

of the proposed "crucial experiment." An iron wire plated with copper will certainly not "be found to conduct as well as a copper wire of the same thickness;" while a tinned copper wire will as certainly be found not only to conduct far better than a tin wire of the same dimensions, but nearly as well as if there were no tin plating on it at all. This should settle the question. According to Dr. Matthieson, taking the conductivity of pure copper at 100 (or more correctly perhaps 99.95) the relative conductivity of tin is 12.36. And so upon the theory of surface conductivity this would be the true value of tinned copper wire,—a very cheering idea for those who deem tin plating a preservative from chemical action in their adoption of the best known practicable insulating substance. But those gentlemen who prefer tinned to naked copper require no words of mine to reassure them. The extreme standard of copper conductivity, fixed by any electrician or engineer in their specifications, is 88 per cent. taking pure copper at 100, and as a general rule 85 per cent. is the maximum that can be depended on in a conductor where softness, pliability, and other essentials are necessary, and if an engineer can but obtain that, you may rest assured he will be very well satisfied. How will it be reconciled, then, with this "solely surface conductivity" theory when I state that tinned copper wire is supplied every week having a conducting power of from 80 to 85 per cent.?

As Mr. Waterson's theory of electric retardation, or rather the plan of obviating it, is based upon the foregoing unsubstantial assumption, it were almost a work of supererogation to make any remarks upon it. Certainly if the mere covering only of gutta-percha caused retardation, the difficulty would soon be got over by adopting a more efficient insulating medium, and increasing the thickness of such dielectric; and with all deference to this gentleman's theory on this matter also, I believe that this will be found to be one of the principal and most important means to effect that end, providing a certain limit is not overstepped of the ratio of diameter of conductor to thickness of insulating medium. My views on this subject, and I believe of most electricians and engineers, are diametrically opposed to those advocated by Mr. Waterson, whose theory, by the way, for all that I can see, will do as well for totality as for surface conduction. He would facilitate conduction (a comprehensive term in this theory, including induction) as a whole; and hence his style of cable would be a conducting exterior equivalent to the conducting interior, by means of which, as it is innocently supposed, the induced current which accumulates on the exterior would be transmitted with the same speed and assist in producing the same signalling results as the primary current. And so it would be a copper conductor inside and a copper conductor outside. It is expected, however, that this outside conductor would require to be insulated—for unquestionably if it remained uninsulated, the cure would be worse than the disease. But the ingenious theorist does not seem to be aware that it would be equally so if insulated unless the quantity of exterior insulation were so great as to render the cable altogether impracticable from its great weight, size, and unwieldiness. The arrangement would simply cause the phenomenon to repeat itself, and, instead of having one induced current, there would be two to contend with.

Now, I believe engineers would abandon metal-sheathed cables for deep seas *in toto* if they could only hit upon a plan of getting the core safe to the bottom without, and this for obvious reasons, the most important of which is that a freedom from metallic exterior would very much lessen the inductive action, and this might further be reduced to its minimum point (and I venture to say it is the only way it ever will be done) by employing that material for an insulator which is of the lowest inductive capacity, and constructing your core with as large a conductor as practicable, taking care at the same time that the respective diameters of copper and dielectric shall be in accordance with that mathematical formula which demonstrates what should be their relative proportions, in order to obtain a maximum signalling power with a minimum of inductive retardation. I believe, and I have no doubt it will soon be demonstrated, that it is possible, and far more easy, to submerge submarine cables without any external sheathing; and this once accomplished it will admit of cores being made much larger than hitherto with corresponding increase of conductor, and inductive retardation thereby become of comparatively little consequence. S. TAYLOR.

December 18.

TUBULAR BOILERS.

Sir,—In the able and interesting article on Boulton and Watt which appeared in your impression of the 8th inst. I notice a small inaccuracy which I wish to set right. You speak of Boulton having first suggested iron tubes in boilers, and as having introduced the tubular system, in placing four copper tubes in a boiler. It is then said that he anticipated the invention of the tubular boiler

and adopted it in practice. As no dates are given to show at what period this was done, I am inclined to think that it must have been after 1797, and will therefore call attention to the following extract from a patent granted to Sutton Thomas Wood in 1784, for "improvements in steam boilers."—"My third improvement is in causing the heat of the fire to be conveyed through the water or liquor, either by means of tubes, flues, or other hollow bodies, or by causing the fire or furnace to be in the middle, or in any other part within the body of the liquor, either in the form of a cone or pyramid, or any other form, and the water or liquor to surround the same; nor is it of any consequence in what form or shape the copper or boiler is made or constructed, or in what direction the pipes or tubes are placed, provided it is constructed upon the above principle of causing the fire or heat to be conveyed through the body of the water or liquor contained therein. Instead of conveying the heat or fire entirely through the water or liquor in the copper, boiler, or vessel, I sometimes cause the bottom of the copper or boiler to be made in the shape of a cone or pyramid so as to cause a greater surface to be exposed to the heat of the fire, and the heating or boiling of the liquor contained therein to be forwarded thereby."

So far as I can find, this is the first idea and description of a vertical or horizontal tubular boiler with internal fire-box, and it seems to have been entirely overlooked or unknown to all the writers on boilers or engines that I have read. It may be possible that Boulton had applied his tubes practically before the date of this patent, but it is certain, so far as I can find, that Wood has published the first idea and description of what in present practice is found so beneficial in such a number of cases.

I am, Sir, yours, &c.,

CHARLES F. T. YOUNG, C.E.

7, Duke-street, Adelphi, December 19.

[Boulton's invention of the tubular boiler dates as far back as the autumn of 1780, when he designed the Whal Busy boiler with four tubes, which he soon afterwards made. This invalidates Wood's patent, which nevertheless may be, and we think is, the first published record of the tubular system.—Ed. M. M.]

Meetings for the Week.

TUES.—Royal Institution.—"On Sound" (Juvenile Lectures), by Professor Tyndall, 3.
THURS.—Royal Institution.—"On Sound" (Juvenile Lectures), by Professor Tyndall, 3.
SAT.—Royal Institution.—"On Sound" (Juvenile Lectures), by Professor Tyndall, 3.

TO CORRESPONDENTS.

The MECHANICS' MAGAZINE is sent post-free to subscribers of £1 ls. 8d. yearly, or 10s. 7d. half-yearly, payable in advance. Post-office orders made payable to Mr. R. A. Brodman, of 168, Fleet-street, K.C.

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5d. per line for 6 insertions, 5d. per line for 12 insertions, 4d. 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, 168, 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.—J. K.—J. G.—J. C.—L. I.—R. S.—O. F. T. Y.—J. N.—W. W.—H. and T.—Messrs. P. P. and O.—W. and G. R.—F. S. F.—T. C.—W. W.—A. C.—O. F. T. Y.

Miscellaneous.

On Saturday last the foundation stone of the pumping station of the Northern Main Drainage Works was laid at Abbey Mills, by Mr. Freeman, in the presence of Sir J. Thwaites, and several members of the Metropolitan Board of Works.

The latest from America is that in Chicago a building, 80ft. by 160ft., five stories high, and weighing 27,000 tons, has recently been raised 2ft. from its original foundations. It was done by means of 1,580 screws placed underneath the building and turned simultaneously. The work occupied three days.

The London, Chatham, and Dover Railway Bridge across Ludgate-hill approaches completion, and will be as handsome as the disproportion between its length and necessary massiveness will permit. In addition to the railway lines, it will have a footway on either side for passengers. The erection of foot-bridges at various thronged crossings has been brought under the consideration of the city authorities, and the subject, in connection with a measure for the more effectual regulation of the vast traffic, is about to be seriously entered upon.

M. Desor, a Swiss naturalist, has investigated and confirmed the statement that small fish have been found in Algerian artesian wells 200ft. deep. These fish belong to the carp species. They are healthy, and have fine, large, and perfect eyes. Subterranean fish are usually blind, on account of the uselessness of eyes to such creatures.

"Ile" speculators are rapidly investing in lands in the growing town of Meredith, on the O. G. railroad. Telegraph and express offices are already up, and other buildings are in process of erection. The inhabitants believe it is bound to rival Pithole at no distant day. Franklin has built 33 new buildings the present year, costing, all told, \$98,100 dollars—the result of the oil business.

M. Simonin has just communicated to the Academy of Sciences some determinations of the Pressure and Temperature of the Air in Mines. His results do not enable him to establish any general laws, but the mean of four experiments at the coal mines of Croizat and Epinau, gave a rise of one degree (C.) of temperature for every 45 metres of vertical descent; and a rise of one millimetre in the barometer for every 10½ metres of vertical descent.

The last of the series of lectures at the Museum of Practical Geology, Jernyn-street, on the Chemistry of Coal, took place on Monday evening. The lecturer, Dr. Frankland, after referring to the former lectures as to how coal was put together by nature, and the process of taking coal asunder for the production of heat and light, showed by experiments how colour and other useful products are derived from coal. The process of extracting the colouring matter from coal tar to produce those beautiful colours known as magenta and aniline was clearly exhibited. Samples of the dye colours now obtained from coal tar were shown, some of them the most brilliant, and were duly appreciated by the audience.

The success of the "Hercules" target, recently operated upon at Shoeburyness with the 600-pounder Armstrong and other guns, has created serious doubts as to the propriety of proceeding with the construction of the granite fortifications now in progress at various points of the coast, and which, when completed, are to be faced with iron, the late experiments made against stone fortifications at Shoeburyness having proved their comparative failure in contrast with the results achieved by the "Hercules" target.

A machine for mining coal has been undergoing a series of practical tests in one of the coal mines of the Cambria Iron Company's Works, at Johnstown, Pa., and the results have proved satisfactory in the highest degree. The machine consists of a heavy truck, on which a frame having sides is hung, and above this another frame bearing 23 augers is placed. The augers are 2½ in. in diameter, having bits of 2½ in. in diameter attached. These augers are rotated by a series of cog-wheels, in connection with a pair of engines, placed on the top of the auger frame. The power used is compressed air, which, at a pressure of from 28lb. to 30lb. to the square inch, gives the augers about 100 revolutions per minute, making a bearing in or out of the height of the tools, 4ft. 7 in. wide, and 3ft. deep, in from four to five minutes.

The island of Sylt, which in winter has been often cut off from all intercourse with the continental districts of Schleswig, has been connected by a submarine cable with the town of Tondern.

The Committee of the Paris Universal Exhibition of 1867 has just decided that there shall be no days of admission gratis. The charge will be one franc, except on Friday, when it will be five. Persons who may wish to enter before ten in the morning will pay one franc extra. The price of season tickets will be 100f. for men, 60f. for women, and 20f. for children.

A vein of gold has lately been discovered at Klein-Steinheim on the Maine, in the territory of Hesse-Darmstadt, and sixteen pounds of the ore have yielded one pound of the precious metal. It is not yet known whether the vein in question has any great extent and is to prove the commencement of a German California, or whether it is merely a lucky find for the happy proprietor.

Dr. Voelcker has analysed the phosphatic deposit recently discovered at Penygarneid, in Montgomeryshire, and his opinion of its value is in every way satisfactory. The Penygarneid property is only a quarter of a mile from a proposed railway, and has the advantage of having ample water-power available at all seasons. A level has been driven 50 yards into the hill and this deposit of natural manure improves by depth.

A Reggio paper, the *Italia Centrale*, says that an English company is prosecuting a search for petroleum in the district known as the Sals di Querciola, and that it has already discovered a considerable deposit of that oil, as well as a large quantity of coal. There can be no doubt that Italy contains many mineral treasures that have still to be sought out and realised.

The Spanish railways, with hardly any exception, are in the utmost distress, as may be inferred from the fact that a commission has lately arrived in Spain from France, with a view to inquire into the condition of the Seville and Cadiz line, and see what may be done to save it.

A new form of filter has been devised by the Appareteur of the College of France. It is made by placing in a tank of impure water a vessel so arranged that a sponge which it contains shall lap over its edge and dip into the water of the tank. The sponge gradually sucks up and purifies the water in the reservoir, and allows it to drop into the smaller vessel or receiver, from which it may be drawn off by a tube. By placing a few lumps of charcoal in the bottom of the receiver, filtration of the most perfect kind is effected.

The magnesium light is said to be fast superseding the lime light in American theatres, having been first introduced at the Boston Theatre. The wire is burnt in a large lamp and delivered by clock-work. The flame sustains itself continuously from 1½ to 2 hours, in which time from ½ to 1½ oz. of metal is consumed. The fumes are arrested within the lamp by mechanical means, and thus the reflector and the glass in front are preserved from fouling. Although the lamp costs 100 dollars, the maker finds it difficult to meet the orders he receives for it. An American magnesium company has commenced operations in Boston, and is driving a brisk trade in the novel commodity.

The best substance for an infusible crucible to stand the compound blow-pipe is quicklime, entirely free from silica and other impurities. The lime is formed into a solid cylinder, by a hydraulic press; the cylinder is sawed in two transversely; the lower part is scooped out to hold the substance to be melted, with a small channel for pouring out the molten mass, and a hole is made in the centre of the cover to admit the blow-pipe.

In casting a large fly-wheel at the Fort Pitt Works, Pittsburgh, an American contemporary says that the molten iron was conducted from the furnace across one of the streets of the city, a distance of 163 ft., to the mould. The diameter of the wheel is 25 ft., and its weight 42 tons.

The misconception recently alluded to as the progress of the Suez Canal works is thus referred to in the *Levant Herald* by an old resident at Suez:—What was really done was the opening of the several locks on the freshwater canal, both at Ismailia and at Suez, whereby flat-bottomed lighters were enabled to pass from the *riyole* at Ismailia into the freshwater canal, and from the canal at Suez into the sea. The surface of the water in the freshwater canal at its proper height is 7 ft. above the level of the sea at high water, and we have a rise and fall of tide varying between springs and neaps from 4 ft. to 8 ft. Boats can only now be let into the sea at high water, whereby the communication of the two seas was so far completed that a dozen of these lighters, bringing something less than 200 tons of coals, were enabled to, and did, pass from sea to sea, receiving the fuel at Port Said, and delivering it at Suez and partly in the roads.

A company boring for oil in Kansas has struck a fluid which looks like milk, which puzzles them greatly. They have been unable, thus far, to churn it into butter.

An immense deposit of black marble, equal to the Belgian, and superior to the Irish, has been found near Williamsport, Pa. It is the only one known in America, and it is to be worked upon an extensive scale.

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 acknowledgment.

SOILS AND FURNACES.—1448, 1451, 1469
BUILDINGS AND BUILDING MATERIALS.—1474
CHEMISTRY AND PHOTOGRAPHY.—None
CULTIVATION OF THE SOIL. Including agricultural implements and machines. —None
ELECTRICAL APPARATUS.—1457
FIBROUS FABRICS. Including machinery for treating fibres, pulp, paper, &c. —1443, 1464, 1466
FOOD AND BEVERAGES. Including apparatus for preparing food for men and animals. —1461
FURNITURE AND APPARATUS. Including household utensils, time-keepers, jewellery, musical instruments, &c. —1410, 1412, 1444, 1446, 1448, 1452, 1456, 1470, 1476, 1478, 1487, 1499, 1500
GENERAL MACHINERY.—1452, 1454, 1468, 1483, 1488
LIGHTING, HEATING, AND VENTILATING.—1458, 1471, 1494
METALS. Including apparatus for their manufacture. —1460, 1480
MISCELLANEOUS.—1441, 1450, 1453, 1456, 1459, 1466, 1467, 1472, 1473, 1476, 1478, 1479, 1482, 1484, 1489, 1490, 1498
ROADS AND VEHICLES. Including railway plant and carriages, saddlery, and harness, &c. —1456, 1477, 1492, 1493, 1495

SHIPS AND BOATS. including their fittings. —1449, 1481, 1496
STEAM ENGINES, &c.—1447, 1491, 1497
WARFARE.—1461, 1463

1440 H. E. NEWTON. *Certain improvements applicable to spinning, weaving, and knitting machines.* (A communication.) Dated May 25, 1865

This invention consists in the employment of electricity to stop the motion of spinning, weaving, and knitting machines when any breakages occur during the working, such as the breaking of the warp or weft threads, or any derangement of the treadles or other of the working parts of the machine. *Patent completed.*

1441 T. H. HOBLYN. *A new or improved compound spherical rest for ornamental turning lathes.* Dated May 25, 1865

The patentee claims, first, the construction of a rest that will enable a turner to work a true curve, both concave and convex, by having a tool-holder to radiate round a centre, in such a manner that, if the cutting part of the tool is between the centre round which it radiates and the work operated upon, a concave shape is the result; and if the work operated on is between the cutting part of the tool and the centre round which the tool-holder radiates, a convex shape is the result. Second, the general construction and combination of parts. *Patent completed.*

1442 J. KUSTACK. *An improved composition to be employed in the manufacture of bonnets and hats.* Dated May 25, 1865

This composition is formed by mixing with the ordinary gelatine solution or size for stiffening or glazing bonnets, or otherwise, powdered bismuth, or a preparation thereof, together with the metallic substance known as silver bronze. This composition is applied by a brush or sponge, thereby obtaining, when dried and blocked in the usual way, a silvery-like effect or metallic appearance upon the surface of the bonnet, of any required shade, the said composition also admitting of gold or other bronzes or colouring matters being applied in like manner as above. *Patent abandoned.*

1443 M. H. NEV. *Improvements in treating fibrous materials and textile fabrics, and in producing soap.* (A communication.) Dated May 25, 1865

For these purposes the material or fabrics are treated with caustic alkalies, as, for example, caustic soda or potash, and with oil or any oleaginous substance, in an open or close vessel, and by using these agents, combined with the employment of heat, the fibrous substance and fabrics will be boiled, scoured, gummed, ungummed, cleaned, or purified, and in some cases an improved fabric will be obtained; and the alkali and oil or fat combining with the gummy or resinous matters will produce soap. *Patent abandoned.*

1444 C. OTTOM, F. ANDERSON, and D. BOOKER. *An improved plan or graduated gupping or puffing and pressing machine.* Dated May 25, 1865

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

1445 W. CLARK. *Improvements in knitting machines.* (A communication.) Dated May 25, 1865

This invention relates to that class of knitting machines that employ straight rows of needles. One part of the invention relates to the manner of arranging two straight rows of needles in a knitting machine so that the rows will operate alternately, one row while the yarn is passing in one direction, and the other while the yarn is passing in the opposite direction, uniting the work produced on the two rows of needles at the ends of the rows. Another part relates to the construction of the cams for operating the needles, and the manner of operating such cams; another part to the manner of supporting the sliding carriage; another to the manner of constructing the jacks; another to the manner of driving the sliding carriage; another to the construction and operation of the yarn guide or carrier, and to the means of driving it; another to a novel construction of latch opener; another to the means of connecting suitable weights to the work when beginning a new fabric; and another to an apparatus for setting up work on a knitting machine, by means of which the work of setting up the heel is accomplished without the aid of old work. The invention is not described apart from the drawings. *Patent completed.*

1446 W. E. GEDGE. *An improved stay or corset busk.* Dated May 25, 1865

This invention is not described apart from the drawings. *Patent abandoned.*

1447 J. A. HICKINCK. *A new system of rotative machines to be used as steam engines and water pumps.* Dated May 25, 1865

This invention is not described apart from the drawings. *Patent completed.*

1448 R. CANHAM. *Improvements in cupola and other blast furnaces.* Dated May 25, 1865

This invention was described and illustrated at page 344 of this Journal. *Patent completed.*

1449 G. ELLIOT and R. P. CLARK. *Improved machinery for loading and discharging cargo from ships and other vessels.* Dated May 25, 1865

This machinery is intended to be worked by steam in order to effect the rapid loading and discharge of cargoes, and applies more particularly to the discharge of coal from colliers. It consists of a shaft or derrick carrying a pulley at top, and fitting at bottom into a socket or otherwise connected to a foot or bed, so that the shaft may be more or less inclined, according to requirement. At the rear of the shaft the patentees fit a winch, and work the winch by means of cylinders supplied with steam from the ship's boilers, or from other boilers, should the collier not be a steam vessel. A rope or chain is carried from the winch over the pulley at the head of the shaft and is made fast to a cage or bucket, or carries a hook or hooks according to the cargo to be acted on. The shaft is held at the incline desired by guys carried from the upper end. They prefer to place two shafts over each hatchway or opening into the hold, by shafting, to work several winches from one or under or pair of cylinders. They adapt clutch gearing to each winch to throw it into and out of gear as required. Supposing the machinery applied to discharge coal from a collier, a bucket is lowered by the winch into the hold, on its being filled it is run up by the winch above the level of a stage or platform, which they erect above the deck, and there held suspended; a man pushes the bucket to the side and tilts its contents into the coal measure or shoot. The bucket is returned over the hold to be lowered, filled,

raised, and emptied as before. To load cargo they sometimes erect the machinery on the wharf or stage from which it is to be shipped. *Patent completed.*

1450 O. B. SPANTH. *A new preparation for subduing and extinguishing fire.* (A communication.) Dated May 25, 1865

This preparation is made up and enclosed in cases, which, from their similarity to, the patentees call cartridge cases. He takes about 60 per cent. of saltpetre (refined), about 36 per cent. of sulphur (refined), and about 4 per cent. of charcoal and chalk, reduces to powder, thoroughly mixes it, and forms the powder into a paste with water or other liquid. He presses the paste into the cartridge cases by hydraulic or other power. He next encloses the cartridges in airtight boxes in any quantity required. The cartridges communicate with the outside of the boxes by a train of thread or fuse protected by a capsule. The cartridges are set into operation by removing the capsule and by lighting the train or fuse by a match, or otherwise, or by being thrown into the fire. As soon as the composition burns the fire is subdued and very soon extinguished. *Patent completed.*

1451 M. CORN. *Improvements in the construction of furnaces or fireplaces.* (A communication.) Dated May 25, 1865

This invention relates to improvements in locomotive, marine, and stationary furnaces, whereby the combustion of fuel may be economically effected without the emission of smoke. In each arrangement the fire bars are set transversely of the fireplace, and they form an inclined bed for the fuel. The air for supporting combustion enters above the fuel, and passes, with the gases evolved from the fuel, out of the firebox through horizontal spaces formed by the firebars. These bars are cast with rectangular lumps at their ends, which lumps fit into slots formed in inclined side-supporting bars. The bars are so arranged that they overlap one another, and thus prevent portions of coal from falling through, while ample space is left between them for the combustion and flame to escape. The face of the bars presented to the fuel is inclined and slightly hollowed longitudinally, and the rear is wedge-shaped. This description of the form of grate applies to marine, locomotive, and stationary furnaces. In the case of locomotive furnaces it is preferred to bring the air from an under ashpit (which is capable of being closed by a valve), and leading it upwards in front of the ordinary ashpit to the upper part of the firebox. *Patent abandoned.*

1452 O. FRAZER. *Improvements in sawing machines.* Dated May 27, 1865

The patentee claims, first, the construction of sawing machines with two saw frames, arranged as described, and worked by a double crank on the driving shaft, for facilitating the working of the frames at increased speeds; and, second, the use of a double fence, with friction rollers, for guiding the upper and lower parts of the planks or deals, the upper rollers being adjustable, to suit the varying depths of the planks or deals. *Patent completed.*

1453 S. SEQUELIM. *Improvements in purifying animal and vegetable oils or fatty matters to be used for lubricating and other purposes.* Dated May 27, 1865

The patentee claims the purification of animal and vegetable oils or fatty matters by means of iodide of potassium, combined with the application of heat, substantially as described. *Patent completed.*

1454 L. BRINKLEY. *Improvements in ornamenting japanned surfaces, and in machinery or apparatus for that purpose.* Dated May 27, 1865

In ornamenting japanned surfaces according to this invention, the inventor employs a roller, on the cylindrical surface of which the ornamental forms to be produced on the surface to be ornamented are made in relief. The said roller is elastic or flexible, and is made in the manner hereafter described. With this roller he takes up colour or gold size, when the design is to be produced in gold leaf, metal leaf, or bronze, and he passes the roller over that part of the surface on which the ornament is to be produced. By rolling the roller charged with colour or gold size over the surface to be ornamented, the ornament in relief on the roller leaves the colour or gold size with which it is charged on the said surface. When gold size has been used, gold or metal leaf, or bronze, is laid on in the way usually practised by japanners. The inventor constructs the roller in the following manner:—He prepares a mould having a cylindrical hole through it of the size of the roller to be made. On the inner cylindrical surface of the mould he forms the pattern to be produced on the roller, the said pattern being sunk in intaglio in the mould. The mould is made in two or more parts, so that it may be readily engraved and easily put together and taken apart. *Patent abandoned.*

1455 J. M. ROWAN. *Improvements in making cast-steel railway tyres, and in apparatus therefor.* Dated May 27, 1865

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

1456 B. A. BROOMAN. *A new method of manufacturing oil from fatty matters or the residuum arising from the distillation of fatty matters, the manufacture of tauric acid soap, and purification of oils.* (A communication.) Dated May 27, 1865

In carrying out this invention the inventor places fatty matters or the residual products remaining after the distillation of fatty bodies in the manufacture of stearic acid, soap, and in the purification of oils, into shells closed at both ends and open at top. He places these shells into retorts open at one end and otherwise closed except to a tubular outlet from the top. After the insertion of the shells the retorts are hermetically closed at the end through which the shells have been admitted by means of stoppers with a rim which fits a groove in the end of the retort. The stoppers are secured by screw clamps. The tubular outlet fits into a tube terminating in a coil carried through a condenser; a tap regulates the outlet from the coil. The vaporised products enter the tube and coil and flow out condensed into a vessel placed to receive them. These, like similar products, are treated by sulphuric acid, and distilled. The resulting product is of a low density, and burns without smell or smoke in shale lamps, without any diazo or special chimney being necessary, as is the case with such lamps when burning shale oils. *Patent completed.*

1457 R. A. BROOMAN. *Improvements in reproducing or producing copies of writings, drawings, music, and other characters, and in preparing originals to be transmitted by*

electric telegraph. (A communication.) Dated May 27, 1865.

This invention consists of an electro-chemical process for the double reproduction of writings, drawings, music, and other characters, and for preparing originals to be transmitted in fac simile by electric telegraph. The inventor proceeds to describe the several operations which constitute this process. First, preparation of a metallic paper.—Upon a sheet of ordinary paper he applies by a roller or pressure a thin sheet of tin coated with paste for affixing it. When these two sheets have been well affixed to each other, and the paste is dry, he places them to be pressed or glazed on a steel plate, the polished side of which has been grained by grinding, or by glass or emery paper, or by sand or otherwise. The side of tin is applied on the grained surface of the steel plate, and he passes the sheet and the plate in this position between rolls or otherwise, so that the tin may be grained identically to the graining on the steel plate. The tin is thus better fitted to receive the bodies which are to be deposited thereon. By the aid of this grained tin paper, or by any other metallic oxidizable sheet similarly prepared, he continues the following operations. Second, chemical preparations and first reproduction on ordinary paper.—He spreads on the metallic surface of the tin paper a thin layer of essential oil, such as turpentine or petroleum, capable of resisting the biting action of acids; he wipes with linen until dry, then he applies thereon a sheet of white paper which has remained several hours in a bath composed of about 100 parts of distilled water, 100 parts of azotate of ammonia, 2 parts of yellow prussiate of potash, and 25 parts of dextrine. He dries this sheet of paper as much as possible with a linen cloth, so that it may have great adherence to the metal, and be without folds or tears, and he puts the tin sheet in metallic communication with the negative pole of a voltaic pile, while the positive electrode terminates in a movable iron needle, by means of which he obtains by its contact with the chemically prepared white paper, and by employing it as an ordinary pencil, blue marks of the writing, drawing, or other character, in consequence of the passage of the electric current, and the formation of double cyanide of iron, which is the Prussian blue used in some electro-chemical telegraphs. Third, second reproduction on metal, treatment of the oxidized metallic sheet by electricity.—When writings, drawings, or other characters, have been thus traced, either mechanically or by hand, on a chemical sheet, prepared as before explained, he separates this sheet from the sheet of grained tin paper, which leaves no apparent trace of the characters, and he treats the metal in the following manner in order to render visible the double reproduction of the characters which exist in the state of oxide, and also to make a metallic original capable of being transmitted telegraphically by telegraphic apparatus. He places the electrified tin sheet in a frame to keep it straight, and throws upon the metal a decoction of nut galls, or other vegetable acid, into which a few drops of azotic acid have been previously poured. By degrees there is formed on the metal in relief a very apparent whitish product, which forms exactly the same marks as the blue marks on the chemical paper which has been separated from it. The tin sheet, after being well drained, is placed on a heated semi-cylindrical iron plate, which desiccates the nascent product, and fixes it to the metal. To give more solidity to this product, and in order that it may be capable of bearing without being removed from the tin the action of a brush or rag, it is necessary to submit it to a bath composed of soda or ammonia, or an alkali and water. *Patent completed.*

1458 R. A. BROOKMAN. *Improvements in apparatus for measuring gas and other fluids.* (A communication.) Dated May 27, 1865.

This invention consists in constructing liquid, gas, and fluid meters with an internal drum carrying a central perforated tube and spiral vanes, extending from the tube to the inner edge of the drum. The drum is free to revolve upon a shaft extending at back beyond the drum, and carrying a worm which gears into and works a worm wheel on the shaft of an ordinary gas counting or registering apparatus. Space is left all round between the outer casing and the drum. The gas inlet pipe is carried through the front of the drum and is bent upwards; a valve is placed over the top of the inlet pipe and communicates by a cross head with two floats, the gas outlet pipe is placed in the upper part of the casing; there is an inlet pipe for the admission of water into the apparatus and an overflow pipe for running off the water should it rise beyond the proper level. *Patent completed.*

1459 T. BOURNE. *Improvements in machinery for turning and finishing bodies of a spherical form.* (A communication.) Dated May 27, 1865.

For this purpose two discs are employed which are capable of rotating in opposite directions about the same axis; one disc is also capable of being moved endwise along the axis by a lever, or otherwise. Between the discs is placed a circular or annular cutter, the inner edge of which is the cutting edge; this edge is turned to a true circle, and the cutter is held so that this edge shall be parallel with the discs. The cutter is made with a straight shank to enable it to be conveniently secured to the machine, and this shank is clamped to a slide capable of moving parallel with the axis of the discs. The slide is arranged to be moved by a screw, so that the cutter may be brought nearer to or further from the disc that is fast on the shaft. Before introducing the article to be turned to a sphere into the machine, the article is first turned in a lathe or otherwise formed approximately to the size required, and is then placed between the ring cutter and the fixed disc, the cutter and loose disc being moved away from the fixed disc to allow of this. The opposite faces of the discs may be flat or have concentric grooves formed in them to receive the body to be turned. The body to be turned having been placed between the ring cutter and the fixed disc, as above mentioned, the loose disc is pressed towards the fixed disc, and the two discs caused to revolve rapidly in opposite directions; this imparts a compound rotary motion to the article to be turned, viz., a rapid rotary motion in planes parallel with the axis of the disc, and the slow rotary motion in planes parallel with the planes of rotation of the discs, the latter motion being produced by the difference of velocity of the portions of the discs with which the article or body is in contact, which results from the difference in the distances of the said portions from the axis of the discs. Whilst the discs are thus revolved, the cutter is fed slowly towards the disc that is fast on the shaft, and the whole surface of the article to be turned is thus subjected to the action of the cutter, so that it cannot fail to be reduced to a true sphere. *Patent abandoned.*

1460 L. MOSER. *Improvements in the manufacture of steel, and in furnaces used in such manufacture.* (A communication.) Dated May 27, 1865.

The patentee claims the use of animal excrement as a converting material for making steel; and also constructing converting furnaces in the manner described. *Patent completed.*

1461 T. BISSELL. *Improvements in breechloading firearms, and in sights for rifles.* Dated May 27, 1865.

The first part of this invention is applicable to breech-loading firearms in which the breech ends of the barrel or barrels are exposed by turning the barrel downwards on a hinge, and which firearms are intended to be loaded with cartridges which are contained in cylindrical cases, provided at the centre of their rear ends with a cap, or with a patch of detonating material, by which the explosive compound in the case is to be ignited, and this part of the invention consists of an improved arrangement of mechanism for withdrawing the empty cartridge cases from the breech end of the barrels after the gun has been exploded. Cartridges of the above description are now made with a projecting flange around the rear end of the case, a portion of which flange, when the cartridge is inserted into the breech end of the barrel of the firearm, overlaps the edge of the extractor (which is a sliding piece at the breech ends of the barrel or barrels) so that when the extractor is moved backwards, away from the breech ends of the barrels, the cartridge case or cases is or are drawn back with it, and the empty cases may then be readily removed by hand. In order to cause the extractor to move in this manner, the patentee places on the under sides of the barrel or barrels, and close to their breech ends, a lever, one end of which is connected to the sliding piece called the extractor, and the other projects downwards from the under side of the barrels, and when the barrels are turned down on their hinge this end of the lever is brought against an incline carried by the fixed breech or body, which causes the lever to turn on its centre, and to give the requisite motion to the extractor. *Patent completed.*

1462 L. DIELE. *Improvements in mechanism for locking or fastening tiers or sets of drawers arranged in writing tables, cabinets, chests, or other articles of furniture.* Dated May 27, 1865.

This invention relates to improved arrangements or combinations of mechanism for locking or fastening simultaneously one or more tiers or sets of drawers, mounted or arranged in connection with pedestal, writing, or other tables, cabinets, chests, or other articles of furniture containing a series of drawers or receptacles one above the other. The patentee renders the action of the locking apparatus or mechanism altogether independent of the movement of the central or other drawer forming part of the combination. *Patent completed.*

1463 G. G. BURNETT. *An improved method of loading and turning over the shells of cartridges, and in the machine used for the same.* Dated May 27, 1865.

This invention has for its object the more easily and rapidly loading and making ready for use the cartridges used for breech-loading guns. Whereas by the methods and machines now in use much time is lost by having to place in the machine one shell at a time, and operate only on that one, these improvements consist in making a machine in two separate and distinct parts in the manner following:—The part hereafter to be called the cartridge holder consists of a series of tubes (of a diameter suitable for the cartridge) fixed together, or of holes drilled out of a solid piece, so that any number of cartridges (by preference six to twelve) when inserted into these tubes or holes are made to stand side by side about one-eighth of an inch apart. They are prevented from falling out by a plate or lid made to hinge on the solid part of the holder (either end or side). The other part of the machine consists of a frame which can be fixed to a table by screws, cramps, or other means. This frame is provided with a space that will exactly admit of the cartridge passing through, and has at one end a screw or spindle with crank handle, the end of the said screw or spindle being cupped out, as is usual for the purpose of colling down cartridges. *Patent completed.*

1464 J. A. HINRICH. *A machine for washing raw materials worked out or unworked to be employed in the manufacture of fabrics, and specially of fabrics made into pieces.* Dated May 29, 1865.

This invention is not described apart from the drawings. *Patent abandoned.*

1465 H. TIPPER. *Tipper's Australian shirt.* Dated May 29, 1865.

This invention consists in making shirts so as to avoid the necessity of putting the shirt over the head in dressing. The different parts of the shirt are made in the ordinary way, except the front, the opening of which, instead of being in the centre, is on one side, which opening is continued through to the bottom of the flap; thus the shirt is open from the side of the neck near the shoulder strap commencing in the neck band. *Patent completed.*

1466 W. SETTLE. *An improved bottle stopper.* (A communication.) Dated May 29, 1865.

This invention consists in an improved stopper to be attached to bottles, from which they are not required to be removed when the liquid is poured out, the necks of the bottles being formed for the purpose. The said stopper consists of a coiled spring having its top end bent over and fixed to a central wire or rod carrying a valve composed of a disc of india-rubber between two buttons, the upper one of which is less than the other. The stopper is inserted by simply thrusting the valve through the neck of the bottle; the disc folds around the upper button during the passage into the bottle, while the greater size of the lower button prevents the withdrawal of the valve as the disc folds over it in attempting to force it out of the bottle. The lower coil of the spring rests on a shoulder in the neck of the bottle, and the top of the neck is taper for preventing the spring from coming out, but at the same time allowing the coils to be pressed together. When the spring is not pressed, it pulls up the disc against the bottom of the neck, and effectually stops the passage; but when the spring is pressed down the valve moves with it and opens the bottle. *Patent completed.*

1467 P. A. LE O. DE FONTAINEMOREAU. *Certain improvements in the manufacture of lime.* (A communication.) Dated May 29, 1865.

This invention relates to certain improvements in the manufacture of lime by which kilns are dispensed with, the baking taking place on the spot where the calcareous materials are formed. The invention consists in imparting on the ground first a bed or layer of wood, coals, or any

other suitable fuel; on this layer the calcareous substances are laid, on these another layer of combustible material is placed, and on this latter is placed a second layer of calcareous substances, and so on alternately, the whole being arranged in suitable proportions of layers so as to ensure the quantity of calorific necessary for a perfect combustion or baking. In the interior of these layers a place or places is or are provided for the setting of the shaft or chimney for obtaining the required draught, and an equal degree of temperature in all parts of the layers. The time being thus burnt it can be used directly if it is for agricultural purposes, but if it is to be employed for building it must be first sifted or colled. *Patent abandoned.*

1468 H. MOSELEY. *A machine to be driven by the pressure of a fluid, or to displace a fluid, or to measure it.* Dated May 29, 1865.

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

1469 P. YOUNG. *Improvements in the construction of furnaces.* Dated May 29, 1865.

The patentee claims the use and application to double flued steam boiler furnaces of a wrought or cast-iron metallic casing, upon the front of which casing the furnace doors are swung, and through which casing the smoke generated in either furnace may be passed to the other furnace, and there be consumed. *Patent completed.*

1470 H. SON. *Improvements in the construction of keyless watches.* Dated May 29, 1865.

This invention has for its object improvements in the construction of keyless watches of small dimensions, whereby they are rendered less liable to derangement or injury, and suitable for being worn by ladies attired in evening dress as appendages to bracelets or other articles of jewellery or otherwise. In this construction of miniature watch the winding part or instrument is the largest separate piece of mechanism in the combination. The main spring in this arrangement being about six times higher or broader than in any other watches of similar diameter, is thereby rendered much less liable to break. The axes and pinions being much longer or deeper than in miniature watches of ordinary construction, strength and regularity of action are thus imparted to watches of small diameter constructed according to this invention, and as they are never required to be opened for winding or for setting the hands they do not require such frequent cleanings. *Patent completed.*

1471 E. MYERS and J. STODART. *Improvements in the means and apparatus employed for preventing downward draught in chimneys, facilitating the escape of smoke therefrom, and for ventilating apartments or buildings.* Dated May 29, 1865.

This invention has for its object the arrangement and application of improved means and apparatus for the purpose of causing a current or currents of air to act upon or over a chimney top, so as to exhaust or withdraw the smoke, air, or gases from within the chimney flue, thus preventing downward draught, facilitating the escape of smoke, and aiding in the ventilation of the apartments or buildings to which these improved chimney tops are applied. *Patent completed.*

1472 W. JOHNSON. *Improvements in vices.* Dated May 29, 1865.

This invention consists in fitting the movable jaws of vices in manner hereafter described, to enable the vice to hold parallel and taper objects. The patentee carries a cross bar from the lower part of the fixed jaw and forms a hole through the free end thereof. He inserts in this hole a spindle depending from a crutch formed with wings, and secures the spindle by a nut screwing on to a thread at bottom which passes through the cross bar. The wings have pin holes formed through them, and there are pin holes to correspond in the cross bar. The lower end of the movable jaw enters the crutch and is free to move upon a pin. When the vice is used for parallel objects the crutch is prevented from turning by passing pins through the holes in the wings and into the cross bar; on removing these pins the vice is ready for holding taper objects. *Patent completed.*

1473 F. A. PAGET. *Improvements in locking screws and the nuts of bolts, as also in the preventing an unequal straining of their threads.* Dated May 29, 1865.

In performing this invention the patentee makes a washer of steel, and of such a form that the screwing down of the nut or of the screw brings the washer into a state of initial strain. This he generally does by hollowing out the steel washer on its under side. Sometimes he forms a number of concentric corrugations in the steel washer, and at other times he forms it of one or more dish or steel plates or discs. In some cases he fills up, or partly fills up, these hollows by means of such elastic vegetable gums as gutta-percha or india-rubber. He also sometimes mills or serrates the surfaces of contact of the washer and its nut, and the spring of the washer allows these surfaces to pass each other, and afterwards to naturally interlock. Sometimes he turns a groove in the bottom part of the nut or head of the screw into which he inserts a spring. *Patent completed.*

1474 C. H. MURRAY. *Improved machinery or apparatus for cutting off wooden piles below water.* Dated May 29, 1865.

The patentee claims the adaptation of a horizontal circular saw or cutting tool to a vertical shaft mounted in a swinging frame or arm capable of being moved horizontally in either direction, so that the saw may be brought to act against either row of piles, and may be raised and lowered when required. He further claims combining the swinging frame and its vertical shaft and circular saw with any suitable motive power engine mounted on a travelling frame, so that the whole apparatus may be made to move along a way constructed on the tops of the piles to be operated upon as the cutting-off operation proceeds, as described. *Patent completed.*

1475 W. T. HAMILTON. *Improvements in circular saws, commonly called "drunken saws."* Dated May 29, 1865.

The patentee claims the use of a guide or guides for causing the saw to turn upon a centre of motion at the same time that it is swivelled, as described. *Patent completed.*

1476 S. DAVIS. *An improved dog leash or slip.* Dated May 30, 1865.

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

1477 W. SMITH. *A self-delivering road scraper.* Dated May 30, 1865.

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

1478 W. H. STANLEY. *Improvements in wickets for the game of cricket.* Dated May 30, 1865.

This invention consists in constructing the wicket in such a manner that the three stumps or vertical sticks shall be joined to a frame of iron, brass, wood, or other suitable material, by means of a ball and socket or other suitable joint, the frame being fixed firm to the ground by means of pins, screws, or other suitable appliance. To each vertical stick or stump, one or more springs are attached (of steel, india-rubber, or other elastic material) to keep it vertical before being struck, and to enable it to regain the said vertical position after being struck by the ball or otherwise. The cross pieces or bats may be connected to the said stumps or vertical sticks by means of a small chain or otherwise to prevent their being lost. *Patent abandoned.*

1479 J. HARE, jun. *Improvements in instruments or apparatus for cleaning the interior of tubes or hollow cylinders, gas chimneys, and other hollow articles.* Dated May 30, 1865.

This invention consists of apparatus the rubbing or scraping surfaces of which are made capable of adapting themselves more or less to the figure and size of the articles to be cleaned, and thus enable the said rubbing or scraping surfaces to clean with ease all parts of the said articles. *Patent abandoned.*

1480 J. HIBELL. *Improvements in annealing pots and saucers, for annealing iron and steel wire, sheet metal, and other articles.* Dated May 30, 1865.

The patentee claims making the said annealing pots of two concentric hollow cylinders of different diameters, the space between the said hollow cylinders constituting an annular chamber in which the articles to be annealed are placed, the said annular chamber being exposed to the fire and heat both on its outer and inner sides. Also making the said saucers with a double flange by means of which the bottom of the annealing pot is protected from the injurious action of the fire, as described. *Patent completed.*

1481 J. JOELING. *Improvements in apparatus for propelling and steering vessels.* Dated May 30, 1865.

This apparatus consists of a hollow vertical shaft on which is fixed a circular case, open in the centre to allow the water to enter when open, for about one-third, more or less of its circumference, to allow the water to pass freely out. Inside of the hollow shaft rotates another vertical shaft, on which is fixed a fan or fan-wheel, having two, three or more arms, fans, or blades, which, when in motion, cause the water to pass freely out of the case. For turning the vessel, or going astern, or altering the direction of the vessel's motion, this will be accomplished by causing the hollow shaft with the case to revolve or turn until the opening in its circumference allows the water to escape in the direction desired; it will thus not be necessary to reverse the engines, nor is any other rudder required. The apparatus may be fixed near the sternpost, and the shafts pass up where the rudder trunk usually is. The fan wheel shaft may be driven from above or below the circular case, as may be desired. *Patent completed.*

1482 W. MARTIN. *Improvements in brooms or brushes.* Dated May 30, 1865.

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

1483 M. MEISEL. *Improvements in spinning machinery. (A communication.)* Dated May 30, 1865.

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

1484 B. LAWRENCE. *An improvement in inkstands. (A communication.)* Dated May 30, 1865.

This improved inkstand is composed of a glass or other vessel with an opening or neck at the upper part, through which is passed a removable pipe enlarged at its upper end to form a bowl. The vessel is formed without a bottom, that is to say, it has not a bottom in a piece with it, nor has it a rigid bottom, but an elastic diaphragm is employed to form the bottom thereof, so that the glass or other vessel, together with this diaphragm, forms a receptacle or holder for the ink; the diaphragm is confined airtight to the lower edges of the body of the vessel by means of a rim or plate of metal or other material which forms the base of the inkstand. Across this base is a rod carrying a head stud or turning button at the outside of the base. It also carries a cam projection or eccentric at or near its middle portion below the centre of the elastic diaphragm, so that, by turning the rod, this eccentric will press up the elastic diaphragm, and cause the ink to rise in the bowl at the top of the pipe which descends into the ink. On the outside of the inkstand the glass or other material of which it is made may project in the form of ledges, highest at their outer edges, and pens or pencils may be laid upon these ledges, the inkstand itself thus serving as a pen rack. *Patent completed.*

1485 S. GRAYTON. *Improvements in keys of locks having through holes.* Dated May 30, 1865.

Locks having through holes support the key by means of bearing plates, one on each side of the lock, in which the key rotates and takes its bearing while operating on the lock. For a lock so made the key is furnished with a projection on the end which passes through the bearing plate on the opposite side to that at which the key is entered, and this oftentimes projects even through the door, so that the key can be turned by applying an instrument to grip such projection. Now, according to this invention the inventor proposes to make such projecting part of a concave or a hemispherical form, or it may even be of an oblate or prolate spheroidal form, but in all cases such that an instrument cannot be applied to take hold of it. *Patent abandoned.*

1486 B. H. COLLYER. *Improvements in the process and apparatus for the treatment of materials for the manufacture of paper and other purposes.* Dated May 30, 1865.

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

1487 J. CALVERT. *Improvements in the construction of locks.* Dated May 30, 1865.

This invention consists of certain improvements in the construction of locks, in which great simplicity is combined with extraordinary security. The mechanism employed consists of one or more cog wheels in combination with a circular plate or certain having teeth or projections formed on the periphery thereof, such teeth or projections being at right angles with the plane of the plate or certain. The said circular plate or certain is placed parallel to or in the same plane with the cog wheels, and it is actuated by a key or analogous contrivance from the ex-

terior of the lock. The specification of the invention is too voluminous to be given here in detail. *Patent completed.*

1488 L. MARTIN. *A wheel moulding machine, and method of moulding wheels.* Dated May 30, 1865.

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

1489 T. SPENCER. *Improvements in the composition and manufacture of paints applicable to iron and other ships' bottoms, and for other general purposes.* Dated May 31, 1865.

This invention consists, firstly, in the application of a ferruginous material known to mineralogists as "spathose ore" for the purpose of a pigment or paint to be used in mixture with oil, turpentine, or varnish, or any media with which paints, such as white lead, are usually mixed. Secondly, in the application of metallic iron in fine powder for a paint to prevent the adhesion of the well-known animal and vegetable bodies which so injuriously "foul" the immersed portion of iron ships, as well as in many instances those of wood. *Patent completed.*

1490 T. A. BROWNE and J. KNIGHT. *Improvements in driving apparatus for hair brushing and shampooing machinery.* Dated May 31, 1865.

This invention consists in placing on any number of bearings of the driving shaft, or on the driving shaft itself, any number of arms, so that they can be moved either way in a rotary direction. Each arm carries a two grooved pulley, one groove corresponding with a pulley fixed to the driving shaft, and the other groove corresponding with the pulley to which the brush is connected, which arrangement is for the purpose of enabling the brush band to be always tight in any position in which the brush is placed. A short arm projecting from the back of each arm is connected to a metal or india-rubber spring or weight of sufficient power to balance or overcome the weight of the other end, so that the front arm shall rise out of the way when not in use, and whatever may be the number of brushes the foregoing improved apparatus is applied separately to each. *Patent completed.*

1491 P. PILKINGTON. *Certain improvements in steam hammers, partly applicable to steam engines.* Dated May 31, 1865.

This invention consists, first, in making, the anvil block of steam hammers movable by rack and pinion, or other suitable means, and in applying two or more sawe blocks to the anvil block; by this arrangement each sawe block can be brought under the hammer head. The second part of the invention, which is applicable to steam hammers and other steam engines, consists in an improved arrangement of levers and eccentric to work the slide valve for admitting steam to the cylinder, both above and below the piston. The valve spindle is jointed to a beam which vibrates on a movable fulcrum, the position of which is governed by an eccentric; the beam above referred to is worked by a lever actuated by the piston rod or other convenient part of the engine. On this lever is a sliding block the position of which is varied by hand. By this arrangement the length of the stroke of the piston rod can be varied and the level through which the piston rod moves can also be varied. *Patent abandoned.*

1492 R. HOWARTH. *Improvements in apparatus for increasing the safety of railway passengers and trains, signalling, lighting, and forming a communication between all parts of such trains, also for securing the carriage doors.* Dated May 31, 1865.

The first of these improvements consists in so fitting and making the footboards of railway carriages that they may form a continuous platform or gangway along the side of the train. The next improvement consists in the introduction of a shaft and levers along each side of the carriages, and coupled at the ends, carrying rising and falling steps at the doors and securing the doors thereby. Another improvement relates to the mode of lighting the carriages and signal lamp by gas. For this purpose the inventor places compressible gasholders under the seats, on the tops, or under the carriages. *Patent abandoned.*

1493 I. ROGERS. *Improvements in means or apparatus for signalling on railway trains and effecting communication between passengers and guards or others in charge of such trains.* Dated May 31, 1865.

According to this invention communication is effected between the guard or others at one end or part of a train, to the engine-driver, or vice versa, by means of cords or other bands or chains conducted under the middle of the carriages, or otherwise along the train. These cords, bands, or chains are supported between pulley or other guides to each carriage, and they are formed in parts connected together, so as to be separable at each carriage for facility of varying the length of the trains, the parts being connected together by spring hooks or other suitable connections, whilst each end or other suitable part of each cord, band, or chain, is connected to a lever and clapper to act on a bell, gong, or other suitable alarm, and to a lantern for night signal, to attract the attention of the engine-driver, the guard, or others in charge of the train. *Patent abandoned.*

1494 H. MONIER. *An improved burner for gas and other lighting apparatus.* Dated May 31, 1865.

This invention is carried out as follows:—First, the patentee makes the burner in such manner that openings or draught holes may be formed by means of two or several pieces of glass, or other suitable transparent material, fitted together face to face, having formed throughout their length or width openings or concavities varying according to requirements; thus, when the two plates or pieces of glass are brought together face to face, the openings or concavities in one plate will come opposite those in the other plate, thereby forming a series of draught holes; or one plate only may have concavities, the other being plain, as may be desirable. He claims this improvement as applicable not only to his new gas-burner, but also to other gasburners for dividing the air into a number of small streams, and also to all kinds of burners for oil lamps. Secondly, another part of this invention consists in the use of a metallic alloy, which, although fusible, can be employed in these gasburners, because the heat produced is never high enough to melt the said alloy, in consequence of the new arrangements, and of the treble draught system introduced therein, and which is not used in other gasburners, or oil lampburners. Thirdly, the new burners are composed, first, for the metallic parts, of an alloy of tin, lead, regulus, and copper, combined in certain proportions; secondly, for the tubes and burners, of plastic porcelain, earthenware, and any refractory clay; thirdly for the draughting system of

glass, or any other vitrifiable and transparent materials, so arranged as to serve as a substitute for all the accessories of ordinary burners, that is to say basket, gallery, cone, and other metallic parts used in other systems. *Patent completed.*

1495 F. HAZELDINE. *Improvements in the construction of vans, waggons, or carts employed for transporting furniture and other goods on common roads and railways.* Dated May 31, 1865.

This invention consists in substituting wrought iron lattice work, or a combination of iron and wood work, on the girder and tension principles, in place of the ordinary wooden framing at present employed in the construction of vans, waggons, or carts, and in covering the whole with corrugated metal (zinc by preference), mahogany paneling, tarpaulin, mackintosh, or other suitable material, and, further, in arranging or disposing the rods employed to form the sides of the vans, waggons, or carts, either in parallel lines to each other or diagonally to the bottom sides of the vans, waggons, or carts. *Patent abandoned.*

1496 W. A. BROWN. *Improved mechanical arrangements for steering ships and other navigable vessels.* Dated May 31, 1865.

This invention is carried out as follows:—When the steering wheel is situated on a stage amidships, the inventor fixes on the axis of the said wheel a spur wheel which gears into another spur wheel mounted immediately under the former spur wheel; the bottom wheel aforesaid gears into a toothed rack mounted horizontally in suitable guides. To each end of this rack he connects one end of a chain which passes over pulleys suitably placed along the gunwale of the ship; the other ends of the said chains are connected to a long arm or lever fixed on the head of a rudder post. The outer end of this lever he proposes, if desirable, to connect with a toothed quadrant to neutralise or lessen the tremulous or vibratory motion of the rudder. He does not intend to limit himself to two spur wheels and one rack aforesaid, but proposes as a further security to us, a second steering wheel fixed on the opposite end of the axle of the former wheel, and to employ spur wheels and a rack similar to those already described, thus forming a double-action steering wheel, which can be used by a man at each wheel; or, if desired, one of the said wheels may be disconnected and the single action only be brought into use. He also proposes to adapt a stop to the rack rack aforesaid to hold the rudder in a fixed position when it is required to back the ship. *Patent abandoned.*

1497 F. N. GIBBS. *Improvements in apparatus for indicating the pressure of steam or liquids in gauges, and for signalling.* Dated May 31, 1865.

This invention consists of an apparatus to give motion to a hand or pointer on the face of a dial, having letters or other indications thereon, by the pressure of steam or liquid through tubing in communication with a corrugated chamber of an instrument similar in its substantial construction to an aneroid barometer. As the pressure is increased, the chamber is expanded, and motion is communicated to the hand or pointer; and so, if the pressure in the chamber be diminished, motion is communicated to the hand or pointer in a manner similar. The motion is given by the increased or diminished expansion of the chamber, so as to act on the parts connected with the hand or pointer, as in an aneroid barometer. For the purpose of signalling the signs are marked on the face of the dial, and the hand or pointer caused to move thereto by the pressure imparted. *Patent completed.*

1498 T. SUMMERSON. *Improvements in foundry cupolas.* Dated May 31, 1865.

This invention has for its object the saving of fuel used in foundry cupolas by utilising the heat at the top of the cupola to heat the blast of air before it enters the cupola. For this purpose the patentee places in the interior of a foundry cupola, and near its top, three or more concentric tiers of cast-iron chambers, through which the air is passed before being forced into the cupola. Each chamber is rectangular in section, and passes around all sides of the furnace, a small space being left between the back of the chambers and the sides of the cupola, so that the flames and heat may act on the backs of the chambers. The chambers are placed one above the other, an interval of a few inches being left between them, so that the flames may also circulate freely beneath them. The bottom tier, which supports the others, rests on the firebrick lining of the cupola level with the feeding door. The current of cold air produced by the fan or other means enters the bottom tier by one inlet, and after passing around the chamber it ascends to a chamber above through suitable passages formed for the purpose. The air is thus caused to pass through and around each of the chambers, and is so brought in contact with the whole heating surface. In the top tier are two or more outlets for discharging the heated air, which is conveyed by pipes to the tuyeres. Or the currents of the cold air may communicate with the top tier and be forced down to the bottom tier, where two or more outlets may be placed to convey the heated air to the tuyeres. *Patent completed.*

1499 W. E. NEWTON. *Improvements in the manufacture of carpets and other terry and cut pile fabrics. (A communication.)* Dated May 31, 1865.

The patentee claims, first, a back composed of a back of linen, jute, or other material, having a coat of rubber or other gum, upon which is fastened a face of yarn, of silk, worsted, wool, fur, or other material, the same being looped or tufted, as described. Second, a fabric made as described, and coloured, dyed, or printed, or coloured, and dyed, and printed, either before or after the face is applied. *Patent completed.*

1500 J. PETRIE, jun. *Improvements in machinery or apparatus for washing wool and other fibrous materials.* Dated May 31, 1865.

This invention consists in so arranging the aprons or other such apparatus in 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 adapting the guide of the feed apron, or other travelling apparatus above and over the surface thereof. Or he disposes the squeezing or delivering rollers horizontally, and in like manner carries the apron or other such apparatus above and over one of them. Another part of the invention consists in applying a connecting apparatus between the arrangement which lifts the material from the fluid and the squeezing or delivering rollers. *Patent abandoned.*

1501 F. and J. G. RICHMOND and H. CHANDLER. Improvements in machines for cutting hay, straw, and other vegetable substances. Dated June 1, 1865.

The first part of this invention consists in applying a movable or expanding jaw to the mouthpiece of machines for cutting hay, straw, and other vegetable substances, which jaw swivels upon or is hinged to the axle of the upper toothed roller, and is pressed down so as to securely hold the vegetable substances while being cut by a curved spiral spring or other suitable springs or weights. The second part of the invention consists in an improved arrangement of gearing for driving the toothed rollers, so as to vary their speed, and thereby to cut chaff of different lengths. To the fly-wheel shaft are fixed two bevel pinions gearing into two wheels of different diameters, one of which is keyed to while the other is loose on the line shaft, and these two wheels are connected when required by clutch boxes; when the clutch boxes are in gear, and the larger wheel is being driven, the line shaft imparts a slow motion to the toothed rollers by the usual change spur wheels and pinions, and when the clutch boxes are out of gear, and the smaller wheel on the line shaft is being driven, the toothed rollers revolve at a greater speed. The line shaft is moved to and fro in the direction of its axis to bring the clutch boxes into or out of gear by a starting rod which is acted upon by an eccentric and handle, or in any other convenient manner. Patent completed.

PROVISIONAL PROTECTIONS.

Dated August 11, 1865.

2080 W. T. Cole, Wentworth-road, Bow-road, H. S. Smith, Campbell-terrace, Hill-street, Peckham, and A. Soares, Seething-lane, City. Improvements in apparatus for obtaining and applying motive power to various useful purposes.

Dated October 10, 1865.

2606 J. A. Leon, Liverpool. Improvements in means and apparatus to be employed in the manufacture of sugar. (Partly a communication.)

Dated November 15, 1865.

2936 H. Clifton, Birmingham. An improvement in the process for making butter.

Dated November 16, 1865.

2992 R. Jones, Botolph-lane, City, provision merchant. Improvements in preserving animal and vegetable substances, and in means or apparatus employed therein.

Dated November 17, 1865.

2982 P. J. Fallon, Caryfort-avenue, Black Rock, Co. Dublin. Improvements in the treatment of spirituous liquors.

Dated November 20, 1865.

2977 A. Vesovalli, Claverton-street, St. George's-square, London. A new appliance for the electro-magnetic apparatus to increase the adherence of locomotive engine wheels to the rails.

Dated November 21, 1865.

2992 W., E., and J. Gray, St. Philip's Works, Sheffield. Improvements in the manufacture of beaters for threshing machines.

Dated November 24, 1865.

3014 H. J. Cox, Aston, near Birmingham, and W. Leach, Birmingham, mechanical draftsman. Improvements in the manufacture of airtight coffins, and in the mode of ornamenting or finishing the same, as also in the application of a material or composition not hitherto used in their production.

3018 J. Wauthier, Dalton. Improvements in obtaining motive power, and in apparatus employed therein.

3018 J. Whitworth, Manchester, engineer. Improvements in casting iron and steel, and in apparatus employed for this purpose.

3020 S. C. Salter, Market Drayton, Shropshire. An improved apparatus for shrinking cotton, woolen, and other textile fabrics.

3022 W. E. Newton, Chancery-lane, civil engineer. Improvements in shields for trunks or packages. (A communication.)

3024 A. V. Newton, Chancery-lane, mechanical draftsman. Improvements in the construction of railways, and in spikes for securing the rails in position. (A communication.)

Dated November 25, 1865.

3026 J. Draper and W. Leech, Wigan, Lancashire, brassfounders. Certain improvements in water gauges to be employed in connection with steam boilers.

3027 J. Arrowsmith, Bilton, Staffordshire, engineer. An improved machine or apparatus for shaping and forging iron.

3028 R. T. Hothersall, Darwen, head knitter, and S. Cook and W. H. Hacking, machinists, Bury, Lancashire. Improvements in machinery for the manufacture of heads for looms for weaving.

3030 F. Traohsel, analytical chemist, and W. Hall, brassfounder, Manchester. Improvements in moulding for casting steel, iron, and other metals.

3034 G. T. Bousfield, Loughborough Park, Brixton. Improvements in making wrought iron. (A communication.)

Dated November 27, 1865.

3036 J. P. Baragwanath, Upper Thames-street, City, engineer. A combined adjustable spanner tube cutter and pipe wrench. (A communication.)

3038 W. Hodgson, Bradford, machine and tool maker. Improvements in screw mill boxes.

3040 W. E. Newton, Chancery-lane, civil engineer. Improvements in machinery for cutting mouldings in wood. (A communication.)

3041 W. E. Newton, Chancery-lane, civil engineer. Improved machinery to be used in the manufacture of paper. (A communication.)

3042 W. R. Lake, Southampton-buildings, Chancery-lane, consulting engineer. An improved composition for enamel, paint, varnish, cement or plaster. (A communication.)

3044 W. R. Lake, Southampton-buildings, Chancery-lane, consulting engineer. Improvements in shaft shackles. (A communication.)

Dated November 28, 1865.

3049 E. Drucker, manufacturer, Rue Gaillon, Paris. Improvements in the manufacture of stays, corsets, and other similar articles.

3050 L. D. Carbonnier, Rue de la Chaussée d'Antin, Paris, doorpad manufacturer. Improvements in apparatus for preventing draughts of air between the floor and the lower part of doors.

3051 W. Simons and A. Brown, Renfrew, engineers and shipbuilders. A new or improved method of preventing the escape of heat from steam cylinders.

Dated November 29, 1865.

3056 H. A. Bonneville, Porchester-terrace, Baywater. Improvements in coverings for the head. (A communication.)

3057 T. Laurie, educational publisher, Cockburn-street, Edinburgh. An improved piece of furniture convertible into a seat with back on either side, a seat with desk on either side, or a seat with a table on either.

3060 J. Stokes, Dudley, Worcestershire, ironmonger, and T. Gray, Birmingham, brush manufacturer. Certain improvements in the manufacture of brushes.

3062 T. Lancaster, Bootle, near Liverpool, engineer. Improvements in means or apparatus for economising and inducing more perfect combustion of fuel in furnaces.

Dated November 30, 1865.

3071 W. Thompson, Lower Gardiner-street, Dublin. Improvements in fining, purifying, and mellowing spirituous liquors by combining therewith other substances for the production of a new spirituous or vinous compound therefrom.

3073 J. Kerfoot, Blackburn, Lancashire. Improvements in the "top rollers" employed in the manufacture of fibrous substances.

3075 J. Gangee, Albert Veterinary College, Baywater, prof. of veterinary surgery. Improvements in disinfecting stables and cattle sheds, and in the apparatus employed therein.

3077 J. L. Norton, Belle Sauvage yard, Ludgate-hill, and J. Landless, Nelson, near Burnley, Lancashire. Improvements in apparatus for registering the speed of machinery and apparatus for registering the pressure of steam and other fluids.

Dated December 1, 1865.

3081 J. Wilson, Birmingham, brassfounder. Certain improvements in the manufacture of knobs for doors, cupboards, ashtrays, and for other like purposes.

3083 L. J. Handley and C. Wilkins, manufacturers, Aston-juxta-Birmingham. Certain improvements in the manufacture of compasses, callipers, and dividers.

Dated December 2, 1865.

3089 W. Johnston, Glasgow, lamp manufacturer. Improvements in lamps, lanterns, and gas fittings.

3091 E. Scott, Manchester, engineer. Certain improvements in looms for weaving. (A communication.)

3093 T. A. Weston, King's Norton, Worcestershire, mechanical engineer. Improvements in apparatus for raising, lowering, and moving heavy bodies, and for transmitting and exerting motion for various purposes.

3095 E. B. Wilson, Edinburgh, engineer. Improvements in furnaces.

3097 R. Cooke, Hathersage, Derbyshire, umbrella manufacturer. An improved stretcher for umbrellas and parasols.

3099 T. Bell, Plaistow. Improvements in treating the oxide of iron, residues, of gas, and purifying in order principally to extract sulphur therefrom.

3101 T. N. Bennie, Gowan, Lanarkshire, engineer. Improvements in apparatus for distilling oils and condensing oily vapours.

Dated December 4, 1865.

3109 W. Beardmore, Parkhead, Lanarkshire. Certain improvements in the construction of forge furnaces.

3111 A. Paraf and R. S. Dale, Manchester. A new colouring matter for producing scarlet colours upon woven fabrics and yarns.

3113 E. O. Hodges, Florence-street, Islington, gun maker. Improvements in the construction of breechloading firearms.

3115 J. Tomlinson, Eden Mount, Carlisle, merchant. Improvements in the manufacture of disinfectants.

Dated December 5, 1865.

3117 P. A. Muntz, Keresley, near Coventry. Improvements in the manufacture of metal tubes.

3119 R. A. Brooman, Fleet street, patent agent. A new or improved cement or composition applicable to the agglomeration or moulding of various materials, and to other useful and decorative purposes. (A communication.)

3121 J. Prest, secretary, H. Harrison, commercial traveller, and B. Roebor, civil engineer, Bedford Leigh, Lancashire. Certain improvements in insulators for electrical purposes.

3123 I. Holden, M.P., Bradford. Improvements in means or apparatus for preparing and combing wool and other fibrous substances.

3127 G. E. Donisthorpe, Leeds, top and noll manufacturer. Improvements in machinery employed when getting coal and other materials.

3129 E. Healdy, Cambridge, ironmonger. Improvements in the manufacture of tanks, baths, managers, and other vessels.

Dated December 6, 1865.

3131 J. Taylor, Birmingham, metal merchant. Certain improvements in the manufacture of railway chairs and in the manner of securing rails thereto.

3135 H. B. Hamilton, East-street, Manchester-square, bedstead manufacturer. Improvements in the construction or manufacture of metal bedsteads.

3137 G. Macdonald, Aston, near Birmingham, civil engineer. Improvements in machinery or apparatus for cleaning and ginning cotton and other fibrous substances.

3139 J. H. Pepper, Boundary-road, St. John's Wood, prof. of chemistry, and T. W. Tohin, Watson's-road, Wood Green. Improvements in apparatus for illusory exhibitions.

3141 W. E. Newton, Chancery-lane, civil engineer. Improvements in steam boilers and in the furnaces and grates thereof, the same improvements in furnaces and grates being also applicable to other furnaces and to stoves. (A communication.)

3143 N. Salomon, and W. J. L. Davids, Ludgate-street. Improved machinery for manufacturing sewing machine needles. (Partly a communication.)

3145 W. H. Claburn, Norwich, shawl manufacturer. Improvements in manufacture of shawls and similar ornamental weavings.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

Dated December 9, 1865.

3184 N. W. Wheeler, Brooklyn, New York, U.S. Improvements in steam boilers and in apparatus adapted for cleaning the flues of boilers.

LIST OF SEALED PATENTS.

Sealed December 15, 1865.

1637 W. Howes and W. Barley	1649 C. T. Porter
1652 W. E. Gedge	1684 E. Finch
1661 D. M'Glashan	1723 R. Boot and J. Oxen
1662 E. Dupont	2086 H. E. Guy
1666 W. E. Gedge	2119 J. B. Brown

Sealed December 19, 1865.

1659 A. Barff and E. L. Sim	1712 J. Spratt
1674 E. K. Dutton	1724 P. Jacobson
1691 R. A. Brooman	1808 J. Willis
1693 P. A. le C. de Fontaine	1898 J. H. Wray
1694 P. G. David	2429 H. A. Bonneville
1698 C. R. Bamber	2432 W. Turner, S. Shore, and W. Halliwell
1705 J. Whittle	2436 T. V. Lee
	2453 W. E. Newton

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the London Gazette, December 19, 1865.

2014 H. D. P. Cunningham, Workingham.	
2019 P. Robertson, Brewing.	
2022 J. Gankroger and J. Dodgeon. Sizing yarns.	
2037 T. Smith and J. Brook. Selfacting coupling.	
2047 L. J. Crossley. Electric telegraph. (A communication.)	
2051 M. P. W. Boulton. Generating steam.	
2057 J. Gale, jun. Gunpowder.	
2063 S. and J. Law. Breechloading firearms.	
2064 C. West. Warning of undue heat.	
2067 B. Russ and E. Gandell, jun. Sewing machines.	
2070 L. Schad. Violet colours.	
2073 J. and H. Ingham and J. Broadley. Looms.	
2074 C. O. Crosby. Needles.	
2080 W. T. Cole, H. S. Swift, and A. Soares. Motive power.	
2082 R. D. Morgan. Couplings.	
2083 R. A. Brooman. Printing threads. (A communication.)	
2086 T. E. Stephens. Communication in railway trains.	
2021 W. Bullock. Looms.	
2097 F. Brampton. Files.	
2103 R. O. Lilly and J. Sunderland. Sleeve links.	
2126 R. A. Brooman. Washing fabrics. (A communication.)	
2134 J. L. Clark. Recovering telegraph cables.	
2137 R. A. Brooman. Cast steel. (A communication.)	
2170 D. J. Moody. Floating lights.	
2173 J. Wrigley and M. B. Westhead. Preventing the vibration of sliding windows.	
2244 H. C. Ash. Ice safes.	
2256 W. Clark. Permanent way of railways. (A communication.)	
2258 W. E. Newton. Winding yarns. (A communication.)	
2278 J. Cunningham. Fireproof floors.	
2303 J. A. Leon. Sugar. (Partly a communication.)	
2385 C. Cochran. Separating dust from gases.	
2399 H. O. Garden. Metronome.	
2398 J. R. Cooper. Breechloading firearms.	
2392 W., E., and J. Gray. Threshing beaters.	
3018 J. Whitworth. Casting iron.	
3022 W. E. Newton. Shields for trunks. (A communication.)	
3024 A. V. Newton. Railways. (A communication.)	
3034 G. T. Bousfield. Wrought iron. (A communication.)	
3047 C. H. Newman. Untoxicating malt.	
3071 W. Thompson. Fining spirituous liquors.	

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 £20 HAS BEEN PAID.

3331 C. Hancock and S. W. Silver	3394 I. Holden
3336 J. W. Baker	3395 I. Holden
3366 W. Tongue	3397 W. S. Longridge
3379 G. A. Huddart	3401 A. T. Blakely
3384 J. Clayton	87 E. Luby

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

2876 J. Wardill	2900 J. Mackenzie
2896 J. Kerr	39 J. Howard

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending December 16, 1865.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
122	a. d.	247	s. d.	254	s. d.	261	s. d.	268	s. d.
202	1 0	248	0	255	10	262	10	269	0
212	0	249	1 6	256	0	263	0	270	0
243	1 10	250	10	257	0	264	0	271	0
244	0	251	0	258	0	265	0	272	1 10
245	0	252	10	259	3	266	0	273	0
246	0	253	1 10	260	0	267	0	274	0

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. Bennett Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

MECHANICS' MAGAZINE.

LONDON: FRIDAY, DECEMBER 29, 1865.

THE ATLANTIC TELEGRAPH.*

THE Atlantic Telegraph has been so recently before us in all its varied details, and has had its history so minutely recorded in the public journals, that we were scarcely prepared to see it so soon reproduced in the form now before us. But we gladly hail this record of an expedition which riveted the attention of the whole world as it sped on its mission of peace, and welcome this gathering-up of the detached chapters in the cable's history into one interesting and consecutive whole. It is most meet that such a history should be preserved from the oblivion to which it naturally becomes heir when recorded only in pages which can command but little more than an ephemeral interest. But perhaps there is only one man at whose hands the public would be inclined to accept the history of the Atlantic cable, its hopes and fears and final disaster, and that man is the one who has treated the matter so well already. Remembering Mr. W. H. Russell's diary on board the "Great Eastern," we are led to anticipate the result of his treatment of the subject in detail and at leisure. Nor are we disappointed in our expectations, for in the volume just fresh from Mr. Russell's pen he fully sustains his reputation as a writer of narrative and a chronicler of fact. The interest of the present work is greatly enhanced by the numerous admirable illustrations of scenes and events in the cable's history by which the narrative is accompanied, and which are the production of Mr. Robert Dudley. The publication of the book has been entrusted to Messrs. Day and Sons, nor could it have been placed in better hands, as by their happy style of chromo-lithography the illustrations have had full justice done them, whilst the whole work is an elegant production of its kind. We have so closely followed the fortunes—and misfortunes—of the last Atlantic cable expedition that, although presented in a new garb, we cannot find in the narrative many new things of special and exclusive interest to our readers. But Mr. Russell does not confine himself wholly to the recent mission of the "Great Eastern;" he prefaces the subject with a reference to the antecedents of the last telegraphic expedition, and here we find points worthy attention. Written rather as a popular than as a scientific record, the volume before us very appropriately omits any notice of the progress of electrical science in past times, although the author cursorily refers to its more modern development. In the course of his remarks he raises a question which is very often raised in the present day, and to which we have occasionally referred. This question is: whether the man who gives a new idea to the world, or he who embodies that idea in a form and turns it into a fact, is deserving of the credit to be assigned to any invention. We grant it is not always an easy point to decide, but, with our author, we do not think a discovery is involved in a vague expression of belief that a certain end may be attained at a future period by means then unknown. It certainly does not entitle the person from whom it emanated to the honour due to him who indicates specifically the way of achieving the object, or who actually accomplishes it by methods he has either invented or applied. But there is still a certain degree of credit due to those who, contending with imperfect materials and lack of knowledge, persistently work out their views and thus place themselves on a level somewhat above that of mere visionaries.

The history of the practical application of electricity to the purposes of telegraphy is an interesting one; it stretches away farther than we are apt to imagine who measure its age by its more recent rapid developments. The first electric telegraph is ascribed by Humboldt to Salva, who in 1798 constructed a line between Madrid and Aranjuez, a distance of twenty-six miles. Aerial telegraphic lines are attributed to the Baron von Schilling, who in 1834 proposed a line from St. Petersburg to Peterhoff below Cronstadt, and although the Russians laughed at the Baron's proposition they yet claim for their country the honour of having invented this system. The Baron, however, succeeded in transmitting messages through the air along wires supported by poles. To Mr. Wheatstone the Count du Moncel has awarded the credit of inventing submarine telegraphy. Although this is a moot point it is certain that in 1840 Mr. Wheatstone brought a proposition before Parliament to lay a cable between Dover and Calais. He was, however, by no means clear as to the manner in which insulation was to be effected. Three years later Professor Morse experimented with an electric magnetic telegraph between Washington and Baltimore, and in reporting the results he stated the practical inference to be that a telegraphic communication on that plan might with certainty be established across the Atlantic. He further expressed his confidence in the ultimate realisation of that project. But these were merely suggestions which it required much subsequent hard work in the way of experimental research and discovery to bring into practical shape, although it must be admitted that, before Professor Morse expressed the sentiments embodied above, he was careful to satisfy himself that what he prophesied was practicable. In 1842 he stretched a submarine cable from Castle Garden to Governor's Island in the harbour of New York, and clearly demonstrated the practicability of effecting electric communication through the sea. He subsequently sent a current across the canal at Washington. But even Morse was not the first to effect this means of communication, inasmuch as in 1839 Sir W. O'Shaughnessy laid an insulated wire across the Hooghly at Calcutta and produced electrical phenomena on the other bank of the river. In 1846 Colonel Colt, of revolver notoriety, and Mr. Robinson, of New York, laid a wire across the river from that place to Brooklyn, and from Long Island to Coney Island. At home, three years later, we had Mr. Walker sending messages from a steamer, off Folkestone, to land, through an insulated wire two miles in length.

But it was not until 1851 that an electric cable was laid and worked successfully in the open sea. This was the wire laid between Dover and Calais, and which was unquestionably the first practical submarine telegraph. In the previous year a concession had been granted to Mr. Brett by the French Government for this purpose, but, like the Baron von Schilling, Mr. Brett only got laughed at, and his scheme was regarded by some as purely chimerical, and by others as something worse. But it came to pass, however, that in spite of all opposition, the cable was made and laid and worked. It was made of one solid copper wire, coated with gutta-percha; it was laid from Dover to Calais, the landing-place being Cape Grisnez, and for some hours was successfully worked. But an unhappy fate awaited it. An unsophisticated fisherman took up part of the cable in his trawl, and cutting a piece out from it, hastened to Boulogne, where he exhibited the fragment as a piece of rare seaweed with its centre filled with gold! This untoward circumstance naturally drew attention to the means of preserving submarine cables from accidents of this nature, and led to Mr. Küper's proposition that the wire insulated with gutta-percha should form a core to a wire rope. This idea was adopted by Mr. Crompton in the next cable, which was laid between Dover and Calais by that

gentleman and others in 1851. This cable has since remained in perfect order and constitutes the main channel of electrical communication between England and the continent. Mr. Crompton exerted himself very considerably in laying the first cable under water. Not only were his personal services freely given, but in a pecuniary point of view he contributed very materially to its success. These circumstances, however, appear to be but little known, and his devotion to the cause of submarine telegraphy has met but scant acknowledgment. When once the proper method of constructing a submarine cable had been proved, there was no lack of enterprise in that direction. In a very few years several lines of a similar character were laid between England and the continent. Amongst the first were—one eighteen miles in length across the Great Belt, one from Dover to Ostend, another from Donaghadee to Portpatrick, one from Holyhead to Howth, and one from Orfordness to the Hague. But the superiority of the wire rope covering for cables was signally established in 1853, when the Electric and International Company laid down four wires between England and the continent. Their engineer advised the use of four separate cables of light wire, which owing to frequent injury from anchors and other similar causes were found so expensive to maintain that they were speedily replaced by heavy cables of great strength which remain in good order and cause no anxiety.

America appears to have been rather slow in appreciating the advantages of submarine telegraphy, for twelve lines were laid in the Old World before particular attention was given to the subject in the New. Corsica had been linked with Italy by one hundred and ten miles of cable, and Denmark had adopted the same method of connecting one of her little islands with the other. But then we must bear in mind that there were no great waters dividing the American lands. The rivers were the most formidable opponents the people had to contend with, and they were not too wide to be spanned by the overhead system of telegraphy, which in 1844 had gained rapid ground throughout the Atlantic and Gulf States. So the first step on the other side of the Atlantic to lay down a submarine cable was made by a British North American province. In Newfoundland a project was started in 1851-2 to run a line of steamers between Galway and St. John's in connection with a telegraph to Cape Ray. From this point a submarine cable was to be laid to Cape Breton, and to complete the route another cable was to be laid from New Brunswick to Prince Edward's Island. Mr. F. N. Gisborne, an English engineer, laid down the first submarine cable on the other side of the Atlantic. Mr. Gisborne was in London at the time of Mr. Brett's success, and soon after returned to America, where he had previously held a post in the telegraph department, and formed a company for facilitating telegraphic communication between Europe and the United States. In 1852 an act was passed by the legislature of Newfoundland conferring upon the company the important privileges, in the event of the project being completed in Newfoundland, which are now possessed by the Atlantic Telegraph Company. In carrying out his views Mr. Gisborne constructed a road from St. John's to Cape Ray over a barren tract of four hundred miles, and also made a coast survey. Eventually he laid an insulated cable eleven miles in length from New Brunswick across the Straits of Northumberland to Prince Edward's Island. A similar attempt, however, to connect Newfoundland with Cape Breton proved unsuccessful, and by this time the pecuniary resources of Mr. Gisborne's company gave out, so that early in 1854 the works were suspended, and Mr. Gisborne proceeded to New York in the hope of finding speculators who would back him with money to carry out the telegraphic scheme.

We have now reached the spring of the

* "The Atlantic Telegraph." By W. H. RUSSELL, LL.D. Illustrated by Robert Dudley. Day and Son (Limited), 5, Gate-street, London.

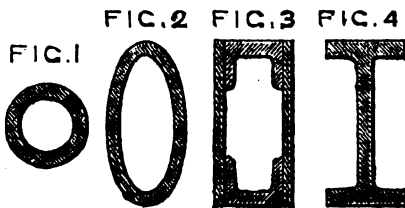
year 1854, which may be considered as the date of the birth of the great Atlantic Cable scheme, the father of the idea being Mr. Cyrus Field. It was to this gentleman that Mr. Gisborne communicated his plans respecting the completion of the Newfoundland and Cape Breton cable. Revolving this in his mind Mr. Field at length hit upon the grander scheme of spanning the Atlantic itself with a wire. Having conceived the idea he at once took the necessary practical steps towards its realisation, and from that time to the present he has been the great worker in and hearty sustainer of the enterprise. He first made himself acquainted with the soundings of the Atlantic, and investigated the possibility of conveying a magnetic current across that ocean. Having satisfied himself of the feasibility of the scheme he next took steps to form a company, which purchased the privileges of Mr. Gisborne's company and obtained others still more valuable from the legislature of Newfoundland. In a comparatively short time the company were in possession of most beneficial rights on both shores of the Atlantic, and this was brought about mainly through the exertions of Mr. Field, who threw every energy of body and mind into the work, and at an early stage of the proceedings was entrusted with the general management of affairs. In fact, to Mr. Field is due the sole credit of having converted the Atlantic cable from a mere conception into a practical possibility, though through many difficulties, and no little opposition. At length the manufacture of the first cable was commenced. This was on the 6th December, 1856, and within six months of that time the entire length of two thousand five hundred miles of cable was completed. In determining the structure of the cable no fewer than sixty-two kinds were tested before the ultimate decision was arrived at. In the cable finally adopted the central conducting wire was a strand made up of seven pure copper wires of No. 22 gauge. This strand, when subjected to strain, stretched 20 per cent. of its length without giving way or having its conducting power materially impaired. Over the strand, three coatings of gutta-percha were laid, which brought the core up to a thickness of about 3-8ths of an inch. Around the core was wound a serving of hemp saturated with a composition made chiefly of pitch and tar, and which served as a bed for the outer protection of wire. This outer covering consisted of eighteen strands of seven-thread wire of the same gauge as in the copper strand. The laying of this cable was entrusted to the British "Agamemnon," and the American "Niagara." The applicability of the "Great Eastern"—then known as the "Leviathan"—for the purpose was not overlooked, but at that time she had not been tried, and her failure would have involved that of a far more important experiment. So the cable was divided, and on the 7th August, 1857, the squadron sailed, the "Niagara" commencing to pay out her half. The unfortunate sequel is well known. After several minor accidents, the final break-down occurred on the 11th of August—four days from the time of starting. The cable broke in about two thousand fathoms of water when some three hundred and thirty nautical miles were laid at a distance of two hundred and eighty miles from Valentia.

Thus abruptly ended the first attempt to span the Atlantic with a telegraphic wire; but undaunted by the failure Mr. Field urged the immediate renewal of the enterprise. The paying-out machinery was improved, a further length of cable manufactured for replacing that which had been lost or damaged, and when the favourable season came round the ships again started for a point in the Atlantic midway between the landing shores. There on the 26th of June, 1858, the two halves of the cable were spliced and the ships turned their bows east and west and made for their respective destinations. But this attempt also proved abortive, for after three breakages and as many splices, the final fracture

occurred on board the "Agamemnon," which led to a suspension of operations. The ships returned to their starting-point, but as there yet remained a sufficient length of cable for the purpose it was determined to make another attempt to lay it. Pursuing the same course as before, the "Agamemnon" and "Niagara" once more met in mid-ocean on the 28th July, 1858, and on the 5th of August England and America were telegraphically united. During the few following days messages were transmitted and replies returned, and on the 18th the Queen of England sent a message through the wire to the President of America, to which an answer was speedily returned through the same medium. Everything appeared most hopeful, all went on satisfactorily until the 3rd of September, when a fault occurred which was the foreshadowing of the great calamity so soon to follow. The consummation of the disaster was not long postponed, for slowly, yet surely, the signals became less and less intelligible, until at last the cable utterly refused to transmit them, and thus the long-cherished hopes of many were silently annihilated. But there was no yielding to despair. Mr. Field, active as ever, compassed land and sea incessantly, and pressed his friends on both sides of the Atlantic for aid to renew the attempt. And ultimately the attempt was renewed; a new cable was made in which all the most recent improvements were introduced, the "Great Eastern" was chartered, and, in fact, everything was done that science could suggest or skill devise to ensure the success of the enterprise. But all was of no avail. Every contingency appears to have been properly provided against except the one which led to failure—the necessity of picking up the cable. But unsuccessful though the recent expedition proved it has only stimulated the ardour of Mr. Field and his colleagues and led them to renewed exertions. A new cable is now being manufactured, improvements are being made in the picking-up machinery, and in the "Great Eastern" to fit her for the next voyage. With all this in view, and the experiences of the past to guide operations it is not too much to expect that the next attempt to lay a telegraphic cable from our shores to those of America will prove a glorious success. In his concluding lines Mr. Russell observes that the "last word transmitted through the old telegraph from Europe to America was 'Forward,' and 'Forward' is the motto of the enterprise still."

HOLLOW IRON IN SHIP CONSTRUCTION.

THE arrangement of the materials of a structure so as to combine the least weight with the greatest strength is a matter for serious study, especially in the construction of ships. If in these there are portions where great weights are particularly objectionable it is at the extremities, and here in iron ships—especially ships of war—the requirements of stem and sternposts involve the use of large forgings. The sternposts and afterpiece of keel in the largest of the latter class of vessels weigh upwards of 30 tons. The reduction of this dead weight without decreasing the strength of the parts, or in any way unfitting them for their work, is a matter requiring consideration.



This object might be effected in many instances by the substitution of forgings of the forms shown in the accompanying engraving for the solid ones now generally in use. Figs. 1 and 2 show sections of tubes for rudder-

posts and portions of bodyposts above the screw shaft. These may be made with a welded side joint, in the same manner as the hollow wrought-iron pillars in present use, or, if preferred, the joint may be riveted like those of an iron or steel mast or yard. When used as rudderposts the tubes may easily have flanges formed at their heels for security to the keel; and bearings for the pintles of the rudder, after end of shaft, also flat surfaces for securing to any interior portion of the ship, may be readily shrunk on the posts, and secured to them where required. As the advantages of using hollow tubes are greater in cases of torsion than when subjected to transverse strains, and as hollow cylinders—at least cast-iron ones—have already been found advantageous when used in shaftings, why should not steel or wrought-iron tubes be substituted for the solid rudder-stocks, which, in our largest class of vessels are generally from 10in. to 12in. in diameter? If they could be constructed so as to withstand the vibration, they might be used in place of the greater part of the solid screw shaftings, which in large ships, it will be remembered, are about 20in. in diameter, and sometimes exceed 100ft. in length. If the opinion entertained by some be correct, that the destruction of screw shafts is occasioned, not by crystallization caused by vibration, &c., but through their central part not being formed into a homogeneous mass, owing to the difficulty of forging such large pieces, this difficulty would be overcome by substituting for forgings tubes formed of well-rolled iron or steel plates, of the homogeneity of which there need be little doubt. The advantages, if a lighter system of screw shafting could be adopted, would not simply be a decrease in the displacement and straining of the ship, but—as is evident—power would be economised, the bearings would not be so liable to get heated, and their wear would not be so rapid. As it is usual to support only one end of each piece of the shaft on bearings, this part might consist of a short solid piece of forging, having at one end the usual flange for securing to the adjacent piece. The hollow cylinder, after having also been flanged at one extremity, might then have its unflanged end fitted to encircle the unflanged end of the forging, to which it might then be secured, and into which it might be partly recessed if necessary. Fig. 3 shows an application of the box form, which, if preferred to the preceding sections, could with slight modifications be carried out in the afterpiece of keel, rudder, and bodyposts, a short forging being introduced in the middle of the latter to form the bearing for the shaft. Fig. 4 shows another form, which could be rolled and welded similarly to a Batterley beam. The rudderpost and upper portion of the bodypost may be made after this manner, the spaces between the flanges in the submerged portion of the rudderpost being filled in flush with timber, so as not to retard the progress of the vessel. In the case of twin screws a double advantage would be gained by the adoption of any of these methods of construction.

ANNUALS.

UP to the present time we have but a slender stock of Annuals, or, to call things by their right names, Almanacs, for 1866. However abundant the crop may be we have received but sparingly of the fruits, and have been waiting in the hope of adding to the number of the few now to be noticed. Gutch's Literary and Scientific Register and Almanac has now kept steadily on its way for a quarter of a century, and the present issue in no way falls short of those by which it has been preceded. It will be found an especially useful pocket companion to every man of science, embodying, as it does, in a condensed form valuable information relating to every department. Great credit is due to

London: W. Stevens, 421, Strand. T. Agnew, 5, Fleet-street.

the editor for having kept the different branches of science treated on *en courant* with our present knowledge, and for having introduced several improvements in the new volume. But not only to men of science does the book commend itself, for it is of interest to all classes, as besides the useful matter given in the almanac itself, it contains an amount of literary and scientific intelligence surprisingly large for so small a compass as a pocket-book. The matter is arranged alphabetically, is easy of reference, and forms, in fact, a complete pocket encyclopædia, which we can well recommend to our readers. The miscellanea is especially full of useful and valuable recipes, and even the cover is utilised by having the standard English and French lineal measures printed thereon. Although very specific in its information, Dietrichsen and Hannay's *Almanac** is not less useful to the general public, and should have a place on every library table and office desk. The editor has this year added the names of the staff-commanders to the list of officers of the Royal Navy, and has given a table of the value in British currency of foreign money, which latter will be found generally useful. Our horticultural readers will find much to interest them in the Gardener's Year-Book, Almanac, and Directory,† by Robert Hogg, LL.D., F.L.S., which has reached its seventh year. The well-known ability of the compiler is a guarantee for the value of the contents, which are well worthy of perusal, forming as they do in one part, a record of the progress of horticulture. After a comprehensive almanac is a well-written article on the new roses, by Mr. William Paul, who gives a select list of those introduced in 1864-5. The new or notable fruits, plants, and flowers of the past year are then treated of, and the book concludes with a directory especially serviceable to those engaged in horticultural pursuits. Nor will our agricultural friends find Newcombe's Farmer's Pocket-Book‡ less useful to them; it contains a well-arranged almanac, the stock breeder's calendar, a list of fairs and markets in England, with numerous agricultural and other useful tables. In addition to these, there are ruled pages for diary memoranda, and cash account, as well as some concise articles on various legal points with which the farmer will do well to make himself perfectly acquainted.

THE RIVAL RIFLE 7-INCH GUNS.—HAS LANCASTER'S SYSTEM BEEN JUSTLY CONDEMNED?

Those who every day around us so glibly prattle of "facts being stubborn things" have but little notion how flexible they may be made, and what slippery things they become even in the most honest heads and hands, when people experimentally seeking for them, and intending to ask a given question of nature, put it so awkwardly or indistinctly that they really put quite a different one, and yet accept the answer that nature gives—for she always answers the real question put—as if it were the response to the intended question. This happens constantly in the experiments of men of untrained minds; and, even with the best, is most likely to happen where the conditions inseparable to the subject are most numerous. This last fact is one of the reasons why it is found so hard to elicit the truth as to any artillery question—even if the determination were unbiassed by rivalries and partialities—where guns, ammunition, materials, wind, weather, men's nerves, and other circumstantialities, are all mixed up in the problem. We have never been more struck with this than in reading the report made by the Ordnance Select Committee on the trials in firing shot from the 7-inch competitive guns, rifled on the Lancaster, French, and Scott systems, moved for by the Marquis of Harrington in March, and ordered to be printed by the House of Commons in July last. Nobody, it would seem, unless it be the Select Committee itself, has been satisfied with the report—elaborate a mass of facts and figures, extending to 84 blue-book pages, though it be; for of the five original competitors two, Messrs. Jeffery and Britten, were at once "bowled out" on the ground that their lead-coated shot would not stand the shock of explosion; Com-

mander Scott has, we are informed, demurred to the conclusions arrived at against himself, and has had his cause advocated in the pages of our contemporary the *Engineer*; while Mr. Lancaster, we are given to understand, formally protests against the condemnation of his system. This is contained in the statement that "The Committee having then witnessed the firing of upwards of 400 rounds from these (the Lancaster, French, and Scott) guns, were unanimously of opinion that the Lancaster system should be rejected on account of the tendency to crush in the bore, evinced by the condition of the recovered shells, its inferior accuracy, and the difficulty of loading; and that of the two remaining competitors, they considered the so-called French system to be the better." Thus, for the moment, "the so-called French system" (such are the Committee's words) holds the stage; but in steps Major Palliser and the august chorus of the Select Committee itself, exit the so-called Frenchman, and enter "the Woolwich gun," as we are instructed the chosen instrument is now and hereafter to be called.

We do not mean to touch upon the question of the Ordnance Select Committee being, in the same persons and at the same time, themselves inventors, contrivers, and improvers—functions that we should be far from denying to them under different arrangements—and also experimental judge, jury, and counsel for the Crown against the private inventor, who has no counsel for him, and who is sometimes, although not always, tried in his own absence. Nor do we propose to go into the question of whether the Scott system has been justly set aside in this report; nor whether "the Woolwich gun" really deserves the *optima spolia* it has acquired from the hands of its own foster-fathers. Nor do we mean to suggest any intentional unfairness towards any one of the candidates on the part of the Select Committee, sitting on which, besides their able and accomplished president, General Lefroy, we know there are men of whom such a supposition would be absurd. This, however, we do boldly affirm, that there is scarcely a deduction made or a conclusion come to from the facts of the trials that is not vitiated and rendered untrustworthy, as respects the Lancaster system, by reason of an inceptive fallacy in the conditions; and that the condemnation of the Lancaster system, which has been based upon the deductions supposed to have been elicited from trials co-ordinate and equal as respects all the competitors, is fallacious, and not warranted. These are outspoken words; but we expect, without much difficulty, to justify them to our readers—at least to those who are in possession of the requisite amount of preliminary knowledge of artillery.

It will be recollected that the late Lord Herbert of Lea, when Minister of War, directed a set of experiments to be made with cast-iron rifled guns, all of a 32lb. calibre, and 56-cwt. guns; the trials being primarily for endurance under several different systems of rifling. A long and tedious course of trials was made, which, in brief, eventuated in the following results:—1. Four Whitworth guns—two being 32-pounders, and two 68-pounders—all burst under the 25th round. 2. One Britten gun, 32-pounder, but only bored up to 18-pounder calibre, burst on the 60th round. 3. One gun, 32-pounder, Scott's rifling, burst on the 73rd round; one gun, 32-pounder, Scott's rifling, burst on the 810th round. 4. Two guns, 32-pounders, Jeffery's rifling, burst on the 50th round. 5. One gun, 32-pounder, Hadden's rifling, burst at the 205th round. 6. One gun, 32-pounder, on the French plan of rifling, burst on the 120th round. 7. One gun, 32-pounder, oval bore, rifled on Lancaster's system, fired 2,000 rounds without injury, and is now, we believe, deposited in the Rotunda at Woolwich, sealed by the Ordnance Select Committee, with the history of its remarkable endurance painted upon it. Yet, notwithstanding the fact that out of twelve guns tried, eleven had burst with between 50 and 310 rounds, while one alone (the Lancaster) had stood uninjured 2,000—had then actually tired out the patience of the Committee, and it remains still to be tried how many hundred more rounds it might fire before its being worn out or being destroyed: in the face of all this, and against all probability, the Ordnance Select Committee of that day, in their discussion of the results of those trials, reported their opinion that the superiority of the Lancaster gun was a mere accident, and that it was to be attributed to the fortuitous fact (which is itself a simple unproved assumption) of the superiority of the metal of which the Lancaster gun was made.

Strange indeed, that seven rivals, with Mr. Whitworth amongst them, and eleven competitor guns, should have been so preternaturally unlucky, and Mr. Lancaster, not himself an ironfounder, and hence obliged to entrust the making of his guns always to others, so fortunate—with the chances alone eleven to one against him! The opinion, we may not shrink from saying, looked like a foregone condemnation. It was under any view improbable in itself, and ignored wholly those circumstances in the molecular constitution of cast iron and of other bodies, by which fracture under severe and especially impulsive strain is superinduced by re-

entering angles and abrupt changes of contour, such as are inevitable in all sorts and forms of grooved rifling. Our own remarks in elucidation of this, in relation to the preceding competition—may, our own prediction of what the result of such a competition should be—may be found in some of the past pages of this journal. However, we recur to this competition with cast-iron guns no further than to point out that a result so remarkably pronounced in favour of Lancaster's system ought to have entitled it long since to a far more searching and exhaustive series of experimental investigations than it has even yet received, and to fairer treatment than it has had accorded to it in these later trials with wrought-iron guns. Before passing on to these later trials we may just remark, that had the opinion of the Ordnance Select Committee, that the surprising endurance of Lancaster's cast-iron gun, so facile *principes* above all rivals, was due to a more happy accident of metal, had any foundation whatever beyond mere unsupported conjecture, it ought to have become supported by observation of the results of trials with wrought-iron rifled guns made at Woolwich, Elswick, &c., upon various grooved systems of rifling, and upon the oval bore system, subsequently to the series of cast-iron experiments. Here, with wrought iron, there is little or no room for happy accidents; the metal is and can be known to be the same for all; the workmanship of Woolwich or of Elswick cannot be called in question. The happy accident of superior metal, therefore, must here disappear. Lancaster must stand or fall on his naked merits or demerits; and if it be that the endurance of his guns in cast iron—seven times greater at least, possibly greatly more, than that of his next best competitor—was only so because good metal saved him in spite of his evil system, while bad metal destroyed all his seven opponents in spite of their several and many virtues, then must the gods decree contrary now, when the nature of the material must give equal and fair play to all.

Well, what appear to be the general facts since then? Sir William Armstrong's 600-pounder 22-ton gun, 13-inch calibre, made at Elswick under his own eye, has probably not fired one hundred rounds, if so much (we do not know the precise number); yet it is said to be deeply fissured along the angles of the rifle grooves, and to be no longer safe with full charges. The 300-pounder 12½-ton gun, made by Sir William, blew the breech out before it had fired a very few rounds. The French 7½-ton gun was found to be deeply fissured along the rifle grooves, reaching, we have understood, quite through the steel lining tube. The Scott 7½-ton gun suffered the same fate, at or near the breech end. The 7-inch Armstrong shunt gun met with the same disaster, after very little practice; and only this year (if we have been rightly informed) the Frederick 7-inch 135-cwt. gun, a six-grooved shunt rifle, had only fired a very few experimental rounds before it was also split at the angles, through the steel lining tube, and was returned by the navy as unserviceable. Against all these varied misadventures we have the fact that the Lancaster 7½-ton 7-inch oval-bored gun of wrought iron, after having fired nearly 500 rounds with 19lb., 20lb., and 25lb. charges, remains sound, smooth, unassured, and uninjured. Are we here once more to say with Hamlet—

— "Oh no, here's metal more attractive?"

or must we admit at last the truth that all true science points to beforehand—viz., that there are real elements of endurance in the oval bore that are wanting to all grooved guns? These latent but unshunnable evils of the grooved or polygonal system are masked in small guns; but they have shown themselves unmistakably enough in every attempt made to produce a rifled gun of great calibre on any grooved system. If rifled guns of great calibre are to be produced, and admittedly these are the demand of the moment and of the future, then must the Lancaster system be resorted to, or some other equivalent, if any such can be found, that will permit the rifled principle to be employed without sharp grooving, or any abrupt changes of contour or of thickness in the interior of the chase. For this reason it is, because we hold still, as we have long done, that in the Lancaster system lies the hope of the heavy rifled artillery of the future, do we regret the circumstances and the conclusions of the Ordnance Select Committee as to the trials reported on in July last.

We proceed now to point out briefly why we view those trials as having been unfair to the Lancaster system, and in their results fallacious. For the competition—which, be it remarked, was not as to any one special quality, but as to all the qualities appertaining to a heavy rifled cannon, variously rifled, and included range, accuracy, &c.—five wrought-iron rifled muzzle-loading guns were manufactured and rifled, viz., on Britten, Jefferys, Scott, the French, and the Lancaster plans. Each gun had a steel interior tube 3in. thick; the average weight per gun was 149 cwt.; the length of chase, 10ft. 6in.; the vents, 5½in. from the breech, for quickest ignition with 20lb. charges. Jefferys and Britten's guns had thirteen grooves each; Scott's

* Edward Cleaver, 63, Oxford-street.

† London: Journal of Horticulture and Cottage Gardener, 171, Fleet-street.

‡ Simpkin, Marshall, and Co., London.

From the *Practical Mechanic's Journal*.

gun, five grooves; and the French gun three grooves—all pretty shallow, and all in cylindric bores; Lancaster's, of course, the oval bore. All the guns were thus assumed to have been strictly similar—to have differed in nothing but in the forms of the rifling. The programme was to make like experiments with all of them. Were this assumed similarity a genuine reality, the results ought to have been valuable and decisive; but if the fact be, as it truly is, that the guns were not similar, that they were made to differ in one particular, which involved dissimilarity of projectile, and which gave an advantage or a disadvantage to any one competitor, then must the results be viewed with distrust, and every opinion or conclusion based upon them be subjected to a searching retrospective criticism before it ought to be admitted as even warranted at all—far less as decisive.

The Committee state in their report, section 2:—"Warned by the experience of the former competition, they determined to limit the trial strictly to the rifling of the guns, and they therefore endeavoured to eliminate all other sources of difference, and themselves fixed a uniform weight and form and windage of shot, and also the charges of powder." Nothing could have been better or fairer than this, had it been carried fairly out; but what do we find in the very next paragraph as to how it actually was carried out? The Committee proceed:—"Mr. Lancaster's shot are slightly shorter than the others, because the Committee had previously determined that the term 7-inch gun should mean a gun down which a 7-inch spherical shot could be rolled, and under that definition the internal sectional area of an oval-bored gun must necessarily be larger than that of a grooved gun of the same nominal calibre." Now we submit that the question assumed as that about being asked experimentally of nature, was this, Which of these five guns shall, on the whole, best answer all requirements when tried for throwing a projectile of equal weight and with equal charge, the length and the weight of the projectile being both fixed, and the transverse area or cross section of the projectile being the same for all, and the form of the bore being determined solely by the preceding conditions of the projectile, and by the exigencies of the mode of rifling? This would have been to frame a precise question, and to ask it fairly. But what does the Committee previously (to what is not clear) determine? That the minimum diameter of the bore of Lancaster's guns is to rule everything; that a 7-inch gun is to mean one down which a 7-inch round shot could be rolled: so that it was not equal guns with equal projectiles and various rifling they really were to try, but guns with a purely fictitious title to equality.

Now what was the effect of this arbitrarily introduced extraneous condition—one made in direct conflict with their own assertion just before, that "they desired to eliminate all other sources of difference," "except the rifling of the guns,"—upon the Lancaster guns? All the other competitive guns were cylindric-bored, with grooves relatively very shallow. All were 7in. diameter, and had a transverse section of bore of about 38'4846 square inches, exclusive of the grooves, which, at the most—viz., in the French gun—gave not more than about 0'5 square inch additional. But if Lancaster's gun was to admit a 7-inch round shot to be rolled down its bore, it is manifest that his calibre cannot be taken at 7in.—a mean between his major and minor elliptic axes—nor, in fact, in any other way but by making his minor axis equal to the 7-inch round shot. He then must make his major axis as much larger as will ensure his method of rifling. What is the result, in fine? Lancaster's gun is in bore 7in. minor and 7'60in. major axis, and the transverse section of the bore becomes 41'7833 square inches. And thus he starts at once weighted for the race, with a bore of 3'2967 square inches greater than that of any one of his competitors, or nearly 10 per cent. against him.

Let us pause an instant for one remark. It is highly important that any rifled gun should be capable of discharging, without danger or injury, round shot if need be, and we have always maintained that one of the several advantages of the Lancaster system is the facility it presents for doing this without the injury to the chase that must happen to grooved rifled guns if round shot be fired from them, the ballottage of which will soon hammer out the grooves altogether, or distort their edges so as to wedge the rifle shot loaded after them. It was therefore quite suitable and *en règle* for the Ordnance Select Committee to have in their report noticed the relative capabilities of the several competitors' guns to throw round shot, and if Lancaster had been left free to choose his own calibre, to have remarked that his system involved this result—that his gun, for a given length and weight of rifled projectile, was only competent to throw a somewhat smaller diameter of round shot than the others. This, in our judgment, they should have done, and let the result prove of such disadvantage, in this one respect, as it might to the Lancaster system. But it was not competent to the Committee, in fairness as judges, or in exactness as experimental philosophers, to have insisted upon a condition which it could not have escaped any man even moderately

acquainted with the subject, must put Lancaster at a serious disadvantage in respect to each one of his competitors—a condition, too, in direct conflict with their own alleged programme.

Let us just take the several points in the order reported on by the Committee, and note how this disadvantage tells against Lancaster in each. Section 9, Report (Endurance).—With equal total weight and length of gun the surplus strength (which is the magazine from which endurance is drawn) must be less as the calibre area is greater, because less metal is left to give surplus strength. (Easiness of Loading). Report, section 10.—The ease of loading must be, *ceteris paribus*, in the ratio of the surfaces of contact of projectile and of gun. Now the surface of cylindric bore of all the guns, except Lancaster's, was for the unit of length, 18'849 square inches, but in Lancaster's it was that due to the elliptical surface of 7'6 X 7in., or 22'933 in. for unit inch of length. On the 11th section (Liability to injury of projectile by rough usage) we need say nothing, as the Committee admit Lancaster's to be the very best in this respect; nor on section 12 (Recoil), because it is pretty obvious, as admitted in the report, that with equal weights of guns, carriages, projectiles, and charges, the recoils must be alike for all, within the limits possible to be observed in rough artillery experiments; though we may remark that, rigidly, the larger bore forced on Lancaster, as offering a larger front of resistance to the air, tended to give him the disadvantage of showing a greater recoil. Nor need we pause on section 13, as to initial velocity, because the Committee admit, as the results indeed oblige, that the highest initial velocities were produced in the Lancaster projectiles. Then we will to section 14 (Range and accuracy), and here, *nil obstante*, Lancaster comes in with the largest range, but with somewhat smaller accuracy. The following table is copied from the report:—

Name of Gun.	GENERAL MEANS.		Mean Deviation from Mean Range.	Mean Reduced Deflection.
	Mean Range.	Mean Range.		
Scott	2645	46.6	6.7	
Lancaster	2762	38.3	7.4	
French	2701	27.2	3.6	

At the commencement of the report, the Committee, with a sort of half-apologetical consciousness (paragraph 2), states:—"Mr. Lancaster's shot are slightly shorter than the others, because the Committee had determined that the term 7-inch gun," &c. Well, the first consequence of their determination was, that to get a projectile of equal weight with his rivals, viz., 110lb., Lancaster had to be satisfied with a shot shorter than theirs in the ratio of 38'48:41'78, where the greater length of bearing of his rivals was only 9'2in. But this was not enough; for some reason (the exact nature of which the Committee fail to explain in a manner intelligible to us), after a first supply of 110lb. projectiles had been fired, the Committee reduced the weight of projectile to be fired by all the guns from 110lb. to 100lb., the further effect of which upon the Lancaster shot was (in consequence of the great area of calibre forced upon him) to reduce the length of his previously shorter, and already too short shot, from 8in. to 7in., so that now Lancaster had to fire shot of a less length than his major calibre axis against those of his antagonists, which were, in some instances, in length of bearing nearly one calibre and a half.

Now as it is beyond dispute that, other things the same, the steadiness of a rifle projectile in flight is greater as its transverse section exposed to aerial resistance is less, and as its length within certain limits is greater, it is plain at what a disadvantage Lancaster was now placed by this second decision, so directly unfavourable to him in particular. But it is equally beyond dispute, that with equal weights of projectile and equal initial velocities and gun elevations, the ranges will be greater as the transverse section of aerial resistance is less; so that here again Lancaster was disadvantaged. And yet, notwithstanding all this, we see in the above table that in range, with nearly 10 per cent. dead weight against him, he beat the field. In accuracy he appears a little below his opponents—so little that it is fairly a matter of inference, that had he been on the same fair level with them in conditions, he would have beaten them also in this.

Section 16.—The cost of rifling the Committee admits to be the same for all the guns. Section 17 (Cost of projectiles).—The Lancaster shot stands as the cheapest, per 1,000, of all but Scott's first system, viz., a system which it was found would not answer, cheaper in the ratio of £450 to £570 than that of 1,000 projectiles for the French gun, which has won the favour of the Committee as "the Woolwich gun," but not fairly won the race in our judgment. Then Section 18 (The value as shell guns).—The dictum of the Committee is not a little startling. Although as yet no shells had been fired—nothing but solid elongated shot—they say, "There seems no reason for doubting that these guns will have the same relative value as shell guns, as they have when used with solid projectiles. The shells may be of equal length and weight, and carry equal bursting charges." Did not the Committee

know that as they had compelled Lancaster to make his gun of larger calibre area than any of the others, shells for his gun for equal weight must be shorter, or if made of the same weight must be thinner, and therefore weaker than the others? Did they not equally know that in consequence of the larger calibre area, with equal weight and length, they must contain a larger bursting charge, and in this respect be better than those of the other guns? But more of this anon.

Then comes Section 19, as to the capability of firing round shot, to which, as in duty bound, after their extraordinary preliminary condition, "the committee declare that they attach some importance." The results given are just what might have been foreseen. Lancaster's gun has, in respect to a round shot, a good deal more windage than the others, and yet the range shows well as against those produced by the Scott or the French guns. The report winds up with the following sentences:—"The guns being essentially shot guns, the present trial has been restricted to solid projectiles; nor do the Committee think it probable that any disparity will appear in their performance with longer projectiles (that is longer, but having the same relative lengths *inter se*), which can alter the order in which they now stand, but at the same time they think it quite necessary to fire some common shells, and as the differences as yet elicited between the three systems left in competition are not such as to disqualify absolutely any one of them, they wish to reserve their final report until these shells have been fired and the shunt gun tried."

One result of this in many ways doubtfully worded and curiously inconsecutive conclusion was, that sixty shells were prepared for each of the three competitive guns. "The weight of the shell, and the minimum thickness of metal were fixed by the Committee, but full latitude upon other points was left to those gentlemen," i.e., to the competitors. The mean weight of the shell filled and plugged was to be 100lb., and the upshot of the "full latitude" allowed to Lancaster, after the original large bore forced upon him, resulted in this, that the lengths of the shells were respectively—French, 15'17in.; Scott, 15'12in.; Lancaster, 13'52in. And yet the capacity for bursting charge was in the proportion—French, 5lb. 9oz.; Scott, 5lb. 7oz.; Lancaster, 5lb. In a word, with so much larger a base exposed to the shock of the explosion in the gun, Lancaster was obliged to thicken parts of his shell so as to lose capacity. As regards the practice, it is not worth while to go into it, presenting as it does nearly a repetition of the results had with solid shot, and showing the Lancaster practically as good as its rivals, though with sufficient numerical difference in mean ranges and mean reduced deflection to warrant the Committee in affirming that the accuracy was less. They finally come to this conclusion, section 5:—"The Committee had then witnessed the firing of upwards of 400 rounds from these guns (i.e., all), and they were unanimously of opinion that the Lancaster system should be rejected on account of the tendency to crush in the bore, evinced by the condition of the recovered shells, its inferior accuracy, and the difficulty of loading; and that of the two remaining systems, they considered the so-called French system to be the better."

It had previously been stated in the supplementary report, that, "as before, much difficulty was observed in loading the Lancaster gun." In the first report it had been only stated that "Mr. Lancaster's shot were all got home with more or less difficulty, and in some cases a metal rammer had to be used." "The Lancaster shells," it is added (sec. 4), "with only one exception were found on recovery to be split at the head, showing apparently as has always been suspected, that in that system the projectile has a great tendency to jamb in the bore, bringing severe pressure both on the gun and on the projectile." It is subjoined under a footnote.—"P.S. Mr. Lancaster has since produced eight shells of a different pattern which were fired on the 22nd June (1865), with charges of 20lb. (the largest employed in the competition), and with 7lb. 6oz. bursting charge in each; six of them weighed 115lb. filled, two of them 109lb.; none of these burst prematurely." Now, let us ask of any competent authority, Do the facts as given by the Committee themselves bear out and justify their conclusion? For ourselves we may unhesitatingly say no. The shells fired were all of equal weight. The projecting charges were the same. Notwithstanding the seriously greater relative aerial resistance, due to its larger sectional area, of the Lancaster projectile, the effect of which must have been greater with the hollow projectile than with solid shot, the mean ranges made by him are within fifty yards or so of those of his competitors. His initial velocities must therefore have been almost precisely the same as those of the others, against which no charge of jamming in the bore is suggested. But as there is only a given amount of work locked up in 20lb. of powder, and the whole of this is transferred to the shot and gun, if a jamming in the bore bringing a severe pressure to bear both on the gun and on the projectile had occurred, the ranges could not have remained the same; for all the work expended on driving out the

jammed shot must be so much deducted from the work-producing range, and the latter must have fallen short, and proved equal only to that of the residual work of the charge which had not been so wasted on shot and gun in overcoming resistance in the bore. This we hold to be uncontradictable evidence, given by the Committee's own facts, of the unfounded nature of the Committee's own conclusion.

But further, the shells on recovery were found split at the head, that is to say, at the forward hemispherical end, where the surfaces of the shell do not touch the bore of the gun at all, and at the end remote from the blow of the exploded powder. What is the conclusion that the facts should have warranted? This simply and only, that the Lancaster shells were too weak in proportion to their large calibre; and this is sustained by the postscript, where it is admitted that eight heavier shells subsequently fired all stood well. Perhaps, also, it is a fact, that the machine employed at Woolwich for turning the spiral oval on the external contour of the Lancaster projectiles did not do its work unerringly, and that the allegation is well founded, that between the first trials with solid shot, and the second with shell, some alterations or repairs were done to this machine, by which its inaccuracy was produced or increased. If this be so, it would alone account for the alleged difficulty of loading. We have reason to believe, however, that Mr. Lancaster, who was himself present at the trials, formally and officially denies that any such difficulty of loading was experienced. But whether it were, or not, matters nothing. Ease or difficulty of loading simply means goodness or badness of fit, more or less windage between shot and gun; it may occur with any gun, and actually has occurred repeatedly with Whitworth, with Armstrong, with Shunt, with the favourite Woolwich gun itself, and with common smooth bores; it argues simply nothing, except a misfit, and that is a matter to be remedied, not reported on as an inherent ground of complaint. Again, if there were this—"as has always been suspected" by those who have always been suspicious of the Lancaster gun—occult tendency to jamb in the bore, and so to visit a severe pressure upon the gun, &c., how was it that the cast-iron Lancaster already referred to stood uninjured its 2,000 rounds, and lived to see all its cast-iron competitors blown to Tophet? If there be any inherent tendency to jamb, it must have shown itself then as afterwards, and most evidently and easily with the weak cast-iron gun.

Thus, in conclusion, of the triple-tongued condemnation of the Committee, of the Lancaster system, not one of the three *pieces* appears to us proven. There is no proof (even offered) that the recovered shells, split at the head, were split in the bore of the gun at all, while the splitting at the head suggests their having been split on striking the butt or ground. But if they were indeed split in the bore of the gun, then the tables of initial velocities and ranges disprove incontrovertibly the assumption that the splitting was due to jamming. It must then have arisen from weakness in the shell, from its walls being too thin in relation to calibre and weight; and this is supported not only by a consideration of all the facts to which we have referred, and by some others which might be deduced from the tables in the reports, but by the admitted fact that Lancaster made and fired subsequently shells only from 9 to 15 per cent. heavier than the weight prescribed by the Committee, which stood perfectly well. Is it to be supposed for a moment that if jamming in the bore really took place, 15lb. of additional cast iron added to the 100lb. shell would enable it to resist such a prodigious and immeasurable strain and crunch? And if jamming had really taken place, how is it that no trace of its formidably abrasive effects were observable on any of the shells fired? Lastly, as to the matter of accuracy, had Lancaster been put on the same footing with his competitors, we believe he would not have been very nearly equal to the best of them, as he now stands, but very much better than any of them. The accuracy which his system has shown in small arms must not only be true in great guns, but be as much greater as the projectile in them is larger. We regard this Ordnance Select Committee's report as a national mischance, not to use the too comprehensive word misfortune. The utterances of such bodies, once made, are hard to be unsaid, and, however ill based, are harder to be gainsaid, for official pride comes in to prop up the tottering work of untimely mortar it has erected before the world. On other than public grounds we neither know nor care aught of Lancaster or of his system, nor have we interest to serve, or passion to gratify, in once more expressing our own unaltered confidence in it, and our own belief that like everything having a real basis in natural law and truth, it will ultimately make good its ground, as the simplest, and on the whole the best system yet proposed for heavy rifled artillery. But so far it has been unhappy in its history; hastily taken up when all in government employ were very ignorant on the subject of artillery, when tools did not exist or were inadequate, and when wrought-iron ringed guns, i.e., guns of adequate

strength, were yet of the future, it was as hastily thrown aside, why and wherefore, and in the interests of whom, we need not here recur to. The experiments since made in partial reference to it—over millions had been wasted on the plans that were supposed to have for ever superseded it and all others, but which now in their turn have been themselves in great part weighed in the balance and found wanting—have been insufficient and incomplete, and notwithstanding the terms of this last condemnatory report, present material to every impartial and competent judge, in the highest degree encouraging in relation to the Lancaster system. But they are utterly insufficient to decide its merits or demerits. Always the Lancaster gun as it exists has been assumed perfect, and pitted against opponents nearly in the shape first designed for it by its inventor, without any attempt having been made steadily and cautiously first to ascertain its best proportions, the most advantageous conditions as regards gun and projectiles, in a word, without any previous experimental progress towards developing the system itself, which, before proceeding to compare it with any other or rival system, should have first been effected.

We hope, after all, the subject will be taken up once more, and in a new and more philosophical and broad spirit of inquiry. Let the same amount of mechanical skill, the same perfection of machine tools, be applied to it, that have brought to such precision and success the Armstrong guns. Let the best proportion of oval for the bore, and of its spiral for given natures and weights of projectiles, be determined separately. Let it be not "always suspected" but accurately ascertained if there be any inherent tendency to jamb in the bore; if such be found to be the case, let it be ascertained either how to rectify it, or that it is of a nature impossible to rectify, and if so, let the limit of the amount of its resistance to the expulsion of the shot be found. We shall then, and not till then, know whether the objections on this score have any and what weight, or be wholly groundless. Let these and other such questions be first asked and answered experimentally and exhaustively, and then will come the time for pitting a perfected Lancaster gun against all comers—not before. The expectation that in the end we may secure the cheapest, the most enduring, and the most efficient heavy rifled artillery in the world, sufficiently warrants the commendation still of such a programme. For heavier and still heavier artillery looms in the future, as the destiny before us which we must accept: and while little field-guns, or up to 40 or 50 pounders, may be made to answer on Armstrong or Whitworth, or almost on any system or no system, none present the advantages and facilities in construction and use, for the very heaviest classes of ordnance—for 600 or 1,000 pounders—that the Lancaster system does, and with this remarkable condition superadded—that its alleged defects, whatever their reality may be worth, are of such a nature, that they must tend to disappear as the size of the gun becomes magnified, while the admitted evils of its various grooved rivals become more and more unmanageable as the gun is enlarged.

We compliment Mr. Mallett on his able article, and supplement it by some tables showing the results of shot practice with the three systems of guns, which we abstract from results published by the Ordnance Select Committee in their report.

REPORT No. 3575.—APPENDIX 1 A, PAGE 8. SCOTT.

Date, 1864.	110lb. Projectile.	12lb. Charge.	
July 27	1:213	21'4	0'8
27	2:286	49'6	5'4
27	3:909	109'8	40'7
	3) 7'408	3) 180'8	3) 46'9
	2'469	60'27	15'63
20lb. Charge.			
July 15	1'462	21'5	0'9
27	1'495	11'2	2'2
26	2'711	44'7	3'3
10	2'621	69'7	4'3
27	2'810	56'8	3'6
15	4'444	63'5	28'2
26	4'440	69'2	7'0
	7) 20'013	7) 336'9	7) 49'5
	2'859	48'13	7'07
25lb. Charge.			
July 14	1'604	15'6	2'4
27	1'517	21'8	1'0
13	2'834	35'6	7'1
27	2'991	48'8	3'7
12	4'695	26'8	24'9
14	4'779	31'4	8'9
26	4'922	87'4	20'6
	7) 23'375	7) 267'4	7) 63'6
	3'339	38'2	9'8

APPENDIX 1 B, PAGE 9.

FRENCH.

Date, 1864.	110lb. Projectile.	12lb. Charge.	
July 27	1:153	19'7	0'8
27	2:219	54'5	2'8
27	3:908	136'5	8'3
	3) 7'279	3) 210'7	3) 11'9
	2'426	70'2	3'9
20lb. Charge.			
July 15	1'336	33'4	0'7
26	2'613	33'3	2'0
Oct. 10	2'405	57'1	5'2
July 15	4'210	46'2	14'6
	4) 10'613	4) 172'0	4) 22'5
	2'653	43'0	5'63
25lb. Charge.			
July 14	1'500	52'4	2'0
27	1'420	81'8	1'6
13	3'713	36'1	4'7
27	2'768	41'8	4'9
12	4'489	48'2	10'8
14	4'543	45'8	22'4
26	4'586	82'6	24'5
	7) 22'039	7) 388'7	7) 70'9
	3'148	55'53	10'13

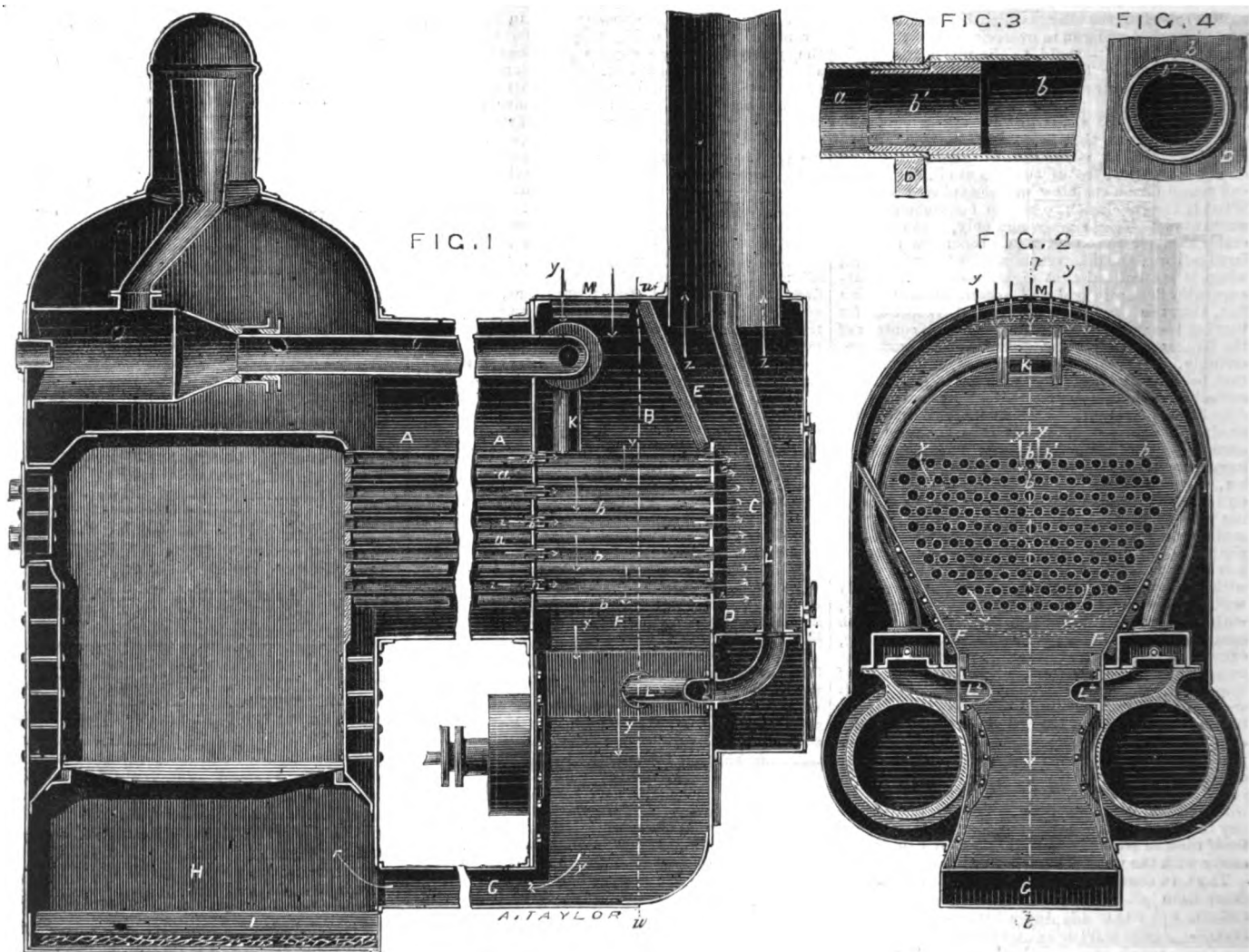
APPENDIX 1 C, PAGE 10.

LANCASTER.

Date, 1864.	110lb. Projectile.	12lb. Charge.	
July 27	1:198	25'4	0'3
27	2:287	57'2	1'2
27	3:907	24'8	4'0
	3) 7'392	3) 107'4	3) 6'0
	2'464	35'3	2'0
20lb. Charge.			
July 15	1'455	27'3	2'0
27	1'380	34'0	1'8
26	2'688	22'6	4'8
27	2'611	43'0	2'1
Oct. 10	2'520	55'7	3'9
July 15	4'299	75'1	12'9
26	4'353	54'0	9'2
	7) 19'306	7) 311'7	7) 36'7
	2'758	44'5	5'2
25lb. Charge.			
July 14	1'590	28'8	2'0
27	1'545	26'0	0'7
13	2'817	18'9	3'6
27	2'903	32'0	2'7
12	4'487	16'5	4'5
14	4'605	25'6	6'6
26	4'757	127'2	20'5
	7) 22'704	7) 285'0	7) 40'6
	3'243	40'7	5'8
12lb. Charges.			
Scott	2'469	60'27	15'63
French	2'426	70'2	2'9
Lancaster...	2'464	35'8	3'0
20lb. Charges.			
Scott	2'859	48'13	7'07
French	2'653	43'0	5'62
Lancaster...	2'758	44'5	5'25
25lb. Charges.			
Scott	3'339	38'2	9'8
French	3'148	55'53	10'13
Lancaster..	3'243	40'7	5'8

For testing barometers sent for verification to the Kew Observatory, an iron airtight box is provided, of sufficient length to contain barometers, and fitted with glass in front and back so that the mercurial columns and scales of the enclosed barometers may be easily seen. A standard barometer is fixed within, and the barometers to be tested are suspended by its side. By a pump the air is exhausted, thereby the pressure upon the mercurial columns is diminished, and, by comparison with the standard, the corrections at each half-inch of their scales is ascertained. Thermometers are tested by comparisons with a standard instrument under similar circumstances of temperature, heated and cooled water being commonly used for the purpose.

FACILITATING THE COMBUSTION OF FUEL.



FACILITATING THE COMBUSTION OF FUEL.

THIS invention, which has been patented by Mr. Frank O. Hills, of the Chemical Works, Deptford, has for its object the application of heated air instead of air at ordinary temperatures to the ashpits or ashpans belonging to the furnaces of steam boilers and to the fireplaces of stoves, and also to gasburners. For this purpose the external air is heated in its passage to the said ashpits or ashpans, or gasburners, by that which is in most cases waste heat. When applied to a locomotive engine the smoke box should be prolonged, and the air to be heated is passed either between and around a number of tubes (which may be extensions of the ordinary boiler tubes) through which the volatile products of combustion pass on their way to the chimney (the said air being separated by a diaphragm from the waste heat escaping to the chimney), or the said air is passed through tubes or chambers between and around which the products of combustion pass on their way to the chimney, the air heated in either way being conveyed by a pipe or flue from the smoke box to the ashpit of the furnace, which said ashpit is kept closed except at the part communicating with the pipe or flue. By either arrangement the air used for supporting combustion will be heated before it enters the ashpit, and a saving of fuel will be effected. In applying the invention to the boilers and furnaces of marine or of stationary engines the apparatus by means of which the external air is heated on its passage to the hot-air flue leading to the ashpits of the furnaces will be varied according to the particular construction of the boiler to which the apparatus is to be applied. Where the heat to which the fire-bars are exposed is great they should be made of cast or wrought iron, preferably of a V or taper shape in cross section, and with a longitudinal channel or space of a section corresponding with that of the bars, and the channel or space is to be filled with firebricks, tiles, or clay.

In applying the invention to stoves the stove

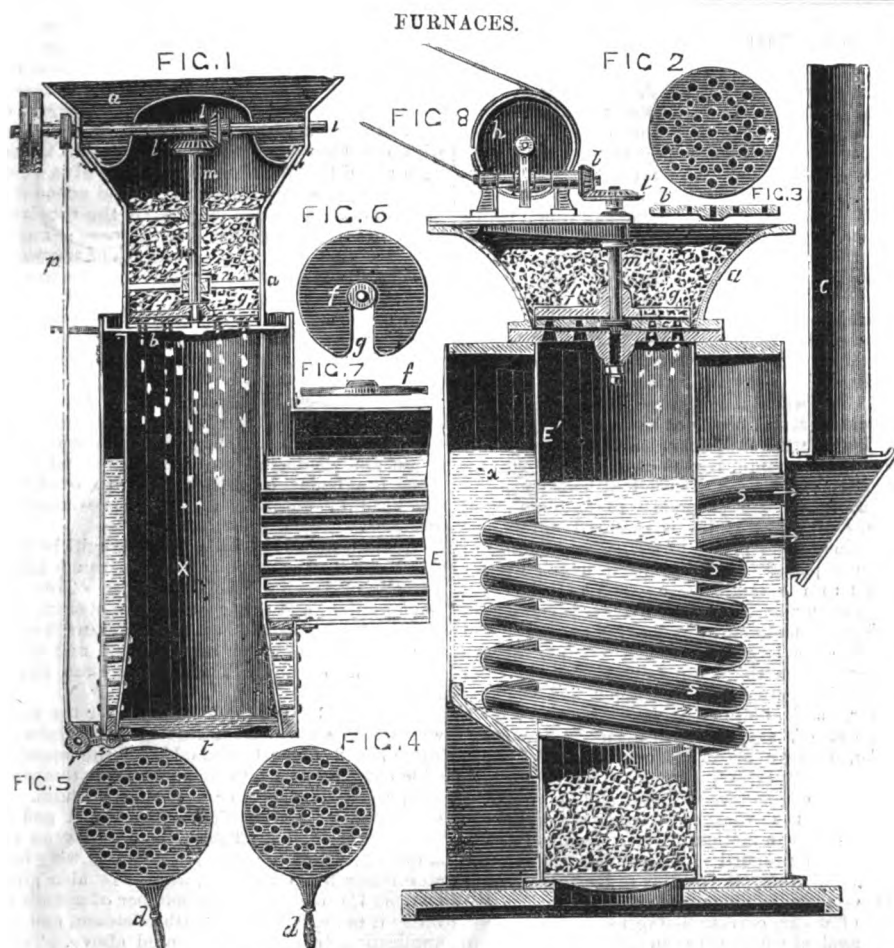
is constructed with a double case, the inner case containing the fire, and the outer case surrounding and being of greater depth than the inner case, so as to form the ashpan, the outer case being of such a diameter as to leave a small space between it and the inner case. Air is admitted through an aperture or through apertures in the outer case above the fireplace, and such air passing through the space between the interior of the outer case and the exterior of the inner case enters the closed ashpan in a heated state. In applying the invention to gasburners the burner is furnished with two glasses fixed one outside the other. The inside glass should be about twice the height of the outside one, which should be of such a diameter as to leave a small space between it and the inside glass. The outside glass should be fitted into or upon an airtight gallery or support, so as to prevent the access of air to the burner except through the passage between the two glasses, the inner glass being mounted on an open gallery or support at a higher level in order to allow the heated air to pass under its lower rim and up to the burner.

Fig. 1 in the engraving represents a longitudinal section (taken on the line *t*, fig. 2) of certain portions of a locomotive engine to which is applied one of the arrangements of apparatus for heating the air used for the support of combustion according to this invention; and fig. 2 is a transverse section (taken on the line *u*, fig. 1) of the smoke box of the said engine and the parts in connection therewith; figs. 3 and 4 represent, in full size, portions of the apparatus. A is the boiler of the engine and B is the smoke box, which is prolonged at C, the parts B and C being separated by the front plate D of the smoke box and the inclined diaphragm E; *b b* are tubes which form continuations of the ordinary boiler tubes *a a*, and are connected therewith by being driven on the ferrules *b' b'*, as shown in figs. 3 and 4, which represent in longitudinal section and end elevation (partly in section) respectively one of the ferrules *b'* and the ends of the tubes *a* and *b*, which it serves to connect; the other ends

of the tubes *b* are fixed by ferrules in the usual way. F F are sheets or plates of metal which, together with the front and back plates of the smoke box, form an airtight passage communicating at its lower end with a flue G, which is fixed low enough to clear the machinery under the boiler, and communicates with the ashpit H, which is closed except at the part which opens into the said flue; I is the ashpan, into which a little water may be admitted in any convenient way in order to keep the ashes damp, and thus cool the fire-bars and prevent them from clinking; or, instead of admitting water into the ashpit a small jet of waste steam from the cylinders may be admitted into the ashpit for the purpose specified. K is the induction pipe, L' is the blast pipe, and L' is the breeches pipe communicating with the eduction ports. The action of the apparatus is as follows:—The volatile products of combustion pass from the tubes *a* through the tubes *b* into the prolonged part C of the smoke box, whence they escape by the chimney, as shown by arrows *z*. The air to be used for the support of combustion enters the part B of the smoke box by apertures M M, formed in the top thereof, and passing between and around the tubes *b b*, passes through the flue G and enters the closed ashpit H, as shown by arrows *y*.

THE BUILDING NEWS.

We see it is announced that the *Building News*, which has hitherto enjoyed a high character and a wide circulation at Fourpence a week, will in future be published at the low price of TWO-PENCE WEEKLY. The announcement says that this reduction in price will not be accompanied by any diminution in quality or quantity. As many well known recent literary adventures have triumphantly demonstrated the practicability of a very wide circulation with the minimum of profit, we expect that this reduction of the price of our contemporary will make it the widest circulated journal of its class in the world. We heartily wish it success.



FURNACES.

THIS invention which has been patented by M. Francois Durand, of Paris, consists in constructing furnaces at top with discs through which the fuel held in a hopper above them is to pass into the fire; in the adaptation of one or more levers to stir and clear the spaces between the furnace bars; and, in the case of furnaces for vertical boilers, in the adaptation of a serpentine flue carried through the boiler and conducting the products of combustion into the chimney. Over the top of the furnace is placed a hopper for containing the fuel to be consumed. At the bottom of this hopper is a fixed disc or plate with holes or apertures formed therein. Above this fixed disc is another similar but movable disc with similar apertures to the first. When the apertures in the two discs correspond, the fuel passes as if through one disc only, but at the will of the stoker the movable disc may be moved so as to regulate and even shut off the supply, a handle being fixed to the movable disc, whereby it may be turned on a central pin. Above these two discs there is a third distributing disc formed with one radial aperture and connected to a shaft to which rotary motion is imparted. This shaft carries at top a mitre wheel geared into by another mitre wheel on a shaft driven by some prime mover. This shaft also carries a cam which communicates motion to a rod connected to the short arm of levers, the long arms of which enter and move up and down between the furnace bars and thus stir and keep them clear. For vertical boilers, the furnace is placed in an annular water space and one or more serpentine flues are carried in and through the water space. The flame and products of combustion circulate in the coil or serpentine flues, heat the water, and then pass into the chimney. The fuel feed and the stirring apparatuses are together or separately applicable to all kinds of furnaces.

Fig. 1 of the accompanying engraving is a vertical section of the furnace of a tubular boiler with the improved fuel-feed and stirring apparatus applied thereto; *a* is a hopper placed over the top of the furnace, and containing the fuel to be supplied to the furnace; *b* is a fixed disc or plate at the bottom of the hopper, and of a diameter corresponding as nearly as possible with that of the furnace *X*. This disc has holes or apertures formed therein as represented in the detached views, figs. 2 and 3. Above this fixed disc is a similar but movable disc *c* with similar apertures. When the apertures in the two discs *b* and *c*

correspond, the fuel passes as if through one disc only, but at the will of the stoker the movable disc *c* may be moved so as to regulate or even shut off the supply, a handle *d* (see the detached view, fig. 4) being fixed to the disc *c*, whereby it may be turned on a central pin *e* to the disc *b*. Fig. 5 shows the disc *c* moved so that the apertures in the two discs do not entirely correspond; *f* is a distributing disc above the disc *c*; this disc is represented detached in figs. 6 and 7; *i* is formed with one radial aperture *g*, and is connected to a shaft *m* to which rotary motion is imparted. The shaft *m* is guided by collars *n* and carries at the top a mitre wheel *l* geared into by another mitre wheel *l'* on a shaft *i*, which is driven by a band from any prime mover passing over the pulleys *h h'*. The fuel in the hopper *a* passes through the aperture *g* in the disc *f*, and by the rotation of this disc is distributed over the disc *c*. The apertures of the discs *b* and *c* may vary in diameter from the periphery to the centre; likewise the opening *g* of the disc may be wider at the periphery. The shaft *i* carries a cam which acts upon one end of a rod *p*, the other end of which is connected to the short arms *r* of levers pivoted at *s*, the long arms *t* of which enter and move up and down between the furnace bars and thus stir and keep them clear. Fig. 8 shows the fuel-feed apparatus applied to the furnace of a vertical boiler. The boiler is composed of a double casing *E E'* forming an annular space *s* for containing the water to be evaporated. *S S* are serpentine flues, surrounding the inner casing *E*. The flame and products of combustion from the fireplace *X* circulate in the serpentine flues, heat the water, and then pass into the chimney *C*.

SOCIETY OF ENGINEERS.

ON Friday evening last the annual dinner of the Society of Engineers took place at the Bridge House Hotel, London Bridge, Mr. William T. Carrington, the President, in the chair. There was a very good muster, and among the members and other gentlemen present were Messrs. A. Williams, R. M. Ordish, Z. Colburn, R. M. Christie, B. Latham, F. W. Bryant, Vaughan Pendred, S. Owens, P. F. Nursey, W. Pickering, Henry Dicks, W. Rigby, H. P. Stephenson, W. H. Lefevre, L. Olrick, W. Roberts, E. Winscom, W. Walter, J. Warren, C. B. Loughman, Captain Jones, and Lieutenant Scott. Mr. Toole acted as toastmaster. After the usual loyal and patriotic toasts had been duly given and honoured, the

toast of the evening, "Success to the Society of Engineers," was proposed by the President, who, in the course of his remarks, observed that the Society of Engineers had been established eleven years. When he (the president) joined it, ten years since, it had only sixteen members, and its meetings and papers were alike of a very limited character. The progress of the society, its present position and prospects, were ably delineated by Mr. Alfred Williams, the indefatigable honorary secretary, and with whose name the toast had been coupled. In the course of his remarks, Mr. Williams observed that the society had progressed steadily, but had obtained perfect success. He hoped that in the years to come it would advance as surely and safely, though he could hope that its progress would be faster. At the annual dinners the number of members present had varied, but the present was a larger gathering than any which had preceded it, and therefore this might be regarded as one mark of success. On the 1st of January in the present year the society numbered 309 members. During the year 69 associates and members had been elected; this would make a total of 378, but from this number a few deductions had to be made on account of deaths and resignations. At the annual meeting, held on the 11th inst., a series of resolutions were carried, embodying a total alteration of all the amounts paid in support of the society, which was likely to be much benefited thereby. Instead of the income for 1866 being £317 7s. 6d., as it would have been at the old rates, it would be £588 16s. 6d., supposing the number of members and associates remained the same as at present. The funds which accumulated would be applied towards providing a house for the society, comprising a meeting-room, reading-room, and library. Mr. William Fairbairn, of Manchester, who was expected to have been present at the dinner, had, in anticipation of the formation of the library, already sent some valuable books. The council had made arrangements for the yearly exchange of "Transactions" with the Welsh, the Irish, and the Scottish Institutes of Engineers. The Society of France sent their publication weekly. While on the subject of books, he might mention that the society's last volume had been sent almost all over the world. Much advantage must arise from sending out the society's proceedings promptly. The financial position of the society was highly satisfactory, and was likely to be much more so very shortly. Since the beginning of the year there had been received £105 for life subscriptions, £53 for entrance fees, £290 for annual subscriptions, and £59 for books. There was deposited at interest at the London and Westminster Bank the sum of £107 10s., derived from life subscriptions, to form the commencement of a building fund. That fund would go on accumulating. Early in the present year a proposition was set on foot for a permanent fund, and the council and many members had so well supported it that up to the present time there were £220 subscribed to that fund. He believed that there was no question that in the course of time the society would stand in a very prominent position. It was gaining not only members, but also a good standing before the public. This toast was followed by several others of a special and complimentary character, after which the meeting broke up, having spent a pleasant evening.

ON GIFFARD'S INJECTOR.

BY LEWIS OLBRICK, Memb. Soc. Eng.

(Concluded from page 396).

HAVING now finished the description of the practical working of the injector and its different modifications, illustrated by drawings, I will now endeavour to explain the different phenomena that take place during the working of the injector, and which, at first sight, might seem paradoxical. The first step towards explaining the action of the injector will be to explain what is generally called the "induced current." The induced current has received its name from the fact that a column of air, gas, or other fluid in motion always has a tendency to draw into itself and along with itself atoms or particles of the fluid through which it moves. This phenomenon can be observed in many ways; if, for example, we would apply a small blow-pipe, of one-sixteenth inch diameter at the nozzle, to the end of a piece of, say, three-quarter inch gas-pipe, open at both ends, and blow through the blow-pipe, we would find by applying a lighted candle to the

mouth of the gas-pipe that the flame would be drawn into the latter. Also, if we drilled a number of small holes in the gas-pipe, and then blew a strong current through it, we would again find by applying a candle to one of the holes that the flame would also in this instance be drawn in through the hole. Another instance is the ordinary bellows for kitchen use, for it is not the amount of air actually drawn through the bellows that brightens the fire, but it is the amount of air drawn into the fire by the induced current that gives such good results. This may very easily be substantiated by applying a trumpet-shaped tube to the mouthpiece of the bellows, and the difference in the effect will very soon be apparent to anyone who has not tried it before. That the same takes place when applied to water may be seen by filling a squirt and applying the nozzle to the surface of a vessel filled with water. As soon as motion is given to the jet, we shall find that it will not only force its way through the water, but also set in motion all the surrounding particles of it in the same direction as the jet. One of the most useful applications of the induced current is, no doubt, the blast pipes in locomotives, but it has also been applied for many other purposes, mostly in connection with steam jets—for instance, Nicholson used it for his steam blasting apparatus; Goldsworthy Garney, and Hackworth, also applied it in different ways; a member of this society, Mr. Danchell, made a very ingenious pressure gauge on this principle; and one of the last applications is Rimmel's perfume distributor. The application, however, which is most pertinent to this paper, is that of a steam jet to raise water, and this was first found out by Nicholson, and since used by Bourdon, Du Tremblay, and Mr. Danchell, who also used it to raise other liquids than water. The theory of the "induced current" no doubt rests, first, on the fact that the atmospheric air presses with an equal force in all directions, and it consequently follows that, whenever there is created even a partial vacuum only, the atmospheric pressure will immediately force either air or other fluids in the vacuum space. For instance, if we draw a bucket of water out of a well, it does not leave a hole in the water, but fills up immediately the vacancy is made. Secondly, the theory that all fluids consist of very minute atoms of a globular shape, and of equal distance, makes it much easier to understand how the disturbance of a number of them by a forward moving column of fluid will act upon all the nearest in contact and carry them along with the current (theoretically, it ought to act upon the whole mass of fluid infinitely), for as the moving column consists of minute globes, similar to those of the fluid through which the column moves, the moving globes and the globes at rest are, so to say, intermingled in such a manner, being kept together by the atmospheric pressure, that it would be impossible for the moving column to proceed without either forcing the globes out of their places or carrying them along. Those forced out, it must be recollected, will immediately be replaced by others, which, in their turn, will undergo the same process. When, for instance, a screw steamer is forced through the water at a speed of, say, twelve knots per hour, and dead calm happens to exist, anyone on board, looking at the ship's side where it is in contact with the stagnant water, will almost be able to perceive the same process taking place as above described.

In applying this theory of the "induced current" to the injector, it seems that the first service it has to perform consists simply in creating a vacuum in the space surrounding the steam cone, by drawing out all the air, and thus at the same time also creating a vacuum in the tube leading to the supply cistern. It must here be remarked that, the first steam entering the injector will drive all the air out of the combining cone, the overflow chamber, and the receiving cone. As soon as a partial vacuum has been formed in the water supply tube, the atmospheric air, pressing on the surface of the water in the cistern, will force it up through the tube into the injector from a depth corresponding to the vacuum created, and which is generally from 5ft. to 7ft. It may here be worth noticing, that many others before Giffard had arrived so far as to lift up the water by the assistance of a jet of steam, but from this commences M. Giffard's discovery, viz., that the steam, after coming in contact with the water, and after being partially or wholly condensed, should still be able to force its way into the boiler against the full pressure of the steam, arriving along with it an additional

supply of water, and that, even although the steam is taken from the same boiler and at the same steam pressure as that against which the feed water has to be forced. This is the so-called paradox which has given rise to so many suggestions and surmises, and caused so great a difference of opinion amongst the profession.

Now, the second service the "induced current" has to perform is to draw the water into the combining cone, where it comes in contact with the steam jet, and immediately takes part in the tremendous speed of the steam (being, according to II. C upwards of 1,800ft. per second), but only a proportionate part of the velocity is imparted to it, as the steam at this point is being condensed with immense rapidity, and this causes the water to rush into all the vacuum spaces formed by the sudden condensation. The water thus mingled with the particles of steam which have not had time to return to the liquid state as quickly as it was deprived of heat and pressure, is at once carried along at a speed reduced from the original velocity of the steam, in inverse proportion to the number of pounds of water which is required for the condensation of one pound of steam, and adding to this the pound of steam itself which has returned to the liquid state. The rapidity with which even a large amount of steam is condensed can best be understood by looking at the vacuum gauge of a large condensing engine, at the moment when the slide valve opens the communication between the cylinder and the condenser, and allows the whole contents of a cylinder, of, say, 50 square feet area and 4ft. stroke, making about 200 cubic feet of steam of a total pressure, of, say, 20lb., to empty itself into the condenser without any perceptible change in the vacuum. After the water has thus been set in motion by the steam jet imparting to it a proportionate amount of its velocity and momentum, it remains to be seen whether this velocity is great enough to overcome the head of water, corresponding to the steam pressure against which it has to force the water into the boiler. To make this better understood it is proposed to resort to figures, and to use as an example, injector No. 8, feeding into a boiler carrying 60lb. pressure, the temperature of the feed water to be 60 deg., and the temperature of the water after condensation to be 140 deg. In this instance the velocity of the steam rushing into the combining cone would be 1,824ft. per second, taking the vacuum at 3½lb. per square inch. By referring to tables Nos. 1, 2, and 3, it will be seen how this is calculated. The velocity with which steam flows into a vacuum is precisely equal to that which a liquid of the same weight as the steam would acquire in falling through the height of a column 1in. square equal in dead weight to the pressure of steam per square inch. This height is found by dividing the total pressure per square foot by the weight of one cubic foot of the same steam. Having found the height, we apply the usual formula for falling bodies, to find the velocity in

feet per second, but instead of $8 \sqrt{\frac{p}{w}} \times 144$,

the shorter formula, $96 \sqrt{\frac{p}{w}}$ is used (see table No. 1).

As, however, in this instance the steam does not flow into a perfect vacuum, but into a partial one, the counter-pressure must be deducted, as shown in formula II. C, table No. 3. We next have to find the amount of water required for the condensation of 1lb. of steam, which, according to formula III., table No. 3, gives 13lb., and adding to this the pound of condensed steam, we get 14lb., which divided into 1,824ft., gives 130ft. per second, being the reduced velocity with which the feed water rushes across the interval between the combining and the receiving cones. The next point to be taken into consideration is the head of water corresponding to the steam pressure in the boiler to be fed, against which the stream of feed water has to be forced. This is, for 60lb. pressure, equal to a head of water of 138ft.; and to compare this with the reduced speed of the steam of 130ft. per second we must also reduce the last figure into head of water, which, according to VI., table No. 5, is equal to 264ft., and $264 - 138 = 126$ ft., which again corresponds to a velocity of 89.8ft. per second, and this is, consequently, the theoretical speed at which the water ought to enter the boiler. From practical experiments we find that about 1,030 gallons are fed into a

boiler by No. 8 injector, under the circumstances mentioned above as an example. 1,030 gallons per hour are equal to 78,969 cubic inches per second; and dividing this by '08 square inches—the area of the receiving cone—we get 887in., or 82ft. per second; the real velocity, as compared with the theoretical, 89.8ft. per second. It has been urged that the size of the check-valve would prevent the water from entering, on account of its area being so much in excess of the receiving cone. This, however, is not the case; and as the receiving cone at the first rush of the water will be filled, the stream or jet has only to contend with a solid column of water, which will act as a ramrod in opening the valve; and the valve once open, the superior velocity of the inward current will easily keep it open, and allow the water to enter the boiler in spite of the paradox attributed to the apparatus. In fact, the working of the injector is simply dependent on the question whether the speed with which the steam and condensed steam and the feed water enter the boiler is great enough to overcome the head of water in the boiler resisting its entrance.

From formula III., table No. 3, it will be seen that if the feed water is very hot a much larger quantity of water will be required to effect any condensation, and the speed of the stream will thereby be so much reduced that it cannot overcome the head of water in the boiler, and consequently the feeding will at once become impossible.

Table No. 1 gives the formula I. for the speed with which steam rushes into a perfect vacuum. Table No. 2 gives formula II. for the speed at which steam flows into steam of lower temperature, the atmosphere, or a partial vacuum. It also gives two arithmetical examples, A and B, worked out in full. Table No. 3 gives an example (II., C) of the speed of steam flowing into an injector No. 8 whilst at work. It also gives formula III. for finding the number of pounds of water it takes to condense 1lb. of steam, and its application to the example used above. Table No. 4 gives the head of water corresponding to the boiler pressure; and next, M. Giffard's formula for calculating the amount of water fed into a boiler by the injector. Table No. 5 gives the formula VI. for reducing velocity into head of water, and also the theoretical velocity with which the water is fed into the boiler, and next, it gives the real velocity with which 1,030 gallons pass the orifice of the receiving cone, being '08 square inches in area.

This being the end of the theoretical investigation, we will now turn to the practical application of the injector as a feed apparatus, and here also exists some difference of opinion amongst engineers, although to a great extent unfounded, as the injector seems to have many advantages over the ordinary pumps. It has, for instance, no parts in motion while working; consequently it is not affected by wear and tear of such parts as are constantly at work in the pumps. In a pump there is a blow for every stroke; the continuation of these blows cause leaky joints, and, in extreme cases, bursting of pipes, &c., not to speak of the occasional replenishing of valves and valve seats. This is entirely avoided in the injector. Next, the amount of feed water can much easier be regulated to suit the requirements of a boiler than it can with a pump, and as the injector is entirely independent of the main engine, it is able to feed water into the boiler whether the engine is working or not, a point which is very important. It may be said that a donkey engine can do the same; true, but the donkey not only absorbs all the steam that is required for its working, but it also causes a reduction of the temperature in the boiler when feeding into it; this is not the case with the injector, and the reason is, that the feed water takes up nearly all the heat from the steam at the moment of condensation in the combining cone and returns it to the boiler, and thus it makes up to a great extent for the fact that it is limited as to the use of very hot feed water. What has been said about the donkey absorbing all the steam required for its working, applies equally to the pumps worked by the main engine, but here we find even an additional loss in the fact, that as a rule the pumps cannot be disconnected, and, therefore, absorb steam to drive them even when they are not feeding water into the boiler. Although it is true that the injector cannot pass feed water beyond a certain temperature, it is also equally true that the heating of the feed water can in most instances be done after the water has passed the injector, to any

amount required under the circumstances, and it may not be uninteresting to know that a great many injectors are in use where Green's, and also Twibill's economisers are at work. These receive the water from the injector, and then subject it to the waste heat passing from the boiler flue to the chimney. According to the opinion of locomotive engineers, it is very seldom that engines are sent into the shops for repairs owing to defects in the injector, whereas it has been stated that about one-third of the engines coming into the shops for repairs, do so on account of defects in the pumps and their appendages. Upon the whole, therefore, taking everything into consideration, it seems that the injector is undoubtedly preferable as a feed apparatus compared with the ordinary pumps.

In conclusion, it must be distinctly understood that the mathematical demonstration given below is not put forward as an infallible production, but merely as an attempt to substantiate with figures what seems to take place when the injector works; and if we have thereby advanced one step further to clear up the mystery that seems to surround the injector, the object of this paper will have been fully obtained.

TABLE No. 1.

v = velocity in feet per second into a perfect vacuum.

h = height in feet of a uniform column 1 inch square and equal in weight to the given pressure " p " per square inch.

p = total pressure per square inch.

p^I = total pressure per square inch of steam or other fluid, of a lower pressure than " p ,"

w = weight of 1 cubic foot of steam of pressure " p ."

$$v = 8 \sqrt{h}$$

$$h = \frac{p}{w} \times 144$$

$$\therefore v = 8 \sqrt{\frac{p}{w} \times 144}$$

$$I.- \quad = 96 \sqrt{\frac{p}{w}}$$

TABLE No. 2.

$$II.- \quad v = 96 \sqrt{\frac{p - p^I}{w}}$$

This formula applies when steam flows into steam of lower pressure, the atmosphere, or a partial vacuum.

$$A. \quad v = 96 \sqrt{\frac{75}{1759}} \\ = 96 \sqrt{426} \\ = 96 \times 20.64 \\ = 1981 \text{ feet per second into a perfect vacuum.}$$

$$B. \quad v = 96 \sqrt{\frac{74.7 - 14.7}{1759}} \\ = 96 \sqrt{341} \\ = 96 \times 18.47 \\ = 1773 \text{ feet per second into the atmosphere.}$$

TABLE No. 3.

$$C. \quad v = 96 \sqrt{\frac{74.7 - 11.2}{1759}} \\ = 96 \sqrt{361} \\ = 96 \times 19 \\ = 1824 \text{ feet per second into the combining cone, vacuum} = 3.5 \text{ lb.}$$

H = total heat of steam.

t = temperature of water after condensation.

T = temperature of feed water.

N = number lbs. of water necessary for the condensation of 1 lb. of steam.

$$III.- \quad N = \frac{H - T}{T - t} \\ = \frac{1175 - 140}{140 - 60} \\ = \frac{1035}{80} \\ = 13. \quad 13 \text{ lbs.} + 1 \text{ lb.} = 14 \\ \text{and } \frac{1824}{14} = 130 \text{ ft. per second}$$

TABLE No. 4.
Head of Water.

$$IV.- \quad 60 \text{ lb. of steam} = 138 \text{ ft.} \\ \frac{14.7}{33.9} = \frac{60}{138}$$

M. Giffard's formula :—

$$V.- \quad d = \text{diam. in millimeter.} \\ Q \text{ in gallons} = 6.16 d^3 \sqrt{P} \text{ in Atm.} \\ = 6.16 \times 64 \times 2 \\ = 788 \text{ gallons per hour.}$$

TABLE No. 5.

$$VI.- \quad v = 8 \sqrt{h} \\ h = \left(\frac{v}{8}\right)^2 \\ = \left(\frac{130}{8}\right)^2 = (16.25)^2 \\ = 264 \text{ feet} \\ 264 - 138 = 126 \\ v = 8 \sqrt{126} = 8 \times 11.225 \\ = 89.8 \text{ feet per second.}$$

$$VII.- \quad 1030 \text{ gallons per hour} = 17.17 \text{ gallons per minute.} \\ = 286 \text{ gallons per second.} \\ = 0.457 \text{ cubic feet per second.} \\ 0.457 \times 1728 = 78.969 \text{ cubic inches per second.} \\ \frac{78.969}{.08} = 987 \text{ inches per second} \\ = 82 \text{ feet per second.}$$

Meetings for the Week.

TUES.—Royal Institution.—"On Sound" (Juvenile Lectures), by Professor Tyndall, 3.
THURS.—Royal Institution.—"On Sound" (Juvenile Lectures), by Professor Tyndall, 3.
FRI.—Architectural Association.—"Fir and Pine as used in Modern Buildings," by Mr. T. A. Britton, 7.30.
SAT.—Royal Institution.—"On Sound" (Juvenile Lectures), by Professor Tyndall, 3.

NOTICE.

THE Publisher of the MECHANICS' MAGAZINE begs to notify that on account of the difficulties attending the collection of moneys in different parts of the country, in future no one will receive the MECHANICS' MAGAZINE direct from the office, through the post, who has not paid his subscription in advance. All who object to this plan are respectfully requested to order the paper through their newspaper agents.

TO CORRESPONDENTS.

THE MECHANICS' MAGAZINE is sent post-free to subscribers of £1 ls. 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 8d. per line for 6 insertions, 5d. per line for 13 insertions, 4d. 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.—L. Bros.—N. W., Jun., and Co.—R. P. E.—T. H. E.—W. H. G.—E. K. A.—H. and Co.—W. W.—T. B.—R. E.—W. H.—J. H.—W. E.—R. A. T.—Constant Reader (Lewes).—Messrs. S. W. and Co.—T. H. E.—F. S. F. (Shanghai).—W. C. T.—H. and B.—J. D.
Mr. R. D.—We shall be glad to see you or to receive your address.

Miscellaneous.

It has been announced at Chatham that a committee is about to be appointed to inquire into the whole principle on which the fortifications now in progress are being constructed, with special reference to the advisability of discontinuing their erection on the existing principle and adopting the "Hercules" target principle.

From Arkansas we learn that coal, fully equal to the Pittsburgh, exists in abundance in the immediate vicinity of Fort Smith city. Petroleum, it is said, has been found, and, upon a thorough exploration, will become an important article of commerce.

The Ancona Railway is practicable from Rome to the tunnel beyond Foligno, and an experimental train was run recently over the line.

The Royal Society of Fine Arts of Ghent has determined upon a grand international exhibition of photographic objects. It will be under the joint patronage of the Belgian Government and the town.

We understand that the last of the popular ploughing competitions for the year took place on Thursday, the 21st instant, at Withington, Herefordshire. The competitors were Brown and Purser, the two celebrated ploughmen of Messrs. Howard; Barker, the champion of Messrs. Ransomes and Sims; and four champion men of the district. The Ipswich man had here to contend against both his formidable rivals from Bedford; but they could not prevail against his matchless ploughing; and the prize was accordingly awarded to Messrs. Ransomes. We learn that this firm have won nine out of the last eleven matches this season at which they have competed.

It is stated that by means of the machine for microscopic writing, invented by Mr. Peters, the words, "Mathew Marshall, Bank of England," can be written in the two and-a-half millionth of an inch in length.

The American Academy of Arts and Sciences has given the Rumford gold medal to Professor Treadwell, of Cambridge, "for improvements in the management of heat, made and put in practice by him in constructing cannon of a series of coiled rings, in the year 1842."

Only 60 parts by weight of charcoal are required to produce 100 of Austrian charcoal iron. The ore is a brown decomposed spathose ore, containing when roasted 52 per cent. of iron.

The story of the silting up of the Hooghly is not quite so baseless as was supposed. It now appears that the Rungafulla Channel, the only one navigable by large ships, is in a state of commotion, and that a new passage is opening up.

According to the American official account of the export of petroleum from all the ports to all the world up to the 31st of July of each year, the number of gallons for the last three years were:—1865, 7,010,650; 1864, 15,071,581; 1863, 15,105,844.

The vestry of Marylebone has resolved to oppose a project for an underground railway from the Baker-street Station of the Metropolitan Railway to Oxford-street.

The Indiana Legislature lately passed a resolution inquiring into the expediency of licensing locomotive engineers, making them all pass examination as to qualifications, moral character, &c.

It turns out that the new screw pile moorings sent out in consequence of the cyclone, at such unnecessary expense overland, do not suit the bed of the Hooghly, the fine mud of which will not hold them. Government has appointed a committee to investigate the matter.

The number of patents issued in America since January 1, 1865, to the end of November was 6,220. The estimated number to be issued during the month of December is 450, making a total of 6,670 for the year 1865. The number issued in 1864 was 5,220.

A Philadelphian paper states that a company has just laid down an iron tube of six inches diameter, capable of transporting 20,000 barrels of oil in the twenty-four hours from Pithole to the port at about one-third of the present cost. The tube is not constructed on the London plan of blowing or sucking anything along, but with a regular fall of 50 ft. to the mile.

We have to announce the death of Mr. Alan Stevenson, eldest son of the late Robert Stevenson, the well-known civil engineer, and author of the Bell Rock Lighthouse. He was born at Edinburgh in 1807, and pursued his father's profession until obliged by illness to retire from work, though not before he had made a name for himself by the services he performed as engineer to the Commissioners of Northern Lighthouses.

On Monday next, the 1st proximo, the act passed in the late session to establish a fire brigade in the metropolis will come into force. The brigade will be under the control of the Metropolitan Board of Works, and Captain Shaw has been appointed chief officer. The plant of existing fire-offices is by the act directed to be transferred to the Board, and a force of men maintained. Arrangements have been made, and on Monday the Board will take the management of all fire-engines and an efficient force of officers and men.

The Queen has conferred a baronetcy on Sir Roderick Murchison, the venerable President of the Royal Geographical Society, in recognition of distinguished merit and attainments.

It seems probable that the Prussian North-Pole expedition, as projected by Dr. Petermann, will really be undertaken next year, as both Count Bismarck and General von Roon, the Minister of War, are in favour of it, and have promised the assistance of the State.

We have occasionally to draw attention to the trifles upon which some of the inventive energy of the country is expended. The latest which has come under our notice, is an instrument for picking the collected dirt from the barrels of keys! just as if a pin, or failing that a toothpick, would not answer the purpose. We are certainly reminded of Hogarth's complicated machine for drawing corks.

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 acknowledgment.—

BOILERS AND FURNACES.—1510, 1517, 1521, 1523
BUILDINGS AND BUILDING MATERIALS.—1533
CHEMISTRY AND PHOTOGRAPHY.—1515
CULTIVATION OF THE SOIL. including agricultural implements and machines.—1503
ELECTRICAL APPARATUS.—1541, 1544
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c.—1512, 1514, 1519, 1524, 1526, 1530, 1550, 1551
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals.—1520, 1535, 1545
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.—1508, 1518, 1528, 1529, 1537
GENERAL MACHINERY.—1527, 1531, 1532, 1534
LIGHTING, HEATING, AND VENTILATING.—1507, 1513, 1548, 1549
METALS, including apparatus for their manufacture.—1505
MISCELLANEOUS.—1522, 1536, 1539, 1540, 1547
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—1502, 1511
SHIPS AND BOATS, including their fittings.—None
STEAM ENGINES, &c.—1504, 1509, 1516, 1538, 1542, 1543
WARFARE.—1506, 1525, 1546

1502 H. MARTIN. *Improvements in apparatus for signalling on railway trains, and for effecting communication between parts of such trains.* Dated June 1, 1865

In carrying this invention into effect, sliding bars or rods are applied to the compartments of a train of carriages, and they are connected together in pairs, so as to be simultaneously moved in opposite directions, in order that signals carried by them may be exposed to view or withdrawn therefrom at each side of the carriage. These rods or bars are retained in position to withhold the signal from view by a stop, whilst the tendency of them is to be brought into view by the action of a spring or other pressure when they are released from such stop. The releasing is effected by a stud or tappet from an axle acted upon by a lever handle or winch in position to be worked by a passenger. The invention also applies indicating apparatus in the compartments appropriated to those in charge of a train to indicate in such compartments the particular part of a train where attention is required. *Patent abandoned.*

1504 D. HANCOCK AND F. BARKES. *A new or improved method of obtaining motive power, together with certain machinery or apparatus for applying the same.* Dated June 1, 1865

This invention is carried out as follows:—Upon a shaft or axle (by preference hollow) the inventors insert a series of radial arms, also hollow, and perforated at their outer ends. To the outer end of each shaft they attach flexible vessels capable of expansion and contraction, and made by preference of india-rubber. The hollow shaft is mounted, and free to revolve on another shaft or axle which is formed with two valves in it on opposite sides. One of these valves is in communication with a pipe through which air, gas, steam, or other fluid is conveyed to one radial arm at a time, and when air is used from a bellows, fan, or other appliance, for generating the same, the other valve allows the air or other fluid to escape from the radial arm. To apply the apparatus the inventors place it in a tank or vessel containing water sufficiently deep to cover or nearly cover the top of the flexible vessels attached to the arms, supposing air to be used they admit it to the arms and thence to the vessels, according to the direction in which the wheel is to revolve. One vessel is first filled, and the buoyancy thereof causes it to rise, and the wheel consequently to commence rotating; as the flexible vessel rises, the next vessel becomes filled with air by the office of its arm coming opposite the valve, and so on for all the vessels until they get over the centre of gravity; the other valve then opens, and the air from each vessel successively escapes as the arms descend until the vessels are again filled on the other side, and rise as before described. *Patent abandoned.*

1505 H. ALLMAN. *Certain improvements in the formation and construction of metallic vessels, chambers, or hollow cylinders used in hydraulic apparatus, cannon, or heavy guns, and for like purposes.* Dated June 1, 1865

The patentee claims the application of brass or other analogous soldering material to the strengthening coils of guns, cylinders, or other articles prepared and treated in the manner described. *Patent completed.*

1506 H. ALLMAN. *Certain improvements in the manufacture of iron and steel, and in apparatus connected therewith.* Dated June 1, 1865

This invention consists in the substitution of a drawing process in reducing and laminating iron or steel for the rolling process, as in ordinary; by this means the fibre or laminae become much more condensed, finer, and of much greater toughness than the fibre or laminae of rolled iron. *Patent completed.*

1507 W. CLARK. *Improvements in the means of carburizing or treating aeriform fluids for lighting and heating purposes.* (A communication.) Dated June 1, 1865

The patentee claims employing and constructing apparatus of any form composed of superposed reservoirs containing a certain quantity of light inflammable essence (such as American petroleum, benzine, or other hydrocarburate), which reservoirs are connected together by tubes serving for the passage of the ambient air to be transformed into gas for lighting and heating purposes, all as described. He also claims the exclusive right of placing the reservoirs in communication with a supply chamber having a constant flow, as also of disposing one or more diaphragms of wire gauze in the tubes above mentioned, for the purpose of intercepting the passage of the flame. Lastly, he claims the

transforming without any mechanical means of atmospheric air into gas suited for lighting and heating purposes by the passage of air over light inflammable essences of petroleum, benzine, or other hydrocarburate, and this, whatever may be the form of the apparatus employed for effecting such transformation, without the aid of any apparatus for inducing artificially the entrance of the atmospheric air and the escape of the gases, which are thus naturally or spontaneously generated in the said apparatus. *Patent completed.*

1508 T. BRINSFORD. *An improved exercising chair for infants.* Dated June 1, 1865

The base of this exercising chair consists of a plank of wood supported upon suitable feet. To one end of this plank is connected a second plank or spring board, which may be either attached to the former rigidly by a block at one end, or by means of a hinge, in which latter case a metallic spring will be inserted between the two planks. The second plank or spring board is placed at an acute angle with the former, so that its free end rises up several inches above the corresponding end of the base, and a chair or seat is secured to or formed on the free end of the said plank or spring board. From the first or base plank a vertical or slightly inclined board rises up in front of the seat or chair, so that a child placed in the latter can easily reach the former with its feet. It will be evident that if an infant be placed in the chair or seat, and properly secured by a strap or otherwise, the slightest movement of its feet against the vertical or slightly inclined board in front of the seat will cause the spring board, together with the seat or chair and the infant, to spring up and down. *Patent completed.*

1509 T. E. WRIGHT. *Certain improvements on "Bourdon's" well-known steam pressure gauge.* Dated June 1, 1865

These improvements in Bourdon's steam pressure gauges, patented in this country in the name of O. Cooper (No. 12,889), the 15th December, 1849, consist, first, in making the partly circular tube forming the motive power of a non-oxidising and more elastic metal than has hitherto been used in the production of this description of pressure gauge, and by which the instrument will be rendered more enduring and certain in action, as the pressure however great will not have the effect of setting the tube in its expanded condition, a defect (after comparatively limited use) common to this description of pressure gauge. Instead of the tube of metal being composed of copper and zinc, commonly known as brass, the inventor diminishes these proportions, and adds nickel, varying the proportions as to obtain the additional hardness which gives it the condition essential to prevent the metal setting under great pressure, as the additional hardness affords that elasticity and steel-like quality desirable for this object. This mixture, or its equivalent, also enables the inventor to finish this part of such pressure gauges with a brilliant white surface, by which any defect or flaw in the metal will at once exhibit itself. Secondly, the improvements consist in applying precious stones, or other such like suitable hard material, for the pinions to work in that retain the lever or levers, quadrant, and pinions, or, in other words, the mechanical parts in connection with the finger or indicator of such gauges. *Patent abandoned.*

1511 T. HUNT. *Improvements in the construction of permanent way of railways.* Dated June 1, 1865

This invention consists, firstly, in the division of each sleeper into two parts or halves longitudinally throughout its whole length, one end of each part or half having a projection upon its upper surface, which fits against the inside of the rail, the other end having a similar projection which fits against the outside of the rail; the projections on the other half of the sleeper are placed in the reverse position as regards the rail, which is gripped between the respective projections by a wedge or wedges, or by bolts. Secondly, in the division into two halves longitudinally of only a portion of each end of the sleeper, the central portion being solid, and secured to the above-mentioned halves by bolts. Thirdly, in the division transversely of the sleepers into two or more parts, so that in the event of fracture of any one part the entire sleeper is not rendered useless, but may be repaired by simply replacing a sound part for the fractured one. Fourthly, in having a rib or ribs or corrugations on the under side of the sleeper, in order to give the desired stiffness and strength, which rib or ribs or corrugations may, if necessary, be so arranged as to prevent the bolts which secure the rail and sleeper together from turning round. *Patent completed.*

1512 H. MALLET. *Improvements in the manufacture of lace in twist lace machines.* Dated June 1, 1865

In the manufacture of imitations of Valenciennes laces in twist lace machines, the purled or looped edges have heretofore been produced in various ways. Now according to one part of the present invention, the loops of the purls are so formed as to be closed at the roots, and there they are also intersected by a single thread, while the loops forming the purls are each beyond the root produced by a single thread, or two threads slightly twisted and worked as a single thread. When making lace in imitation of Valenciennes laces the inventor produces the ground by the employment of two warp threads to each bobbin thread, and where there are to be weavings produced the hairs of warp threads are wound on separate beams, so that the two warp threads of a carriage or bobbin thread may be worked up unequally; and then, in place of the hairs of warp threads passing through the weaving side by side and as one warp thread, and also in place of employing extra warp threads as weft threads, one of each of such pairs of warp threads is used as weft threads, or as a boundary thread to the weavings, and thus the corded or ribbed effect heretofore resulting from the use of pairs of threads as single threads in the weaving is avoided, and the cutting off of threads, as when extra weft threads are used, is rendered unnecessary; the weavings thus produced are like what have been produced when using one warp thread to each bobbin thread, and they are formed on a ground or net of two warps to a bobbin. *Patent completed.*

1513 W. E. NEWTON. *An improved pocket lantern.* (A communication.) Dated June 1, 1865

This invention is not described apart from the drawings. *Patent completed.*

1514 W. E. NEWTON. *Improved machinery for raising the pile of woven or other fabrics.* (A communication.) Dated June 1, 1865

The patentee claims, first, raising the pile of the fabric by operating upon the latter with reasels, cards, brushes, or other pile producing apparatus, in different directions, such as longitudinally and transversely. Second, the arrangement of apparatus or mechanism set forth, whereby

this compound operation may be effected in one and the same machine. *Patent completed.*

1515 H. ALLMAN. *Certain improvements in the means employed for the prevention of the ignition of matter capable of combustion or explosion.* Dated June 2, 1865

This invention may generally be described as being the employment of certain gases, such as carbonic acid gas or other gases of a similar character, in which combustion cannot be easily maintained. *Patent completed.*

1516 J. NUTTALL. *Improvements in valves for steam and other fluids and liquids.* Dated June 2, 1865

This invention consists in making steam and other valves of a segmental form, and fitting the valve in a cylindrical case or box; the spindle of the valve passes at one or both ends through a stuffing-box in the lid or lids of the box or case, and to it is or are fixed one or more projections, with recesses containing springs, which act on the segmental valve, and hold it against its face. When the valve is opened by a handle fixed to the spindle or otherwise, the steam or water, or other liquid or fluid, is at liberty to flow freely through the valve-box, and through an opening in the handle which connects the valve to the valve spindle, thus allowing an uninterrupted current to pass from one pipe to another, when the valve-box is placed in a line of pipes. *Patent completed.*

1517 T. PRITCHARD. *Improvements in furnaces used in the manufacture of welded iron tubes.* Dated June 2, 1865

The patentee claims introducing a blast or blasts of air into the heating chambers of the said furnaces, by preference at the leading or fireplace end, and nearly opposite the bridge, the said blast or blasts being delivered into ignited fuel, so as thereby to produce a gaseous combustible mixture, by means of which, and the fire from the fireplace, the strips or skelps in the heating chamber are rapidly and uniformly heated. *Patent completed.*

1518 R. A. BROOM. *Improvements in electro-magnetic clocks and other timekeepers.* (A communication.) Dated June 2, 1865

This invention consists in the use of electricity to set timekeepers going directly by electro-magnetism, so that the electric current only exerts its action when the pendulum is reduced to a fixed minimum of oscillation, and that a new impulse by electro-magnetic power only takes place when the force of the preceding impulse is spent; it is therefore the clock itself which regulates the supply of electricity, after a time depending upon the power of the battery, with a constant current or not. *Patent completed.*

1519 W. GARD AND J. MOORE. *Improvements in the manufacture of pile fabrics.* Dated June 2, 1865

By these improvements the patentees produce together in the same loom at the same time two distinct fabrics, which are simply held together face to face during the formation of rows of pile on such two fabrics. *Patent completed.*

1520 G. KENT AND W. H. WKE. *Improvements in apparatus used when boiling milk.* Dated June 2, 1865

This invention consists in applying to vessels in which milk is boiled apparatus so constructed that, when the milk boils it shall be caused to flow up the interior of the apparatus over the top thereof, and descend boiling over the outside, by which the milk will be prevented boiling over the vessel in which it is boiled. *Patent abandoned.*

1521 H. E. NEWTON. *Improvements in steam boilers.* (A communication.) Dated June 2, 1865

This invention consists in inserting between that portion of the boilers subjected to the direct action of the fire and the main body of the water a semicircular false bottom or lining, which is so arranged as to allow a narrow space between it and the boiler plate, so that the water may circulate freely all round it, and also that there may be a comparatively small quantity of water acted upon at one time by the heat of the fire boiler. Steam will by this means be generated very quickly, and as it passes out of the narrow space or chamber it escapes into the upper portion of the boiler in a completely disengaged state. *Patent abandoned.*

1522 F. J. BOLTON AND H. MATTHEW. *An improved process for producing printing surfaces.* Dated June 2, 1865

This invention has for its object to produce printing surfaces on stone, zinc, or other metal or suitable substance, partly by the agency of light, and partly by the action of chemical agents on the surfaces to be operated upon, so that the surfaces when prepared may be used for printing therefrom with ink, as is well known in lithographic, zincographic, and other printing surfaces. *Patent completed.*

1523 J. SHEPHERD. *Improvements in safety apparatus for steam boilers.* Dated June 2, 1865

This invention consists in an arrangement of parts whereby, at a certain time, these parts are operated by steam, and the safety valve is lifted, whereby a greater aperture is obtained for the escape of steam from the boiler than would be the case if the safety valve was not so lifted. *Patent abandoned.*

1524 T. FORSTER AND J. ECKERSLEY. *Improvements in looms for weaving.* Dated June 3, 1865

This invention has for its object to take up or wind the cloth or fabric as it is produced either in a hand or power loom on to the "cloth beam" or roller, by means of a positive motion drawn from a part of the loom itself. *Patent abandoned.*

1525 A. LANCASTER. *Improvements in breechloading firearms.* Dated June 3, 1865

This invention is not described apart from the drawings. *Patent completed.*

1526 W. HOLDEN. *Improved machinery for putting twist in all fibrous substances.* Dated June 3, 1865

The object of this invention is to do away with all flys and spindles belonging to roving frames, and all other such kind of machinery. The inventor performs the invention by revolving tubes working perpendicular or otherwise, and which may be applied to all kinds of machines used where fibrous substances require twisting. *Patent abandoned.*

1527 C. TAYLOR. *Improvements in tube cutters and screw stocks.* Dated June 3, 1865

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

1528 E. EASTMAN. *Improvements in apparatus for measuring the human figure for garments.* Dated June 3, 1865

This invention is not described apart from the drawings. *Patent completed.*

1529 J. STEPHENSON. *Improvements in umbrellas, parasols, and sunshades.* Dated June 5, 1865

This invention relates to a cap or apparatus to be

attached to the ends of the ribs of umbrellas, &c., so as to embrace the silk, cotton, alpaca, &c., secure the same by the pinching of the said cap. A strip of india-rubber solution, or other waterproof fabric, is applied down the fold of the covering of the umbrella, &c. *Patent abandoned.*

1530 W. TOWNSEND. *An improvement in the process of doubling or twisting of yarns or threads whereby much waste is prevented.* Dated June 5, 1865.

This invention consists in the use of a lever or other mechanical contrivance, whereby so soon as the continuity of the twisted thread is destroyed, or by any means the said thread gets out of its proper courses, a blade or blades is or are at liberty to act on the untwisted thread and destroy its continuity. *Patent completed.*

1531 O. DE BEAUV. *Improvements in the manufacture of rivets.* Dated June 5, 1865.

This invention refers to machinery for forming the heads of rivets by punching off the "fin" or burr at the base of the head with which they are, in the first instance, produced by ordinary machines. This is effected by tubular or annular punches and dies, through which the rivets are passed as they are acted upon successively. *Patent completed.*

1532 C. DE BEAUV. *Improvements in machinery or apparatus for bending and straightening angle iron, T-iron and other iron bars.* Dated June 5, 1865.

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

1533 O. DE BEAUV. *Improvements in the manufacture of iron girders or erections, applicable more especially for carrying bridges at high elevations, or available for other legs and lighthouses.* Dated June 5, 1865.

This invention is not described apart from the drawings. *Patent completed.*

1534 T. GENTLE and J. ALLMARK. *Improvements in turbines.* Dated June 5, 1865.

This invention consists of a hollow shaft with a raised chamber in the centre, in which chamber is placed or cast a number of tubes or water passages in a curved form, gradually receding from the centre, the whole forming a disc or circle of which there may be one or more. The outer ends of the tubes or water passages are reduced so as to make in the aggregate a less area than the feed-pipe, thus causing the water to be backed up in its passage through the tube, and causing them and the shaft to rotate. In some cases the patentees place over the tubes a shell or casing with a passage for conveying away the water after it has passed through the tubes, the shell or casing being provided with one or more apertures or air valves to assist the water in its exit from the shell. The water is admitted through each end of the hollow shaft into the raised chamber first mentioned, whence it passes through the tubes, either into the shell or casing, or into any other channel of escape. The patentees employ the foregoing arrangement of turbine by fixing or casting to the hollow shaft one or more wheels or runners, each having in it a number of water passages of a curved shaft, and of any required width. The said passages, as in all these improved turbines, gradually recede from the centre of the shaft, and are reduced in area at their discharge ends. *Patent completed.*

1535 P. ODOMANS. *An improved apparatus called "the whey extractor," to be employed in the manufacture of cheese.* Dated June 5, 1865.

In carrying out this invention the patentee constructs a pump of any ordinary kind, preferably made of metal, and with metallic valves, and he makes the lower end of the suction of fine wire gauze, or of finely perforated, or, which he greatly prefers, he surrounds the lower end of the suction pipe in and by wire gauze, or finely perforated material made to resemble a vessel several times larger than the diameter of the suction pipe. The said pump, with its perforated or open-work lower part, is provided with a stand, and when it is to be used the lower part is placed in or amongst the coagulated milk, from which, by operating the pump, a regular and continuous extraction of the whey is effected, and such whey may be discharged at the delivery nozzle, or forced to any desired place. *Patent completed.*

1536 A. J. ASHALL. *An improved hand stamp for printing letters, numerals, and other figures.* Dated June 5, 1865.

This invention consists of a handle or shank, the lower end of which is formed with a pair of forked jaws or standards, between which are mounted on a transverse axle wheels, on the periphery of which are engraved the numeral letters or other devices required. We cannot here give space to the details of the invention. *Patent completed.*

1537 J. A. WOODBURY. *Improvements in paper or cloth lined paper collars, and in the mode of manufacturing the same.* Dated June 5, 1865.

This invention consists, chiefly, in giving to the surface or surfaces of paper collars the appearance of linen, or other woven material, by passing the paper between a pair of pressure rollers, one of which at least is covered with linen fabric, or other substance suitable to secure the desired result. *Patent abandoned.*

1538 J. ROSEKRON. *Improvements in the machinery or apparatus for actuating the slide valves of marine steam engines and in the slide valves thereof.* Dated June 5, 1865.

This invention relates to a certain arrangement of mechanism for working the slide valves of marine engines. One modification of this invention is carried out by dispensing with the ordinary slide valve, and substituting in lieu of it two or more valves driven by means of a cam or cams on the main or other shaft of the engines, in which cam or cams one or more oblique grooves are cut round the circumference. The end of a lever passes into these grooves, and as the cam revolves the lever is accordingly caused to vibrate. The vibrating lever being connected to upright shafts, passing into the steam chest and exhaust chest for working the slide and exhaust valves, receives a partial rotary movement corresponding to the vibrations of the lever or levers, and by means of a toe or short lever on those portions of the shafts on the interior of the steam and exhaust chests, the motion is transmitted to the valves. *Patent completed.*

1539 J. H. JOHNSON. *Improvements in corks or bungs for closing bottles and other receptacles for liquids.* (A communication.) Dated June 5, 1865.

This invention consists in making one or more annular grooves round corks or bungs intended for closing bottles and other receptacles for liquids, and in introducing into

such annular groove or grooves, a ring or rings of caoutchouc, gutta-percha, leather, or of any suitable elastic material, whereby a more effectual closing of the neck or orifice of the bottle, or other liquid-holder, is obtained. *Patent completed.*

1540 R. A. BROOMAN. *Improvements in the manufacture of soap chind in apparatus employed therein.* (A communication.) Dated June 5, 1865.

These improvements in manufacturing soap consist in the agitation by any suitable machinery of oils, fats, or other saponifiable materials, with salts of alkali in solution with water, in any closed vessel, while under heat and extraordinary pressure, in such a manner as to cause a thorough mixing and co-mingling of such saponifiable materials with such solutions while under heat and extraordinary pressure, causing thereby an instantaneous combination of the acids of the oils with the bases of the alkaline solutions. *Patent completed.*

1541 W. E. NEWTON. *An improved photo-electrotyping process.* (A communication.) Dated June 5, 1865.

The patentee claims producing directly upon the surface of any transparent picture, drawing, or manuscript, produced by the action of light, a mould capable of yielding a cast in plaster, or other suitable material, for the purposes and in the manner described. *Patent completed.*

1542 F. TOLHAUSEN. *An improved brake applicable to various descriptions of steam engines and also to railway purposes.* (A communication.) Dated June 5, 1865.

This invention consists in converting the steam cylinder of any stationary or other steam engine into a compressed air cylinder, by means of an intermediate slide valve acting in conjunction with other parts, whereby the air is compressed in the cylinder so as to form an air cushion acting as a brake. *Patent abandoned.*

1543 A. I. L. GORDON. *An improved system of telegraphic communication on railways, parts of which invention are also applicable to other telegraph purposes.* Dated June 5, 1865.

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

1544 J. KENNEDY. *An improved method of submerging telegraphic cables.* Dated June 5, 1865.

This invention consists, principally, in submerging marine telegraph cables by suspension, instead of laying them down at the bottom of the sea, as usually done. In carrying out the invention the patentee proposes to suspend the cable by means of lines, cords, or chains of any suitable material from buoys or other similar contrivances placed at suitable intervals along the line of communication, and floating at the surface of the water, so that the submerged cable shall be suspended, say at a depth of 100 to 200 fathoms below the surface of the water from coast to coast. *Patent completed.*

1545 C. H. WANSBROUGH. *Improvements in the treatment of condensing pans employed in the concentration of milk.* (A communication.) Dated June 5, 1865.

This invention consists in covering the interior surface of the vacuum or other condensing pans employed in the concentration of such milk, with any oily, fatty, or waxy material or substance, for the purpose of preventing the milk from burning, and for preventing the albuminous particles in the milk from adhering to the surface of the pan; and also for ensuring a more rapid and thorough concentration of the milk under treatment at a much lower temperature than heretofore, and, consequently, the milk need never acquire that unpleasant boiled flavour which is present when the ordinary mode of concentration is adopted. *Patent completed.*

1546 G. HASELTINE. *Improvements in breechloading firearms, and in metallic cartridge cases for the same.* (A communication.) Dated June 5, 1865.

The first part of this invention relates to an improved mode of drawing the cartridge case from the barrel after the discharge, and consists in the use of a sliding bolt operated by a wedge cam fixed on the breech cap, the said sliding bolt being provided with a catch or projection to act against the projecting rim on the end of the cartridge case, and working in a guide attached to or formed on the breech end of the barrel. The second part of the invention consists in marking that part of the barrel holding the cartridge case of varying diameter, and this variation of diameter is preferably obtained by a taper or gradual increase from the inner to the outer end of the said portion of the barrel. The third part of the invention relates to the means employed for obtaining greater certainty in exploding or self-igniting cartridges, and consists in causing the piston to strike the cartridge case in two or more points. This is accomplished by making the ends of the piston forked, each division being arranged to strike the part of the cartridge case covering the fulminate. The fourth part of the invention consists in making the cartridge cases of varying diameter to facilitate their insertion and removal from the barrel. *Patent abandoned.*

1547 D. BAKER. *Improvements in the manufacture of artificial fuel.* Dated June 5, 1865.

This invention consists in the manufacture of an artificial fuel by the combination of coke, coal, peat, charcoal, and tan, with a farinaceous manure and other ingredients. The invention partly relates to a former patent dated 23rd July, 1864 (No. 1,842). *Patent completed.*

1548 H. H. and J. F. KNOX-SCHROEDER. *Improvements in dry gas meters.* Dated June 5, 1865.

According to this invention the leather for forming the flexible chamber of a dry gas meter is obtained by cutting the central portion from a square or oblong piece of leather. The square or oblong ring of leather so obtained is fixed to two square or oblong frames, the corners or angles of which are rounded off. By this construction the form of the flexible or collapsible chamber will be well adapted to work in a rectangular outer case; besides, there will be no seams in the leather, and the leather is not injured by blocking. *Patent completed.*

1549 R. A. BROOMAN. *Improvements in the construction of reservoirs for containing and storing petroleum and other oils.* (A communication.) Dated June 5, 1865.

This invention is not described apart from the drawings. *Patent completed.*

1550 R. A. BROOMAN. *Improvements in machinery for combing wool and other filamentous and textile materials.* (A communication.) Dated June 5, 1865.

This invention is not described apart from the drawings. *Patent completed.*

1551 A. and A. W. FEMBERTON. *Improvements in machinery or apparatus for spinning, doubling, or twisting cotton and other fibrous materials.* Dated June 5, 1865.

This invention is not described apart from the drawings. *Patent completed.*

1552 G. HASELTINE. *Improvements in fuses and projectiles for rifled ordnance.* (A communication.) Dated June 5, 1865.

This invention is not described apart from the drawings. *Patent completed.*

1553 J. HOWARTH. *An improved method and apparatus for distilling coal shale and other carbonaceous substances.* (A communication.) Dated June 7, 1865.

The patentee claims distilling coal, shale, or other carbonaceous substances, for the production of oils, gases, vapours, and volatile products, by passing through the material to be acted upon a current of superheated steam in one body, in a vertical plane, or nearly so, through an upright retort, that is, so that a body of superheated steam shall come in contact with every portion of the said material, as set forth also, so combining devices for superheating steam flues for the passage of combustion, and a suitable retort, or retorts containing carbonaceous materials, as to cause the internal heat, or that caused by the superheated steam, to always predominate over the external heat, and perform the work of extracting the liquid and volatile products from the contents of the retort or retorts, without producing destructive distillation, substantially as described. Also the double chambered upright retort, arranged and operating as described, and for the purpose specified. *Patent completed.*

1554 A. C. HENDERSON. *Improvements in tanning hides and in apparatus connected therewith.* (A communication.) Dated June 7, 1865.

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

1555 V. DUTRIVE. *An improved metallic stuffing.* Dated June 7, 1865.

This invention is not described apart from the drawings. *Patent completed.*

1556 F. FOSTER. *Improvements in oil and other liquid feeders.* Dated June 7, 1865.

This invention consists in constructing the feeders with a hemispherical top, bottom, side, or end. In the interior of this hemispherical portion the inventor fits a hollow elastic hemisphere of india-rubber or other flexible material. The non-flexible and the flexible hemispheres are firmly united at their greatest circumferences. In the upper part or highest centre of the non-flexible hemisphere he fits a tube, one end of which projects outwards beyond the vessel, and is screwed so as to receive a cover or top; the other end of this tube is in the interior of the feeder, and is provided with a shoulder or flange made in two pieces; between these pieces is—as to make a perfectly tight joint—the higher or upper part of the flexible hemisphere, which is here cut away for that purpose. Against this flange also presses one end of a spiral spring, the other end being attached to that part of the feeder opposite where the tube enters. The top or cover on the tube before named being removed the feeder may be filled with the liquid to be used, and the top replaced. The tube, with its cover, acts as a plunger, and upon pressure being applied to the plunger the flexible hemisphere will be partially collapsed, and the liquid driven through the discharge orifice with a force varying with the pressure employed. The plunger tube will be returned to its original position by the spiral spring. *Patent abandoned.*

1557 W. TONGUE. *Improvements in machinery for combing and heckling fibrous materials.* Dated June 7, 1865.

This invention is not described apart from the drawings. *Patent completed.*

1558 T. SMITH. *Certain improvements in the manufacture of axes, adzes, picks, and other like tools having a hole urege formed in them for receiving a handle.* Dated June 7, 1865.

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

PROVISIONAL PROTECTIONS.

Dated August 14, 1865.

2102 J. Gamgee, Albert Veterinary College, Bayswater, prof. of veterinary surgery. *Improvements in the construction of cowhouses.*

Dated September 29, 1865.

2509 G. Gillett, Whitehaven, Cumberland. *Improvements in apparatus for impressing designs upon biscuits made by machinery.*

Dated October 7, 1865.

2580 T. V. Lee, Macclesfield. *Improved methods in the manufacture of candles and other illuminating bodies from peat and petroleum.*

Dated October 20, 1865.

2710 R. Fell, Robinson-row, and D. Hammond, Hackney-road. *An improved apparatus for regulating the supply of water to tanks, water butts, or cisterns, applicable also to other purposes.*

Dated October 23, 1865.

2741 W. Clark, Chancery-lane, engineer. *Improvements in the manufacture of paper from marine vegetable matters.* (A communication.)

Dated October 26, 1865.

2758 H. A. Dufrenoy, 8, South-street, Kinsbury, civil engineer. *New or improved means and apparatus for destroying ships and such like floating bodies, parts of which said apparatus are also applicable to saving life and property at sea.* (A communication.)

Dated October 27, 1865.

2772 W. E. Newton, Chancery-lane, civil engineer. *Improvements in breechloading firearms.* (A communication.)

Dated November 1, 1865.

2812 J. Baggs, Chancery-lane, electrical engineer. *Improvements in preserving provisions, and in the apparatus connected therewith.*

Dated November 6, 1865.

2858 R. Sims and R. Burn, Beilfont, Lancashire. *Improvements in the formation of railway carriages.*

Dated November 10, 1865.

2898 E. J. Davis, Globe Wharf, Mile End. *Improvements in treating brewers' grains in order to render them more suitable for the food of animals.*

Dated November 15, 1865.

2938 C. Atherton and A. H. Renton, Whitehall, civil engineers. *Improvements in the means of apparatus for steering ships and other floating bodies.*

Dated November 20, 1865.

2184 W. J. Burgess, Brentwood, Essex, engineer. Improvements in cotton gins.

Dated November 23, 1865.

3010 N. Greenhalgh, cotton spinner, and J. Mallison, yarn agent, Halliwell, Lancashire. Certain improvements in sizing and dressing yarns.

3012 W. S. Malley, shipping surveyor, Plymouth. Improvements in planking or sheathing iron ships and iron framed ships.

Dated November 24, 1865.

3017 C. Reader, Derby, elastic belt truss manufacturer. A new or improved elastic belt or hand truss.

Dated November 25, 1865.

3032 O. F. Whitworth, Lawton's Hotel, Upper Mill, Saddleworth, Yorkshire, civil engineer. Improvements in apparatus for signalling on railways.

Dated November 28, 1865.

3046 E. M. Roberts, Earl-street, Kensington, mining engineer. Improvements in machinery for deriving motive power from the application of the force of gravitation alone, without the aid of steam, water, wind, and compressed air, or any other similar means.

Dated November 29, 1865.

3064 E. Farr, Cavendish-street, Chorlton-upon-Medlock, Manchester, and I. Gregory, Victoria Park, Moss Side, Lancashire. Improvements in the construction of pianofortes.

Dated November 30, 1865.

3069 A. C. Duncan, Manchester. Improvements in the treatment of madder for dyeing and printing.

3070 J. T. Hall, Edgell Hill Station, Liverpool, gas engineer. Improvements in lamps for burning petroleum, paraffin, and other hydrocarbon liquids without a glass chimney in the roofs of railway carriages, and other like places and positions.

3078 J. Hollands, Clerkenwell Green, E. R. Hollands, King's-square, St. Luke's, and T. Hollands, Baker-street, Pentonville. Improvements in the manufacture of gold and other ornamental chains.

3078 W. Clark, Chancery-lane, engineer. Improvements in the manufacture of materials for decolouring sugar, and other saccharine matters. (A communication.)

Dated December 1, 1865.

3079 I. M. Singer, Euston Hotel, Euston-square. Improvements in sewing machines, and in sewing or embroidering.

3081 W. Pringle, Birmingham, machinist. Certain improvements in breechloading firearms.

3086 H. Hedley, draper, and G. Ainsley, photographer, South Shields, Durham. Improvements in sewing machines.

3087 W. R. Taylor, Oxford, brewer. Improvements in the treatment of grain, and in the process of malting, and in the apparatus employed therein.

3088 L. M. M. Rogers, Boner-street, Fleet-street, merchant. Improved means of preventing water pipes from bursting. (A communication.)

Dated December 2, 1865.

3090 I. M. Singer, Euston Hotel, Euston-square. Improvements in the construction of ocean steamers and paddlewheels for propelling the same, which paddlewheels are also applicable to the propulsion of other steam vessels.

3096 E. Morin and R. Schweitzer, Sherborne-lane, City. A new or improved swivel snap.

3098 G. Ash, Great Marlborough-street. Improvements in securing artificial teeth in the mouth.

3100 A. Nicoll, Boho-square. Improvements in carriages and endless tracks on and with which they run.

Dated December 4, 1865.

3103 J. S. Templeton, Glasgow, manufacturer. Improvements in power looms for weaving pile fabrics, such as "patent Axminster carpeting."

3106 F. Braby and A. Moore, Fitzroy Works, Euston-road. Improvements in the construction of metal tanks and cisterns.

3108 W. Clarke, Nottingham, lace manufacturer. Improvements in the manufacture of ornamental laces and fabrics in twist lace machinery.

3110 R. A. Brooman, Fleet-street, patent agent. Improvements in dyeing, printing, and other operations based on chemical reactions. (A communication.)

3114 W. E. Newton, Chancery-lane, civil engineer. Improvements in the construction of artificial arms. (A communication.)

Dated December 5, 1865.

3118 W. B. Cluderay, Leeds, engineer. An improved leather shaving machine.

3120 E. W. Wilkinson, Stockport, cotton spinner. Improvements in machinery for opening and cleaning cotton and other fibrous substances.

3124 W. B. Masters, Shoreditch. A new or improved press for pressing shawls, clothes, table linen, and various other fabrics, manufactured articles, and substances requiring pressure.

3126 E. A. Cowper, Great George-street, Westminster. Improvements in apparatus employed for grinding corn and other substances capable of being ground by millstones.

3130 A. B. Brown, Cannon-street. Improvements in steam cranes and hoists.

Dated December 6, 1865.

3132 J. Walker, Birmingham, press tool maker. Improvements in fastenings for waistband buckles applicable also for other similar purposes.

3136 T. L. Nicklin, Summerhill Ironworks, Tipton, Staffordshire, ironmaster. Improvements in puddling, heating, and other reverberatory furnaces used in the manufacture of iron and steel, and for other purposes.

3138 G. Daws, Fenge. A new or improved method of and apparatus for locking and unllocking gates, turnstiles, and stiles on railway crossings.

Dated December 7, 1865.

3147 W. Grosvenor, Princethorpe Priory, Rugby. Improvements in means or apparatus to aid in the teaching of arithmetic.

3149 W. E. Evans, Market-place, Great Portland-street. Improvements in harmoniums, pianofortes, organs, and other similar keyed instruments.

3151 S. Norris, Regent-street. Improvements in breechloading firearms. (A communication.)

Dated December 8, 1865.

3155 T. Olaridge, Bilston, Staffordshire, engineer. Improvements in machinery for rolling gun barrels and other articles.

3159 W. Boulton and J. Worthington, Burslem, Staffordshire, engineers. An improved method of and apparatus for making mortars, bowls, spill pots, jelly cans, galvanic troughs, and other similar articles.

3161 G. Wallis, Stroud, Gloucestershire, engineer, and B. Cooper, Frome, Somersetshire, manufacturer. Improvements in apparatus to be employed in the feeding of scribbling and carding engines.

3163 A. Parkes, Birmingham. Improvements in preparing compounds of xyloidine or gun cotton, and in the apparatus employed.

Dated December 9, 1865.

3167 H. A. Bonneville, Forchester-terrace, Bayswater. Improvements in the construction of barometers. (A communication.)

3178 S. G. H. Davies-Gwyn, Parliament-street, Westminster. A covering or cap for protecting the ends of maps, drawings, rolls of paper, and other materials that are capable of being rolled up.

3177 C. Baylis, Alvechurch, Worcestershire, fish hook manufacturer. Improvements in fish hooks.

3179 A. Barclay, Kilmarnock. Improvements in certain apparatus for injecting and ejecting fluids and liquids.

3181 W. T. Eley, Gay's Inn-road, cartridge manufacturer. Improvements in central fire breechloading cartridges.

3183 E. Morewood, Stratford. Improvements in coating metals, and in apparatus to be used for this purpose.

3185 R. F. Fairlie, Gracechurch-street, engineer. Improvements in locomotive engines, and in the means employed for generating steam therein.

3187 W. Clark, Chancery-lane, engineer. Improvements in cups or sockets applied to candles and other lights. (A communication.)

Dated December 11, 1865.

3189 T. C. Usher, Dublin. Improvements in machinery for cutting paper.

3191 J. Townsend, Shelf, near Halifax, worsted spinner. Improvements in steam boilers or apparatus for generating steam.

3193 J. T. Griffin, Fleet-street. An improved ruler. (A communication.)

3197 W. J. Murphy, Lady's Well Brewery, Cork. An improved method of and apparatus for the working of breechloading guns.

3199 W. R. Lake, Southampton-buildings, Chancery-lane, consulting engineer. Improvements in the permanent way of railways. (A communication.)

3201 J. Jones, Leadenhall-street. Improvements in the waterproof linings of cases, boxes, and apparatus in which articles are desired to be packed waterproof.

Dated December 12, 1865.

3203 J. Kaspary, Windsor-terrace, City-road, merchant. A new and improved compound to be employed as a drinking beverage. (A communication.)

3207 H. Y. Thompson, Cleveland-row, St. James's. Improvements in envelopes.

3209 R. Howarth, Gaythorn Mill, City-road, Manchester. Improvements in apparatus to be employed in stiffening fabrics.

3211 R. Beck, Cornhill. Improvements in microscopes.

3213 J. Stoker, Amersham Vale-road, New Cross. Improvements in steam engines.

Dated December 13, 1865.

3217 J. H. Smith, East-road, Hoxton, machinist. Improvements in sewing machines.

3219 R. A. Brooman, Fleet-street, patent agent. The manufacture of pulp from the "lygum spartum." (A communication.)

3225 P. Gardner, Banbury, Oxfordshire, surveyor. An improved construction of rotary engine.

3228 E. A. Dana, Brookline, Mass. An improved projectile for rifled cannon or ordnance.

Dated December 14, 1865.

3205 M. K'ots, Rue du Mont Thabor, Paris, manufacturer. Improvements in sewing machine shuttles, and in the winding or reeling of the thread employed with them.

Dated December 19, 1865.

3278 E. A. Dana, Brookline, Mass. An improved projectile for rifled cannon or ordnance.

LIST OF SEALED PATENTS.

Sealed December 22, 1865.

1700 M. Ashby
1702 R. A. Brooman
1709 H. M. Kennard
1710 H. Shaw
1711 R. A. Brooman
1714 J. H. Johnson
1716 H. G. Fairburn
1727 W. Botham
1728 R. H. Leese
1730 R. A. Brooman
1731 J. Cox
1733 A. Prince
1740 H. W. Rosser
1744 W. H. Davey
1769 J. Naveaux

1767 J. Harrington
1769 J. E. Wilson
1777 J. W. Gray
1781 T. S. Pridaux
1784 W. Thomson and O. F. Varley
1816 H. A. Dufrene
1822 F. Taylor
1842 J. E. Wilson
1975 J. Ramabottom
2603 O. F. Cotterill
2627 V. A. and V. J. Messenger
2759 E. Hunt

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the London Gazette, December 28, 1865.

2084 R. W. Armstrong. Moulding hollow articles.
2089 J. Tatham and J. Smith. Cotton.
2093 W. Betts. Capsules.
2099 W. F. Henson. Railway chairs.
2102 J. Ganges. Cowhouses.
2104 J. W. M. Dermott. Bolt-heading machines.
2113 J. Smith and W. Schofield. Dyeing yarns.
2114 J. Ingham and J. Culpan. China grass.
2121 S. Phillip and J. Groves. Safes.
2123 O. Lawrence. New medicine.
2127 A. V. Newton. Drying timber. (A communication.)
2140 A. Watt. Soap.
2144 J. S. Watson, A. Horwood, and C. Brumfit. Galvanic batteries.
2147 R. A. Brooman. Twisting threads. (A communication.)
2151 W. Soper. Breechloading firearms.
2155 H. Willis and G. Rice. Sewing machines.
2169 D. Macpherson. Sewing machines.

2191 J. Moula. Tar.
2197 J. Symmons. Horsehoes.
2199 R. G. Rattray. Regulated quantities of water.
2210 P. Polain. Breechloading revolvers.
2213 W. P. Pigott. Electric telegraph cables.
2216 A. Gwilt. Utilising sulphurous smoke.
2231 J. H. Johnson. Tanning. (A communication.)
2239 M. Woodfield. Carrying railway tickets.
2246 W. E. Newton. Paper pulp. (A communication.)
2263 J. Elverson. Sawing curved designs.
2273 A. V. Newton. Lifts. (A communication.)
2286 W. Clark. Steam engines. (A communication.)
2320 S. Davis. Stirrup latch bar.
2356 W. Clark. Magnetic telegraphs. (A communication.)

2367 F. Meyer and J. W. Freemans. Night lights.
2428 C. and T. White. Books.
2504 G. Davies. Reclining chair. (A communication.)
2574 O. G. Lank. Purifying water.
2772 W. E. Newton. Breechloading firearms. (A communication.)
2869 W. E. Newton. Checking the recoil of cannon. (A communication.)
2949 O. Sarony. Reels for taking photographs.
3010 N. Greenhalgh and J. Mallison. Dressing yarns.
3017 C. Reader. Elastic belt.
3079 I. M. Singer. Sewing machines.
3090 I. M. Singer. Ocean steamers.
3106 F. Braby and A. Moore. Metal tanks.
3159 W. Boulton and J. Worthington. Making morian.
3208 M. Klotz. Sewing machine shuttles.

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 10s HAS BEEN PAID.

3415 G. E. M. Gerard
3432 G. H. Birkbeck
3438 A. P. Tronohon
3438 W. Henderson
3442 R. Lakin and J. Wain
3452 W. Clark
3453 C. F. Varley
3470 J. Johnston
3473 H. A. Bonneville
3482 W. B. Adams
47 M. Hodgart

PATENTS ON WHICH THE STAMP DUTY OF 10s HAS BEEN PAID.

2975 W. Taylor and W. D. Grimshaw
3007 J. H. Johnson

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending December 23, 1865.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
282.0	a. d.	293.0	a. d.	301.0	a. d.	309.0	a. d.	317.0	a. d.	325.0	a. d.
283.0	4	293.0	10	302.0	4	310.0	4	318.0	10	327.0	4
294.0	4	294.0	8	303.0	10	311.1	4	319.0	4	328.0	10
295.0	4	296.1	4	304.2	0	312.0	4	320.0	4	329.0	4
296.1	4	296.0	4	305.0	4	313.0	4	321.0	6	330.0	4
297.0	10	297.0	6	306.0	8	314.0	8	322.0	10	331.0	4
298.0	10	298.0	8	307.0	8	315.0	4	323.0	10	332.0	10
299.0	4	299.0	4	308.0	4	316.0	4	324.0	8	333.0	10
291.0	8	300.0	8								

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. Bennett Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

TO INVENTORS AND PATENTEES.

MESSRS.

ROBERTSON, BROOMAN, AND CO.,

Civil Engineers and Patent Agents,

166, FLEET STREET, LONDON.

Established 1823.

UNDERTAKE TO OBTAIN PATENTS FOR INVENTIONS

PROVISIONAL PROTECTIONS

APPLIED FOR.

SPECIFICATIONS DRAWN & REVISED.

OPPOSITIONS CONDUCTED.

PERSONAL ATTENDANCE IN LONDON NOT NECESSARY.

Searches made for Patents, and Copies or Abstracts supplied.

ILLUSTRATIVE AND WORKING DRAWINGS MADE FROM MODELS OR SKETCHES.

ADVICES ON CASES SUBMITTED,

OPINIONS AS TO INFRINGEMENTS, &c.

This book should be returned to
the Library on or before the last date
stamped below.

A fine of five cents a day is incurred
by retaining it beyond the specified
time.

Please return promptly.

