that the Government is either indisposed to keep pace with the requirements of the public, or it determines to maintain its control over the Indian telegraphs. The whole question therefore remains in abeyance, but the public will not rest quiet under the infliction of such a palpable and grievous wrong. There is still a course open for those whose interests require the establishment of an efficient telegraphic system to and in India, and who have been the victims of a mistaken policy on the part of the Government of India. They can put that policy to the proof by having the whole principle investigated before a Parliamentary committee, and this course we trust to see pursued.

SURFACE CONDENSERS.

TO condense steam effectually is to reduce its temperature to a freezing point. This, however, is impracticable with marine engines, and to attain a continual vacuum of 14lb. on the square inch is hailed as an event worthy of record in the annals of engineering. Surface condensation was in vogue some time back; at its outset it met with many enemies, who to a certain extent prevailed for a time. Latterly, however, the system has been revived and has met with general favour. In our steam vessels space is of the greatest importance; therefore, for surface condensers the superficial tubular area must be considered; a certain proportion must also be maintained in relation to the quantity of steam passing from the cylinders. To attain the correct amount of cooling surface required, three important facts must be considered—the heating surface of the boiler, the grade of expansion in the cylinder, and the temperature of the circulating water used. Other important desiderata also enter into the question, viz., correct arrangement of the tubes, and the disposition of the steam and water. Surface condensers as at present arranged may be said to be of two classes, those having external and those with internal cooling surfaces. We will first describe the most modern arrangements in practice, and then consider their relative merits. The tubes in one arrangement are disposed longitudinally of the hull in four separate sets, two sets over each other. The steam enters the condenser at right angles with the tubes at the top of the compartment. On the steam coming in contact with the upper external portion of the tubes, partial condensation ensues, and the vapour forming into a liquid passes through or amongst the lower set of tubes; hence, total condensation is attained in due course. The pumps for the circulating water and condensed steam are situated below the tubes in separate compartments. One end of each pump is used for the forcing of the circulating water, and the other end for the discharge of the condensed steam. In order to obtain a correct circulation of the water, the discharge chamber above the valves terminates on a level with the top of the first set of tubes. It is obvious that, on the water passing through the first set in one direction, a contrary action ensues through the upper set, and thus the tubes are continually filled with a certainty, a matter of importance in external surface condensation. The circulating water in the present case enters the supply chamber below the pump at the back end. The suction and delivery valves are under and over the pump at the side of the same. The valves for the condensed steam are opposite to those last alluded to, or at the back end of the condenser. The suction valves are inverted over the pump, and those for the discharge on the same level but reverse in action.

Our second example is arranged as follows:—The tubes are located in one set, transversely of the hull; the steam enters the compartment at the top. A separate pump is used for draining the condenser or the discharge of the condensed steam. The suction valves are inserted in the bottom of the chamber, and those for the delivery beyond, on the same level. The air pump is situated below the valves, at or near the bottom of the entire arrangement; the circulating water is forced by a centrifugal pump through the tubes, entering at the front end and passing direct to the back; it may be added that the water is forced from the bottom and discharged at the top, thus enabling a certain amount of compression to be available. Access in this case is attained at the front and back ends for the purpose of cleansing and renewal of the tubes, while in the former example the doors are at the sides and ends for the same purpose. It will be observed that in the latter example the air pumps are double-acting. A third arrangement is where the tubes are perpendicularly secured in the chamber. The principle of the pump is the same as in the first example, one end being for the circulating purpose, and the other for the discharge of the condensed steam. The tubes are located in two separate sets. The circulating water enters

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the supply chamber under the pump at the back end, the suction valves are under the barrel, and those for the delivery above the former, at the side of the pump. Air valves are introduced above the pump to ensure a good vacuum. The water is forced up through the first set of tubes, and down through the second set, a final discharge being under the same. It may be here argued that the gravity of the water would tend to prevent the last set of tubes from being as full as the first, but this is counteracted by the position of the discharge valve at the side of the hull being above the top of the condenser. By this arrangement, the action of the water passing through the last set of tubes assists that of the pump, while the compression is maintained. The valves for the purpose of discharging the condensed steam are suitably arranged at the side and back end of the pump.—Those for the suction are inverted in the bottom of the tube compartment for the entire length of the same; the discharge valves are situated beyond the pump barrel and the tube compartment, in order to retain a free access for repair or renewal. The access available for cleansing the tubes is by doors on the top and ends of the condenser. The condensed steam enters the compartment at the front end, sufficient space being allowed for a perfect distribution. The three examples to which we have alluded bear reference to external surface for condensation, the steam surrounding the tubes; when this arrangement is adopted, the tubes should be perpendicularly located rather than horizontally. The tallow used in the cylinder for lubrication passes with the steam into the condenser, and when the tubes are placed horizontally, a sediment accumulates on the upper periphery of each tube, more or less, according to the distribution of the same. The amount of this sediment cannot be detected or removed without disturbing the larger portion of the tubes. Another reason in favour of the perpendicular arrangement is, that the action of the water will to a certain extent prevent the tubes from choking, particularly when a return action is maintained.

With reference to the repairing facilities in the perpendicular and horizontal types, the lengths of the tubes adopted must first be noticed. With the perpendicular arrangement, the vertical distance between the tube plate and the under side of the deck must exceed the length of the tube in order to withdraw the same. For vessels of light draught or shallow depths, the horizontal system is, therefore, generally adopted. The position of the tubes in the hull, whether longitudinally or transversely arranged, demands consideration in connection with the space allotted for the coal bunkers. When the beam of the vessel is sufficient, the transverse position for the tubes should be adopted in preference to that at right angles to it. The arrangement of the pumps for surface condensers is subject to the means adopted as prime movers. Should motion be attained from the piston, horizontal action is imperative with screw engines, to which class our examples all relate. At the end of the description of the second example we alluded to the circumstance of a double-acting pump being adopted. This should be imperative, if practical, as in all cases a double-acting pump will produce a better vacuum than that of the single kind, to say nothing of the difference in the material required and the space occupied.

The second method of condensing is that where the steam enters the tubes and the water surrounds them. Condensers of this class are not much varied in arrangement, owing to the fact that a more direct action is maintained both for the steam and the water. Our remarks apply to two arrangements, perpendicular and horizontal. When the former is adopted the steam enters the space over the tube plate at the front end, and in some cases at the top. The air pumps and valves are located below the tubes, so as to effectually drain them, assisted of course by the gravity of the water or condensed steam. The circulating water is forced amongst the tubes at the bottom of the compartment, and discharged at the top; the pumps in each case being double-acting, and located horizontally. The tubes when horizontally arranged are located transversely of the hull of the ship. In order to ensure a perfect drainage the tubes are inclined from the front end to the side of the hull. The steam enters the tubes at the front end, passing to the back direct. The pumps are similar to those last alluded to, and alike in principle and action. We have expressed an opinion upon the arrangement of the tubes for given purposes, for external surface condensers. The same holds good for that of the internal kind.

With reference to condensation, further remarks will not be out of place. Let it be assumed that two condensers are arranged alike as to the position of the tubes; the internal and external surfaces, however, are to be operated on by the steam. The impurity of the water in each case is presumed to be the same, so that the chemical action of the steam is alike in both cases, and of course the sediment in either case will be equal. Now it is obvious that the most simple and available means for cleansing should be adopted. It must be remembered that in the one case the steam enters the tubes, while in the other it surrounds them, but the action of condensation is alike in both. Let a vertical position for the tubes be agreed on, it will be found that in each case the sediment collected will be alike in quantity inside and around the tubes, and on the plates, but with this difference of location. In the case of internal condensation the sediment collects mostly on the top plate, while for external condensation the bottom plate receives the most. Next, as to the removal of the sediment. With internal condensation access to the tubes and plates is available without disturbing them; but with external contact the sediment collects inside the plates and outside the tubes; hence both must be disconnected for cleansing. We have thus far proved that, with reference to the steam sediment, internal contact is better than external condensation, cleansing being considered. The sediment from the circulating water depends on its nature and purity. Care should always be taken to strain the water before it enters the pump, although the power thereby will be increased owing to the friction being lessened. Another reason for preferring internal condensation is that the chemical action of the steam does not affect the tube at the lower end. When the tube plate collects the main portion of the sediment from the steam, a corrosion of the tube ensues at the plate, to a greater extent than at any other portion, due of course to the increase or accumulation of sediment at that part. Remedies in profusion have been proposed for protecting the tube, but it should be remembered that to ferrule the tube is to injure its conducting powers, and so to affect condensation. It should not be forgotten either that the tube plate is to a certain extent a condensing surface not unworthy of notice, and therefore requiring attention as much as the tube. Surface condensers as at present arranged in some instances are fitted with injection pipes and valves, so that, in the event of a fracture or entire corrosion of a tube, the ordinary mode is adopted without stoppage to any extent. Much could be said in relation to the many plans for securing the tubes. In fact, the best method of securing the metals of a railway, and the tubes in the plates of condensers, are alike matters involving similar amounts of varied opinion. We prefer wooden hollow plugs to any other system of fixing. For a good connection affording ready means of renewal, the nut and india-rubber washer is as simple as any.

NOTICES OF BOOKS.

ALREADY have railway engineers commenced revolving in their minds, or sketching on their Ordnance Surveys, schemes of railway innovation for deposit for Session 1865-6. Soon the ideas will have ripened somewhat, and then will come the distribution of surveyors and levellers throughout the length and breadth of the land. Be sure that no spot of country unmarked by a railway track will long remain so, if Great George-street can help it. Wherever the oracle says a railway is required, there it *must* be required whether it is wanted or not. And it generally turns out somehow or other that railways ultimately prove at least useful. Only commence a railway from an inhabited part, and no matter that it terminates in the centre of a desert, habitations will soon spring up along its course, and its desolate terminus rapidly become the centre of a populous city. The satisfaction of one want but creates another, and so the construction of one railway only opens up a necessity for many more. But now that the country is tolerably well intersected by main lines, it is really worth while pausing to consider how the general interests may be served by the construction of what are termed second-class branch railways. And this is a point which ought to receive the careful attention of engineers ere they plunge headlong into the old beaten track of main lines with all their costly appurtenances. The idea of constructing cheap branch railways has been carefully thought over by Mr. David Jones, the engineer of the Rumney Railway, and his notions have been embodied in a very readable pamphlet.* There can be no doubt that cheaply-made branch railways would prove a source of considerable advantage to the proprietors of main lines. The influx of additional traffic brought upon existing railways by the proposed branches would benefit the former very considerably, without any outlay or trouble on their part. Landowners, too, would come in for their share of profit, for in many instances all their land for miles around would soon double its value. That the districts served by such schemes would be materially advantaged, needs no demonstration, the fact is too patent; universal experience testifies to the benefits which accrue to any neighbourhood served, even approximately, by a railway.

But the parties who would be mainly interested in the construction of branch railways are of course the shareholders, and their remuneration, therefore, becomes a question of the first importance. That such railways can be made highly remunerative is certain, provided due economy in construction, working, and maintenance is exercised. To this end Mr. Jones proposes that these lines should, in the first place, be constructed in a totally different manner from ordinary main lines. The heavy expenses incurred in crossing under or over public and other roads may be avoided by level crossings, which need not be the cause of accident, as the trains would travel at slow speeds. Besides the saving of expense to the shareholders, the public would gain, inasmuch as the lines would prove far more accessible than at present, both for passengers and goods. In establishing communication with existing roads, too, the heavy items of land for approaches, and the making them, would be omitted in the estimates. The railway need only be constructed for a single line of way, and the strength can be considerably reduced upon that of main lines, light engines with slow speeds only being requisite. Smaller curves would also be admissible; the minimum limit of twenty chains radius observed on main lines can here be reduced to ten or even eight chains with safety. Further, instead of about thirteen acres per mile of land being required for approaches, &c., as on main lines, only five acres per mile would be found necessary. The estimated cost per mile of these branch or second-class railways is put at £4,000, including stations, lodges at level crossings, signals, lamps, &c., complete. The estimate is based on a very fair schedule of prices as

* "An Illustration of the Benefits derivable from the Making of Second-class Branch Railways." By DAVID JONES, C.E. London: F. Farrah, 282, Strand, 1865.

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regards the *matériel* of the railway, but it may be questioned whether £150 per mile will cover engineering expenses, or whether directors, secretary, and lawyers will be content to divide another £150 per mile. To prevent the expenditure usually incurred in the purchase of lands, Mr. Jones recommends a plan suggested by Mr. Edmund Sharpe in a letter to Lord Stanley, when President of the Board of Trade, and which consists in obtaining legal permanent possession of the land for the purpose of the line without actual purchase by payment. In carrying out such schemes the sympathies of the landowners must be enlisted, and the prospective benefits of the system would prove a strong inducement to this class to lend a helping hand. Of course, a special act of Parliament would be necessary to carry out these schemes, but in the present day this ought to involve no serious difficulty. With the facilities such an act, properly constructed, would afford, and with the 5 per cent. return, which Mr. Jones clearly demonstrates to be obtainable, there is no reason why second-class branch railways should not rapidly take a position of very widely-diffused usefulness.

Another work of a practically useful character to engineers and railway companies has reached us at a seasonable time; it bears very materially too on the question we have just discussed. Mr. Charles Wordsworth, Q.C., has annotated the Railways Construction Facilities Act* of 1864, and has incorporated with it abstracts of nineteen general statutes. The act in question is of a very important character, inasmuch as it delegates what have hitherto been deemed legislative powers to a Government department, subject only to an active, not a silent, veto of Parliament. In the next place, under its provisions, by means of a certificate granted by the Board of Trade the entire works of a railway may be constructed without the necessity of obtaining a special act. This certificate secures all the powers usually granted by an act, but the entire concurrence of all parties concerned in the matter is the basis upon which the whole proceeding is carried out. Under this act the method of procedure is as follows:—The promoters of a railway memorialise the Board of Trade, sending in at the same time a draft of the certificate containing the provisions deemed necessary, together with an estimate of the cost of the proposed works. It is also required that plans and books of reference—similarly prepared to those for application to Parliament for a bill—should be lodged at the same time as the memorial. These documents are also to be deposited with Clerks of the Peace and others as heretofore. The only notice required is an advertisement that application has been made for a certificate, no personal notices being necessary, except in the instance of road trustees. If an existing railway or canal will be affected in any way by the proposed undertaking, the proprietors may be heard in opposition to the certificate. The Board of Trade cannot then proceed on the application of the promoters, who are thus left to the alternative of an application to Parliament. If opposition has been offered and has failed, or if even no opposition has appeared, the Board of Trade are required to carefully consider and inquire into any representations made to them as affecting the scheme. If the Board considers for any reason that an application should not be complied with, it can refuse to settle a draft certificate, the act not rendering acquiescence in the promoters' wishes obligatory with the Board. Of course all contracts for land become inoperative if no draft certificate is settled, the measure only proceeding, as already observed, upon the entire concurrence of all parties.

Assuming no oppposition to have been offered, and that the Board resolves to comply with the application, a draft certificate is settled, in which are inserted such provisions as may be deemed necessary for effectuating the purposes of the certificate, which is then laid before Parliament. At this stage, by a resolution of either house, the certificate can be stopped, when all contracts cease to be binding. This parliamentary veto is an active one, for, according to the act, "if neither house thinks fit to resolve that the certificate ought not to be made," the Board may issue a certificate in conformity with such draft, and, as the statute in several places states, the certificate is deemed to be a special act of Parliament. The next step is the deposit, and in order to secure the construction of the railway the act requires the promoters of the scheme to pay into the Court of Chancery a deposit of 8 per cent. on the estimate before the certificate is granted. If the railway is not finished and opened for traffic within a prescribed time the deposit becomes forfeited, unless it is proved that one-half the company's capital had been paid up and that they had expended a like amount for the purpose of the certificate, or unless a bond has been given to the Treasury in double the amount of deposit to complete the line, or afford the above proof. Such, in outline, is the Railways Construction Facilities Act, an act, as will be perceived, of considerable importance to all interested in the promotion of railway schemes, and one which must have a beneficial influence upon the financial position of such schemes as can be brought within the scope of its powers. The edition of the statute before us is rendered of still further utility by the addition of the 27th and 28th Vict., c. 120, an act for facilitating the obtaining of further powers by railway companies. This act applies, firstly, in cases where a railway company desires to enter into an agreement with some other railway company with respect to maintenance, management, working, running powers, tolls, revenues, &c. Secondly, it applies where a railway company desires to obtain an extension of the time for the sale of superfluous lands; and thirdly, where powers are sought for raising additional capital. On the whole this excellent little work of Mr. Wordsworth's embodies a statute and commentary, which latter must prove invaluable to all engaged in the promotion of railways.

The next work to be noticed addresses itself peculiarly to engineers and surveyors, and here we still keep railways in view. The want of a complete set of earthwork tables has long been felt. From the over-condensed character of Mr. Bidder's tables, they are to a certain extent useless. Their compactness was certainly a recommendation, and their utility may be inferred from the fact that of late it became difficult to obtain a copy, although, on the other hand, this very difficulty might be construed into an evidence that there was not a sufficient demand to justify their reproduction. But the fault of Mr. Bidder's tables is absent from Sir John M'Neill's, yet here the other extreme is met with, and from their unwieldy expansion Sir John's tables are somewhat unsatisfactory. Now to hit the happy medium between these two extremes, is to meet all views, and we think this has been effected in a highly satisfactory manner by Mr. David Cunningham in his earthwork tables.* He felt the want of a set of tables possessing compactness without too great compression of matter, and completeness without unwieldy expansion. Setting himself to work he has succeeded in producing this desideratum, and a most creditable production it is. The tables start with a base 6ft. wide, and advance by successive increments of 1ft. up to 36ft. of base. An advance is then made to 38ft., 40ft., and 45ft., terminating with 50ft. In each of the tables the four slopes in most general use—viz., ¼ to 1, 1 to 1, 1½ to 1, and 2 to 1—have respectively two columns, and they are arranged in a manner which will be found most convenient in everyday practice. Almost all the tables are calculated to a depth of 60ft. with intervals of 3in. for the thirteen bases in general use. Supplementary tables are added, which are chiefly intended to supply intermediate slopes omitted from the table of bases, but which may be used in other ways. A table is also appended which the author has designed for a rough and ready method of measuring earthwork by means of transparent paper or horn. This will prove very useful to resident engineers and contractors in the cursory measurement of works. Various other tables are added, those for gradients and resistances on roads amongst others. The whole appears to have been carefully checked, and the volume is one which may safely be left to work its own way amongst those for whose assistance it has been prepared.

The important question of the supply of water to towns has been well treated at the hands of Mr. Baldwin Latham, so far as he has at present gone into the subject.* If we may judge from the first part of these papers, we may look for some important information on this interesting subject. The part now before us is a reproduction of the two valuable papers read before the Society of Engineers last year, and to which we alluded in our notice of the Transactions of that society. The author inquires into the various methods that have been, and still are, adopted to furnish supplies of water to large cities or towns, and the papers abound with original information upon the subjects of rainfall, circulation of water, water-collecting areas, rivers, wells, &c., all of which is of a highly useful character to the profession generally, and hydraulic engineers in particular. These papers are accompanied by some excellent lithographs, and lose nothing by being published in an independent form. Although we have no notice of the plan proposed for their future publication, we shall look forward with interest to the appearance of the second and subsequent parts.

NOTES ON NEW DISCOVERIES AND NEW APPLICATIONS OF SCIENCE.

The Mechanical Equivalent of Light—Industrial Applications of Napthaline — New Method of Obtaining Chloroxynapthalic Acid — The Chloroxynapthalates as Pigments—Benzoic Acid from Napthaline—Production of Pure Carbonic Acid—Engraving in Relief on Zinc.

BY a method of which we shall give some account on another occasion, Professor Thomsen, of Copenhagen, has succeeded in ascertaining the mechanical equivalent of *light*. He finds that the mechanical equivalent of the luminous radiation, as distinct from the obscure radiation, from the flame of the French standard "bougie," is as nearly as possible 1·74 kilogrammètres per minute, being about one-fiftieth of the mechanical equivalent of the total radiation from the same flame. From this a writer in "Cosmos" has calculated the mechanical equivalent of the total light of the sun. He finds it to amount to something like that of 1,230 septillions of "bougies," or to thirty-five billions of tons lifted a billion of kilomètres per second,—the lifting of thirty-five billions of tons (French) a billion kilomètres being about equal to lifting the weight of the earth twenty feet.

Napthaline, which is so abundant a by-product of the preparation of coal-naptha, has been the subject of most extensive and laborious researches,—Laurent devoted nearly twenty years to the study of it and its derivatives, and it has occupied [much of the attention of many other chemists scarcely less able,—but it is only

* "The Railways Construction Facilities Act, 1864, with Notes and Abstract of nineteen general Statutes incorporated therewith, and the Act for giving additional powers to existing Railway Companies." By CHARLES WORDSWORTH, Esq., one of Her Majest's Counsel and Counsel to the Institution of Civil Engineers. London: Shaw and Sons, Fetter-lane, 1864.

* "Tables for Facilitating the Calculation of Earthwork in the Construction of Railways, Roads, Canals, Drains, &c." By DAVID CUNNINGHAM, Civil Engineer. London: E. and F. N. Spon, 16, Bucklersbury, 1865.

* "Papers upon the Supply of Water to Towns." By BALDWIN LATHAM, C.E., &c. London: E. and F. N. Spon, 16, Bucklersbury.

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now that industrial applications of it are beginning to be found. MM. Paul and Ernest Depouilly, so well known by their researches on the aniline colours, have recently discovered a method of obtaining benzoic acid from it, and have also devised a remarkably economical modification of the process by which Laurent obtained from it the compound which he called chloroxynapthalic acid. This last-mentioned acid dyes wool an intense red without any mordant, and nearly all its salts are coloured, and well fitted for use as pigments. Its lime salt is of a beautiful golden yellow, its barium salt of a fine orange, and its aluminium salt of a deep madder-red. Its compounds with copper and mercury are of an intense bright red, its compounds with zinc and cadmium are of a rich red brown, and its compounds with nickel and cobalt of a fine garnet colour. With lead it forms a beautiful nasturtium salt. It combines, too, with the organic bases, aniline and rosaniline, its compounds with the former being of a fine red and with the latter of a very brilliant green. Now that it can be produced at a moderate cost, chloroxynapthalic acid,—a shorter name must be invented to buy and sell it by,—will probably come into extensive use.

The process by which MM. Depouilly obtain benzoic acid,—the starting point of the aniline manufacture,—from napthaline, is exceedingly simple and very interesting. They first produce phtalic acid by oxidising napthaline by means either of bichromate of potash, permanganate of potash, or oxide of lead, or by oxidising bichloride of napthaline by means of nitric acid. They then combine the phtalic acid so obtained with lime so as to produce a neutral phtalate of lime. One equivalent of this compound they mix intimately with one equivalent of hydrate of lime, and they then expose this mixture for ten hours to a temperature of from 626 deg. to 662 deg. Fahrenheit. This they effect by placing the mixture in sheet-iron cylinders, which they then immerse in a bath of molten lead. The cylinders are of such size as to contain each about twenty-four pounds of the mixture, and are entirely closed, except that a little vent is left for the escape of vapour of water. After ten hours' heating, the contents of the cylinders, which originally consisted of a mixture of phtalate and hydrate of lime, are found to consist of a mixture of benzoate and carbonate of lime. After the whole has cooled, the benzoate of lime is separated from the carbonate by means of boiling water, in which the benzoate dissolves, and from the solution of benzoate of lime so obtained the benzoic acid is finally precipitated by means of hydrochloric acid.

The Paris Société d'Encouragement de l'Industrie has awarded its platinum medal to M. Ozonf, the celebrated manufacturer of seltzer-water and soda-water, for the simple and ingenious method by which he obtains pure carbonic acid gas with which to aërate those beverages. M. Ozonf burns coke in a furnace lined with refractory fire-clay, and supplies the furnace with sufficient air to effect complete combustion. The products of the combustion, consisting chiefly of carbonic acid gas and nitrogen, he first passes through water, in order to cool them, and at the same time to free them from mechanically admixed impurities, and then forces into the first of a row of receivers filled with solution of carbonate of soda. Except the last, which is open to the atmosphere, each of these receivers has a pipe passing from its upper part to the lower part of the next. The carbonate of soda in these receivers absorbs the carbonic acid contained in the gaseous mixture which is forced into them, becoming thereby converted into bicarbonate of soda, and the other elements of that mixture pass off from the last of the row of receivers into the air. When the solution of carbonate of soda with which the receivers were originally charged has become wholly converted into solution of bicarbonate, it is pumped into a boiler, in which it is heated by steam to 212 deg. Fahrenheit, at which temperature the bicarbonate of soda gives off its second equivalent of carbonic acid and is re-converted into ordinary, or mono-carbonate. The carbonic acid so evolved is mixed with vapour of water, but is otherwise perfectly pure, and the aqueous vapour in association with which it leaves the boiler can be readily separated by condensation. M. Ozonf effects this condensation by carrying through a reservoir of cold water the pipes which convey the gas from the boiler to the gasholder. The solution of carbonate of soda left in the boiler is used to re-charge the receivers. As the portion of carbonate of soda first used will thus serve over and over again, *ad infinitum*, no carbonate of soda being actually consumed in the process, the cost of the carbonic acid obtained by this method is very little more than that of the coke which supplies the carbon for it, labour and wear and tear being quite insignificant items. While, therefore, both simple and highly effective, M. Ozonf's process is also very cheap.

M. Boëttger has communicated to the "Journal für Praktische Chemie" the following simple process for engraving in relief on zinc. He dissolves one part of dry chloride of platinum and one part of finely-powdered gum-arabic in twelve parts of water, and with this solution writes on a plate of clean zinc with a quill pen. The writing appears black, by reason of the zinc decomposing the chloride of platinum and so causing "platinum black" to be deposited. Before the writing is quite dry he plunges the zinc for a few moments into a solution of double cyanide of gold and potassium, whereupon the whole plate becomes covered with a very thin film of metallic gold. He then immerses it in nitric acid diluted with sixteen times its weight of water, which, while leaving the gold firmly adherent to the platinum-black writing, causes it to peel off all other parts of the plate, thereby exposing the zinc, wherever not written upon, to the solvent action of the acid. That action is allowed to proceed until the writing is left in the desired degree of relief.

ATLANTIC CABLE GOSSIP.

THE Atlantic Telegraph Company have again commenced working in earnest. No time has being wasted in useless regrets over past failures, but those failures have been utilised with a view to future success. Various precautions have been taken and improvements resolved on whereby all weak points are so guarded against as to render accidents well nigh impossible in the next attempt to submerge the cable. A new cable has been ordered and its manufacture has already been commenced. As at present arranged, it is intended that the "Great Eastern" shall sail from Valentia in the last week of May next with the new cable on board. This cable will be laid to Newfoundland, and when that operation is completed the "Great Eastern" will return to the spot where the buoy was placed upon the broken cable a few weeks ago. She will grapple for the broken end, and no doubt is felt that it will be found. A splice will then be made, and the rest of the cable necessary to complete the line to Newfoundland will be laid. There is every reason for believing that by the autumn of next year two cables will be in full work across the Atlantic. The facts whereon this belief is based have been advanced in a statement drawn up by gentlemen who have taken an active part in the recent and previous attempts to lay a cable. This statement establishes twelve points, which plainly demonstrate that the obstacles which have hitherto prevented the accomplishment of the scheme are only of a temporary nature, and that the knowledge bought by experience in the past will infinitely reduce the risk in the future operations. The main facts deducible are—that the insulation and conducting power of the cable are improved by immersion in deep cold water; that the superior steadiness of the "Great Eastern" will enable a cable to be laid irrespective of weather; that faults can be immediately detected and made good, and that, if even the cable do part, it is possible with proper tackle to recover it uninjured from the depths of the Atlantic Ocean.

The Atlantic Telegraph Company have, as might have been anticipated, received numerous communications on the subject of the recent failure, and suggestions for future operations. In like manner the daily press has teemed with correspondence, in some instances of a practical and pertinent character. We extract some of the many proposals and suggestions which the emergency has called forth. With regard to the doubts entertained as to the cable remaining on the surface of the ooze until operations are renewed next spring, Mr. W. T. Henley states in the *Times* that his experience leads him to believe that no danger need be apprehended on that score, in confirmation of which he states that last year he was engaged in the middle of the Adriatic in grappling for and recovering a cable lost in the previous winter in a depth of close on 600 fathoms. The bottom consisted of soft ooze or mud, precisely similar to that found in the Atlantic. This was a cable covered entirely with iron, weighing about three tons to the mile, and much more likely to sink into the mud than the light Atlantic cable, but it had sunk scarcely any distance, and was recovered in a few hours after getting on the spot, although there was no buoy to mark the spot, and he did not know the situation of the cable within several miles. In fact, the cable could be pulled a much greater distance through the ooze than along a turnpike road, owing to the perfectly smooth nature of the semi-liquid mud. Upon the capability of the cable to meet any resistance or strain it would have to encounter, Mr. W. Hall in the same paper observes that as a great part of the cable was kept in water some eight or ten months prior to its being payed out by the "Great Eastern," it having been passed into tanks filled with water as it came finished from the sheathing machines, considerable oxidation of the iron wire must have taken place during that time. Presuming, therefore, that the sheathing to an extent deteriorated in consequence, it may be inferred that the wires were broken in places and forced into the gutta-percha in passing through the many wheels of the paying-out machinery; hence the destruction of the cable, and the uselessness, as he thinks, of grappling for it. As to the question of recovering the cable, "S." submits to the public through the *Times* the following idea. He suggests that the end at Valentia be secured on board the "Great Eastern," the vessel proceeding at once to the spot where the last misfortune occurred, winding up the cable on her way. This method of recovering the lost wire could not, of course, be performed in an unbroken voyage. It would necessitate a repetition of all the labour expended in paying out the length already laid down, but "S." feels convinced that in the end both time and expense would be saved.

The part the little schooner "First Fruit" played in directing the "Terrible" to the buoy after the cable had parted has doubtless not been forgotten. This vessel arrived at Harbour Grace, N.F., on the 11th August, and made the following report, which reaches us from New York:—On the 6th of August, at four a.m., saw steamship "Great Eastern" and British war steamer "Terrible." At six a.m. saw a beacon buoy with a flag upon it marked "'Great Eastern,' No. 5." The "Great Eastern" and "Terrible" were then about five miles south-east from the beacon buoy. The weather was quite foggy. The "Terrible" reported that the cable parted on the 2nd of August. The "First Fruit" then laid two sails to the mast and hoisted her ensign. At noon the "Terrible" came near the "First Fruit," and received from her information of the bearings of the beacon buoy. The position of the buoy, by the account of the "First Fruit," was in lat. 51 40, long. 38. The failure of the "Great Eastern" has not discouraged either the shareholders of the Transatlantic Cable Company or the new French company, which has obtained permission to lay down a cable between France and the United States. The *Nord* states that M. Alberto Balestrini has undertaken this enterprise at his own risk. But this time the company does not intend to submerge a cable for any enormous distance, as there will be intermediate stations. The following is the track at present contemplated:—From Paris to Lisbon, and thence to Cape St. Vincent by land; from this last place to the Canary Islands, along the coast of Morocco; from the Canary Islands to Cape Verd, along the

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African coast, with stations at St. Louis (Senegal), and at Goree; from Cape Verde to Cape St. Roque, on the coast of Brazil, a distance of less than one half that of the cable intended to be laid by the "Great Eastern;" from Cape St. Roque to Cayenne, along the American coast; and from Cayenne to New Orleans by the coast, or probably by cables connecting the principal West India Islands. The enterprise is more easily practicable than that conceived in England. The only difficulty will be to secure the preservation of the line on the African coast, and that security may be obtained by means of guard stations.

We understand that experiments have been made to test the value of seaweed as utilised by Mr. Ghislin, of Hatton Garden, who gained the prize medal for manufactured articles made from this substance, and placed in the International Exhibition of 1862, and which it is now proposed to apply in the manufacture of the next Atlantic cable. Several specimens of a submarine cable made from this patented algæite have been tested by eminent scientific men, who have reported most favourably as to its merits. The advantages are said to be that it is a perfect non-conductor of electricity; it readily combines and amalgamates with rubber, gutta-percha, and other gums; it will resist the influence of salt water when other supposed non-conductors have lost their insulating powers, and that whilst the ocean destroys nearly everything submerged in it, seaweed, being its natural offspring, is preserved by restoration to its native element.

MANCHESTER BOILER ASSOCIATION.

THE last ordinary monthly meeting of the Executive Committee of this Association was held at the offices, 41, Corporation-street, Manchester, on Tuesday, August 29th, 1865, when Mr. L. E. Fletcher, chief engineer, presented his report, of which the following is an abstract:—During the last two months 380 engines have been examined and 688 boilers, and 6 of the latter tested by hydraulic pressure. Of the boiler examinations, 490 have been external, 37 internal, and 161 entire. In the boilers examined, 197 defects were discovered, 7 of those defects being dangerous. The following is a statement of defects, omissions, &c., met with in the boilers examined from June 24th, 1865, to August 25th, 1865, inclusive:—Furnaces out of shape, 19; fracture, 17; blistered plates, 21; internal corrosion, 23; external corrosion, 26; internal grooving, 16; external grooving, 1; feed apparatus out of order, 6; water gauges out of order, 20; blow-out apparatus out of order, 7; fusible plugs out of order, 3; safety valves out of order, 11; pressure gauges out of order, 15; boilers without pressure gauges, 4; boiler without blow-out apparatus, 1; boilers without feed back-pressure valves, 16; cases of over pressure, 1.

The preceding defects, under the head of external corrosion, are just those which are so frequently met with on "flue" examinations, though entirely unsuspected. The plates were found to be seriously eaten away, and immediate repair was absolutely necessary. These unexpected revelations show the importance of the members availing themselves more frequently than many of them do of the opportunity of having their boilers examined both internally and in the flues.

The only explosion reported during the past two months occurred at a marine engine and iron shipbuilder's works, at about twenty minutes before six on the morning of Monday, July 31st. Two persons were killed and a third injured by the explosion. The boiler was not under the charge of this Association. I had no opportunity of making a personal investigation of this explosion, but have been favoured with a report thereon, accompanied with sketches from an engineer who examined the boiler officially at the request of the coroner, and gave evidence thereon at the inquest. From this it appears that the boiler was of plain Cornish construction, having a single flue, and being internally fired. Its length was 17ft., its diameter in the shell 6ft., and in the furnace tube 2ft. 10½in., while the thickness of the plates was 7-16in., and the load on the safety-valve about 55lb. The boiler failed from collapse of the furnace crown, which gave way at about 6ft. from the front end or furnace mouth, rending transversely in two places close to the seams of rivets, and also rending longitudinally for half the length of the furnace tube at a seam of rivets running along the crown towards the back end of the boiler. The boiler was not moved from its seating, but from the rush of steam and water that ensued upon the collapse, the three men already referred to as injured were scalded, two of whom died several days after. The collapse was attributed at the inquest to overheating of the furnace crown in consequence of shortness of water, combined with an injudicious introduction of the feed water. This was admitted near to the hottest part of the fire, which was just where the collapse assumed the greatest amount of depression, and where it appears to have commenced.

Although it is difficult to speak positively, without having made a personal examination, yet there appears ground at least to question the correctness of the above conclusion. The official investigation was not made until a fortnight after the explosion occurred, since the poor men who died from scalding lingered for some days, and there were then no positive indications of the plates having been red hot. The furnace tube was not strengthened either with flanged seams or with T or angle iron hoops, and it is reported that the crown had been damaged through shortness of water some few months previously, when two new plates were put in, and also that the furnace tube was out of shape when the explosion occurred, and had been so for some time; while to this it may be added, that it was at that part of the tube which had been repaired at which the collapse assumed the greatest amount of depression and appears to have commenced. It is thought to be quite possible, therefore, that the distorted shape of the tube, as well as its previous injury and repair, may have been the cause of the explosion rather than shortness of water, although it is not wished to express a positive opinion on the subject since the boiler has not been personally examined. But without determining whether the explosion resulted from shortness of water, or from weakness of the furnace tube, it may be pointed out that both of these dangers might have been guarded against. Low water safety valves, which relieve the pressure of the steam on the water's falling below its proper level, are a great safeguard against explosions through overheating of furnace crowns. Many of them are attached to boilers under inspection, and work well. Also the furnace flue, even though somewhat out of shape, would not have collapsed from simple pressure had it been strengthened with encircling hoops, so that the explosion might have been prevented had the boiler been better made and more liberally fitted. There should also have been a duplicate glass water gauge.

ROAD STEAM CARRIAGES IN INDIA.

A SMALL steam carriage for ordinary roads has been imported into Calcutta. It has been built for a private carriage having ample room for four or five persons in front and a stoker behind, and is arranged to run at an average speed of ten miles an hour; indeed, on good roads sixteen miles per hour could easily be attained. The carriage is mounted on three wheels, each having independent springs, the small wheel in front for guiding and the two behind, one or both of which are used for propelling, one of them being fixed on the shaft and the other engaged by a clutch, so that when disengaged the carriage may be turned round in its own length without stopping. It is easily guided by a handle from the fork of the front wheel, which is central with the outside seat; a brake is applied to each driving wheel worked by a lever from the seat, so that the engine is entirely under the control of the driver.

The engine is built upon a tank which forms a strong tubular framework, the boiler being placed above, and the whole of the machinery is contained in the space between the boiler and the tank, entirely protected from dust and dirt, and within reach of the stoker for oiling. The tank contains 35 cubic feet or 210 gallons, which would enable a run of 20 miles to be made without taking in fresh fuel or water. The boiler is made of steel, and so constructed that it is not injuriously affected by variations of level. The diameters of the cylinders are 3½in.; the length of stroke 7in. The diameter of the driving wheel is 3ft. 6in. The number of revolutions is sixteen per minute. From a trial made with this carriage it has been pronounced a complete success.

Apropos of this subject in England we may observe that this day ushers into operation the new act, the 28th and 29th Victoria, cap. 83, which effects several important alterations respecting the passing of locomotives along turnpike roads. It provides that locomotives not exceeding 9ft. in width, or 14 tons in weight, and having wheels constructed according to the act of 1861, may be used upon any turnpike road or public highway, but locomotives exceeding the above dimensions or weight are not to be used on any such roads, except subject to the provisions contained in the third section of the act of 1861. The new act regulates the working of the locomotives, and directs that at least three persons shall be employed to drive and conduct them. One of such persons is to precede the locomotive on foot 60 yards, and constantly to display a red flag. The drivers are to give as much space as possible for the passing of other vehicles, and are not to sound the whistle for any purpose, or open the cylinder taps within sight of any person riding, or in charge of a horse upon the road, or allow the steam to attain such a pressure as to exceed the limit fixed by the safety valve, so that steam shall blow off when the locomotive is upon the road. The speed at which locomotives may be driven is not to exceed four miles per hour, or through any town, city, or village two miles per hour.

GUNNERY ON BOARD THE "SCORPION."

THE iron corvette "Scorpion," 4, double turreted, has just completed her gunnery experiments in St. Helen's Roads. The guns in her turrets have been fired with 52 deg. training forward—within 8 deg. of her line of keel. The result of this severe test has been just the same as was the result of the "Royal Sovereign's" experimental firing. Wooden doors, skylights, and all light wood fittings on deck, have more or less suffered from concussion. The engine-room skylight was unshipped when the guns were being fired at extreme training, and, somewhat strange to say, the concussion struck down the engine-room and started the bulkheads of the engineer's berth. Iron hatches, &c., similar to those in the "Royal Sovereign," will have to be fitted to prevent this. The gun-carriages are found to be very defective; they are of wood, and were sunk in the ordnance screw storeship which was lost off the coast of Ireland when on her way from Birkenhead to Woolwich. The ship is spoken well of on board as a seaboat, but she takes water in amidships, from being low on deck from her water-line. Messrs. Laird Brothers have now two other double-turreted ships building at Birkenhead, which are much higher out of the water than either the "Scorpion" or the "Wivern," and which are estimated to realise a 13-knot sea-going speed. The guns and carriages of the "Scorpion" are fitted with winches, but they are not capable of being worked efficiently, owing to the warped and otherwise defective nature of the carriages. As showing the want of a Naval Board of Ordnance, separate altogether from the present United Board, it is enough to mention that the "Scorpion" has been supplied with rope sponges for the guns of a line-of-battle ship's lower deck when the ports are kept closed, and also with shot plugs for stopping shot-holes in a wooden ship!

RAILWAY TURNTABLES.

LETTERS PATENT have been granted to Mr. Charles Greenway, of Albert-place, Cheltenham, for an invention which has for its object improvements in railway turntables. For these purposes the central axis or pillar of a turntable turns in a bearing constructed in the centre of the foundation, and is stayed thereto by diagonal or other stays or supports. The central axis or pillar rests by its lower end on a step or bearing, whilst it is surrounded by upright antifriction rollers or cylinders, which are arranged to turn freely within a hollow frame or upright cylinder, which is fixed to the foundation and stayed as above stated. The upright cylinder and the antifriction cylinders or rollers rise up nearly to the under side of the table, so that the supporting bearing, constructed as above explained, presents a very extended support, whilst it offers but comparatively small friction to the central axis or pillar of the table.

Fig. 1 in the engraving shows a transverse section of a turntable; fig. 2, a vertical section of

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RAILWAY TURNTABLES.

FIG 1

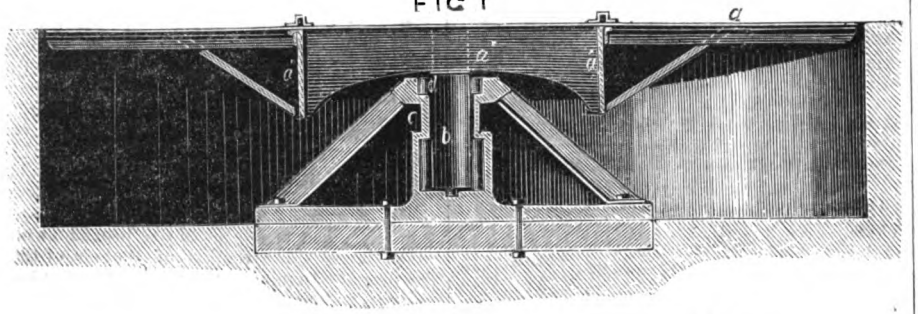


FIG. 2

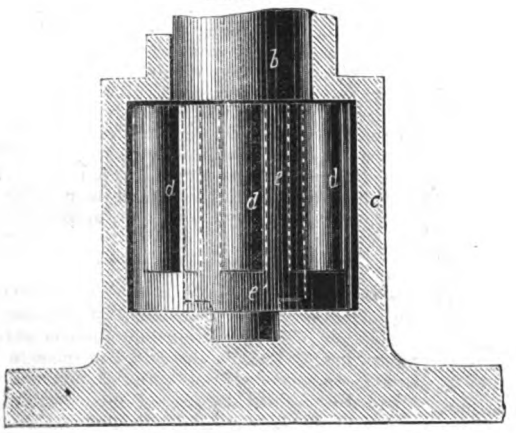
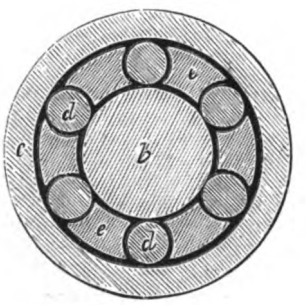


FIG. 3



the upright cylinder; and fig. 3, a horizontal section of the upright cylinder, in which the antifriction rollers are placed vertically around the central axis or pillar of the table. *a a* is the surface of the table, which is strengthened by the cross piece a^*, and also by deep beams a^1 below the rails; *b* is the central axis or pillar, on the upper end of which the table *a a* is fixed; the lower end of the pillar is stepped in, and turns in a step or bearing. *c* is a cylinder which is fixed and stayed to the foundation by diagonal stays, so that the cylinder is made as secure to the foundation as may be required. Within the upright cylinder are vertical antifriction rollers *d d*, which are in contact with the central pillar or axis of the table, and they are kept in position by the filling uprights *e e*, which are all connected by the base plate e^1. By these means a turntable will be well supported by a central pillar or axis, whilst such central pillar or axis will be securely retained in a vertical position by the fixed cylinder and vertical antifriction rollers, whilst the pillar or axis will be able to turn freely within the fixed cylinder.

OSCILLATING STEAM VALVE.

THE object of this valve is to overcome the resistance and loss of power in the use of common valves, more particularly the slide valve. It is plain that, by overcoming this resistance, there will be just so much power added to the engine for practical purposes. The chief difficulty has been to balance the valve properly, without making it too complicated or expensive. It is claimed that this has never been so successfully accomplished as in the valve herewith illustrated, which has been patented by the Rev. Dr. Carhart, of Troy, N.Y., through the "Scientific American" Agency. This valve may be perfectly balanced; is about as simple in its construction as an ordinary steam cock, and is claimed to be much cheaper to construct than any other valve known. In addition to these several advantages, it will out-wear any other, since the working parts are not subject to heavy pressure. It may be applied to engines of any ordinary device, without alteration in the valve motion, link, or any part of the engine proper.

In the engraving, fig. 1 represents an engine with the valve attached. This engine formerly had on a slide valve. No alteration has been made in the cylinder or valve seat. There are flanges cast on the under side of the valve socket, whereby it is bolted to the old valve seat. The arm A, attached to the valve stem, takes the eccentric rod by which the valve is worked. The position of the pin in which the rod hooks may be varied by means of a slot in the arm, thus varying the oscillation of the valve. B is the steam, and C is the exhaust pipe. Fig. 2 represents the valve isolated, chiefly to show the opening D, which communicates alternately with corresponding openings in the valve-chest, leading to the opposite ends of the cylinder. Steam is admitted at E; the valve being cast hollow

FIG. 1

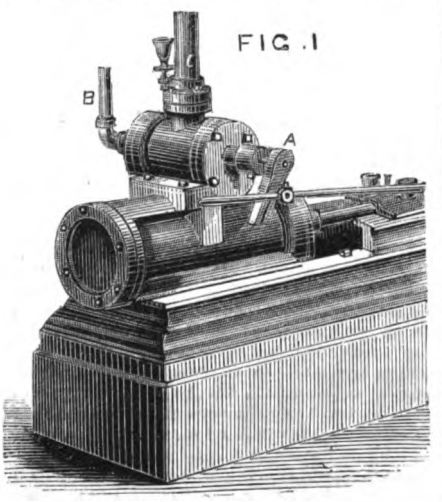
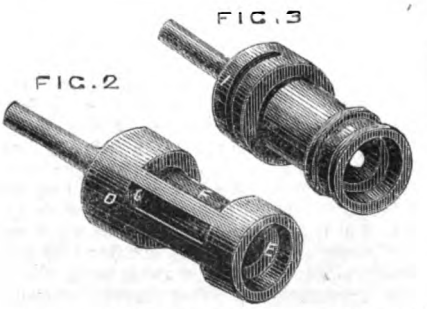


FIG. 3

FIG. 2



communicates alternately with the opposite ends of the cylinder through D, and exhausts over the valve at F.

The valve is made tapering, so as to wear to a fit. It is held in place by steam pressure, and is without a set-screw; there is not a screw or bolt exposed to the action of the steam. The steam passes through the small opening at G, into a thin chamber at the head of the valve, made by a washer being slipped on to the stem. The area of this end being greater than that of the opposite end, the pressure is just enough greater to hold the valve in its place. The washer not fitting steamtight, there is allowance made for expansion of the valve, to prevent it sticking, as it would be liable to do with a set-screw. Fig. 3 shows the upper or exhaust side of the valve, and the recess I, for the purpose of counterbalancing the upward pressure of the valve. There are small openings admitting the steam from the inside of the valve to these recesses. If the sum of the area of both these recesses exactly corresponds to the area of the main opening in the under side of the valve, it is evident that the valve will be balanced. It is found on actual experiment that the valve works as easily under pressure, the surfaces being exactly right, as it does without any pressure. The valve on a six-horse power engine, at work under sixty-five pounds of steam, was worked with the thumb and finger.

SUSPENDING VEHICLES.

THE methods of supporting and suspending vehicles both on rail and ordinary roads offer objections of various kinds. Some of these objections are common to both, while others more especially apply to railroads. Among the first may be mentioned—1st, the employment of a single axle for two wheels; 2nd, the lateral displacement of the body of the vehicle by the jolting of the wheels; 3rd, the necessity of employing small wheels for low speeds; 4th, the neces-

FIG. 1

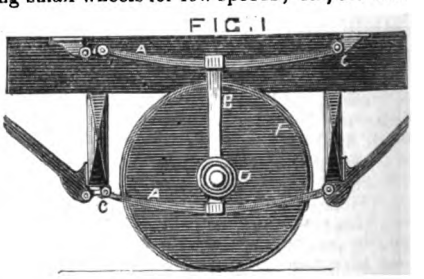


FIG. 2

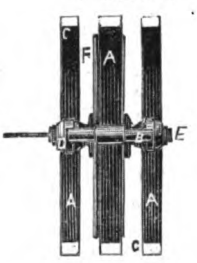
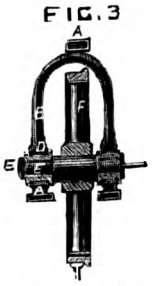


FIG. 3



sity, as a consequence, of mounting the vehicles very high in order to use large wheels. The peculiar objections to railway carriages consequent on the method of fixing the wheels on their axles are—1st, the necessity for inclining the tread of the tyres of the wheels; 2nd, the consequent absence of normal direction either when running in the straight or on curves, in the first case because nothing can force the wheels to maintain their contact on two similar diameters, and in the latter case because the same inclination of tyre cannot adapt itself equally well to the different radii of a curve; 3rd, the lateral play of the tyres is very prejudicial to the motion in a rectilinear direction, and also to the wear of the rolling stock; 4th, the shocks consequent on the play between the tyres of the wheels and the rails, which represents so much lateral distance traversed, and transforms the weight of the carriage into active force by multiplying its weight by the square of the lateral speed acquired.

This patented invention is a communication from M. Constant Jouffroy Duméry, of 29, Boulevart St. Martin, Paris, and its objects are, as regards railway carriages—1st, to dispense with the connection between the wheels without losing the advantage of journals and fixed bearings; 2nd, to diminish the amount of friction on each of the journals or pivots by doubling their number, while for ordinary vehicles, journals turning in fixed bearings are substituted for boxes rotating on fixed journals; and, lastly, for both kinds of vehicles, 1st, to do away with or lessen the lateral play caused by the angular motion of the

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axle; 2nd, to apply large wheels to low vehicles; and 3rd, to pivot each fore wheel on an independent vertical axis, so as to admit of the vehicle being turned without displacing the centres of support of the fore wheels. In order to obtain this result, a kind of elastic parallelogram is formed, composed of two, three, or four springs, and connected near its centre to a rigid fork forming the bearing, and transmitting a uniform and simultaneous deflection from the several parts of the elastic parallelogram. The plates of the springs composing the parallelogram are jointed at their ends to the fixed parts of the body, and as their elasticity can only be utilised in one direction, while laterally and longitudinally they are completely inflexible, the wheels and body of the vehicle can only move vertically.

This invention is illustrated in the accompanying engraving, fig. 1 of which is a longitudinal elevation, fig. 2 a plan, and fig. 3 a transverse section of a railway carriage wheel and part of the framing. The letters are the same for the three figures. A is three springs forming an elastic parallelogram; B, fork for connecting the several parts of said parallelogram; C, joints of the springs; D, bearings; and E, journals of wheel F. The parts being thus arranged, it will be readily understood that each wheel is entirely independent of the others, and that any shock it may receive will not produce a lateral displacement of the carriage, causing vibrations which are very disagreeable, and destructive to the rolling stock. The advantage obtained by the adoption of this arrangement over that of fixed axles and rotating axle boxes may also be utilised, as the weight on each of the journals is reduced to one-half of that carried by the journals of ordinary axles, the number being in this case doubled. The weight on each end of the springs is also reduced one-third what it is in ordinary, enabling the joints to be made with a view to continuous lubrication. The wheels may also be made large without raising the vehicle. The vehicles will in all cases be perfectly balanced on the ground, as the wheels turn independently without being displaced. If it is desired simply to apply the principle of independent axles without the advantage of journals, this may be effected by firmly fixing a couple of springs to an upright arm carrying the journals as in ordinary wheels. It is also evident that, supposing all four journals and springs, or the entire system as applied to a pair of wheels, are desired to be brought to bear in opposition to lateral shocks, this may be readily effected by the aid of a rod fixed to the journals of two contiguous wheels, in such manner that all lateral resistance will be doubled by the application of this improved system. It should be further observed that in proportion to the increased security all difficulties become diminished, as by making the axles independent the play between the tyre of the wheel and the rail is prevented, while all shocks are saved, which, as before observed, are simply consequent on the dead weight of the vehicle becoming transformed into active force by the lateral speed acquired; all shocks are thus prevented, instead of which is substituted a lateral pressure of the tyres on the rail, which if not uniform varies but slightly.

THE ANALYSIS OF WATERS.

It is well known that chemists are at variance as to the best method of calculating the weighed results of waters. The many discrepancies which occur in the analysis of such by different chemists are no doubt due to the existing difference of opinion as to the states of combination of the various salts held in solution. "R. C. M.," in the *Chemical News*, gives a process which he has for some time worked which gives most satisfactory results, and shows beyond doubt the true composition of the saline matters. An ordinary potable water generally contains the chlorides of calcium, magnesium, potassium, and sodium (the chloride of calcium in extremely minute proportion); the sulphates of these alkaline earths and alkalies, with carbonate of iron, lime, magnesia, and silica. One gallon or so of the water is brought to complete dryness at 212 deg. Fah., lixiviated several times with boiling absolute alcohol, filtered, and washed with hot alcohol. This may be marked "alcoholic solution," and contains the chlorides only of calcium, magnesium, potassium, and sodium. This filtrate is boiled with water until all the spirit is driven off, and the chlorine and bases ascertained in three different portions. These results are calculated into chlorides: the chlorine serves as a check. The residue insoluble in the alcohol is gently dried, boiled several times with water, filtered, the filtrate divided into three parts, and the lime, magnesia, potash, and soda, with the sulphuric acid, determined. Calculated into sulphates, the sulphuric acid as check.

The part insoluble in the water contains sulphate of lime (much of which has not been dissolved by the water), carbonate of lime, magnesia, pyroxide of iron, and silica. It is dissolved in dilute hydrochloric acid, the silica filtered off, the filtrate divided into two parts, and the sulphuric acid found in one, the iron, lime, and magnesia in the other. The sulphuric acid is calculated into sulphate of lime, and the excess of lime found into the carbonate; the iron and magnesia into carbonate. (The sulphate of lime found in the water solution is to be added to the sulphate got at this stage.) The escape of chlorine from the chloride of magnesium on evaporation of the water to dryness is most minute, so that any objection on this score is removed, since it seems the large quantity of alkaline chlorides always present prevent this. The total residue, organic matter, and silica should be determined in another portion of the water. In the evaporation of the water for analysis a large beaker or basin is preferred. The advantages of this process are the solubility of the chlorides alone in alcohol, the solution of the sulphates in water, and the carbonates, &c., in the acid.

PETROLEUM CASKS.

The growing importance of the petroleum and naphtha trade renders valuable any means of furthering its safe conduct. With this view Mr. S. Cowles, of New York, has recently patented an invention which consists in partially or entirely saturating the material of the cask on its inner surface with one substance and on its outer surface with another and different substance, employing a material on the inner side which will resist the action of the petroleum or other fluid to be contained in the cask, and on the outer side one which will resist the action and prevent any escape of the lining material. By the aid of both he is able to effect the important end of retaining the contents of the casks, and allowing their storage for any length of time, and their exposure to ordinary changes of temperature or of hygrometric condition of the air, and their transportation to any distance without loss or change. An oily material is employed for the outer side and an alkaline material for the inner side of the staves and heads.

The method of treatment is as follows:—Pour linseed oil in an iron vat, sufficiently large to admit one or more of the casks or barrels to be operated upon. Light the fire and raise the temperature of the oil to 150 deg. or 200 deg. Fah. For old and dry barrels or casks, the oil is used at a temperature of 150 deg. Fah., but for new barrels or casks the temperature is raised to 200 deg. Fah. Maintaining the oil at about that temperature the barrels or casks are introduced one by one, first closing the bungs so that the oil may only be applied to the outer surface and turning each over so that every portion comes in contact with the hot oil. A few seconds' exposure in this manner is sufficient, though a longer period will do no harm: they are then taken out and either while hot or after cooling are ready for the treatment inside. For this purpose a saturated solution of common potash is prepared at a temperature of 200 deg. Fah. or thereabouts in a vat provided with a faucet so that the barrels or casks may be readily supplied through the bung hole. If quite filled they may be left at rest, but if only partially filled, as will usually be the case, they should be turned over frequently. This solution will penetrate rapidly, and after a few minutes if kept filled and hot, and a longer period (say one or two hours), if only a little of the solution is used so that it soon becomes cold, the wood will be sufficiently saturated. The solution may now be returned into the kettle or vat to be employed in the preparation of other barrels or casks. The cask should be filled with the petroleum or other fluid to be contained as soon as convenient after the wood is thus prepared, or the bung should be kept tightly inserted, but casks thus prepared have remained several days unfilled without any appreciable deterioration.

The advantages of this invention and improvement are, first, the hot oil applied to the outer surfaces of the barrel or cask penetrates every portion of it, and renders it impervious to moisture and the influences of the atmosphere, which otherwise causes the wood of the cask or barrel to shrink and undergo a constant change detrimental to the cask for holding the oils or for durability. Secondly, it prevents the water of the alkaline solution from passing out through the pores of the wood composing the staves and heads of the casks. The effect of the alkaline solution is to swell or distend the barrel, which it does in a remarkable degree by entering into combination with the wood where it remains, being kept from passing outward by the coating of oil applied to the surface and from passing inward by the pressure of the petroleum therein. The barrel is thus kept tight as long as the oil remains in it.

Any of the fixed oils may be employed in lieu of the linseed oil when cheaper or more convenient, or a mixture of oleaginous matter or of such material with other organic or inorganic matter, such as oil and resin, or oil and litharge, may be used for coating and saturating the exterior of the casks. The addition of small quantities of the ordinary resin of commerce or litharge, or perhaps of various other substances, to give body or thickness to the material, will be found useful in many instances. In some instances, as where a fixed oil cannot be obtained, the exterior of the casks may be saturated with crude petroleum, coal tar, or other of the products of the refinery, either pure or mixed with other matter. In fact, any substance which will be unaffected by the contact of the material which coats or saturates the inside of the cask, and which will not escape into the atmosphere, but will remain either for a limited or for an indefinite period, may be used in this invention. So also of the inner or lining material.

MOULDING SHIPS' PLATES.

In our issue for the 28th July last, we described and illustrated Mr. T. H. Eastlake's apparatus for moulding the curved portions of vessels, which consists mainly of an adjustable batten. This apparatus is perfectly capable of reproducing the curves for forming the frames with great accuracy, and it may be readily applied where the operation of moulding requires only a single line to be reproduced at one time, as in the case of moulding the angle-irons of the frames, ships' timbers, &c. In moulding plates, however, it is necessary to give the curves of the several lines forming its sides together, and for this purpose the application of the above apparatus would be somewhat too intricate. Mr. Eastlake, therefore, proposes a simple method of moulding plates. This method consists in using a sheet of perforated zinc, or other similar material, having its surface painted white so that pencil marks may be readily drawn upon it and effaced when required. To illustrate its application take the case of a bracket-plate of the frame in ships so constructed. Having first delineated its form in the ordinary manner on the mould loft floor, lay the perforated sheet upon the lines; the form of the bracket will then show itself through the perforations and thus allow of its being drawn upon the zinc. The account of several could be taken on the same sheet, especially if both sides of it were used. To mould the plate lay the perforated sheet upon it and mark off the moulding in the interstices by connecting the lines on the zinc. When it is remembered that upwards of two thousand brackets are sometimes used in forming the frames of a single vessel constructed on the longitudinal principle it will be seen that any method for transferring their form direct from the mould loft floor to the plates without the expense of moulds will effect a considerable saving. To illustrate the application of this principle to the moulding of plates in general, take the case of an armour plate in a ship of war, or any exterior plate in an ordinary iron vessel, and in order to increase the difficulty of fitting it let it be a shutting-in plate. The method employed would be merely to bend home to the ship's side the perforated sheet; the edges to which the plate is to fit would then show themselves through the perforations, and their direction may therefore be marked across the zinc. The process of transferring this to the plate needs no further description, being of course similar to that employed for the brackets.

BOOT-MAKING MACHINERY.

Mr. Charles Baulch, of Bristol, boot manufacturer, has patented improvements in machinery for the manufacture of boots and shoes. This

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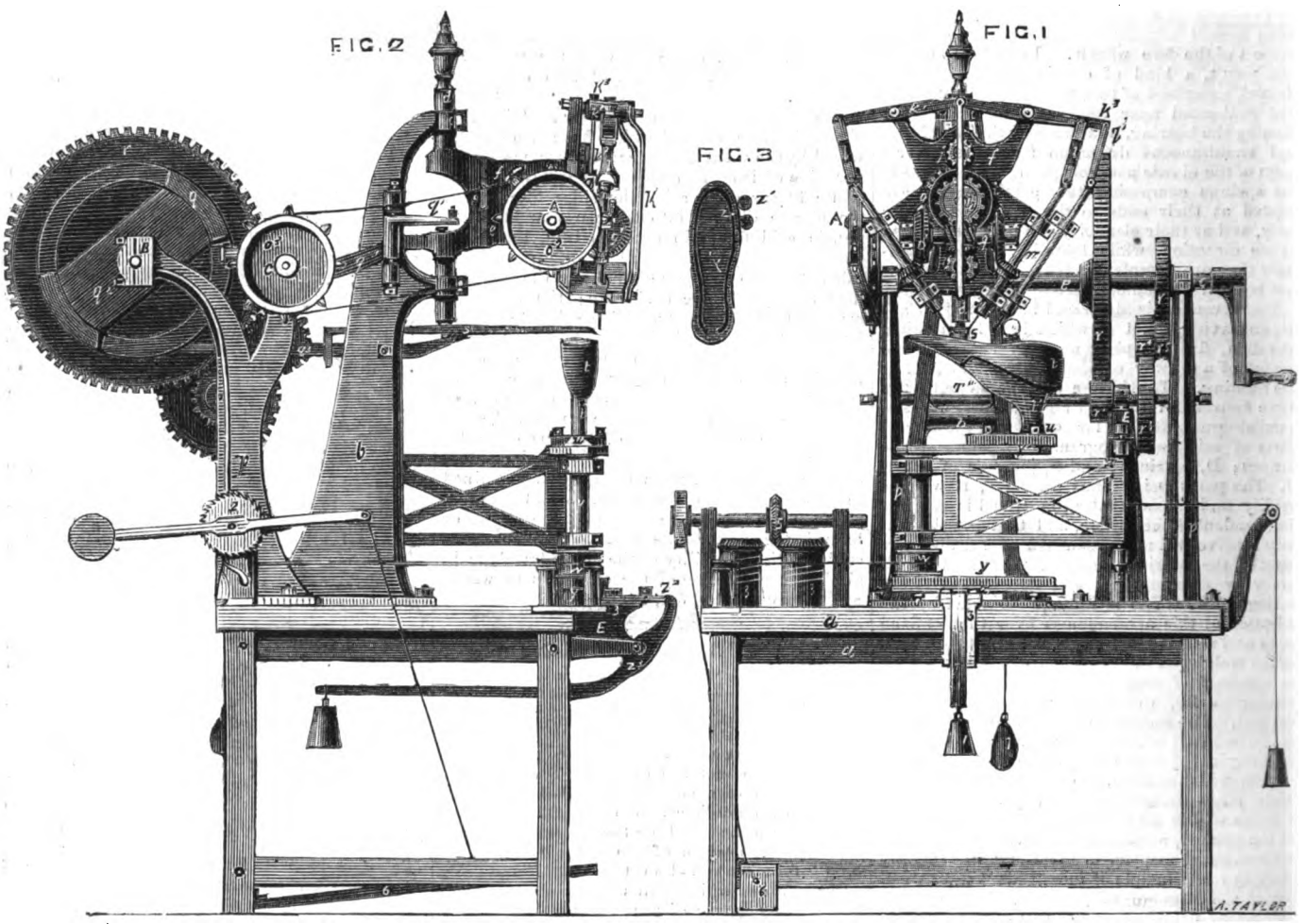
BOOT-MAKING MACHINERY.



invention consists in constructing machinery for sewing or uniting the soles to the uppers of boots and shoes, and for sewing or uniting other hard substances; also for causing the boot or shoe to move into proper position as the sewing is performed. The machine, as applied to sewing soles to the uppers of boots and shoes, is illustrated in the engraving, in which fig. 1 is a front elevation and fig. 2 a side elevation of the machine. *a* is a table or stand on which is mounted a bracket or standard *b*, having two bearings *c c*, in which two axes *d d* are free to slide vertically; to these two axes a plate *e* is attached, on which a sliding piece e^1, with dove-tail or other slides, works; it carries a front plate *f*; the sliding piece and the front plate receive a horizontal movement as hereafter explained, and the axes *d d*, and the whole of the front of the machine, receive a vertical movement also. On the front plate *f* is a shaft *g*, supported by two bearings, and having at each end a bevel cog-wheel g^1, and in the middle an endless screw or worm g^2; this shaft is made to rotate, and the endless screw g^2, by working into a toothed wheel *h*, imparts a rotary motion thereto at the rate of one revolution for each stitch made; to the wheel *h* is attached a disc *i* having on its circumference at proper distances two sets of teeth, as shown, which alternately work into two small wheels *j* j^1, causing them to revolve once each to every revolution of the wheel *h*. The wheel *j* gears into another wheel j^2, to which a crank is connected; this crank works two levers k^1 k^1, by means of two connecting rods *k*; these levers work, by means of connecting links *l*, two rods *m m*, each of which carries a piercer; the wheel j^1 has connected thereto a crank which works, by means of a connecting rod k^2, a lever k_3, which in its turn is connected by a link l^1 with a rod m^1, which carries a needle. To facilitate the penetration of the piercers the rods *m m* are caused to rotate by means of bevel pinions *n n*, which gear into the wheels g^1 g^1 on the ends of the shaft *g*. The pinions *n n* are free to slide on the rod *m m*, to admit of the movement of the rods. The rods are each turned by a tooth on the bevel pinion *n* working in a groove on the side of the rod. The rods *m m* are thus free to receive a sliding movement, and at the same time a rotary motion to admit of their turning and yet of receiving motion from the connecting rods k^1; the ends of the links *l l* are forked to receive a collar, which is held in its place by two centres to allow of an oscillating movement. These collars fit on the end of the rods *m m*, which are thereby free to rotate. To effect the various movements in the front of the machine there is a shaft A, which has a toothed wheel *o* gearing into another wheel o^1 on the shaft *g*. The shaft A has a pulley o^3 at its end, over which passes a band or chain, which also passes over another pulley o^3 on the end of a shaft B supported by two standards *p*. The shaft B has mounted thereon a wheel *r*, in gear with another wheel r^1, on a shaft r^2, which also carries a wheel r^3 in gear with a wheel r^4. The shaft of this wheel r^4 also carries a wheel r^5, in gear with a wheel r_6, on the main shaft C. The main shaft is driven by a crank handle D, or otherwise. On the shaft B is a cam disc *q* which produces, by means of a lever q^1, the horizontal movement of the front plate *f*; the disc *q* or the shaft B carries a projection q^2 (shown in dotted lines), which, in its rotation, presses upon a lever q_3, the opposite end of which bears against the lower axis *d* and raises the front of the machine.

To effect the moving of the boot or shoe there is also attached to the table or stand *a* a bracket E, carrying between centres a frame *s*. This frame carries a second frame s^1, also on centres, so that its end may be moved in any direction. The frame s^1 has at its end one above another two bearings s^2, in which a spindle *v* is free to move. This spindle has at the lower end a drum *w* and plate *y*, and at the upper end a plate v^1, with a dovetailed plate *u* on its surface, so that the last *t* with the boot or shoe (the leg t^1 of which last has a corresponding dovetail slide) can be slid in, and when pushed in tight be in its place. To the plate *y* a shape or form y^1 (shown separately in fig. 3) is fastened. The shape or form is so made that by turning it it will do for either a right or left boot or shoe. A groove corresponding to a channel in the last is formed in the shape y^1, and in the groove a pin or roller *z*, fixed to the plate 8, runs. The plate 8 is adjustable, so that the sewing may be performed nearer to or further from the edge of the sole of the boot or shoe as required. Against the outside of the shape or form y^1, two rollers z^1 run; they are also fixed to a slide s^3, and are acted upon by a weighted lever s^3. The pressing of these two rollers against the shape or form keeps it in its proper position. The boot is moved the length of the stitch by the following means:—Around the drum *w* a chain or cord is passed, the two ends of which are carried to two drums 3 3, round which it is wound alternately as required, according to the direction in which the boot is to travel, by means of a double pinion 5, gearing alternately into the pinions on the drums 3 3; the rod which carries the pinion 5 is moved to and fro by a lever not shown.

The operation of sewing is as follows:—The boot or shoe having been placed on the last *t* the last is screwed to the leg t^1, which slides into the dovetails *u*; the sole of the boot is held firmly down by a foot *s*, projecting from the front of the machine and capable of adjustment by a screw, so as to raise or lower the machine according to the thickness of the work to be done. The machine is then put in motion; the piercers descend owing to the rotation of the cranks fixed to the pinions j^1 j^2, and make two holes in the leather through to the channel in the last at an angle with each other. They are then drawn up out of the leather by the rotation of the cranks fixed to the pinions j^1 j^2, the front plate *f* is made to slide horizontally by the lever q^1 riding on the cam *q*, so that the needle is brought over the hole made by one of the piercers, into which it descends. A wire point on the end of the thread used is passed by hand down the other hole and goes through the eye of the needle, which in its ascent takes it up with it. A winder or drum receives the thread from the needle, and, drawing it tight, completes the stitch, at the same time preparing the wire point for the next stitch. The front of the machine is then raised by the cam q^2 and lever q^3, and the front plate *f* is moved back by the cam *q* and lever q^1, so as to bring the piercers into their first position. The boot or shoe with the last is moved along the required distance by a treadle 6, working a ratchet wheel 2 on the shaft, which carries the double bevel pinion 5. The same operations are repeated until the sewing of the boot or other article is completed. 4 is a weight for preventing the boot moving a greater distance than is produced by the action or pull of one of the drums 3 3. 7 is a weight for keeping the lever q^1 against the face of the cam *q*.

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