

25 per share is to be called up. In this issue it is proposed to allot 50,000 shares to the present shareholders, and 50,000 shares to the general public. These new shares will participate in the next distribution of profits *pro rata* with the existing shares according to the amount of capital paid up thereon. There is great reason to believe that at no distant period this company will stand foremost among the leading monetary institutions of the country.

According to an old saw it is a wise child that knows its own father. The act of recognition, however, is less difficult on the part of the parent. Oblivious of this latter fact, the editor of the *Colliery Guardian* transferred to its columns on the 14th inst., an article on "English Iron Ores and their Products," which owes its parentage to us, having only a short time previously appeared in our leading pages. For the reason above given we lay claim to no particular sagacity in making the discovery, but for other reasons we have no hesitation in publishing the fact of having done so. In plain English, we say, then, that in this cool proceeding the paper in question has only been equalled by a certain American journal which we had to admonish some four months ago, since the last time that it—the *Colliery Guardian*—borrowed from our columns without the usual compliment of an acknowledgment.

On Wednesday last the construction of the Waterloo and Whitehall Railway, which is to be worked upon the pneumatic principle, was commenced under the supervision of the engineers, Mr. T. W. Rammell and Sir C. Fox and Son. The bed of the Thames on the Surrey side of the river, at a point nearly opposite College Wharf, and in a line with Scotland-yard, is now being dredged by steam machinery for the foundations of the south pier, on which the iron tube will be laid. At Scotland-yard the ground for the Whitehall Station has been enclosed in readiness for the building of the terminus on the north side of the Thames. Messrs. Samuda, of Poplar, are manufacturing the tube.

At the last meeting of the Metropolitan Board of Works, the Thames Embankment Committee reported that they had considered the plan for the construction of the Metropolitan District Railway to Blackfriars Bridge, and they expressed their fear that complications and difficulties would arise if the plan submitted by the railway company should be adopted by the Board. The committee felt that the works of the embankment should no longer be retarded, and that immediate steps should be taken to prepare plans and specifications for Contract No. 3, and to carry out the works from the Temple to Blackfriars Bridge simultaneously with the other embankment works, in accordance with the plans sanctioned by Parliament.

A small screw steam yacht, built with plates of steel, by Messrs. Langley and Co., was received a few days ago at Woolwich, by order of the Board of Admiralty, and was afterwards taken down the river on a trial trip. The yacht was built to the order of Lord Alfred Paget, who purposed using it in wild-fowl shooting excursions. It is intended to be purchased by the Admiralty, and appropriated as a steam pinnace to be attached to the flagship at Portsmouth. The trial was not satisfactory, inasmuch as it was found impossible to keep up a permanent supply of steam, and the maximum rate of speed attained was barely six knots per hour.

The report of Captain Tyler, R.E., upon his recent examination of the Crumlin Viaduct shows that there is no immediate danger to be apprehended from the present condition of the structure, but to ensure the safety of the viaduct and to allay the public uneasiness certain additions and repairs are recommended and will be made.

Another failure is announced in the overdone matter of workmen's exhibitions. The late North-east London Exhibition held at the Agricultural Hall, Islington, which was brought to a close on Saturday night, has proved in all respects a failure. In an art point of view the exhibition missed its mark, and towards the close degenerated into the veriest mountebankism; whilst, notwithstanding the "attractions" of tight-rope dancing, comic singing, and conjuring, the visitors were not sufficiently numerous to make it pay, and there is a deficiency of upwards of £1,500.

In 1845 the quantity of iron produced in Scotland was 475,000 tons; that production gradually increased, till in the year 1864 it reached 950,000 tons. For the same year the total production in Great Britain, inclusive of Wales, was no less than 5,600,000 tons.

The French Government has sanctioned the creation of a railway between St. Michael and the Italian frontier, on which locomotives will ply until the railway between St. Michael and Susa be regularly opened.

In the Juries' Report on Section 80 (Photography), Dublin Exhibition, it is suggested that the magnesium light will be found extremely advantageous by the Esquimaux when they take to amusing themselves with photography during their long and sunless winter.

Mr. James Bruce writes to inform us that he has discovered a method of liberating oxygen gas in the stomach, which he considers will prove very beneficial in the treatment of cholera, fevers, dysentery, bronchitis, consumption, asthma, and vertigo, as well as epilepsy. He directs a drachm of nitric acid (the acid may be increased to two drachms) to be diluted with a quart of water, and which quantity is to be taken in the twenty-four hours; but previous to drinking any dose of this acid mixture, the patient is required to swallow a lump, or two, of sugar. The result is the evolution of oxygen gas in the stomach. Mr. Bruce advises a trial of it in the cattle plague.

The operation of casting a large anvil block, weighing 100 tons, was successfully carried out last week at the new works of Messrs. Bessemer and Sons, at East Greenwich. This block is only intended for a 6-ton steam hammer, but the character of the soil renders this extra size necessary. Another smaller block weighing about 57 tons was cast near the larger one. The work of casting these masses was effected by the aid of the staff and plant of Mr. Ireland, of Manchester, who, with his upper tapers cupola furnace, not long ago cast a block in Bolton which weighed over 200 tons.

The "Bellerophon" is ordered to be fitted with a light iron head in order to lessen the force of the large wave now thrown up by the frigate when going through the sea at full speed, and, at the same time, to give her head a handsomer appearance than it at present possesses. During the time the improvements are being effected, alterations will be made in the screw propeller, the recent trials having shown that the principal cause for the comparatively low rate of speed realised was the character of the screw fitted to her, which was much too ponderous.

A Swiss invention has been introduced to aid bees in the formation of their comb. Narrow sheets of wax are imprinted by machinery so as exactly to represent the dividing wall of comb between the cells. These strips are attached to the top of the empty hive, before the new swarm is put in, thus enabling the bees to go immediately to work, and also guiding them in making the sheets of comb in the proper direction.

The extreme heat which prevailed on the continent during the vintage produced a curious result. The grapes being in general very ripe fermented in the vats with extraordinary rapidity. A great portion of the saccharine matter had not time to be converted into alcohol, and the wine, on account of the saccharine matter remaining in it, will ferment for a long time in the cask.

The Seine has been unusually low during the past summer. It marked on the 29th of September last 0.72 below zero on the scale at the Pont Royal, being lower than in any other previous dry year. In October, 1853, it fell to only 0.25 below zero. In consequence of this low state of the water the authorities have determined to complete a plan commenced in the year 1835 for rendering the river navigable at all times, but subsequently abandoned. It has been decided to keep six feet of water in the river from Paris to Rouen by means of dams and sluice gates. Such a work has been commenced at Port-à-l'Anglais, above Paris, and at Suresnes, below the city. By these and similar works to be constructed between Paris and the sea, sufficient water may be maintained in the river to render it navigable at all seasons.

There appears to be no truth in a report which has been going the round of the papers to the effect that the Prussian Government was negotiating with M. Armand, of Bordeaux, and M. Jonet, of Marseilles, for the construction of ten plated ships of war. The report arose from the fact of the Prussian Government having asked for estimates of plated frigates from ten different shipbuilding firms. It appears, however, that materials have been brought from Dantzic for the construction of five building sheds at Kiel, and the works are to commence immediately.

The barque "Edwin," arrived at New York, reports having passed, on the 10th September, in lat. 52, long. 34°48', a red buoy marked "Telegraph, No. 3," or "5." The red flag was nearly gone, and the captain of the "Edwin" believed the buoy was loose from the cable.

It has been decided to adopt throughout the naval service a new pattern of quill friction tubes, fitted with loops and studs, on the gun, the detonating hammers and tubes, as well as the friction tubes now in use, being accordingly withdrawn, and the new tubes universally adopted. All guns now in store at the home stations, whether in ships in commission or in the steam reserve, are to be fitted with the stud, and the vents enlarged at the top, as recommended. Ships now on foreign stations will retain the present proportion of detonating tubes until put out of commission.

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

Several changes have recently been made in the programme of the Royal Polytechnic Institution. Professor Pepper has introduced a lecture on polarised light and the phenomena of diffraction, in the course of which he gives a very clear exposition of the theory of light and the phenomena in question and exhibits some most beautiful experiments. Mr. King describes the thermo-electric battery, illustrating his description by experiments with a large pile on Marous's principle.

The Admiralty have given instructions to another of the iron mortar-boats belonging to the squadron laid up at the eastern end of Chatham dockyard since the termination of the Russian war to be converted into a dockyard tender for service at Woolwich, where the work of converting her is to be carried out. Although several of the mortar boats have recently been brought into use for various purposes there is still a large number lying high and dry at Chatham.

At the Birmingham Industrial Exhibition last week, the first prize, of the value of £25, was awarded to Mr. Peter Gaskell, the inventor and patentee of the cab indicator, which shows the distance the cab goes, and the amount the passengers have to pay.

A very valuable process has been discovered in France, whereby the pyrogallio acid, so largely consumed by photographers, can be made in much larger quantities and at cheaper rates than hitherto. By means of the old process, 100 parts of gallic acid yielded but 25 or 30 per cent. of pyrogallio acid. By the process just made known to the Academy of Sciences at Paris, by M. de Luynes, 100 parts of gallic acid are made to yield 60 parts of pyrogallio acid. The new process is a somewhat complicated one, and the pyrogallio acid is first formed in solution instead of in its usual state.

If we may credit report, we may record the discovery of a new planet, as the *Boston (U.S.) Daily Advertiser* of the 10th inst. says:—"The following despatch was received here yesterday:—'Observatory, Ann. Arbor, Michigan, October 9, 11 o'clock p.m.—Mr. J. C. Watson states that he discovered a new planet at about half-past ten o'clock this evening. It shines like a star of the ninth and one-half magnitude, and is situated in the right ascension, 14 deg. and 45 min., and in declination 6 deg. N.'"

The report of the directors of the West Flanders Railway states that the working of the company's lines had been in the hands of the Société d'Exploitation since the 1st of January last, and that the whole was proceeding satisfactorily under the new arrangement. With regard to the lines conceded in 1864, the plans of the Roulers and Ypres line were under the inspection of the government engineers, and steps were being taken towards the commencement of the works as soon as the plans were approved. The Société d'Exploitation had not yet obtained power from the French Government for the extension of the line from Poperinghe over the frontier to Hasbrouck.

With the exception of the small 4-gun screw vessel "Myrmidon," 695 tons, the "Bulwark," two-decker, line-of-battle ship, originally designed to mount 81 guns, is the only wooden vessel now left standing on the building slips at Chatham Dockyard, the remainder having been taken down, and the materials used in the general service of the yard. The "Bulwark" was commenced about seven years since, and was scarcely half completed when orders were received for the further work on her to be discontinued, and for several years past she has been lying idle on the stocks.

The fish in the river Thames are bearing testimony to the beneficial effects of the main drainage scheme. The chairman of the Metropolitan Board of Works at the last meeting stated that Mr. Webster had sent him a fine roach that was caught in front of the Parliament Houses. He kept it for three days, but could not keep it longer. Since then other specimens of roach and dace have been caught there.

We understand that a new railway is proposed between Sheffield and Manchester, under the London and North-Western system, and for which the survey is being made. The route is to be through Chapel-en-le-Frith, or a point near thereto, and thence through Castleton, Bamford, and Hathersage. Buxton, which is now sixty-one miles from Sheffield via Ambergate, and fifty-four miles via Dronfield, will be brought within twenty-five miles. It is expected that Manchester will be about two miles nearer Sheffield than under the present system of the Manchester, Sheffield, and Lincolnshire Company.

The workmen at Chatham Dockyard have commenced taking down the frames of the wooden screw frigate "Belvidere," 58, 500-horse power, one of the improved class of 60-gun unarmoured wooden frigates commenced at that establishment about six years since, but the building of which has been discontinued for some years, that class of ship being superseded by iron-clad frigates.

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.—891

BUILDINGS AND BUILDING MATERIALS.—875, 911, 939

CHEMISTRY AND PHOTOGRAPHY.—872, 874, 900, 915

CULTIVATION OF THE SOIL. including agricultural implements and machines.—None.

ELECTRICAL APPARATUS.—910

FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c.—887, 889, 901, 907, 919, 921, 928

FOOD AND BEVERAGES, including apparatus for preparing food for men and animals.—895, 927

FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.—879, 881, 883, 894, 903, 904, 908, 918, 922, 933

GENERAL MACHINERY.—882, 885, 886, 888, 909, 913, 924, 926, 934

LIGHTING, HEATING, AND VENTILATING.—876, 887, 917, 931

METALS, including apparatus for their manufacture.—880, 899, 912, 925

MISCELLANEOUS.—877, 892, 893, 914, 920, 926, 936

ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—878, 884, 888, 895, 916, 923, 929, 930, 987

SHIPS AND BOATS, including their fittings.—873, 890, 935

STEAM ENGINES, &c.—806

WARFARE.—902, 932

872 W. WALSH. *Improvements in the concentration or evaporation of all solutions where concentration or evaporation is required.* Dated March 28, 1865.

This invention relates, particularly, to the manufacture of caustic soda and potash, carbonate of soda and potash, chloride of sodium and potassium, or similar alkalies or acid solution, in which a quick concentration or evaporation is essentially necessary; but it is also applicable to all solutions where a quick or speedy evaporation is required. For this purpose the inventor places, or fixes an agitator of any suitable construction in the pan or vessel in which the aforesaid alkalies and acid solutions are required to be concentrated or evaporated, and he gives a revolving motion to the agitator by placing or fixing to it a pulley, to revolve inside the liquor or solution, over which he passes a chain, and extends it to a pulley on the line-shaft above the pan or vessel. He thus avoids the necessity of a cross-shaft and standing-boxes outside the pan or vessel. *Patent abandoned.*

873 T. GLOVER, jun. *Improvements in the construction of ships' yards and spars.* Dated March 28, 1865.

This invention consists in forming ships' yards and spars of bars of iron or steel, of an angular or other suitable section, combined into the form desired for the yard or spar, tapering to both or either end, and bound together by hoops and plates bolted, riveted, or otherwise fastened, so as thereby to form an open framework. *Patent completed.*

874 A. D. GASCOR. *A new febrifuge and digestive elixir.* (A communication.) Dated March 28, 1865.

This invention consists in the composition of a liquid which the inventor calls febrifuge and digestive elixir, and which he prepares as follows:—First, in a quart of good brandy he puts about three ounces of Sooticrine aloes, or aloes perfoliated; second, three drachms of zedary; third, three drachms of white agaric; fourth, three drachms of gentian; fifth, three drachms of saffron; sixth, three drachms of rhubarb; seventh, three drachms of theriac; the whole is pulverized and left to infuse about fifteen days, when it is decanted and kept for use. *Patent completed.*

875 F. THOMAS. *Improvements in the construction of kitchen ranges having their fireplaces enclosed.* Dated March 28, 1865.

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

876 F. A. MOCQUARD. *Certain improvements in gas burners.* Dated March 28, 1865.

The patentee claims, firstly, the application of a reservoir interposed between the burner holder and the burning apparatus, permitting the gas to be diluted before its egress; secondly, the arrangements employed for regulating the current of air and increasing the surface of the flame. *Patent completed.*

877 R. YOUNG and C. F. O. GLASSFORD. *Improvements in the preparation or treatment of seaweed, and in obtaining products therefrom.* Dated March 28, 1865.

This invention consists in the application of artificial heat to the drying of seaweed, whereby the seaweed can be utilized and made available during any and all times of the year, for the production of an ash or kelp. The method of drying adopted in preference for this purpose is by kilns of brick or stone work, the flues of which are covered with fire tiles, or slabs, cast-iron plates, or with stone flags, capable of bearing the temperature required. The kilns are heated by furnaces or steam arranged underneath, having suitable flues to carry off the smoke or vapour, and so contrived that the heat is equally distributed over the heating surface. *Patent completed.*

878 F. W. WEBB. *Improvements in the manufacture of steel tyres for railway wheels.* Dated March 28, 1865.

In carrying out these improvements, the patentee casts the steel in a mould of peculiar shape and arrangement, the lower side of the mould being formed by a plate, upon which he rests or secures the mould box, which is of such shape in its interior as to form a casting resembling a solid railway wheel with a part attached to one side representing the axle at the outside of the wheel, which is placed in a vertical position in relation to the plate forming the bot-

tom of the mould. We cannot here quote all the details of the invention. *Patent completed.*

879 H. W. KING. *Improvements in ventilating blinds.* Dated March 28, 1865.

This invention consists in constructing blinds of a series of segments of tubes pivoted at top and bottom upon stationary rods or bars and connected near one end to studs upon a movable bar. The segmental plates or portions of a tube are placed so close to each other that even when in position to allow of the passage of the greatest amount of air, the blind cannot be seen through. The blind may be more or less closed by causing the plates to move on their pivots by means of the movable bar. *Patent abandoned.*

880 E. SAYAOK. *Improvements in hardening and tempering steel.* Dated March 28, 1865.

This invention consists in the employment of solutions in which to immerse the heated steel, which possess a very high degree of conducting character for heat, so that the utmost rapidity in the cooling will be attained, for in this the true theory of the operation appears to be involved. The patentee has discovered that metals having the greatest conducting power for heat, and which can be held chemically in solution, constitute those solutions media, whereby results may be attained in hardening steel which have hitherto been wholly unattainable. Thus, he employs solutions of gold, silver, copper, and other metals, and the results obtained are in the direct ratio of the respective conducting powers of the metals and the specific gravity of the solution. *Patent completed.*

881 I. L. PULVERMACHER. *Improvements in fastenings for pins, buttons, and other articles with metallic backs.* Dated March 28, 1865.

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

882 J. WRIGHT. *Improvements in forging machines.* Dated March 28, 1865.

For the purposes of this invention the patentee employs four hammers arranged round in a circle at right angles the one to the other; they are actuated by a steam cylinder and piston, one of the hammers being worked directly by the cylinder and piston. This hammer is connected by rods to the hammers on each side of it, and these again are similarly connected to the hammer opposite to the first. Thus it will be seen that, when the cylinder and piston cause the hammer they work directly to strike a blow, the opposite hammer comes to meet it, and the work is compressed between them, whilst at the same time the hammers on either side separate the one from the other, and these strike their blow on the return stroke of the cylinder and piston. *Patent completed.*

883 W. N. WILSON. *Improvements in sewing machines.* Dated March 28, 1865.

The first part of this invention consists in a new arrangement of parts in combination, and forming what is known as a lock-stitch machine. The machine is driven by a pulley from a main driving wheel, and a small crank on the shaft having a pin or stud at its extremity actuates the needle arm by a heart-shaped motion. To the same stud is connected a short straight lever, on the other extremity of which is a stud connecting the shuttle-driver, the action of which arrangement is an irregular rotation of the connecting lever, producing a regular forward and backward action of the shuttle-driver. The parts above the bed-plate are in the ordinary form, with a top feed, the work passing in front of the operator. To prevent the machine being turned in the wrong direction, the patentee introduces above the driving wheel a sliding plate with an inclined plane, having a small projection, which instantly catches the pulley if turned in the wrong direction. By these arrangements he combines simplicity with certainty of action and great economy in production. The second part of the improvements consists in a new arrangement of parts for a knotted stitch machine. The third part of the improvements consists in a new form of arm. The fourth part consists in a new adjustable hammer and a new guide. *Patent completed.*

884 W. ILLAM. *Improvements in cranes and in railway traversers and crossings.* Dated March 29, 1865.

These improvements are applicable to cranes with jibs and pillars, and they consist in constructing the jib and pillar of two beams of rolled girder or double T-iron or steel, or of plates of iron or steel strengthened by angle or other suitable bars of rolled iron. The pillar with a crane jib may be rolled in one piece, or in parts riveted together, or the jib formed of the usual tension bar and strut may be connected to the pillar, which is constructed of two girder beams or plates with angle or other suitable iron, and supports the gearing and chain barrel. The pillar is supported as usual in a footstep, and it swivels within a ring; to the pillar are fixed the bearings of one or more anti-friction rollers, acting against the inside of the ring; to one of these rollers is connected a shaft and gearing for swivelling the crane round when required. *Patent completed.*

885 W. BROOKES. *Improvements in file-cutting machinery.* (A communication.) Dated March 29, 1865.

These improvements relate, first, to so supporting the blank while it is being fed through the machine and receiving the blows of the chisel as always to keep its top surface horizontal, so that the cut shall be of a uniform depth across it. Second, to an arrangement of devices or means which form teeth of the same depth throughout the whole length of the blank, while at the same time the force of the blow of the chisel does not vary. Third, to feeding the blank independently of its bed piece, and in such a manner that it always has a firm bearing immediately where the blow is struck, so that the file cannot possibly spring or warp, thus ensuring uniformity of cut. *Patent completed.*

886 R. O. ROBINSON. *Improvements in machinery for the cutting of nails, brads, or spikes, and in the conformation of some of such nails and spikes.* Dated March 29, 1865.

The peculiarity of the machine for producing these nails, brads, and spikes is in the moving of the dies from right to left and from left to right alternately, so that the dies when they are at the ends of their traverse, present two sets of cutters, which are fixed in the cylinder the necessary shapes or forms for enabling each set of cutters to cut off from the sheet of metal to be acted on the nails, brads, and spikes required, as described. *Patent completed.*

887 E. and F. A. LEIGH. *Certain improvements in machinery or apparatus used in carding cotton or other fibrous substances.* Dated March 29, 1865.

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

888 F. A. LEIGH. *Improvements in the construction of bridges and arches.* Dated March 29, 1865.

This invention consists, principally, in forming arches of hollow cast-iron pipes in lieu of the usual masonry, and dispensing with beams and girders as they are usually constructed. These pipes may be round, square, or wedge like, but the patentee prefers the elliptic or egg-shaped form as better adapted to resist the crushing pressure with less weight of material than any other. For bridges he lays the pipes transversely to the roadway, and keys or bolts them together, laying the ballast and building the parapet walls upon them, allowing the end pipes to rest against the abutments. When used as girders for suspension bridges and other purposes, he casts the pipes in short lengths, spans the chasm in the arch form, and suspends the roadway or supports a roof or other object above or below, as the case may be. *Patent completed.*

889 R. HOLROYD and J. H. BOLTON. *Certain improvements in machinery or apparatus for drying "warps" of cotton and other fibrous substances.* Dated March 29, 1865.

The patentees claim, first, drying warps by the application of heated air to their surface during their passage over rollers, or whilst in motion, in the manner described; secondly, the novel arrangement and combination of the chambers, heating apparatus, flues, and rollers for effecting the said object, as described. *Patent completed.*

890 A. CHAPLIN. *Improved apparatus for the instantaneous lowering and detaching of ships' boats.* Dated March 29, 1865.

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

891 J. FLAYNE. *Improvements in furnaces or apparatus for heating the blast for furnaces used in smelting iron, and for other furnaces.* Dated March 29, 1865.

According to the present invention the patentee arranges apparatus for heating the blast for furnaces in such manner that the combustion of the gases takes place in a separate chamber from that in which the system of pipes or passages in which the blast is heated is situated, and the chamber in which the system of pipes or passages is situated is by preference above the combustion chamber, and only communicates therewith by means of numerous openings through the top of the combustion chamber. The upper chamber is of large dimensions as compared with the space occupied therein by the system of pipes or passages in which the heating of the blast takes place, so that such upper chamber is at all times pervaded by a red hot atmosphere, which acts on all parts of the system of pipes or passages alike, and thus not only is a very highly heated blast maintained, but its heat is more constant and uniform than has heretofore resulted when using the waste gases of blast furnaces in heating systems of pipes or passages through which the blast passes and is heated. *Patent completed.*

892 S. CHILDS, jun. *An improved method of treating fatty matters.* Dated March 29, 1865.

In carrying out this invention, the inventor submits the solid or semi-solid compounds of fats and lime produced in the saponification process to a high temperature after the usual boiling is completed, and the water drawn off, which temperature may be made to reach any desired point short of decomposition, namely, 400 deg. Fah. This he can effect in various ways, viz.:—First, by driving a current of superheated steam through the mass of lime soap when the saponification has been effected in an iron or other suitable vessel having a closed lid or cover, and when the water used in the saponification has been withdrawn. Second, by placing the lime soap in one or a set of iron or clay retorts properly set in a furnace, and there subjecting it to the furnace heat. The pressure produced by the vapour of water set free from the compound by the heat may be regulated by a proper safety-valve in connection with all the retorts in operation. Third, by placing the lime soap in an oven or reverberatory furnace properly constructed, and there heating it to the temperature desired. *Patent abandoned.*

893 W. M. FULLER. *An improved process for reducing or preparing waste animal matters for the purpose of employing the same in the preparation of manures or fertilizing compounds.* Dated March 29, 1865.

This invention relates to the treatment of shoddy, woollen rage, leather, or other kinds of animal refuse with a view to disintegrate the same, and render it easily reducible to powder, that being the form in which such animal refuse is best adapted for use as a fertilizer. This result is accomplished by the destruction of the fibre without the use of acids or alkalies, which are usually employed for the purpose. The patentee attains this object by employing solely superheated steam brought into direct contact with the material to be treated. *Patent completed.*

894 T. W. NORDENFELT. *A portable covered hammock.* (A communication.) Dated March 30, 1865.

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

895 G. GREENISH. *A new or improved arrangement of mechanism for propelling waggons in connection with railway hoists.* Dated March 30, 1865.

This invention relates to transferring the waggons or trucks from the permanent way of railways to the platform of the hoists employed in connection with such permanent ways, and consists in the employment and use of drums and pulleys supported in suitable bearings fixed to the side of the hoist, and driven by the engine working the hoist, or with a separate engine; these drums have coiled round them ropes or chains which pass round pulleys or blocks fixed at suitable distances from the hoist, and are arranged so that, by coupling the ends of the said ropes or chains to the waggons or trucks, they may be drawn along the rails and transferred to the platform of the hoist or vice versa by coupling the ends of the ropes to the truck or wagon when placed upon the turntable; it is reversed in order that it may be transferred by the aforesaid means on to the platform of the hoist. The drums or pulleys round which the ropes or chains are coiled are set in motion at will by means of a clutch box situate upon the drum shaft. *Patent abandoned.*

896 W. M. NAILSON. *Improvements in shaping machines.* Dated March 30, 1865.

In a machine embodying these improvements the shaping tool has a horizontal reciprocating movement, and is carried, together with the gearing for actuating it, by a massive sliding head. This sliding head is arranged to travel or be fed along in a direction at right angles to that of the tool's motion, and it is to the feeding details that the present invention more particularly refers. The feed movement is effected by means of a long screwed shaft carried by the fixed

bed frame, and this screwed shaft gears with a nut carried by the sliding head. By the present invention the shaft is made stationary, whilst the nut is mounted in the sliding head, so that it can turn, and gearing is applied to turn it both by hand and by the action of the machine itself, as will be well understood. The sliding head thus carries its own feed gearing, and at whatever part of the bed frame the sliding head may be the attendant has the feed gearing close at hand. *Patent abandoned.*

897 B. BAUER. *Improvements in the manufacture of reflectors for lamps and of surfaces for reflecting light generally.* Dated March 30, 1865.

This invention consists in making reflectors for lamps and for reflecting light generally of iron or other metal, first coated or covered with glass or enamel, and afterwards made capable of reflecting light in the following manner:—The reflector or the surface which is to be made capable of reflecting light is first coated with glass or enamel. This the inventor effects in the ordinary way, excepting that in addition to the materials ordinarily employed in making the glass or enamel, he employs oxide of manganese, either with or without arsenious acid or white arsenic. The addition of the oxide of manganese gives a purple colour to the glass or enamel, and the white arsenic gives an opacity. These qualities produce a better reflecting surface by the subsequent treatment than could be obtained by a coating of ordinary glass or enamel. After the glass or enamel has been fused on the surface to be made reflecting, and has been allowed to cool, he applies thereto a solution of bichloride of platinum, which solution he applies by means of a brush, or in any other convenient manner. After the solution has dried he subjects the article a second time to the heat of the enamelling muffle. By this treatment the bichloride of platinum is decomposed, and a brilliant reflecting surface of metallic platinum left on the part or parts to which the bichloride of platinum had been applied. *Patent abandoned.*

898 W. SAVORY. *Improvements in the treatment of meal and the dressing of flour and the machinery and apparatus employed therein.* Dated March 30, 1865.

Among the principal features of this invention are the following:—For the purpose of cooling and maintaining the grain and the meal, or other form of produce resulting from the process of grinding, cool, and so in the best condition for being economically manufactured, the patentee, instead of making the metal casings of millstones of a single thickness of metal, makes a hollow or double casing for the purpose of containing water, which he causes to circulate therethrough, and thereby the heat generated during the grinding is rapidly abstracted; or, in some instances, he uses a hollow metal ring made to encircle the bed stone, with suitable feed and discharge pipes to cause the water to circulate round or through it, so that when the meal issues from between the stones, it shall spread over the upper surface of the ring. A brush is fixed on the runner stone sweep off the meal into the spout or shoot. In order to further carry out the heat-abstracting process, instead of allowing the meal to be conveyed from the grinding stone or cooling ring direct to the boiler, he conducts it by suitable spout into a double or hollow trough, or a double or hollow cylinder or tube, which is so constructed that a flow or current of water can be established therethrough, and may be fitted with a screw motor, the threads of which may be cast or formed hollow around a hollow shaft or axis, through both of which a current of water may be caused to pass at any required velocity. Other means of carrying the meal along in contact with the cold surface may be substituted for the worm or screw. *Patent completed.*

899 W. BROOKES. *A new or improved mode of rapidly reducing, cementing, and melting iron and other ores, also iron slag or cinders, dross, and scales or crust, to produce directly therefrom steel or malleable or cast iron.* (A communication.) Dated March 30, 1865.

The object of this invention is to produce malleable iron or steel or cast iron directly from any kind of pulverised iron or other ore, and also from iron slag, cinders, scoria, crust scales, oxidised cast or malleable iron turnings, or the residuum of pyrites. According to this invention the said iron ore, slag, cinders, or other matter, is first pulverised fine, and is then mixed with lime or other suitable flux. To this mixture is added pulverised coal or charcoal, tar, or other carbonaceous matter, and when well mixed together the mixture produced is reduced in a reducing or cementing furnace, either in a powder or after having been compressed, and when reduced is introduced into a heating or melting furnace containing melted, neutral, or furnace slag, or cinders, or slag obtained from the matters above mentioned already melted by this process, and in a liquid state. The cementing or reducing furnaces in which the reduction takes place are situated on the side of the heating or melting furnace, the said cementing furnaces containing retorts heated externally and inclined towards the heating or melting furnace, so that the contents of the said cementing furnaces may readily pass into the heating or melting furnace, or the cementing furnaces may be formed with several compartments one above the other, and heated both above and below the soles. The melting or heating furnace is of ordinary construction, the sole thereof being divided into a series of crucibles or cavities arranged beside the reducing or cementing furnace, so that one of the said crucibles or cavities may receive the reduced matter from two or more of the cementing furnaces, the said crucibles or cavities contain melted neutral slag or slag obtained from furnaces or from matter already melted according to this invention in a melted state. The pulverised iron ore, cinders, or slag mixed with a suitable flux and charcoal, or other carbonaceous matter, as above described, is charged either into retorts or into the upper part of the cementing furnaces, and is spread upon the sole thereof. It is left in the said furnace for one or two hours, and is then made to pass over the lower compartment of the said furnace, and is spread over the sole of the said lower compartment, and when sufficiently reduced it is pushed through a suitable aperture into the heating or melting furnace, where it falls into the crucibles containing neutral or furnace slag in a melted state, the said neutral or furnace slag preserving the reduced or cemented metal from oxidation or decarbonisation, and aiding to melt the gangue. In the space of from six to twelve hours malleable or cast iron or steel will be produced, and may be removed from the heating or melting furnace for use. *Patent completed.*

900 A. A. CHOLL. *Improvements in the manufacture of sulphate of alumina.* Dated March 30, 1865.

These improvements have for their object the obtaining a sulphate of alumina with increased rapidity, economy, and quantity, considered in relation to the quantities of

clay or other aluminous base and of acid under operation, and the time employed in obtaining the results, and the invention consists in employing sulphuric acid (oil of vitriol) diluted to a limited extent with water, and heated to a high degree of temperature to act upon the aluminous base. *Patent completed.*

901 A. TURNER. *Improvements in machinery for winding yarns or threads on to quills, spools, and bobbins.* Dated March 30, 1865.

The patentee claims, first, the mechanical arrangements shown and described for winding yarns or threads on to quills, in the manner set forth, so as to admit of the yarn or thread being drawn off (in the operation of weaving) with uniform tension. Second, the mechanical arrangements described for winding taper or conical bobbins, whereby the thread, as it is wound on to the bobbin, is made to cross and recross, and thus to lock each previous layer of thread, which will thus be prevented from falling off the bobbin or getting entangled, but can be drawn off with ease and regularity. *Patent completed.*

902 A. V. NEWTON. *Improvements in the construction of cartridge and other boxes.* (A communication.) Dated March 30, 1865.

This invention consists in a new and peculiar manner of hanging or attaching a box made of a square, oval, or any other desired shape in and to any suitable outer casing or frame, whereby the box can be easily turned within its outer casing at pleasure, thus allowing the articles or materials placed therein to be more readily and conveniently removed therefrom when so desired. *Patent abandoned.*

903 W. MILLNER and D. R. RATOUFF. *Certain improvements in the fastenings to be employed in metallic "safes" or other similar depositories.* Dated March 31, 1865.

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

904 T. COOK. *Improvements in the construction of safes or depositories intended to contain valuable property.* Dated March 31, 1865.

This invention relates to an improved method of connecting the door of a safe to the body or case thereof, and consists in forming the door of a circular plate of metal with a circular fillet or projection at the back thereof, about one or two inches more or less in diameter than the diameter of the door. Around this fillet the patentee proposes to cut a strong quick-threaded screw, or portion of a screw, to fit into a corresponding screwed hole formed in the front of the body or case of the safe; or he forms two screws, or portions of screws, both on the door and case of the safe, that is to say, he forms a male and female screw on each, one inside the hole into which the door fits and one outside of said hole; he also forms a screwed hole through the centre of the door, and fits therein a screw; the outer screwed end thereof passes through a screwed hole formed in one end of an iron arm, the other end of the said arm being hinged to the outside of the body of the safe, so that as the said door is turned round by means of a suitable handle for the purpose of opening the door (for example), the screw aforesaid passes along the screwed hole in the aforesaid hinged arm, and thus allows the screw on the door to move parallel to the hinge until the door is open, when it may be turned on its hinged arm; a reverse movement will close the door. The door of the safe is intended to be fastened by any approved kind of lock. *Patent completed.*

905 J. PINCHBECK. *An improvement in engines worked by heated air or gases.* Dated March 31, 1865.

The objects of these improvements are to effect greater economy and to increase the power obtained from engines in which atmospheric air and gases are exploded inside the cylinder by means of an electric spark, or by any other method. To carry out this invention the inventor connects the exhaust or discharge pipe of the cylinder with a condensing chamber in a similar manner to that employed in ordinary condensing steam engines. The heated air is condensed in the chamber by a jet of cold water, and by this means a vacuum is produced in the cylinder; the ordinary air pump is used to discharge the injection water. *Patent abandoned.*

906 J. D. B. and O. SWARBRICK. *Improvements in steam boilers.* Dated March 31, 1865.

Instead of placing fire-bars in the flue or flues for supporting the fire, the patentees employ a hollow fire-box having in it any convenient number of vertical tubes, open at the top to the fire, and at the bottom to the ash hole, the said tubes being round, rectangular, or of any other suitable shape. To the said fire-box and boiler they connect pipes through which the water will pass into the fire-box and circulate therein, so that the heated surface of the fire-box and the exterior of the vertical tubes shall give additional heat to the water, and at the same time keep the box at a lower temperature than the ordinary fire-bars, and thereby prevent the clinkers from sticking. They also place one or more movable metal heat spreaders behind the bridge, and in the back part of the flue or flues, in order to cause the heat and flame to radiate and impinge upon the inner circumference of the flue or flues, and in order to enable the heat-spreaders to cause as little obstruction as possible they make their surfaces facing the fire of a spherical or circular shape. *Patent completed.*

907 L. BRIDGE. *Improvements in looms for weaving.* Dated March 31, 1865.

The object of this invention is to dispense with the emery beam, and consists in using an ordinary wood beam or roller on which the cloth is taken up as it is woven, and to prevent it slipping the patentee arranges an apparatus to cause an additional rod to press upon the beam or roller, and thus keep it in a tight and regular position, but to allow this rod to adjust itself to the increasing diameter of the cloth as it is taken up he attaches a rod to the aforesaid apparatus, and connects it by a slide to another apparatus in the framing of the loom. Part of this apparatus consists of two brackets resting on a frame or lever, and having each a slot which clips a rim wheel, and are kept up to their places by springs. As the cloth increases in diameter, the rod upon it rises, and the other rod is depressed, so as to give a gradually diminishing stroke to the frame or lever which carries the slotted brackets, and gives a gradually decreasing speed to the taking-up motion. *Patent completed.*

908 J. POOLE and T. BROWN. *Improvements in soles, soles, or feet protectors to be used loose in boots and shoes or affixed thereto.* Dated March 31, 1865.

This invention consists in the use or application of wood preferably pine, which the patentees propose to render into thin leaves or boards, similar to that known as scale boards,

by sawing, cutting, or otherwise, and from which s leaves or boards they saw, stamp, press, or cut out means of dies, cutters, or other known devices, the necessary shapes or forms for soles or shoes, and which a shapes or forms can afterwards be covered or not on one both sides with a lining of paper, leather, caoutchouc, any woven or felted fabric by means of glue, gum, caoutchouc, or other adhesive substance. *Patent completed.*

909 E. LEAK. *Improved apparatus for condensing receiving pulverised flint or dust.* Dated March 31, 1865.

This invention consists of a screw or other fan mounted upon a vertical or other spindle or shaft in a cylindrical case having a perforated top. The spindle or shaft is mounted in suitable bearings at each end, so as to be capable of revolving, and is furnished with a grooved wheel pulley round which an endless band or strap passes, which means the spindle or shaft with the screw or other fan is caused to revolve, and by the action of the latter pulverised flint or dust is drawn in through the perforated top and collected and received into the case or box. The case or box containing the fan is placed against the outside wall of the room, and a vent hole is cut through the same by which the air drawn in by the fan with the pulverised flint or dust escapes, and also such particles of flint or dust as do not remain in the box. *Patent abandoned.*

910 H. A. BONNEVILLE. *Improvements in telegraphic apparatus.* (A communication.) Dated March 31, 1865.

This invention consists in an improved system of telegraphic apparatus allowing of calling and corresponding directly between all the stations of the same circuit with a single line—that is to say, whatever may be the position occupied by the station called and the calling station, the may call each other and correspond without its being necessary to ask for communication at the intermediate stations, without troubling the clerks at these stations, and without even calling their attention. *Patent completed.*

911 B. GREENWOOD. *Improvements in the means or method of curing or preventing smoky chimneys.* Dated March 31, 1865.

This invention relates to improvements in the means of preventing or curing smoky chimneys, and consists in forming a communication between the interior of the chimney (a short distance above the fire) and the external air by means of a pipe let in the wall and carried to the outer wall of the house, or by a channel or passage formed in the brickwork while building the house. *Patent abandoned.*

912 H. A. BONNEVILLE. *Improvements in the manufacture of iron rods and bars of different forms, and in the apparatus relating thereto.* (A communication.) Dated March 31, 1865.

The objects of this invention are to simplify and considerably reduce the different operations by which bars or rods of iron are obtained at the present time. The apparatus employed consists of a series of cylinders or rollers, in and around each of which are cut grooves or flats, having one or other, or half of one or other, of the forms generally given to iron rods, viz., round, half round, square, octagonal, and hexagonal, and this apparatus allows of using iron slit by any of the known systems. The iron for any of the above forms should undergo two operations. The lump on leaving the reheating furnace should be worked in such a way as to be able to pass the slitter. As soon as this operation has taken place, the first part of the work is done. Any kind of slitting or cleaving apparatus may be used in connection with these improvements. *Patent completed.*

913 A. V. NEWTON. *Improved means of preventing the leakage of barrels and of rendering packages and fabrics impervious to air and gases.* (A communication.) Dated March 31, 1865.

This invention relates to the use of a composition prepared by the admixture of glue and glycerine, either with or without sugar, as a coating for barrels and fabrics. These substances may be combined in about the following proportions, viz.:—Glue, 50lb.; glycerine, 100lb.; sugar, 25lb. *Patent completed.*

914 A. V. NEWTON. *An improved manufacture of inking roller.* (A communication.) Dated March 31, 1865.

The object of this invention is to produce inking rollers that will not be affected by changes of temperature, but will at all times be fit for use. To this end, the rollers, instead of being made as heretofore of glue and treacle which require washing two or three times a day, are composed by preference of glue, glycerine, sugar, or other saccharine matter, soap or alkalies or alkaline earths, or any of the compounds of alkalies or alkaline earths and castor oil, or any of the fixed oils. In some cases the sugar, or the soap, or the oil, or their equivalents, may be omitted from the composition. *Patent completed.*

915 J. H. SMITH. *Improved apparatus for mounting photographs.* Dated March 31, 1865.

This apparatus consists of a fixed block on which is mounted a glass or other plate of the desired shape and dimensions, and the edges of which project a little beyond the fixed block. On this plate is secured, by means of an elastic band or otherwise, a piece of woven fabric or thin cloth, or other porous fabric, which is capable of being kept damp by means of a little water applied thereto from time to time. The glass or other plate is of the shape and dimensions of the pictures which are to be operated upon, and when the photographs are placed face downwards upon the damped cloth, and are pressed down a little so as to force out the air from beneath, the pressure of the atmosphere on the back will keep them down flat, so that their back may be gummed, or covered with some adhesive composition without difficulty. The backs of the photographs having been gummed, the cardboard on which they are to be mounted is placed upon them, and upon being slightly pressed down the photograph will adhere thereto, and upon removing the cardboard the picture will be found to be properly mounted thereon. As the cardboard is generally somewhat larger than the picture, it is important that the latter should be mounted centrally thereon. To this end a set of horizontal adjusting or set screws provided with plates at their ends are placed at one side, and also at one end of the glass plate, and are mounted in vertical blocks, so as to be capable of being screwed up and adjusted with nicety, according to the amount of margin that is required. *Patent abandoned.*

916 G. R. STEPHENSON and G. H. PARRIS. *Improvements in the construction of locomotive engines and railway carriages, for facilitating their passage round curves.* (A communication.) Dated March 31, 1865.

This invention consists of such a combination of the

axles, axle boxes, and framing of locomotive engines and railway carriages generally, whereby any of the axles of such engines or carriages to which the invention may be applied take up a position pointing radially towards or rear to the centre of any curved portion of railway on which the said engines or carriages may be working, and thus facilitating the passing round such curve. This object may be accomplished by connecting the axle boxes to the side framing of any engine or carriage by means of radial links, so placed that, whenever, through the action of the curve, the axle and with it the axle boxes undergo any end-on motion with respect to the frame, the axle is also forced by the action of the radial links to undergo the requisite amount of angular motion to plant it at or near to a direction radial to the curve of the railway. *Patent abandoned.*

917 J. BARNGATE. *Improvements in gas meters and in the machinery or apparatus connected therewith.* Dated March 31, 1865.

This invention relates in the first place, and chiefly, to a new method of construction and arrangement of the parts of dry gas meters the cases of which are made, by preference, in cast iron, whereby great facility is afforded for their being taken in pieces, cleaned, and repaired, and a correct action of the apparatus is insured. In constructing the cases of gas meters under this invention they are made in one piece, and without a central division, in contrast to those now in use, which arrangement enables the diaphragms (when necessary) to be lifted out with little trouble. The one diaphragm back (which is made of sheet iron, or other suitable material) is substituted in lieu of and answers the purpose of two, at the same time supplying the place of and answering the purpose of a central division. This back, on which are fixed the two diaphragms, is fixed by screws, the holders projecting from the centre of the case. The chief advantage derived from this arrangement is that the two diaphragms can be taken out together. The second part of this invention relates to a peculiar arrangement of the valves, which are also easily taken out, each valve being worked upon a separate plate, to which plates are also connected the inlets to the diaphragms and exit tubes. *Patent completed.*

918 T. K. MACE. *Improvements in ficed bands or rib holders for umbrellas and parasols, which said band is also applicable as an ornamental appendage to walking sticks and other purposes.* Dated March 31, 1865.

This invention not only comprehends the band that is usually attached on the outside of umbrellas for confining the ribs and covering together when in a collapsed condition, but also relates to a construction of band or cap to cover and hold close to the stick the tip ends of the ribs. And these objects the inventor obtains, first, by applying the band or fastener to the outside of the umbrella or parasol covering, as now usually adopted, in the following way: He secures by preference a small bit of elastic, or other suitable material, to the fabric of the covering by means of a metal or other suitable eyelet, with or without washers, while at the other end he applies a metal or other suitable projection, which, when the band or cord is drawn around the umbrella or parasol, shall fall into the cavity of the eyelet, and thereby secure the ribs and covering in such a way that no projections will be seen on the outside, thus conserving compactness and neatness. And the improvements as applied to the sticks of umbrellas and parasols for the object of confining and holding the tip ends of the ribs of the same radially around the said stick consist of an india-rubber cap secured to the stick, but capable of being raised when closing the umbrella or parasol, and passing down over and confining them when closed. *Patent abandoned.*

919 W. MAYALL, J. KNOTT, and W. DENNIS. *Certain improvements in mules for spinning cotton and other fibrous materials.* Dated April 1, 1865.

This invention relates to certain mechanism in connection with the head stock of the mule, and is designed to prevent the excessive strain upon the driving strap, gearing, and bands of the mule during the time the backing off frictional gearing is coming into operation, by which means the wear and tear of the said parts is diminished. The improvements consist in a novel construction and arrangement of mechanism for effecting the said purpose, which mechanism consists of a disc revolving in bearings secured to the head stock of the mule, and provided with an adjustable stud or projection which, as the disc revolves, comes into contact with and forces back one end of a bell crank lever, the opposite end of which becomes raised and gives a vertical lift to a sliding plate. This sliding plate before being lifted is interposed between the stud which actuates the mechanism of the backing off frictional gearing to the lever of the frictional gearing, so that, whilst interposed, it prevents the said gearing coming into operation too soon, so as to prevent the excessive strain; the said gearing of the mule carriage is completed, at which time the sliding plate is lifted by the aforesaid mechanism, which thus allows the backing off frictional gearing to come into operation. *Patent abandoned.*

920 J. DRINKWATER. *An improved application of rotating brushes and in the mechanism and apparatus connected therewith.* Dated April 1, 1865.

This invention consists in the application of rotating brushes to grooming or brushing horses and other quadrupeds, for which purpose flat brushes are now employed, and the peculiarity in the mechanism consists in the employment of a thin hollow cylinder or drum attached to the driving shaft by means of light arms or carriers, and covered or coated on its periphery with a surface of leather, india-rubber composition or cloth, in which the bristles are to be secured, instead of in the wood as in ordinary brushes. The brush may be caused to rotate by hand by screwing a spur wheel on the end of the driving shaft, and gearing a larger wheel into it, which may be driven by a handle projecting therefrom, or bevel wheels may be used, or a band may be adapted so as to be driven by steam or other power. The apparatus is supported in the hand by means of handles projecting from the central shaft. *Patent abandoned.*

921 W. KILBERT. *Improvements in the apparatus used in the winding and rewinding of silk and other fabrics.* Dated April 1, 1865.

In carrying out this invention the parts of the apparatus are so combined that a number of supports carrying runners and spindles for winding on are each set at an equal distance from a common centre upon or attached to a circular table or frame. Arms carrying spindles for rewinding are also attached to the same table, and so arranged that, while the silk or fabric is in process of winding from the skein, the same action and rollers set in motion

the spindles for rewinding. Simultaneous motion to the whole of the winding and rewinding runners and spindles is given by a treadle and crank in connection with a band wheel carrying bands to the rollers; the axis of the band wheel turns in the centre of the circular table or frame. A wheel carrying a regulator to each winding spindle is placed under the circular table or frame, and action given to the same by cog wheels and a cam connected with the axis of the band wheel. The circular table carrying the runners and spindles is made to revolve and turn upon castors or runners attached to a stand supporting such circular table. *Patent abandoned.*

922 H. LEWIS. *Improvements in wringing machines, parts of which are applicable to the construction of rollers.* (A communication.) Dated April 1, 1865.

This invention consists, first, in making one or both rollers employed in wringing machines of cork, or in covering them with cork, so as to make them sufficiently elastic to answer the purpose intended. Also in self-adjusting traversing guides for pressing up the edges of the cloth or clothes as they pass in between the rollers. *Patent completed.*

923 R. A. BROOMAN. *Improvements in street railways.* (A communication.) Dated April 1, 1865.

This invention consists in constructing rails of an iron bar, formed with a curved under side adapted to, and resting upon, a corresponding convex surface of a sleeper; the rail is also formed with a curved upper surface with standing sides or edges, being sectionally of a crescent-like form, thicker in the middle than at the edges, and sufficiently strong where the wheels run upon the rails, while the thinner and slanting sides or edges are only sufficiently thick to guide the wheel flanges, and form a cap to protect the sleeper. When laid upon the sleeper the rails are to be secured by screws passed vertically through them. Beneath the joints of the separate rails the inventor inserts a curved metal plate which prevents the ends of the rail becoming imbedded in the sleeper, and both the rails and the joint plate direct off any water that falls on the rails, thereby keeping the upper surface of the sleeper as well as the portion under the joint plates as dry as possible. *Patent abandoned.*

924 G. BURT. *Improvements in machinery for ornamenting metal tubes.* Dated April 1, 1865.

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

925 W. GRAY. *Improvements in rolling or forging steel or wrought iron bars to be used as beaters or beating bars upon the drums, concaves, or breastplates of concaves in threshing machines.* Dated April 1, 1865.

This invention consists in producing these beating bars in steel or wrought iron by rolling or forging, thereby producing a much superior article in toughness, besides being harder, lighter, and stronger, and of much greater durability than those which are now in use, which are merely cast, and also in grooving or fluting the surfaces of such rolled steel or wrought-iron bars, as shown in the drawings. *Patent abandoned.*

926 J. KENNAN. *Improvements in machinery or apparatus for cutting scrolls, frets, and flagree work.* Dated April 1, 1865.

This invention relates to a peculiar combination of machinery or apparatus for cutting scrolls, frets, or flagree work in wood, metal, or other materials capable of being so cut, and consists, essentially, in the employment for that purpose of a vibrating or oscillating frame in which a fret saw is strained, such frame deriving its motion direct from a cam having two or more inclines or actuating surfaces on the first motion shaft, which may be worked by a fret lever or otherwise. *Patent completed.*

927 R. WILLACE. *Improvements in machinery or apparatus for preparing and supplying food for cattle.* Dated April 1, 1865.

This invention relates to a peculiar combination of machinery or apparatus for preparing and supplying food for cattle, whereby a large number of cattle may be fed with any particular quantity of food in a short space of time. According to this invention it is proposed to combine a turnip cutter, or an oil cake or corn crusher or bruiser, or other like food preparer, with a wagon running along rails laid down inside the cattle shed. The main shaft of the food preparing mechanism communicates by gearing with one of the axles of the wagon, so that on driving this shaft in order to cut the roots or otherwise prepare the food the wagons will be simultaneously caused to travel along the rails. Along the side of the tramway there is placed a feeding trough of a peculiar construction extending along the entire length of the cattle shed or house; the back of this trough is made considerably higher than the front, so as to form a species of continuous shoot for directing the prepared food (which falls from the machine as it travels along) into the bottom of the trough. The trough, which is of an angular section, and may be usefully employed irrespective of the machine, in some cases, is thus supplied with a regulated quantity of food distributed easily from end to end. A rail is placed in front of the cattle, and along the side of the tramway, a little above the floor, to prevent the cattle bringing their heads within the range of the machine's course, but at the same time allowing sufficient space underneath for the cattle to feed out of the trough conveniently. *Patent abandoned.*

928 A. W. PEARCE. *Improvements in looms for weaving.* Dated April 1, 1865.

This invention relates to a certain new arrangement of the parts of looms used for weaving which are employed to give motion to the pick stick, whereby the shuttle is caused to traverse the warp. The chief part of the arrangement consists in causing the cam whereby motion is communicated to the pick stick to move the conical roller in a direction the reverse of that at present employed. The shaft upon which the cam is fixed moves or revolves in the same direction as formerly, but the shaft carrying the friction roller upon which the cam or tappet strikes is arranged on the reverse side of the cam, the reciprocating motion of the cam being thus communicated direct to the upper side of the roller. Instead of this friction roller upon which the cam or tappet strikes being fixed upon the vertical shaft, by which in existing arrangements of picking motion the motion of the cam is transmitted to the pick stick, it is in the present arrangement attached to a short reciprocating shaft, this latter being connected by a link to a short crank on the picking shaft, by the intervention of which the motion of the rod and picking movement take place in the same direction as formerly. *Patent completed.*

929 J. C. STOVIN. *Further improvements in the means*

of communicating signals from passengers in railway trains to the guards and engine drivers. Dated April 1, 1865.

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

930 P. HAZENLIN. *Improvements in navigable balloons.* Dated April 1, 1865.

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

931 W. BUNGER. *Improvements in vessels or apparatus for melting sealing wax, glue, or other substances.* (A communication.) Dated April 3, 1865.

For this purpose an external vessel (by preference of conical form, furnished with a suitable handle) is employed, having a door on one side thereof for introducing a spirit or other lamp into the interior. Holes or apertures for the admission of air are pierced through the lower part of this vessel, there being other holes or apertures near the upper part thereof for the escape of the heated air and products of combustion. Upon the upper rim, and descending into this outer vessel, an inner vessel is supported, consisting of a central chamber partly surrounded by a conical-shaped jacket, the smaller part of the cone being downwards, thus forming a space between it and the outer vessel. The wax, shellac, or other substance of a like nature to be melted, is placed in the space or jacket surrounding the central vessel, and as it melts from the heat of the spirit lamp or gas jet underneath, it flows through holes or openings formed around the inner or central chamber into the bottom or lower part thereof, the bottom of the central vessel being, by preference, formed double, or with a space between them to prevent the burning of the wax or other materials when melted. *Patent abandoned.*

932 J. VON DER POPPENBURG. *Improvements in projectiles and carriages for central fire breechloading firearms and ordnance.* Dated April 3, 1865.

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

933 T. CORBETT and J. R. HARRINGTON. *Improvements in the manufacture of letter clips, book markers, paper knives, and clips for suspending stationery, drapery, and pictures, and for other such like purposes.* Dated April 3, 1865.

This invention consists, first, in the part of the clip that carries its fulcrum, in forming which the inventors turn up the sides of the lower, and turn down the sides of the upper parts of the clip, so that when the two parts are placed face to face, the turned sides of one part embrace those of the other part, and leave a hollow space between the two parts; a pin is then passed through from side to side, which forms the joint or fulcrum; the raised sides, although out away so as to allow of the necessary action in opening the clip, are by their embracing sides prevented from moving in any other than the proper direction, and the fulcrum thereby relieved from strain and liability to get out of order. Another improvement consists in the particular arrangement and application of the spring to operate in keeping the clip closed, which the inventors form of a coil placed on the fulcrum pin in the hollow space between the upper and lower parts of the clip, the two ends of the wire forming the coil or spring projecting tangentially therefrom, so that when applied and placed in tension, the ends take effect the one on the tail of the lower, and the other on the tail of the upper part of the clip. The coils of the spring may be one or more, or may be only so much of a coil as will answer the purpose, being somewhat of a U form, but with sufficient compressing powers in its limbs to cause it to encircle and hold on the fulcrum pin. *Patent abandoned.*

934 R. R. RICHES and C. J. WATTS. *Improvements in apparatus applicable to machines for cutting hay, straw, and such like substances.* Dated April 3, 1865.

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

935 W. O. GOLLINGS. *Improvements in paddlewheels, parts of the invention may be applied to other purposes.* Dated April 3, 1865.

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

936 J. H. JOHNSON. *Improvements in the manufacture of postage and other stamps.* (A communication.) Dated April 3, 1865.

This invention consists in incorporating with or applying on to the stamp two or more ingredients each as will chemically combine to produce a dark colour or stain under the action of moisture. *Patent completed.*

937 P. J. JAMET. *An improved safety tackle for raising loads.* Dated April 3, 1865.

This invention relates to that description of hoisting tackle known as pulley blocks, and it consists in a novel and improved construction and arrangement of parts by means of which the pulley blocks are converted into self-acting safety tackle. In using this safety tackle the faller rope, whilst raising or lowering the load, may at any moment be released or slackened without the necessity of first securing the rope. The weight of the suspended load will, immediately upon the faller rope being released or slackened, depress one end of the tackle, and thereby raising the other end cause the faller rope to be securely held fast between the return pulley and a stop piece; which, together, operate in the manner of a break or clutch box upon the rope. The load will thereby be maintained stationary in suspension without the faller rope being further secured. *Patent completed.*

938 G. K. GYSELIN. *Improvements in vermin traps.* Dated April 3, 1865.

Provisional protection has not been granted for this invention.

939 A. LOCKWOOD and A. LOCKWOOD, jun. *Improvements in the manufacture of bricks, and in the apparatus employed therein.* Dated April 3, 1865.

For the purposes of this invention bricks are first formed by expressing clay or brick earth through dies, causing each brick to have a longitudinal hollow passage through it, formed by a core in each of the dies employed. Other bricks are also similarly made, having through them transversely one or more hollow passages formed by a core or cores in each of the dies employed. So far, however, there is no novelty, as it is not new to form bricks with hollow tabular passages through them longitudinally or transversely. The partially formed bricks having been thus produced by expressing clay or brick earth through moulding dies or orifices with suitable cores are allowed partially to dry, when each brick is subjected to pressure in a mould of the size of the finished bricks. These moulds are made simply to contain the bricks, the pressure being applied by means of mandrils which are made somewhat conical, and

which are forced into the hollow passage or passages in a brick, two mandrils being thus used to enter at the ends or sides of the mould to press and expand the clay or brick earth, so as cause it completely to fill the mould. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated June 7, 1865.

1855 V. Duterne, Rue des Fourneaux, Paris, mechanician. An improved metallic stuffing box.

Dated August 4, 1865.

2022 H. A. Bonneville, Forchester-terrace, Bayswater. Improvements in checking or controlling the payment of fares in cabs and other public vehicles. (A communication.)

Dated August 5, 1865.

2039 J. Petrie, jun., Roohdale, Lancashire, machine maker. Improvements in machinery or apparatus for washing wool and other fibrous materials.

Dated August 18, 1865.

2137 R. A. Brooman, Fleet-street, patent agent. Improvements in the manufacture of cast steel and cast iron, and the manufacture of a mixed metal. (A communication.)

Dated August 29, 1865.

2217 R. Laming, M.R.C.S., Priory-road, Kilburn. Improvements in electrical telegraphy.

Dated September 9, 1865.

2313 J. Hose, Leicester, mechanic. An improved wheel feed for sewing machines.

Dated September 11, 1865.

2329 C. J. Webb, Randalstown, Antrim, Ireland, linen manufacturer. Improvements in means and apparatus applicable to the lighting and reviving of fires.

Dated September 15, 1865.

2357 L. G. Sourzac and L. Bombail, Bordeaux, Gironde, France. Improved means for rendering leather more durable and flexible.

Dated September 20, 1865.

2393 L. Villette, Aber-street West, Derby-road, Liverpool, engineer. Improvements in machinery for cutting and shaping cork, with apparatus for registering the manufacture.

2397 D. J. Fleetwood, Birmingham, manufacturer. Improvements in the manufacture of spoons, forks, and other similar articles, and in apparatus or machinery to be employed therein.

Dated September 22, 1865.

2417 F. T. Brandreth, civil engineer, and J. H. Brandreth, manager, Preston, Lancashire. Improvements in machinery for brushing hair.

Dated September 23, 1865.

2445 J. Drehsörner, New York. Improvements in hydraulic pressure engines.

Dated September 26, 1865.

2461 T. F. Cashin, civil engineer, Sheffield, and J. F. Allender, manager, Parkgate, near Sheffield. Improvements in the manufacture of iron and steel, and of furnaces and machinery for purifying, puddling, or heating the same.

Dated September 28, 1865.

2453 R. Beeson, Llandilo, Carmarthenshire, chemist. Improvements in obtaining and applying sulphurous acid and in apparatus used therein.

2468 E. Wren, Stockton-on-Tees, Durham, corn miller. Improvements in grinding wheat and other grain, and in apparatus for drying and improving the condition of damp wheat or other grain.

Dated October 2, 1865.

2523 C. D. Abel, Southampton-buildings, Chancery-lane. Improvements in the mode of treating the roots of the lucerne plant for the purpose of manufacturing paper, pasteboard, fabrics, and ropes therefrom. (A communication.)

Dated October 3, 1865.

2531 C. P. Batton, Cheapside, merchant. A new revolving cover for dishes, bowls, and other vessels requiring a movable cover. (A communication.)

Dated October 4, 1865.

2547 W. E. Stocks, Liversedge, and W. Blakey, Batley Carr Top, near Dewsbury, finishers, and J. Whitwham, Huddersfield, Yorkshire, machinist. Improvements in means or apparatus for cutting or shearing the nap or pile of nap or pile fabrics.

Dated October 5, 1865.

2551 M. Henry, Fleet-street. Improvements in sewing machines. (A communication.)

2553 J. Millar, Bethnal Green, physician, and B. Burton, Hackney. Improvements in breechloading firearms.

2555 W. R. Barker, New Bond-street. Improvements in apparatus for administering injections and douches to the human body.

2557 E. Marsland and P. Williams, Manchester, engineers and machinists. Improvements in and applicable to machines for opening and cleaning cotton and other fibrous materials.

2559 W. H. Phillips, Nunhead, engineer. Improvements in apparatus and means for extinguishing fires, part of such improvements being applicable for other purposes.

2561 A. R. Shaw, M.D., Marina Saint Leonards, Sussex. Improvements in brakes for carriages and other vehicles.

Dated October 6, 1865.

2567 R. A. Brooman, Fleet-street, patent agent. Improvements in rotary engines and pumps. (A communication.)

2569 G. W. Rendel, Newcastle-on-Tyne, civil engineer. Improvements in the construction of gun carriages.

2571 V. J. B. Germaix, Philippeville, Algiers, architect. Improvements in the manufacture of bricks and other analogous materials.

2573 R. M. and D. Cameron, Edinburgh. Improvements in pens used for writing.

2577 T. Machin, Andover-road, Holloway. Improvements in machinery or apparatus for the manufacture of wooden spalls.

Dated October 7, 1865.

2581 H. G. Craig, Passage West, Cork, shipbuilder. Improvements in the construction of railway carriages, waggons, and trucks, and other road vehicles.

2587 J. Howard, Fenchurch-street, merchant. Improvements in the construction of compound cylinder engines. (A communication.)

2593 J. Homan, The Grove, Camberwell, civil engineer. Improvements in the construction of wrought-iron girders.

Dated October 9, 1865.

2597 R. Walsley, Liverpool. Improvements in apparatus for mangling and calendering.

2599 T. Miles, Queen-street, Finsbury. Improvements in the manufacture of scent and smelling bottles.

2601 W. Clark, Chancery-lane, engineer. Improvements in apparatus for propelling vessels. (A communication.)

Dated October 10, 1865.

2607 G. G. Rich, Chesterford-terrace, Stanley-road, Hackney. Improvements in the action of upright pianofortes.

2609 J. D. Woodward, St. John, New Brunswick, merchant. An improved ventilating apparatus for use in steamboats, vessels, and other places requiring to be ventilated.

2611 M. Walker, Mansfield, Nottinghamshire, manager. Improvements in flyers used in doubling machines.

2613 A. Nicholls, Barnsbury-row, Islington, mathematical scale and rule manufacturer. Improvements in rules for measuring and in other instruments or articles requiring to be adjusted or disposed at various angles.

2615 J. J. Parkes, London-street, Paddington, gas engineer. Improvements in the manufacture of railway station and other gas lamps.

Dated October 11, 1865.

2617 T. Warburton, Stoneclogh, Lancashire. Certain improvements in brakes for carts, waggons, and other vehicles.

2619 J. Crutchett, Stroud, Gloucestershire. Improvements in the manufacture of bands, belts, or straps for harness for driving machinery or for other purposes.

2621 M. Henry, Fleet-street. Improvements in railway carriages and locomotives. (A communication.)

2623 T. du Boulay, Sandgate, Kent. Improvements in carriages propelled by manual power.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

Dated October 12, 1865.

2627 V. A. and V. J. Messinger, Boston, U.S. Certain new and useful improvements in shirt collars and bosoms. (A communication.)

LIST OF SEALED PATENTS.

Sealed October 20, 1865.

1110 T. Greaves and J. S. Wright	1380 J. Worrall and T. Hughes
1113 E. Wilson	1375 R. T. Birt
1115 A. C. Hermann	1378 W. Eassie
1122 R. Canham	1474 C. H. Murray
1123 O. Hall	1513 W. E. Newton
1124 O. C. Evans	1541 W. E. Newton
1127 J. H. Wilson	1554 A. O. Henderson
1130 A. Grainger and C. M. Girdler	1561 W. E. Newton
1141 W. E. Gedge	1735 W. E. Newton
1143 J. J. Parkes	1752 J. Calvert
1150 T. Walker	1766 J. F. Jones
1153 J. N. Brown and T. D. Clare	1762 S. Wright
1154 J. N. Brown and T. D. Clare	1786 C. T. Claus
1157 W. Elder	1787 J. F. Jones
1187 T. C. March	1843 J. Saunders and J. Piper
1189 A. C. Henderson	1868 J. P. Wint
1209 G. Johnson	1944 W. Newton
1225 T. H. Campbell	2043 A. V. Newton
	2205 H. A. Bonneville

Sealed October 21, 1865.

1168 F. D. P. J. Cabasson	1195 A. Wyllie and J. M. F. Gray
1174 W. H. Smith	1201 W. Clark
1178 H. W. Wood	1232 P. A. le C. de Fontaine
1179 S. Harvey	1246 D. Y. Stewart
1181 J. F. Feltham	1239 W. Clark
1182 R. A. Brooman	1254 G. Peel, jun., and I. Masou
1184 A. Grainger and C. M. Girdler	1336 W. Davey
1188 E. Moore	1431 J. H. Johnson
1190 E. McNally	2044 W. Pollock and J. Stobo
1191 J. Bernard	
1193 R. Perrie, J. Murray, and A. Wilson	
1200 G. P. Dodge	

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the London Gazette, October 21, 1865.

1441 T. H. Hoblyn. Rest for turning lathes.	
1555 V. Duterne. Metallic stuffing box.	
1588 G. Bonelli. Optical illusions.	
1599 G. Speight. Curving collars.	
1593 W. J. Hixon. Permanent way of railways.	
1596 J. A. Millington and A. Allnutt. Paper.	
1600 O. J. Collins. Artificial fuel.	
1608 O. de Vendeuvre. Easing strains on ships' cables.	
1613 S. Courtauld and C. W. Atkinson. Shutting carriage windows.	
1614 H. Ormson. Multitubular hot water boilers.	
1624 P. Lawrence and G. Jeffreys. Copying presses.	
1626 J. Hartley. Corn screens.	
1628 M. Henry. Recording telegraphic communications. (A communication.)	
1633 W. T. Wanklyn. Silk winding machines.	
1636 A. Klein. Gunpowder. (A communication.)	
1637 W. Howes and W. Hurley. Lamps.	
1638 G. Payne. Purifying cotton seed oil.	
1642 V. Baker. Motive power machinery.	
1643 E. Dupont. Wheels for railway carriages.	
1703 C. Worssam and G. Evans. Compressing machine.	
1723 R. Boot and J. Coxon. Twist lace machines.	
1773 J. Braithwaite. Cutting wood.	
1791 J. W. Swan. Printing surfaces.	
1811 G. B. Woodruff. Marking the width of trucks.	
2033 G. B. Woodruff. Binders for sewing machines.	
2065 A. Budenberg. Adjusting levels. (A communication.)	
2088 H. R. Guy. Submarine telegraph cables.	
2098 W. Blünger. Quality of grain. (A communication.)	
2312 W. E. Newton. Lace. (A communication.)	
2357 L. G. Sourzac and L. Bombail. Durable leather.	
2432 W. Turner, S. Shore, and W. Halliwell. Carding engines.	
2427 V. A. and V. J. Messinger. Shirt collars. (A communication.)	

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 100 HAS BEEN PAID.

2804 H. Wickens	2853 A. Chaplin and G. Russel
2821 J. Clark	2862 R. A. Brooman
2834 J. T. Cooke	2864 J. Turnbull
2838 G. Haseltine	2868 W. J. Williams
2842 J. Spence	2956 M. and R. M. Merryweather and R. Field
2846 H. H. and J. F. G. Kromschroder	2979 J. H. Johnson
2849 T. Greenwood	
2852 W. S. Gamble	

PATENTS ON WHICH THE STAMP DUTY OF 400 HAS BEEN PAID.

2321 C. West	2408 H. Foster and P. Smith
2332 A. Allan, T. Whitster, and R. Gray	2695 J. Targye

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending October 21, 1865.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
3026	1	63041	1	83056	0	103071	1	43068	0	43102	0
3027	0	83042	0	63057	0	103072	0	43069	0	43103	0
3028	0	83043	1	43058	0	43073	1	03060	0	43104	0
3029	1	43044	0	43059	0	103074	0	43061	0	43105	0
3030	0	43045	0	43060	0	63075	0	43062	0	43106	0
3031	0	43046	0	43061	0	83076	0	43063	0	43107	0
3032	0	83047	0	83062	2	43077	0	43064	0	43108	0
3033	0	43048	0	43063	0	43078	0	43065	0	43109	0
3034	0	23049	0	43064	0	43079	1	43066	0	43110	0
3035	0	43050	0	43065	3	23080	0	43067	0	43111	0
3036	0	63051	1	03066	1	03081	0	43068	0	43112	0
3037	0	43052	0	103067	0	43082	0	43069	0	43113	0
3038	0	103053	0	63068	0	43083	1	03070	0	43114	0
3039	0	63054	0	43069	0	103084	0	43071	0	43115	0
3040	0	43055	0	103070	0	43085	0	43100	0	43116	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, *fixed at 5s.* must be remitted by Post Office Order, *made payable to the Post Office, High Holborn, to Mr. Edmund Woodcock, Great Seal Patent Office, 20, Southampton Buildings, Chancery-lane.*

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

TIMBER, duty 1s. per load, drawback 1s.									
Teak -	load	£11	0	213	0	Archangel, yellow -	10	10	10
Quebec, red pine -	3	5	4	15	0	St. Petersburg, do. -	10	10	10
St. John, N.B., yellow -	2	10	10	0	0	Memel -	10	10	10
Quebec oak, white -	5	5	0	0	0	0	0	0	0
" birch -	3	10	4	10	0	0	0	0	0
" elm -	3	10	6	0	0	0	0	0	0
Danish oak -	3	10	6	0	0	0	0	0	0
Memel fir -	3	10	3	15	12ft. by 3 by 5 in.				
Riga -	3	5	2	0	0	yellow -	10	10	10
Swedish -	2	9	2	10	0	Doek's Black Danzig -	10	10	10
Mate, Quebec red pine -	6	10	8	10	0	0	0	0	0
yellow pine -	5	0	0	0	0	0	0	0	0
Lathwood, Danzig, fine -	6	10	8	10	0	0	0	0	0
St. Petersburg -	6	10	9	10	0	0	0	0	0
Doals, per C., 12 ft. by 3 by 9 in., duty 2s. per load, drawback 1s.						Spain, pine -	10	10	10
Quebec, white spruce -	13	6	17	0	0	0	0	0	0
St. John, -	12	6	14	0	0	0	0	0	0
Yellow pine, per reduced C.						0	0	0	0
Canada, 1st quality -	15	10	12	0	0	0	0	0	0
" 2nd -	12	0	10	0	0	0	0	0	0

METALS.	
IRON.	
Welsh Bars, in London -	per ton 7 15 0
Nail Rods -	do 7 10 0
Hoops -	do 6 15 0
Sheets, single -	do 5 10 0
Staffordshire Bars -	do 5 10 0
Bars, in Wales -	do 7 0 0
Rails -	do 7 0 0
Foundry Pig, at Glasgow, No 1 -	do 2 15 0
Swedish Bars -	do 11 5 0
STEEL.	
Swedish Keg, hammered -	do 15 0 0
Swedish Faggot -	do 16 0 0
COPPER.	
Sheet & Sheathing, & Boils -	per ton 121 0 0
Hammered Bottoms -	do 111 0 0
Flat Bottoms, not Hammered -	do 101 0 0
Cake and Tough Ingots -	do 95 0 0
Best Selected -	do 95 0 0
Fine Foreign Copper -	do 90 0 0
Yel. Metal Sheathing & Rods -	per lb. 0 0 2
ZINC.	
English Block -	per ton 97 0 0
do Rodded -	do 95 0 0
do -	do 95 0 0
do -	do 95 0 0
do -	do 95 0 0
LEAD.	
Pig, English -	per ton 21 5 0
do Spanish Soft -	do 19 10 0
Shot, Patent -	do 25 15 0
White -	do 27 0 0
SILVER.	
On the spot -	do 25 15 0
ZINC.	
English Sheet -	per ton 21 5 0
Quicksilver -	per gal. 7 10 0

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THE
MECHANICS' MAGAZINE.

LONDON: FRIDAY, NOVEMBER 3, 1865.

GAS EXPLOSIONS.

THE most formidable antagonist with which gas-lighting, in its infancy, had to contend, was the fear of explosion which then obtained. Scientific men of the day upheld the baseless theory, and supported it by the assertion that the destruction resulting from the explosion of a gasholder containing 15,000 cubic feet of gas would be equal to that produced by the explosion of ten barrels of gunpowder. These arguments led to a royal commission of inquiry on the subject of gas explosions. Sir William Congreve was one of the commissioners, and he concurred with his colleagues in recommending that the capacity of gasholders should not exceed 6,000 cubic feet each. It was further recommended that the holders should be walled in, to limit or confine the disastrous effects of explosions, should they occur. By degrees, however, the light of science broke in here, and showed that gas, instead of being the destructive agent it was at first deemed, was perfectly harmless when unmixed with atmospheric air or oxygen. In fact, if a lighted torch or taper were inserted in a holder filled with pure gas, the gas would extinguish the flame, instead of the flame igniting the gas. We have always accepted this doctrine without doubt or questioning; it comes commended to us by the very fitness of things, and has led to the undisturbed conviction that neither theory nor practice could explode a vessel of pure coal gas. Our faith, however, was momentarily shaken on Wednesday morning by the statements made in the daily papers with reference to the recent explosion at the London Gasworks, Nine Elms, which occurred on Tuesday afternoon. They overturned all preconceived notions of the natural laws governing these cases by informing us that a gasholder containing 1,000,000 cubic feet of gas had exploded. We were also told that the manner in which the explosion occurred was a mystery to all connected with the gasworks, and had upset all previous theories with regard to the explosion of gas. The mystery, however, appears to be confined to the writers of the articles in whose minds alone the theories have been overturned. Of course, the shattered and dismantled condition of the works throws little or no light upon the cause of the accident. Stones, bricks, and fragments of iron will not of themselves tell much of a tale, but there are other ways of accounting for occurrences than by an appeal to them.

The truth of this sad circumstance lies in the fact that there was in the first place a leakage of gas in the meter-house, where the catastrophe originated. This leakage must have been of such a character, and permitted to go on to such an extent, as to call in question the qualification of those in charge for their post. The explosion in the meter-house acting by concussion on the adjacent gasholder, caused it to burst, and the liberated gas, rapidly mixing with atmospheric air, was instantly burnt or exploded. The gasholder at the other end of the premises had its roof broken in, either by concussion or by a fragment of material falling on it, most likely the latter. The escaping gas was ignited, probably by the exposed fires in adjacent workshops, and burned away furiously until the contents were consumed, doing no more damage than buckling the iron sheets of the roof and smartly warming the columns in the quarter where combustion was effected. Although these operations were consecutive, yet, comparatively speaking, they were practically one, or at any rate they occurred within a second or so of each other. Thus, then, the mysterious explosion of a gasholder becomes reduced to naught, for the gasholder was not exploded. Nor was it possible

for such a circumstance to have happened, inasmuch as gas unmixed with oxygen suffocates flame, and in this state cannot ignite or explode. That there was a gas explosion—or rather a series of explosions—is perfectly true, but in each case the coal gas had become admixed with a certain proportion of atmospheric air before explosion occurred. Under what circumstances ignition was effected in the first instance is by no means clear at present, and it may never be made clearer. There were numerous agencies by which it might have been accomplished; builders' workmen were about the place, in the meter-house even where the catastrophe originated. Among the dead may be the unsuspecting victim of a want of due caution under circumstances when the utmost care was needed. An unextinguished lucifer or a discarded pipe-light may, in spite of all rules, have led to the fatal result. A proper regard for regulations made for the safety of life and property cannot be too strongly insisted on, but unfortunately workmen become so inured to danger that they often act in utter disregard of its presence. The labourers who were plastering the meter-house may have become so familiarised to the smell of gas about the works generally that they could not detect any special escape, and so were unaware of particular danger. But this of course presupposes gross negligence on the part of those in charge of this special department who could allow or overlook a leakage from which such consequences should follow.

The proportions in which gas and atmospheric air when mixed become explosive vary considerably. The most explosive compound is formed by mixing seven parts of air with one of gas; the degree of explosiveness, however, is to some extent governed by the quality of the gas. Explosions do not occur where the mixtures consist of less than three of air to one of gas, or more than eleven of air and one of gas. Explosions do occasionally happen at gasworks, and they arise from varied causes. At the City of London Gasworks, a few years since, an accident of this character occurred, but which was unattended by any fatal consequences. Owing to an accumulation of air and gas in the large main communicating with the gasholders a violent explosion ensued, doing considerable damage to the adjacent portions of the works. This accident was traceable to a defect in the valves, in consequence of which air passed into the main with the gas. In some instances explosions have arisen from a new gasholder when just ready for use having been communicated with the manufacturing apparatus. The valve may have been leaky, or it may have been thoughtlessly opened, and gas admitted to the holder. Having thus become admixed with the air in the holder, upon the introduction of a light the gas necessarily exploded. Hence new holders should be perfectly finished before communication is effected, or the pipes should be waterlogged until the holder is ready to receive the gas. But explosions have sometimes occurred on the first introduction of gas into the holder. One in particular happened a few years since, whereby the engineer was killed. Here the new holder contained a considerable quantity of air, and on being charged with gas, a highly explosive compound was of course formed. The holder by chance became set and gave no pressure. In the holder was an orifice about a quarter of an inch in diameter, at which the engineer imprudently attempted to test the quality of the gas. The flame entered the holder and ignited the explosive compound within it, spreading destruction around. The accident was of course preventable, and would not have occurred had an argand or fish-tail burner been screwed into the hole and the gas tried through it. It is on record that an explosion once occurred from a mixture of gas and air taking fire through a joint being made with overheated lead.

It is generally supposed that if a rent was made in a gasholder, and the escaping gas ignited, provided there was no pressure, the

contents would explode directly the holder reached the ground. This, however, is a mistaken idea, for directly the pressure ceased the gas would be extinguished, and this irrespective of the size of the opening. But, when the gas ceased to burn, danger would commence; some of the gas would gradually issue from the crown, and would be replaced by air, so that in time an explosive compound would be formed. When under pressure an explosive compound of gas will only ignite at the mouth of a pipe, but on relieving the pressure the flame enters, and the compound explodes. Bearing on these points are some experiments made by Mr. Samuel Hughes, C.E., for the purpose of specifically determining the circumstances under which explosions take place. He used some old large-sized tin-plate meter cases, which were most suitable for the purpose. These were entirely closed, except at the outlet and the bottom or emptying plug. Gas was allowed to flow through a 50-light case for some time, and then the bottom plug was replaced. On a light being applied to the outlet, the gas burned with a flame of the same diameter as the pipe, and at first about 18 in. high, the height quickly diminishing until the flame died out. The same result occurred at every trial, and proves that when gas is enclosed in a vessel, the moment the pressure ceases the flame is extinguished. After the vessel had stood some time a light was applied, and the vessel was shattered to pieces. This resulted from a part of the gas having gradually escaped, and air having entered and combined with the remainder, an explosive compound being thus formed. In another case the bottom plug was also left open, when the flame was much higher and burned more brightly than in the previous experiment. This was caused by the gas ascending by its lightness, the air entering at the lower orifice and following it. The flame gradually weakened, assuming a deep blue tint; at last it entered the vessel in the form of an inverted cone, when a violent explosion took place. Subsequently a trial was made with a very small holder containing two feet of explosive compound, with a pressure of 5-10 lbs, the gas issuing from a quarter-inch orifice. It ignited with an intense blue flame, but on relieving the pressure and again applying the light an explosion was the result. In former times the explosion of gas was considered to be due to the hydrogen in combination therewith. But modern researches have proved that the richest gases are the most destructive when exploding. In conclusion, we would refer to the groundlessness of the apprehension that immediately arises on the occasion of an outbreak of fire near a gasworks. It is generally assumed that the contents of the gasholder are explosive and would manifest a fearful energy if the flames reached the holder. The fact is, however, that gasholders filled with ordinary gas cannot by any means explode, even though the flames were to make the plates red hot. The only result would be that, expanded by the heat, the gas would issue in detached flames, but no such thing as an explosion could take place. Explosions, such as the recent one at Nine Elms, are of very rare occurrence, and when they do happen they arise from perfectly exceptional circumstances, and must obtain assistance from the atmosphere before they can manifest any undue violence. To guard against them in ordinary is no difficult matter, for, guided by the sense of smell, the slightest escape of gas is readily detected. Of course, if carelessness and indifference to safety are present, there is no guarantee that gas explosions will not become matters of everyday occurrence.

THE HOOSAC TUNNEL.

TWO great works corresponding in general character—one of extraordinary magnitude—have for some time past attracted considerable attention wherever engineering is discussed; these are, the Mont Cenis Tunnel

in Italy, and the Hoosac Mountain Tunnel in America. These two examples of modern engineering skill, although of a similar nature, have recently been brought to a practical standstill from extremely opposite causes. The works at Mont Cenis have been interrupted by the intervention of a rock which is too *hard* to be worked, whilst those of the Hoosac Tunnel have been stopped by the appearance of a rock which is too *soft* to allow of the continuance of present operations. Recent accounts from Mont Cenis tell how the material of the present working-face turns all the drills, and defies every attempt at penetration. On the other hand, we learn from America that in the Hoosac Tunnel the unlooked-for obstacle is a rock which decomposes, and can be neither pumped, shovelled, nor drained out. In either case the impediment is extremely disheartening, considering the time and capital which have been expended, and the interests which are involved. But in neither case ought the obstruction to prove sufficient to prohibit the ultimate completion of the works. The prime mover in engineering operations, as in most other concerns of life, is simply that old familiar friend *E. s. d.* If, therefore, we make this the fulcrum, and engineering pluck the lever working thereon, we shall not fail to find a way to pierce the adamant of Mont Cenis or to wade through the porridge of the Hoosac. Of the two evils, however, that at the latter works has the appearance of being the least, for, although the standing work may there be a matter for serious consideration, yet, with the removal of the sludge added to it, it does not present quite so insuperable a barrier as the Mont Cenis obstruction. At any rate, there are two interesting questions presented to the engineering profession, and we shall look with interest to the solution of each of the problems.

Of the nature of the two works that of the Mont Cenis is the better known, inasmuch as from time to time, both here and on the continent, some very practical descriptions have appeared and we are shortly to have another of a geological character. Much less is known of the Hoosac enterprise, which the late war has kept for long past in the background. But now that America has put a seal on the reign of desolation, her old institutions are reviving, skill and energy are fast returning to their wonted and legitimate channels, and she will soon appear in bright contrast to her past. The Hoosac Tunnel was promoted with the view of effecting a material reduction in the distance between the Eastern terminus of the Erie canal and tidewater at Boston. The Western Railway now places these important points at a travelling distance of 200 miles apart, but the completion of the Hoosac Tunnel would open a new route, shortened by some 23 miles. Nor is this the whole extent of the saving, for by taking into account the superior gradients and curves of the tunnel scheme, it is calculated that the route will practically prove at least 40 miles shorter. This project has now been before the public some sixteen or seventeen years, during which time it has experienced numerous vicissitudes, and is at the present, as already indicated, progressing rather unfavourably. The Hon. F. W. Bird has recently visited the works, and his report throws considerable light upon their present condition. The operation of tunnelling is carried on from four different points, viz., from the eastern and western ends, from a shaft about half a mile from the western end, and from another shaft in a position central between the two ends. At the west end the rate of progress has been slow, and bids fair to be yet far slower, for in this driving the sludgy impediment referred to occurs. Operations were not commenced at this end until the early part of last year, when an open cutting was made to a point where the top surface was 80ft. above the rail level, and here the work of tunnelling

commenced. In the spring of the present year a heading 14ft. wide and 7ft. high was commenced, and has been carried on for 110ft. In the open part of the excavation the materials, for a short distance, are common earth and hard pan, but these gradually change to a substance dissimilar from either. It appears difficult to say whether this is earth turning to rock like that of the mountain, or rock turning to earth. In its normal condition it is hard and rocklike, but on exposure to air and water it runs away like quicksand, or if pent up it becomes "porridge." It has not been inappropriately termed "demoralised" rock.

In accomplishing the 110ft. of heading a stout framework or lining of heavy timbers and planking was set up as fast as the excavation was made in order to resist the pressure and weight of the surrounding material. At first fair progress was made, some 4ft. advance being made in twenty-four hours, but soon the water increased and converted the rock into an unmanageable fluid, difficult alike to drain, shovel, or pump. To such an extent did this affect the workings that at 110ft. matters were almost brought to a standstill by a hole or shaft being washed away in the roof, which at this point was 40ft. thick. Disheartened and dispirited, but not beaten, the engineers continued the work under these most unfavourable circumstances, although the rate of progress has been exceedingly slow. The serious nature of the difficulty to be contended with may be inferred from the fact that the result of nine months' indefatigable labour has been an advance of only 15ft. ! The total distance excavated in the west end is therefore but 125ft. As a last resource it was decided to continue the open cutting on a level passing above the top of the tunnel, until the point directly above the largest spring was passed. A stout timber framework, some 20ft. long (similar in construction to the cribs used in deep-water foundations for masonry), having the sides and forward end planked, but open at the bottom, was then placed over the spring and forced down into the fluid mass until it came to the bottom line of the tunnel. A plank flooring was next added to the crib, and a timber roof has been constructed to make the finish of this portion of the "heading" correspond with the part which was really made by horizontal excavations. Thus far a solution was found to this ugly problem, but beyond this there is another question which is far less easily disposed of; and that is, how to remove the plank and timbers from the forward end of the crib, and yet stay the rush of "porridge" from all directions into the opening. Although the planking originally rested against the face of the rock, it does not do so now, for on examination it appears that the rock behind it has become "demoralised" for 3ft. or 4ft. in thickness. How to remove this porridge does not seem at all clear, and if it is removed it still remains to extend the crib forward, and make tight joints on the sides, top, and bottom against the rock that is yet hard. And even if this is effected there is the further difficulty of keeping the face of the rock open for work without the rush of porridge which inevitably results from exposure to air and water. The distance, too, for which these works will have to be prosecuted through this unfavourable material is not far short of half a mile. In fact, it is altogether a weighty question, but one for which we doubt not our transatlantic friends will find a solution, especially if they are backed by State resources, of which there appears to be a probability.

About 2,300ft. from the western entrance a shaft has been sunk to rail level, and the works have proceeded for about 260ft. in an easterly, and 280ft. in a westerly direction. The work westward has been suspended in consequence of the character of the rock, which is precisely similar to that in the western end workings, running to sludge as soon as air and moisture are admitted to it. Borings have been taken between this shaft and the western

end, and the whole of the intervening material is found to be of the same obnoxious nature. Eastward, however, the work in this shaft is advancing at the rapid rate of 13ft. per week. The hole, however, is but 7ft. high and 14ft. wide, although the Commissioners recommended the section of the tunnel to be 22ft. wide at the grade line, 24ft. wide at the widest point, and 21ft. high above the track, the roof being made circular. These dimensions give a sectional area of 433 square feet, and a solid measure of 16 cubic yards per lineal foot. The tunnel adopted is 7ft. high and 14ft. wide, giving an area of 98 square feet, and 3 2-3rds cubic yards per lineal foot. It seems, then, that the excavation actually done in the distance gone is as 3 2-3rds to 16, or a little over one-fifth of what must be done to complete the tunnel of the size originally declared necessary by the Commissioners. It is intended to enlarge this tunnel hereafter, but the circumstance serves to illustrate our observation that the tunnel had seen some vicissitudes; in fact, Mr. Bird points out a large amount of mismanagement. The next place at which the works are carried on is the central shaft, which is situated about a mile and a half from the western entrance at a point where the mountain surface is 1,050ft. above rail level. A depth of 160ft. has been reached in the shaft, thus leaving 890ft. yet to be sunk. During the last thirteen months 100ft. were sunk, 22ft. being made in the last month, the highest reached in any previous month. Assuming the work here to average the highest figure, or 22ft. per month, the rail level will not be reached under forty months and a half. Until that time the work of tunnelling the mountain proper must be limited to two faces, one at the east end and one at the west shaft.

The eastern end was penetrated by Mr. Haupt for a distance of 2,394ft. to the end of the heading, of which about 2,100ft. was nominally completed of the size then contemplated, viz., 14ft. wide and 18ft. high. Really, however, the work was incomplete, for in some parts Haupt had left his burrow only 13ft. square. Beyond the above workings the heading has been carried forward about 280ft. Since last April the heading has been pushed on successfully, averaging in the last two months about 65ft. per month, and the works have now reached a distance of about 2,700 ft. from the mouth of the tunnel. One of the most extraordinary features of this enterprise is the damming of the Deerfield river, which was effected for the purpose of creating water power to drive machinery in the repairing shops, to ventilate the tunnel, and to compress the air for driving the drills. It is about three quarters of a mile above the east end of the tunnel, is about 250ft. long with a head of 20ft. The water is carried through a canal to the building containing the water-wheels, where it gives a head of about 30ft. The works are of a very excellent character, and had cost some 117,869 dollars up to December, 1864, when they were incomplete. It is estimated that when complete these works will not have cost less than 200,000 dollars. The worst part of the story, however, is that these expensive arrangements are utterly inadequate to the requirements of the work, there being an insufficient supply of water. The total cost of the whole tunnel works up to the present time is stated to be about 5,719,334 dollars; but what that sum will have amounted to when the works are completed no one is able even to surmise.

The history of the Hoosac Tunnel is a chequered one, and full of special interest to the taxpayers of the State. The Troy and Greenfield Railroad Company first had it in hand, and they asked State aid for its construction. In time all the rights and privileges of the Company became concentrated in the contractor who failed not to avail himself thereof. Under the contractor's influence the original project decreased from a double-track tunnel down to a mere mining gallery, and in the same ratio

as the contractor enlarged his demands for State aid, so the capacity of the tunnel appears to have been reduced. At last State supplies were stopped, the contractor gave up the job, and the State then assumed the charge of the project, the superintendence and direction of the works being delegated to three Commissioners. After a year and a half of work and an expenditure of about a million of dollars, and with the best engineering skill at command, the Commissioners appear to have very small results to show. A singular want of judgment has been evinced in recent proceedings, and implies a necessity for better management. For instance, the Deerfield river dam was supposed to secure 800-horse power, whereas only about 50-horse power is obtainable; steam power could have been used at a greater saving. We have seen that the headings are even less in area than those driven by Mr. Haupt, and at variance with the dimensions laid down by the commission. To complete the dismal category, we have the decomposition of the rock at the western end of the tunnel, so that altogether the enterprise wears a very unpromising aspect. Nevertheless, as we have already pointed out, there need be no despair about the work being executed, if only funds are forthcoming, and able management is appointed. The readiest method of dealing with the question would be to construct an iron tube or Brunel shield, open at both ends, and of a cross section corresponding to that of the tunnel. Within this shield an efficient lining of brickwork should be constructed, the work of excavation being carried on at the end. When the brickwork had advanced nearly to the end of the shield, the latter would be forced forward into the excavated portion of the tunnel, by means of screwing apparatus which would have its back thrust on lugs built into the brickwork. A similar arrangement would be provided at the front edge of the shield to take the forward thrust of the screw. The excavation would then be further prosecuted, the brickwork following it up as before. Should the "porridge" in the heading be made too fast, it might be kept back by a plate affixed to the lower part of the shield, and extending about one-third up the face of the work, which would prevent it interfering with the operators. With this suggestion we will leave the Hoosac Tunnel to, we trust, a better fate than that to which it has hitherto been subject. At the best, however, it will require considerable time to bring into proper working condition.

NOTES ON NEW DISCOVERIES AND NEW APPLICATIONS OF SCIENCE.

The Differences between the Properties of Ferrous and those of Ferric—Electric Relations of Aluminium—The Nature of Aluminium Bronze—A New Kind of Artificial Acenturine—Colouration of Glass by Selenium—Another New Blasting Agent—Mr. Ansell's Fire-damp Indicator.

It has hitherto been supposed that it is simply in consequence of their differing in respect of the proportions in which they contain carbon that the three kinds of manufactured iron,—cast iron, steel, and malleable iron,—differ from each other so remarkably in their properties. In the paper by M. de Cizancourt, however, to which allusion was made in last week's "Notes," that gentleman maintains that the diverse properties of these three kinds of iron are due far less to diversities as regards the proportions in which the metal, in each case respectively, has some other substance associated with it, either in chemical combination or otherwise, than to differences of the kind which chemists call "allotropic," but of the nature of which they know so little, in the physical and chemical condition of the metal itself. He was led to enter upon the course of thought and research by which he has been conducted to this conclusion by the well-known facts that cast irons whose chemical constitution, so far as can be ascertained by

analysis, is absolutely identical, frequently differ very widely in quality and properties, and that there are some cast irons which the chemist cannot distinguish from steels, and some steels in which chemical analysis can detect no difference from some kinds of malleable iron. M. de Cizancourt traces all such phenomena to the capacity of iron to exist, when in the free state, in those distinct allotropic conditions in which chemists have for some time been aware that it must exist in the ores of the protoxide, and in the "ferrous" compounds generally, on the one hand, and in the ores of the peroxide, and in other "ferric" compounds, on the other, but which no previous observer had recognised in the reduced metal. He finds that "ferrous" and "ferric" are as distinct in metallurgy as in chemistry, that the physical properties of these two forms of iron are as different as their chemical properties, that both are capable of being submitted to all the usual metallurgical processes without loss of their distinctive qualities, and that the "dominant characteristic" of manufactured iron invariably depends upon how far it consists of the one form of the metal and how far of the other, while this is in great part dependent upon the condition in which the metal existed in the ore,—that is to say, upon whether the iron was obtained from an ore of ferrous, from an ore of ferric, or from an ore containing ferrous and ferric too.

According to M. de Cizancourt, ferrous, or iron in that condition in which it exists in the ores of the protoxides, and in those other compounds the iron in which is in the state in which 28 parts by weight of it are equivalent to 35.5 parts of chlorine, has never been obtained, quite pure, except in the laboratory, in very small quantities, by reduction by hydrogen. Combined with carbon, however, it constitutes the hard, brittle, crystalline variety of cast iron known as "white cast iron." The iron in "grey cast iron," on the other hand, is ferric, or iron in the condition in which it exists in the peroxide and in those other compounds the iron in which is in that state in which 56 parts by weight of it are equivalent to three times 35.5 parts by weight of chlorine, while that in "mottled cast iron" is partly ferric and partly ferrous. Ferrous is harder and more brittle than ferric, is reducible at a lower temperature, and has a much stronger affinity for carbon. Ferrous and ferric can each be converted into the other, but ferrous can be transformed into ferric much more readily than ferric into ferrous, and in metallurgical operations on the great scale the latter transformation takes place very much less frequently than the former. Malleable iron contains only ferric, the distinguishing physical characteristics of which form of iron are its malleableness and tenacity, while those of ferrous are its hardness and fragility. It is obvious that malleable iron may consist either of ferric which existed as such in the ore whence the metal was obtained, or of ferric which existed in the ore as ferrous and has been transformed during the metallurgical operations it has undergone, or of a mixture, in any proportions, of what may thus be called natural ferric and artificial ferric; and M. de Cizancourt attributes the different qualities of the various kinds of malleable iron to such diversities of constitution. Steel he regards as a mixture of ferrous and ferric, and the most perfect steel as that which contains these two forms of iron in atomic proportions, or in the proportions in which they exist in magnetic oxide of iron and in magnetic pyrites. He appeals for confirmation of this view of the constitution of steel to the singular fact that the only bodies which have hitherto been known to contain both ferrous and ferric,—namely, the just-mentioned magnetic oxide and magnetic sulphide,—share with steel the capability of permanently retaining magnetism, and to the circumstance that a good steel is always formed when soft iron, which is nearly pure ferric, and white cast

iron, or carbide of ferrous, are fused together in some approach to atomically equivalent quantities. He concludes his valuable memoir with a promise to speedily publish a simple mode of assay by which ferrous and ferric may be readily distinguished from each other, together with a number of further particulars respecting the characteristics of these two forms of iron, of a kind likely to be of practical value to the manufacturers of that metal.

M. Ernest Saint Edme has recently investigated some of the chemical relations of aluminium. His method consisted in connecting a wire of aluminium with one of the poles of a galvanometer and a wire of some other metal with the other pole, plunging the two wires into some exciting fluid, and then noting the direction and amount of the deviation of the needle. He finds that, with hydrochloric acid as the exciting liquid, aluminium is negative to both zinc and lead,—a result which chemists would scarcely have expected, considering how powerfully, when by itself, aluminium is acted upon by hydrochloric acid. With an aqueous solution of caustic potash as the exciting agent the result is just the reverse, aluminium being positive to both zinc and lead under the influence of that excitant, as it is also under the action of an aqueous solution of ammonia. Aluminium, when alone, is scarcely attacked at all by sulphuric acid diluted until it will dissolve zinc, but when the aluminium is associated with either gold, copper, or platinum it is at once acted upon by this agent, though only feebly. When associated with either zinc or iron, however, aluminium, with dilute sulphuric acid for the excitant, is very strongly negative. The only other liquid M. Saint Edme employed in these experiments is nitric acid. Nitric acid does not act in the least upon either aluminium, steel, or platinum when the metals are isolated, but when a wire of aluminium coupled with a wire of platinum or a wire of steel is plunged into this acid, the direction of the current produced at the moment of immersion seems to show that the steel or platinum is the metal acted upon at first, but almost instantaneously the current reverses, and the aluminium becomes the positive element of the couple. Associated with zinc or iron in the same acid, aluminium is strongly negative.

During these experiments it occurred to M. Saint Edme to compare with the electrical properties of aluminium those of the various kinds of aluminium bronze, in the hope of thereby obtaining some new light upon the question as to whether the remarkable alloys are chemical combinations of aluminium and copper, or only mechanical mixtures of the two metals. Three of these beautiful gold-coloured alloys are manufactured, one containing 5 per cent., another containing 7½ per cent., and the third containing 10 per cent. of aluminium. The homogeneity of these alloys, neither of which is susceptible of "liquation," as ordinary bronze and gun-metal are, and the intense heat which is developed when their constituents are added to each other in the molten state, the mass suddenly rising to such a temperature that the eye cannot bear its dazzling whiteness, have led most chemists to regard them as being compounds, and not merely mixtures. M. Saint Edme comes, however, to the opposite conclusion. We cannot give this week the details of his experiments, but their results served to convince him that, alike in the three above-mentioned varieties of aluminium bronze, and in a fourth, containing 60 per cent. of aluminium, which was prepared specially for his experiments, the two constituents are merely mechanically associated.

For several generations there has been manufactured at various glass works in the neighbourhood of Venice a most exquisite imitation of that beautiful variety of quartz, minutely spangled throughout with yellow scales of mica, which is known as "aventurine." The "Venetian aventurine," as the product in question is called in commerce, is a peculiar kind of glass, coloured brown by per-

oxide of iron, and exhibiting a golden iridescence, owing to the diffusion through it of crystals of metallic copper. M. Pelouze has found that a new variety of such glass may be obtained by fusing together a mixture of 250 parts of fine white sand with 100 parts of carbonate of soda, 50 parts of carbonate of lime, and 40 parts of bichromate of potash. He calls the product "chrome aventurine." Its mass, instead of being brown, like the Venetian aventurine, is of a most beautiful green colour, and the golden spangles diffused through it greatly exceed in brilliancy those to which the Venetian aventurine owes its charm. The green colour is due to chromic oxide, derived from the bichromate of potash, and the diffused spangles consist of the same oxide in the crystalline form. They are described as being not less brilliant than the diamond. The new aventurine is much harder than the Venetian kind,—it is so hard that it will scratch ordinary glass,—but it can nevertheless be readily worked, and the Paris lapidaries seem to regard it as a most valuable addition to the materials for their art.

M. Pelouze has of late been devoting much attention to the chemistry of glass, and among his latest discoveries is that of the fact that selenium will colour glass less powerfully than sulphur, and thus that the resemblance between those metalloids extends to their action on the earthy and alkaline silicates. One per cent. of selenium will communicate to glass a beautiful orange tint, "resembling that of some varieties of topaz and zircon hyacinth." The tint communicated to glass by sulphur is yellow.

We have had to chronicle within a very brief period experiments with at least half a dozen new explosive agents, designed to supersede gunpowder for blasting purposes, and still another now calls for mention. Messrs. Schäffer and Budenberg, of Buckau, Magdeburg, and Manchester, are endeavouring to introduce an "improved blasting powder," which seems to have the great advantages over the best blasting powders hitherto in use of being some 50 or 60 per cent. more effective, weight for weight, and of leaving no smoke behind it, after explosion. The new powder consists chiefly of sulphur, charcoal, and nitrate of potash, like ordinary gunpowder, but these materials are employed in other proportions than in ordinary gunpowder, and certain new ingredients are added to them. The materials are combined in such proportions as to secure comparatively slow combustion, in order that all the combustible gases liberated by the explosion of the compound may be completely burnt, and so the utmost possible effect be obtained from them, and no smoke be left. The new powder has been in use for some months past in the mines at Frameries, in Belgium, under the direction of M. Gille, the Government mining engineer, and a Government report of the results of the experiments with it has just been issued. This report compares the new powder more especially with the blasting powder manufactured by the Belgian Government at its factory at Welleren, and states that the new powder produces as much effect as twice its weight of the Government powder, that it explodes almost without noise, that it leaves scarcely any smoke, and that what little it does leave has no offensive odour, and is not nearly so noxious as the smoke of the Government powder and of ordinary gunpowder in general. When exploded in free air it does not produce any sparks, but burns with an intensely brilliant flame, and almost noiselessly, and leaves no carbonaceous residue, such little residue as there is consisting solely of white globules. When exploded in a bore hole it is said to "act in the manner of a lever, whereas the ordinary powder, exploding more suddenly, acts rather in the manner of a hammer, producing a shock more or less violent. The dislocation of the rock extends to a great depth, and there is no useless projection of debris. The noise of the blast is scarcely perceptible, all that is heard being the dull

rending of the rock; the tamping is not blown out, the smoke is inappreciable, and all the gas resulting from the combustion is burnt within." The new powder is used in precisely the same way as the ordinary powder, except that less of it is required. It costs per pound just about the same as the ordinary powder, but—not to speak of the larger amount of work which the miners can get through in a given time when they have not to wait, after each explosion, for the dissipation of any noxious vapours—it is much more economical than ordinary powder, seeing that it is twice as effective, weight for weight.

Mr. G. F. Ansell, of the Royal Mint, to whose ingenious idea of taking advantage of the laws which govern the "diffusion of gases" in order to the construction of perfectly self-acting apparatus capable of making known at a distance the presence in a coal-pit of the poor miner's deadliest enemy, fire-damp, an article was devoted in the *MECHANICS' MAGAZINE* for the 21st of July, has just returned from a visit to some collieries in the north in which he has been practically testing his "indicator." That instrument consists of a small india-rubber balloon, exactly like the familiar children's toy, filled with atmospheric air, and fixed under a lever, which lever is so connected with a galvanic apparatus that a very slight motion of it will either make or break the circuit. This apparatus being placed in a coal-mine, and connected by a wire with suitable apparatus in the manager's office, when fire-damp becomes mixed with the atmosphere of the mine the fire-damp diffuses into the balloon faster than the atmospheric air diffuses out from the balloon,—in accordance with the law that gases diffuse into each other, whether through porous septa or otherwise, in the ratio of the square roots of their densities,—and the balloon consequently expands, and thereby moves the lever placed above it, and so completes the battery circuit, the completion of which instantly sets a bell ringing on the spot and another in the manager's office, at the same time indicating in the manager's office the exact part of the mine at which the fire-damp has appeared. The bells go on ringing so long as there is any fire-damp in the part of the mine at which the apparatus is placed, but should the atmosphere of that part of the mine be purified the fire-damp in the balloon diffuses out, the balloon returns to its original size, the lever connected with it resumes its original position, the battery circuit is thus interrupted, and the bells cease ringing. This form of the apparatus is intended for giving warning of comparatively slow accumulations of fire-damp; for giving *instant* warning of sudden irruptions of fire-damp, at once to the men at work and to the people above ground, Mr. Ansell modifies the apparatus by using, instead of the india-rubber balloon and lever, a porous battery-cell and a small column of mercury. The action of this form of the instrument, he says, "is so immediate that, unless seen, it would seem incredible; it is, nevertheless, trustworthy and certain." Mr. Ansell has also devised a little pocket instrument, consisting essentially of an ordinary aneroid barometer with the brass back removed and replaced by a piece of porous tile, which will instantly indicate the exact amount per cent. of explosive gas present in the atmosphere of any mine. The practical success of all three forms of his apparatus, as recently tested in the Newcastle district, seems to have been most complete, and such as to leave no doubt that their general use in coal mines would render those terrible disasters, explosions of fire-damp, far less frequent henceforth than they have been hitherto.

PUDDLING MACHINERY IN FRANCE.*

By M. GAUDRY.

At the present time puddling by machinery seems to be the order of the day. The puddling machine of M. Lemut has been in regular prac-

tical working for four years at the Clos-Mortier Ironworks, near St. Disier. All the puddling furnaces at these works are provided with this machine, to the exclusion of any other mode of working. By this machine the ordinary puddlers' rabble is worked regularly over the furnace floor, and the tool is changed with the greatest readiness as often as needed; the puddler has only to watch the operation, without anything to tire him, until the time comes for him to ball up the iron, the machine being then thrown out of action. The apparatus is placed either on the top of the furnace, or else in a pit underneath or alongside. It consists of a suspended connecting rod, which is capable of vibrating in all directions for working the rabble, and is itself worked by an arrangement of rods, shafts, and cranks, supported on the brickwork. The motion is generally obtained from a driving power common to all the furnaces, by means of an intermediate shaft with pulley and strap; and at each furnace the strap is provided with a tightening lever, which is lowered or raised for starting or stopping the apparatus. The whole of the mechanism is of a strong and rough construction, suitable for such a situation, so as to stand dust and rough usage. By this means the rabble receives a rectilinear movement backwards and forwards across the furnace, and, at the same time, a much slower travelling motion from right to left, and *vice versa*, in the direction of the length of the furnace floor. In consequence of this double movement the rabble works over the entire furnace floor, and effects a uniform and complete stirring of the metal with a rapidity and regularity of which few puddlers are capable. The puddling machine can be adapted to all furnaces without alteration; but M. Lemut recommends its application especially to large furnaces, with two doors opposite to each other, where two rabbles work with cross strokes, and where there is the advantage of puddling large charges of metal. In single furnaces working small charges of white iron, which is easily puddled, machine puddling is of little importance; but in working grey iron, the puddling of which is a long and tedious operation, there are generally great advantages to be gained by aiding the puddler by the use of machinery, which relieves him of half his labour. Despite the prejudice of old habit, the workmen at Clos-Mortier at once accepted with readiness the puddling machine.

The following are some of the results that have been obtained with the machine:—1. As the stirring of the metal by the machine is continued under the inspection of the puddler for as long a time as may be necessary, with an energy and regularity of which men are rarely capable, it has been possible, in the majority of cases, to improve the quality of the iron made. It has even been possible to work descriptions of metal which have hitherto been regarded as inferior, and to obtain from them classes of iron which may be very advantageously employed for the smaller descriptions of wrought-iron work, such as trellis work, nail-making, &c. (*pour la trefilerie le feuillard et la pointerie*). This is a fact established by three years' regular work. 2. The length of time of stirring the metal has been perceptibly shortened. At Clos-Mortier, where the black charcoal pigs peculiar to those works, and very hard to refine, are puddled in a double furnace, 3,000 kilogrammes (3 tons) of puddled bar are obtained in twelve hours with the employment of three men. 3. The number of men required for the furnaces has been reduced, and it is more easy to obtain a supply of hands as puddlers, while the wages have been increased 50 centimes (fivepence) a day; and reckoning all expenses there remains an economy over hand work of two francs per ton of iron made. 4. Another saving that was not anticipated is in fuel, which is due no doubt to the shorter time of puddling, and perhaps also to the greater care that the puddler can bestow upon the management of the fire now that he is freed from the labour of stirring the metal. The saving, whatever be its cause, is clearly shown by the results of working. At Clos-Mortier the saving of coal is on an average 200 kilogrammes (3·92 cwt.) per ton of puddled bar. At Montataire, where this puddling machine has been applied to two double furnaces, the following results having been obtained, the consumption of coal and quantity of pig iron supplied to the furnaces having been taken, first, before the machine was applied; secondly, with the machine

* Read before the Institute of Civil Engineers of France.

in use; and, thirdly, with the machine thrown out of action. The following were the results in French kilogrammes:—

	Kilos.	Kilos.
Before the machine was applied	1076.5 pig iron	819 coal
With the machine	1127.8	666
Machine thrown out of action	1108.2	741

Reducing these figures to English weights, the consumption of coal per ton of pig iron was:—

	15.21 cwt. of coal.
Before the machine was applied	11.75
With the machine	13.48
Machine thrown out of action	15.48

Showing an advantage in favour of the machine of 1.64 cwt. of coal per ton of pig iron in one case, and 3.42 cwt. in the other.

In the discussion which ensued M. Fourneyron said he feared that, from the motion that was given to the rables, they would not act on the mass of metal in the same manner as when worked by hand by the puddlers, who, while stirring the mass, turned it over and exposed every part of it to the action of the air. He feared also that the men, having now only to watch the process, would neglect their duty, and allow the proper moment for balling up to slip by. He also desired to know what was the power required for working the machine.

The President (M. Salvétat) inquired whether any special trials had been made for ascertaining the loss of iron that took place with the puddling machine, in order to compare this with the loss in ordinary puddling. He believed all would agree with him that the puddling required to be constantly watched by the workman for ascertaining the progress of the operation, and the man must be ready to stop the process at the exact point required. The puddler's want of experience in this respect was shown by more or less loss of metal; and he wished, therefore, to know the quantity of puddled bar produced with the machine per ton of pig iron supplied to the furnace. He thought the puddling machine could only be regarded as a tool intended to shorten the puddler's labour or prepare the work for him.

M. Gaudry replied that the rabble was very strong, and long enough to reach over the entire mass of metal, which was thereby subjected to a vigorous stirring. Every part of it was thus brought into contact with the air; and the machine was only intended to perform the rough part of the work, the balling up being done by hand labour. On this account it was not employed to advantage with small furnaces, or when the pig iron was of a quality that was very easily worked. Nevertheless it offered the advantage in all cases of not tiring the men from the very beginning of their work, reserving to them all their strength for the delicate portions of the manipulation at the moment when the iron comes into a fit state for balling.

TELEMETERS OR INSTRUMENTS FOR MEASURING DISTANCES.*

By THE LATE ARCHIBALD H. BELL, M.A.

It is surprising that, notwithstanding the great development during the last few years of the science of gunnery, and the perfection to which guns and projectiles have been brought, one of the most important problems connected with the subject has not as yet received the attention which it obviously deserves, and still awaits satisfactory solution. I allude to the problem of determining the distance of objects. To judge distances accurately and with rapidity has at all times been of very great importance to artillerymen; but since the introduction of rifled ordnance this importance has incalculably increased. We have now guns capable of doing fearful execution at a distance of two miles and a half (4,400 yards); guns capable of efficiently throwing projectiles to a greater range than that at which the Americans boast to have shelled the forts and city of Charleston. The promptitude and certainty with which bodies of men and ships of war are now moved add greatly to the importance of this subject. Powerful steamers, for bombardment or for transport, can be brought into action at the rate of fourteen knots an hour, and be withdrawn as rapidly—a pace far exceeding that of the best appointed four-in-hand coach, or a troop of horse artillery at full gallop. The distance of such a vessel from a battery might vary as much as 100 yards in fifteen seconds, or a quarter of a mile in little more than one minute. Of what avail, then, is the beautifully rifled gun,

the accurately fitting projectile, the nicely fixed tangent scale with its verniers, if the true range cannot be determined correctly and instantaneously? What advantage is there in a good direction, rapidity of fire, and penetrating power, if the gun be laid on a point 100 yards or 200 yards beyond, or short of, the object aimed at? To draw increased attention to this subject is the aim of the following remarks—"utilia delibere, magis utilis est," and if this end shall in any degree be attained, it is to be hoped that the service will at length obtain what at present it so urgently requires.

We want the power to determine distances up to two miles and a half with great rapidity, and with sufficient accuracy to enable us to strike such an object as a battalion in column, or a ship of war. By practice the eye may be trained to estimate distances under half a mile with fair precision. At Hythe, the principal school of musketry, this practice is made of prominent importance, and it is found that the average men of a well-drilled class do not err in judging distances of half a mile and under by more than one-tenth of the distance. But it may be asserted, absolutely, that no man can arrogate to himself the power of judging distances of a mile and upwards, with the very smallest degree of certainty; and we therefore require to seek for some kind of instrument for the purpose of obtaining this power. The difficulty to be contended with here is, that no definite space of time, not even one minute, can be allowed for adjusting an instrument, or for calculation; and thence arises the danger that the most perfectly-contrived instrument may be imperfectly used in the hurry and excitement of action. The requirements of such an instrument for military use are, therefore, 1. That it shall be of simple construction; 2. That it shall be capable of being used with rapidity, and shall show the result at a glance; 3. That any error of adjustment shall be easily recognizable, and readily admit of rectification.

In order to make our professional wants as clear and simple as possible, I classify the various circumstances under which we have to estimate distances as follows:—1. Horse and field artillery require to ascertain the distances of objects over land, whatever may be the features and elevations of the ground, and frequently without much topographical knowledge of the surrounding country. 2. Garrison artillery also require to estimate distances over land, but with the advantage of a perfect acquaintance with the localities and landmarks. 3. We require likewise to estimate distances over water, from forts and batteries on the seashore, whether a *fleur d'eau*, or in elevated positions. 4. We require to estimate distances on board ship, where not only the object, but also the observer, may be in motion. With regard to these four cases, it may be remarked that it is perhaps of the least relative importance for horse and field artillery to possess instruments for measuring distances. Our magnificent mounted artillery come so rapidly into action that one or two trial shots could probably be always fired before any satisfactory observation could be taken with an instrument; and the shot thus thrown away are not of the same value as the ponderous projectiles of modern garrison and naval artillery. Even in the case of garrison artillery, it may be argued that an instrument is not of vital importance, for the reason to which I alluded above, that whether the battery be in our own fortifications (a battery of defence), or form part of a siege attack (a battery of offence), the ground in front is usually so studied and planned out, that the ranges of all the remarkable objects in sight are well known, and little more information is required of the distance of any object, whether stationary or in motion.

But it must be allowed by everyone that it is of the very highest importance that we should possess instruments to enable us to determine distances over the sea from shore batteries. The guns used here are usually of the heaviest nature, throwing the most costly projectiles, and requiring very large charges of gunpowder; they are of necessity slow to load and to manoeuvre, and the objects fired at are oftentimes in rapid motion. Trial shots would here be of little use, as there remains nothing to guide the eye to the spot where the last shot struck. In these cases, too, time is everything, the tremendous blow must be struck at one particular moment, or the opportunity may never recur. Consider, for example, the forts at the mouth of a harbour (at the passage of the Needles, or the much-discussed

forts at Spithead), if the very first round fail to crush a hostile vessel advancing at full speed, her escape is certain; and the battery placed there solely for the purpose of stopping her has been merely money thrown away. The fourth requirement is one of the navy rather than of our own profession, but it is of equal public importance; and though there are many difficulties in this form of the problem, there is every reason to believe its solution to be quite practicable, and that it will some day be effected. It may be that a distinct form of instrument is required for each of these four cases, and for this reason I have kept them separate, as failure is often caused by an attempt to achieve a too comprehensive success. By considering each of these cases by itself and in detail, we may hope to hit upon some good means of attaining our particular object.

Among the most beautiful of the instruments hitherto produced for the purpose of measuring distances, may be mentioned the inventions of Cavallo; of Rochan; of Professor Piazzi Smyth, Astronomer Royal at Edinburgh; of Lieutenant-Colonel Clerk, of our own Regiment; and of M. Otto Struve, Astronomer Royal at St. Petersburg. None of these have yet been introduced into our service—"Certant, et adhuc sub judice lis est." I should, however, mention that M. Otto Struve's instrument was some years ago introduced into the Russian service, and is now in use at Cronstadt. Without now entering into the details of these inventions, I may remark that there is one fundamental principle upon which they all depend, and upon which all our efforts to estimate distance must be built, viz., that knowing the base of an isosceles (or of a right-angled) triangle, we can ascertain the height by measuring the vertical angle. We unconsciously put this principle into practice at every moment of the day,—the distance between the pupils of our eyes being the base of the triangle, of which the sides are the rays of light passing from any point of the object looked at to our two eyes. The old experiment of trying to snuff a candle with one eye shut, shows us that we cannot appreciate distance with one eye with the precision and promptness we can attain with both eyes open. When using one eye only, we are instinctively forced to reverse the mode of applying the principle, and to take as our base some known or supposed dimension of the object, and to estimate the angle formed by the rays of light, passing to the pupil of our one eye, from the two extremities of this distant base. It is in this reversed or one-eyed manner that the instruments of Cavallo and Rochan are constructed; the actual size of some distant object, such as the height of a man, is assumed as known, and the distance is estimated by noting the number of graduations which the object subtends on a micrometer in the eyepiece of a telescope. Now, we might possibly obtain satisfactory results from these instruments, if the enemy's army could be forced to pass a night in our own bed of Procrustes; but as men vary in size by as much as one-seventh of their height, and as their apparent height varies considerably by the different national and regimental forms of head-gear, thickness of boots, and other circumstances, it can easily be conceived that the error with these instruments may be very great, probably as much as one-tenth of the whole distance, or 176 yards in one mile, quite enough to make artillery practice very harmless.

A method of estimating distances without any special instrument, by the assumed size of an object (such as the average height of a man), has been lately proposed by J. M. de Tilly (Sous-lieutenant de l'Artillerie Belge), an account of which may be found in the *Revue de Technologie Militaire*, tome iii. He proposes to have upon the chase of a gun (see fig. 1) and near to the muzzle a foresight *a b* capable of sliding backwards and forwards parallel to the axis of the piece. The gun having been laid upon the bottom *p* of the object *p q*, while the foresight is in its position *a b* nearest to the breech, the foresight is moved towards the muzzle until its upper edge is just in line with the top *q* of the object; the space *a c'* over which the foresight has passed is noted, and the distance of the object calculated, or the distances may be graduated upon the chase of the gun. With reference to this method of estimating distances, we may observe that it has all the disadvantages of Cavallo's and Rochan's micrometers, with the additional objection of impeding the proper use of a gun at the very time when probably it is most needed. We may further remark that,

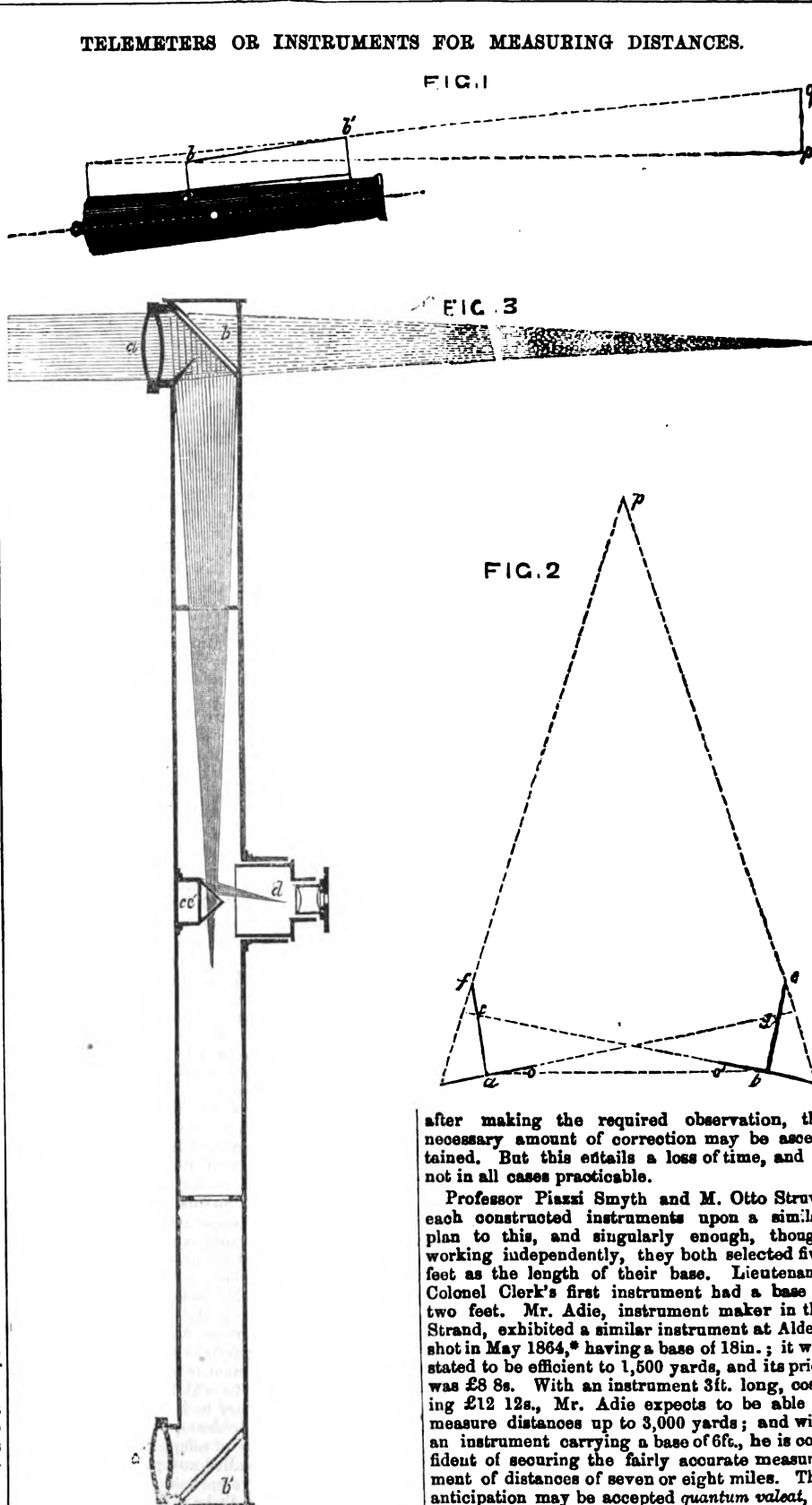
* This paper would have been read at the Royal Artillery Institution, Woolwich, but for the untimely death of the author, who was a Lieutenant in the Royal Artillery.

practically, this means cannot be used for distances over 1,200 metres, and that at that range the error may amount to as much as 89 metres. M. de Tilly also proposes a method of measuring distances by means of two guns and a measured base (see fig. 2). The two guns *a* and *b* are placed about twenty yards apart, the wheels covering each other; the right-hand gun is then laid upon the object with 10 deg. right deflection, the left-hand gun is laid upon the same object with 10 deg. left deflection; the exact distance *a* *b* between the tangent scales of the two guns is then measured with a tape or chain. Each gun is provided with a sliding foresight *c* and *d* similar to that above-mentioned; the tangent scale of each is also furnished with a horizontal arm *a* *o* and *b* *o* perpendicular to the axis of the gun. The foresights *c* and *d* are now moved until they are in the prolongation of these horizontal arms of the alternate guns, and the distances from the tangent scales to the foresights are measured, or they may be graduated upon the guns. From these data, viz.:—1st, the distance apart of the guns; 2nd, the angle of deflection at which they are laid; 3rd, the distances from the tangent scales to the sliding foresights—the distance of the object may be calculated, or a set of tables may be previously calculated of the distances corresponding to all possible values of the variables. The materials required to carry this theory into practice are, then: 1st, two guns, with special arms to the tangent scales, and a movable foresight to each; 2nd, a measuring tape or chain; 3rd, a set of intricate tabulated calculations; and, lastly, four men to take the observations and measure the base. With all this, the errors which may arise in such observations are threefold: 1, a possible error in the positions of the foresights; 2, in the measurement from gun to gun; and 3, in the laying of the guns; combining these together, M. de Tilly acknowledges that, in a distance of 1,500 metres, an error might occur of 117 metres, in a distance of 2,500 an error of 273 metres. This being the case, however much we may admire M. de Tilly's ingenuity, we cannot consider his suggestions to be of practical value.

The other instruments to which I alluded above, viz., those of Professor Piazzi Smyth, Lieutenant-Colonel Clerk, R.A., and of M. Otto Struve, are designed on the principle of binocular vision, consisting in fact of two telescopes, with which simultaneous observations are taken at the opposite extremities of a fixed base line. They differ from each other only in the details of their construction; the following is a brief description of Lieutenant-Colonel Clerk's instrument:—The rays of light from the object are (see fig. 3) intercepted at each extremity of a tube by an object glass, *a* and *a'*, whose focal length slightly exceeds the half-length of the instrument. The pencils of rays are reflected by mirrors, *b* and *b'*, along the tube to the centre, where they are again received by other reflectors, *c* and *c'*, so placed as to throw the two images into the focus *d* of a common eyepiece, so that they can be seen simultaneously by one observer. In the focus of the eyepiece are two vertical hairs, one fixed, the other movable by means of a micrometer screw, by which the interval between the two images can be measured with great delicacy. The distance of the object is estimated, as I have before stated, by the angle subtended at the object by the rays of light passing from any point in the object to the two object glasses of the instrument. This angle is obtained from the following equation:—

$$\text{Sine } \theta = \frac{\text{distance of movable hair from its position when instrument is set to infinity.}}{\text{focal length of object glass.}}$$

These instruments are exceedingly beautiful both in design and in construction; but they are of very delicate construction, and great care and nicety are required to obtain trustworthy observations; they can, therefore, only be put into the hands of an expert observer. For comparatively short distances they are exceedingly correct, distances of two and three hundred yards being measured to within a few inches, which is greater accuracy than is usually attained by ordinary chaining. Such instruments are therefore likely to be of great value in land surveying, and they have, I believe, been applied to that purpose in Russia. But it still remains to be decided whether observations depending on twice reflected images are to be relied on for the long ranges, and under the ordinary circum-



stances of military service. At great distances, the twice reflected images lose much of their sharpness of outline, and the two images being in very close proximity, if not overlapping each other, the greatest nicety is required to measure the interval between them. Strong light—not always attainable in our climate—is also indispensable, so much being lost in the double reflection. A very great source of error, against which it is difficult to guard, is any unequal expansion in the tube of this class of instrument from alteration in the temperature, or the direct influence of the sun; any amount of curvature, however minute, altering the angles of the mirrors and causing a very considerable error. If, however, an observation can be taken of some object at a known distance, either immediately before or immediately

after making the required observation, the necessary amount of correction may be ascertained. But this entails a loss of time, and is not in all cases practicable.

Professor Piazzi Smyth and M. Otto Struve each constructed instruments upon a similar plan to this, and singularly enough, though working independently, they both selected five feet as the length of their base. Lieutenant-Colonel Clerk's first instrument had a base of two feet. Mr. Adie, instrument maker in the Strand, exhibited a similar instrument at Aldershot in May 1864,* having a base of 18 in.; it was stated to be efficient to 1,500 yards, and its price was £8 8s. With an instrument 3 ft. long, costing £12 12s., Mr. Adie expects to be able to measure distances up to 3,000 yards; and with an instrument carrying a base of 6 ft., he is confident of securing the fairly accurate measurement of distances of seven or eight miles. This anticipation may be accepted *quantum valeat*, as it has not been established by experience, and certainly strikes one as chimerical. A very beautiful instrument of Lieutenant-Colonel Clerk's design, having a base of 73.6 in., is now under trial, and, therefore, until this as well as Mr. Adie's improvements have been fully tested, it may be considered premature to express any definite opinion concerning the utmost capabilities of this class of instruments.

(To be continued.)

* Professor Smyth's instrument was constructed in 1855, and Lieutenant-Colonel Clerk's in 1858; Mr. Adie patented his instrument on 10th February, 1860, and registered improvements on 4th March, 1863. Mr. Adie employs prisms for reflecting, instead of mirrors; and, in place of having hairs in the eyepiece, he has one of the object glasses in a movable frame, by which means the two images are made to coincide, and the angle of the object glass is then noted.

BRIDGE OVER THE SCHUYLKILL, PHILADELPHIA.

A BRIDGE is to be built over the Schuylkill River, at Chesnut-street, Philadelphia. It is designed for two arches of 185ft. span each, over the water-way, and two in the approaches upon each side of the river, with spans of 60ft. and 53ft. On the eastern side there is an additional arch over Twenty-fourth-street, the carriage-way of which is spanned by an arch of 26ft., with 8ft. 6in. rise, and a 7-foot semicircular arch over each footway. The shore spans are segmental arches with versed sines relatively of 18ft. and 16ft. The street arch is five-centred. The approach on the east, which is in part sustained by retaining walls, is 595ft. long, from the west line of Twenty-third-street, on the east, to the east abutment, measuring from abutment face, and on the west 547ft. long from the east line of Thirtieth (Bridge-water) street, to west abutment face. The pier is in the middle of the river, about 50ft. west of the channel, and stands about 5ft. in its length (73.57ft.) askew with the general direction of the river at that point, with a width of 16ft. at springing line. The distances between pier and abutments are 185ft., thus giving a total length to the structure, inclusive of approaches of 1,528ft. The main spans are intended to be segmental arches of cast iron, with a versed sine of 20ft., the ribs to have a depth of 4ft., with a sectional area of 147.5 square inches each, which, with six ribs, will give 885.0 square inches of resisting area to each span. The abutments are 42ft. 2in. on length of roadway, and 55ft. 2in. wide at springing line; with three horizontal cells in each, arched at both ends, the thickness of solid work at springing line on face being 16.5ft., and on back, from which the first stone arch springs, 8ft. The cells are each 7.5ft. wide, with piers 4.6ft. wide between.

The masonry in main abutments and pier, as well as the abutments and piers of approach arches, is faced with closely-cut granite, from the quarries of Fox Island, off the coast of Maine, near Rockland; it is laid with the Flemish bond (or alternate header and stretcher), with face "dabbled" and "drafted;" no stretcher has less than 3ft. bed and 6ft. length, no header less than 4ft. length with 3ft. face, the courses varying in thickness from 20in. to 2ft. The backing, which is from the Leipsville quarries, is generally laid with roughly-dressed beds and builds, in no case having a level surface across the work; this arrangement was also carried out upon the main pier and approach abutments.

MANCHESTER BOILER ASSOCIATION.

THE last ordinary monthly meeting of the Executive Committee of this Association was held at the offices, 41, Corporation-street, Manchester, on Tuesday, October 31st, 1865, when, the President, William Fairbairn, Esq., F.R.S., occupying the chair, Mr. L. E. Fletcher, chief engineer, presented his report, of which the following is an abstract:—During the last two months 550 engines have been examined, and 998 boilers, and 14 of the latter tested by hydraulic pressure. Of the boiler examinations, 746 have been external, 27 internal, and 225 entire. In the boilers examined, 282 defects have been discovered, 3 of those defects being dangerous. The following is a statement of defects, omissions, &c., met with in the boilers examined from August 26th, 1865, to October 27th, 1865, inclusive:—Furnaces out of shape, 19; fracture, 14; blistered plates, 6; internal corrosion, 14; external corrosion, 34; internal grooving, 6; external grooving, 6; feed apparatus out of order, 7; water gauges out of order, 29; blow-out apparatus out of order, 14; fusible plugs out of order, 12; safety valves out of order, 12; pressure gauges out of order, 25; boilers without glass water gauges, 8; boilers without safety valves, 6; boilers without blow-out apparatus, 5; boilers without feed back pressure valves, 63; cases of deficiency of water, 2. None of the defects given in the preceding statement call for special or immediate notice, so that the consideration of the explosions that have occurred since the issue of the last report may be at once entered upon.

On the present occasion I have to report the occurrence of six explosions, by which five persons have been killed, and six others injured. Not one of these explosions occurred to boilers under the inspection of this Association. I have visited the scene of catastrophe in three instances; and in the fourth have been favoured with

a careful report, accompanied with a sketch and photograph from an engineer residing near to the spot, and who made a personal examination a few days after the explosion occurred. Of the remaining two explosions I am not yet furnished with correct particulars, which it is generally very difficult to obtain, unless a personal examination is made, since the statements in ordinary reports are so thoroughly unreliable. The following is a statement of explosions from August 26th, 1865, to October 27th, 1865, inclusive:—No. 30 (Aug. 28), cylindrical, externally-fired, 2 persons injured; No. 31 (Sept. 8), ordinary double flue, or Lancashire, internally-fired, no person injured; No. 32 (Sept. 14), ordinary double flue, or Lancashire, internally-fired, 1 person killed, 2 injured; No. 33 (Sept. 26), steam tug boiler applied to stationary purposes, internally-fired, 1 person killed, 2 injured; No. 34 (Oct. 2), particulars not yet ascertained, 1 person killed; No. 35 (Oct. 16), particulars not yet ascertained, 2 persons killed. No. 30 explosion occurred at about a quarter before six o'clock on the evening of Monday, August 28th, at an ironworks. Fortunately no one was killed by this explosion, and though six persons were hurt, their injuries, except in two cases, were very slight. The boiler, which was not under the inspection of this Association, was of cylindrical construction, with elliptical ends and an internal return horseshoe-shaped flue. It was externally-fired, having a furnace underneath it at one end, the flames from which first passed beneath the bottom of the shell and then through the return horseshoe-shaped flue to the stack. It was 26ft. long, 10ft. in diameter, and made of plates 3.8ths of an inch in thickness, while the usual working pressure was 18lb. on the square inch. The boiler was rent into three pieces. One of these consisted of the front elliptical end, and was blown to a distance of about fifty yards. The second consisted of a ring section of the shell, four plates in width, which had rent longitudinally and opened out into a sheet, and was thrown to a distance of about fourteen yards; while the third comprised the remainder of the shell with the internal flue tube. This, although turned upside down, still lay on the original brickwork seating. With regard to the cause of the explosion. The primary rent took place at the bottom of the boiler over the fire, where some of the longitudinal seams had been repeatedly repaired, and ran in a line for four widths of plate. The principle of external firing, especially with boilers of so large a diameter as the one in question, is radically bad. The plates over the furnace are subjected not only to the impingement of the flames, but also to the disruptive strain caused by the pressure of the steam, the weight of the boiler, and the water within it, while any sediment the water may contain is sure to find its way to the bottom of the boiler, and too frequently to lodge immediately over the fire. This soon tells upon the seams of rivets. They begin to leak and have to be repaired. They leak again, and the repairs have to be repeated. Chipping and caulking seams of rivets by no means strengthens them, and even if new plates are put in it is seldom done with such care as not to strain or injure the old work, when, as in the present instance, in which repeated repairs had been effected, rupture ultimately takes place. In the externally-fired boiler, the pressure of the steam, which is internal, tends to open every flaw. In the furnace flue of the internally-fired boiler the pressure of the steam, which is external, tends to close every flaw, so that defects which would lead to explosion in the externally-fired boiler, would, in the internally-fired one, pass unnoticed, and without the slightest danger. This is by no means the first time that these facts have been called attention to in these reports. They have already led in several instances to externally-fired boilers being given up for internally-fired ones, and it will be well when this is as general a practice at ironworks and collieries as it is in mills.

THE "TURKISTAN"

THE construction of this formidable iron-clad frigate of war for the Turkish Government is about to be commenced. This vessel is intended to surpass in offensive and defensive powers, as well as in speed, all other iron-clad ships, not only including those already completed, but even those which, like the "Hercules," are little more, at present, than mere names. The new

Turkish frigate, which is to be named the "Turkistan," will not differ materially in size from several of the ironclads already existing in this country, her proposed dimensions being—365ft. long, 60ft. in breadth, mean draught of water 26ft., and 1,150 nominal and 6,000 indicated horse power. It is, however, in the character and arrangement of her armour and armament that she will be widely different from everything else afloat, rendering her, in this respect, the most formidable vessel of war yet seen. She has been designed by our Chief Constructor of the Navy, and will embody all the improvements suggested during the construction of the latest of the iron frigates composing our iron-clad squadron. The "Turkistan" will be protected from stem to stern at the water-line, and over a battery containing sixteen of the largest guns in each broadside, the armour-plates everywhere being 8in. in thickness, in addition to which the skin of the ship will be double throughout, as is the case with the "Bellerophon." Two of the protected 300-pounder or other larger broadside guns will, at the same time, be placed at a height of about 20ft. above the water, and will thus have a range of fire all round the bow and stern, so that guns of the most powerful kind may be brought to bear upon the enemy in all directions and in all weathers. The engines of the frigate are to work up to a great power, in order to produce a speed in excess of that of the fastest iron-clad ships.

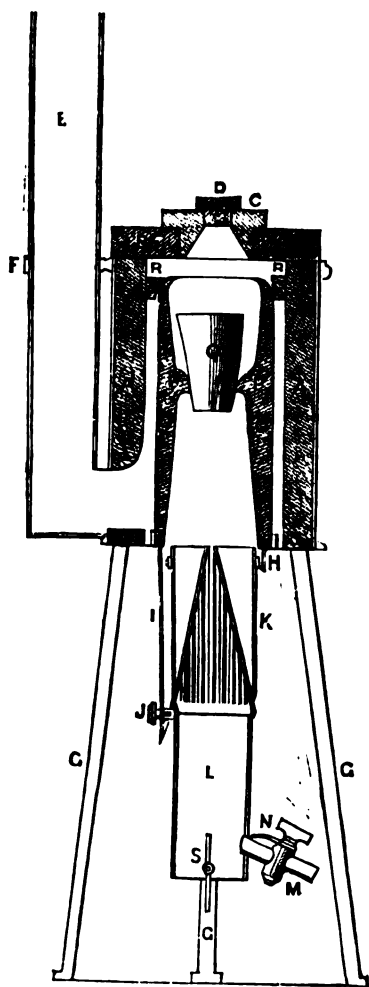
THE IRON PRODUCE OF FRANCE.

FRANCE produces more than 2,000,000,000 kilogrammes of wrought and cast iron annually. This amount, however, is less than her consumption, and she is under the necessity of supplying the deficiency by importations from foreign countries. The quantity of foreign metal imported last year amounted to 40,000,000 kilogrammes, and the quantity will be much more considerable this year, inasmuch as the imports for the first eight months of 1865 amount to 56,000,000 kilogrammes. The Paris correspondent of the *Times* observes that French manufacturers could not, consequently, compete with foreigners were it not for a law enacted during the present reign, by which foreign iron may be imported free of duty on condition that it be re-exported in a manufactured state within a certain period. The articles so re-exported between the 1st of January and 31st of August, 1865, amount to 95,000,000 kilogrammes, and it is probable that by the end of the year the foreign iron re-exported in the shape of machinery will amount to 150,000,000 kilogrammes, or double the quantity re-exported in the year 1863. It is estimated that the wages paid to operatives employed in the manufacture of machinery exported that year, added to the profit realised by the manufacturer, amounts to 98,000,000f., and it is expected that it will amount this year to 200,000,000f. It is this law which enables French manufacturers to execute the large orders they receive from foreign countries. For example, the machinery for two screw steamboats is at present being manufactured in Paris for Russia, and a machine of 2,400-horse power is being prepared at Havre for the same destination. A manufacturer at Nantes is completing a fleet of lighters; a Paris manufacturer a number of dredging machines for Egypt; and a house at Bordeaux is just finishing an iron ship for the King of Prussia, together with the plated frigate "Ancona" for the King of Italy. A war corvette, to be called the "Palestro," has just been launched at La Seyne, near Toulon, where she was built on account of the Italian Government. The same company built three iron-cased gunboats for the Ottoman Government, and has orders on hand for two iron-plated gun brigs and a corvette of 250-horse power for the Emperor of Brazil, two iron-plated corvettes of 300-horse power for Italy, three iron-plated batteries for Turkey, and a variety of machinery for the Isthmus of Suez. France is likewise indebted to her neighbours for coal. The quantity imported during the first eight months of the year 1863 was 34,000,000 quintals, which rose to 37,000,000 during the first eight months of the present year.

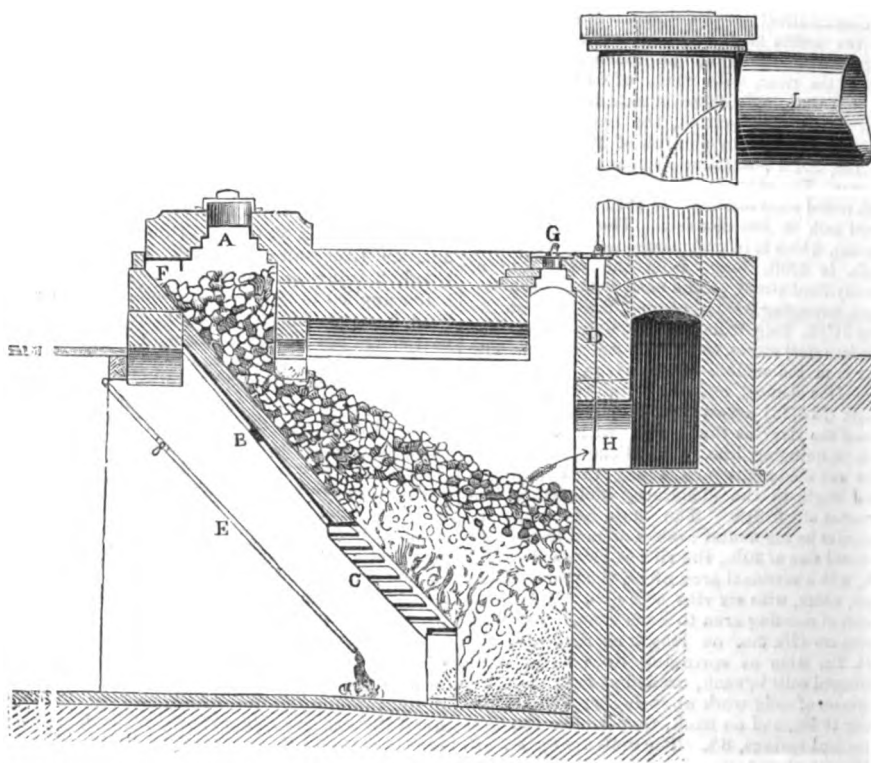
The diminution of the magnetic dip has been going on in London for the last half century with great regularity at the rate of about three minutes annually.

CANTOR LECTURES.

GORE'S FURNACE—FIG. 1.



SIEMENS'S FURNACE—FIG. 2.

ON THE DISCOVERIES IN CHEMISTRY
APPLIED TO ARTS AND MANUFACTURES.*

BY DR. F. CRACE CALVERT, F.R.S., F.C.S.

LECTURE II.

ONE of the most curious and important applications which have lately been made of chemistry to manufactures is that of coal gas as a means of obtaining intense heats. In fact, heats have been secured which far exceed those previously obtained by the combustion of coals and other carbonaceous matters. To understand how this result has been effected, it is necessary that I should say a few words on the combustion of coal gas. When coal gas is ignited, the oxygen of the atmosphere first combines with the hydrogen of the hydrocarbons, either gaseous or sufficiently volatile to assume a gaseous form, so as to produce water. Whilst a part of the carbon of these hydrocarbons combines with the oxygen to produce carbonic acid, the other portions of carbon float in the mass of ignited gaseous matters, and reach a sufficient temperature to radiate light in all directions. It follows, therefore, that the richer the coal gas is in hydrocarbons, into the composition of which enters a large proportion of carbon, the more brilliant will be the flame. This is beautifully illustrated by an invention which I have the pleasure of showing you through the kindness of the Rev. Mr. Bowditch, of Huddersfield, who has lent me one of the apparatuses which he has lately invented to increase the illuminating power of inferior coal gas, and which has been applied with success in the city of London by its learned officer of health, Dr. Letheby. It consists in the introduction of carburetted hydrogen, rich in carbon, into the flame of ordinary coal gas, thus enhancing in a marked degree its illuminating power. This apparatus consists of:—A gas-tight metallic vessel, which holds the hydrocarbons, and which has an inlet connected with a gas supply and an outlet connected with the burner. The gas in its course passes over the surface of the hydrocarbons. Being above the flame, the vessel and its contents become

heated, and part of the latter is converted into vapour, which the passing gas carries with it to the burners to enrich the flame.

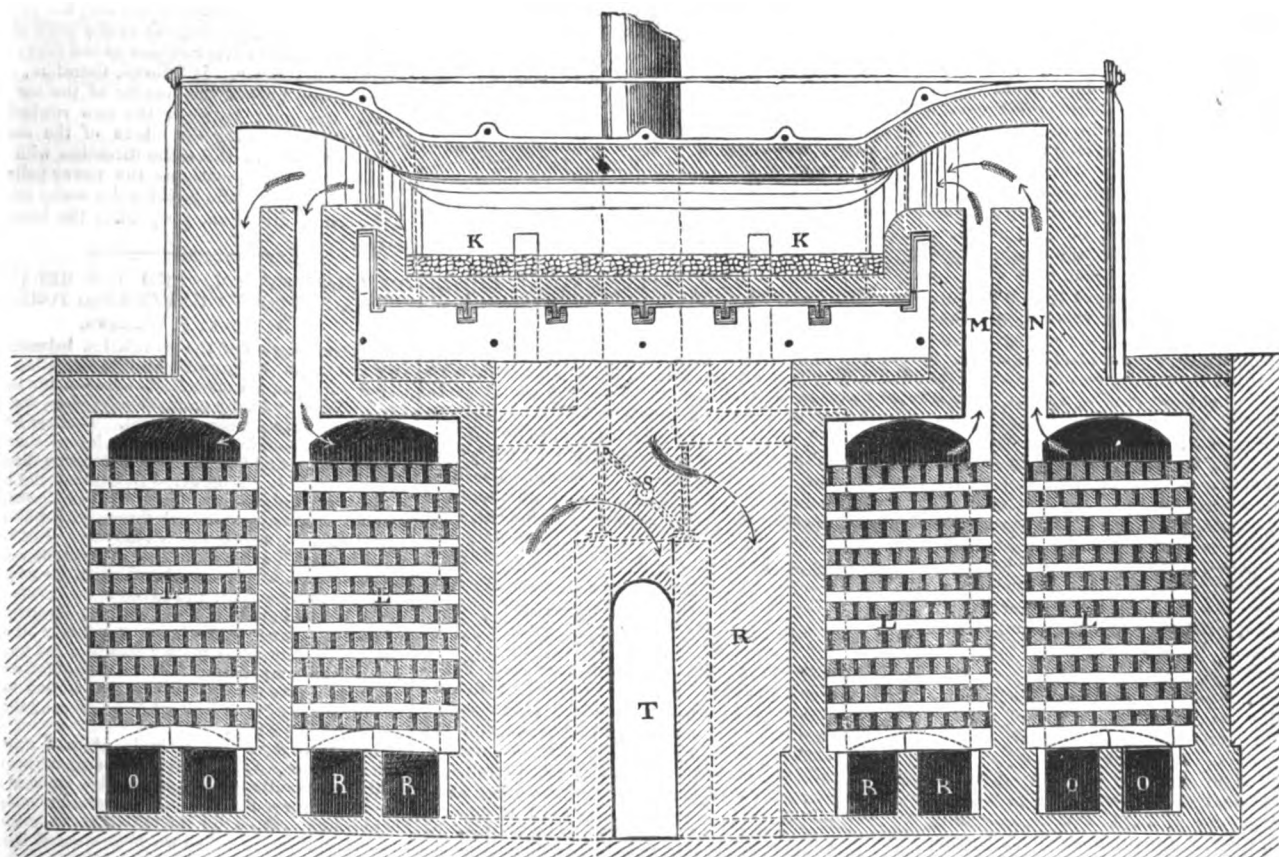
The following are the advantages which Mr. Bowditch's apparatus presents:—Common coal gas, Ashburton flat flame, fish-tail, and batwing, does not yield a light of 1·5 standard sperm candles per foot, though it yields the light of 2·4 candles per foot when burnt in a 15-hole argand with a 7in. chimney. By adding 31·5 grains of naphthalin vapour to each foot of this gas the light-giving value is raised to between seven and eight candles per foot, according to the constitution of the gas with which the vapour is burnt. Oils do not yield quite so high a result as naphthalin, but they afford from 4·5 to 5 times the light given by gas alone. To show the economy of gas, I may cite the following results, given to me by Mr. Bowditch:—A gallon of oil, sold retail for 2s., is capable of producing, with 1,000ft. of London gas, more light than is given by 4,000ft. of gas, or 4s. 6d. gas and 2s. oil against 18s. gas alone. The hydrocarbon vessel requires charging about once in fourteen to sixteen days.

But let us now return to the production of intense heat by the combustion of coal gas. This is effected by burning gas with an excess of air, generally speaking, under pressure, so as to bring into contact in a given space of time a large quantity of gases, especially an excess of oxygen, with a view of rendering perfect combustion of coal gas. The first instance, to my knowledge, of the perfect combustion of coal gas as a commercial application, was its use in machines for singeing cotton and woollen fabrics, or for the purpose of removing from their surface all loose and useless fibres. One of the most perfect machines which I have yet examined for accomplishing this purpose has been lately introduced to the notice of manufacturers by Joshua Schofield and Sons, of Manchester. The great merit of their machine consists in the fact that by it they can vary either the intensity of the flame or its length according to the pressure at which the gases in combustion are made to issue from the machine. In fact, they can adapt with such nicety the action of the machine to the nature of the fabrics they have to singe, that it can be applied to the finest fabric, such as cambrics, and to some of the heaviest materials in cotton, such as fustian. The most remarkable example of the intense heat which can be obtained by the combustion of gases was brought into notice a few years since by that distinguished chemist, M. H. St. Clair-Deville (the discoverer of aluminium), by which he succeeded not only in melting several metals which, until his experiments, had resisted all other modes of effecting their fusion, but in melting in his laboratory

as much as 25lb. of platinum, one of the most refractory metals known, and running it into one solid ingot. In 1862, the well-known metallurgists, Messrs. Johnson and Matthey, invited to their works a large circle of the most scientific men of Europe, who were attending the Exhibition as jurors, to witness the fusion of 220lb. of platinum, and the running of it into one single solid ingot. This wonderful exploit in the production of heat was effected in a furnace similar in principle to that which had been devised by M. St. Clair-Deville, viz., in a furnace, the inner part of which was lined with blocks of quicklime, the only material found by M. Deville to be susceptible of resisting the intense heat which was produced by bringing at the upper part of the furnace a large jet of gas and air intimately mixed, and working under pressure. The flame, in passing from the upper part of the furnace and making its exit at the lower part, produced so great a heat as to melt the above stated quantity of platinum. The observations of M. Deville soon brought into existence some extremely simple and handy furnaces to effect fusions and assays on a laboratory scale. Some of the best furnaces contrived for that purpose are due to Mr. J. J. Griffin, of Bunhill-row. The principal feature of his furnace is using as a generator for heat a large Bunsen burner, which consists of a hollow tube, at the bottom of which there is an inlet for coal gas, and at a certain height in the tube a number of openings through which the air rushes in to mingle with the gas; both air and gas issue at the top of the tube, and when ignited produce an intense heat. The flame so produced is made to play round a crucible containing the materials to be assayed, and which itself is surrounded by thick earthenware tiles, preventing the heat passing through the furnace from radiating itself in all directions, thus concentrating its action entirely on the little crucible placed in the centre. But the most perfect contrivance of the sort which has yet been brought to the notice of the public is one due to Mr. G. Gore, F.R.S. The following is the description of Mr. Gore's gas furnace:—A is a cylinder of fireclay, about 9in. high and 6in. diameter, open at both ends, and with a hole at the back part near the bottom, to lead into the chimney; it is covered by a movable plate of fireclay B, with a hole in its centre for the introduction of the crucible or of substance to be melted; this hole is closed by a perforated plug of fireclay C, for access to the contents of the crucible; and that again is closed by another stopper of fireclay D. E is a chimney of sheet iron, about 5ft. or 6ft. high, kept upright by a ring of iron F, attached to the top of the furnace. The fireclay cylinder is enclosed in a sheet-iron casing with a bottom of

* Delivered before the Society of Arts.

CANTOR LECTURES.
SIEMENS'S HEATING FURNACE—FIG. 3.



iron, to which are fixed three iron legs G. An iron tube H, with a prolongation I, supports by means of the screw J, the burner K, and its tube L, which is open at both ends. Gas is supplied to the burner by means of the tap M, which has a small index N attached to it for assistance in adjusting the gas. Inside the largest cylinder is another fireclay cylinder or cupola O, with open ends, and with three projections of fireclay P for supporting the crucible Q; it is kept steady by means of three clay wedges; R S is an air-valve for closing the bottom of the tube L. The gas burner is a thin metal cylinder, deeply corrugated at its upper end, with the corrugations diminishing to nothing at its lower end, as shown in the engravings. The action of this furnace is as follows:—Gas is admitted to the open tube L by the tap M; it there mixes with air to form a nearly combustible mixture, which ascends through the burner, and burns in the clay cylinder O, being supplied with the remainder of air necessary to combustion through the tube H to the outer surface of the flame by means of the spaces between the corrugations. The flame and products of combustion pass up through the cylinder O, and then downwards outside of it to the chimney, the point of greatest heat being at Q. Mr. Gore states that one of his smallest furnaces, consuming 83ft. of coal gas per hour, is capable of melting 80z. of copper and 60z. of cast iron; that the next sized furnace, consuming about twice the quantity of gas, will melt 400z. of copper.

But the most important improvement which has been effected of late years in the production of intense heat by the combustion of the gases generated through the distillation of inferior coals, is that of Mr. C. W. Siemens, F.R.S., of Great George-street. The benefits which are conferred on manufacturers and the public by the furnaces devised by Mr. Siemens cannot be overrated. They are not only economical in their use, but as they enable the manufacturer to use an inferior class of fuel to generate the heat required, they must undeniably be of great advantage; and to the public in general they will be a great boon, as they do away with the nuisance attached to all manufacturing districts, in the dark black smoke escaping from chimneys, polluting the atmosphere and rendering it so disagreeable to those who are compelled by their occupations to live within reach of its influence. Mr. Siemens's furnaces, I am happy to say, are not in a state of mere experiment, but they have received the sanction of a great number of manu-

facturers, and especially of those who little expected that the necessary heat for their operations could be obtained without interfering with their manufacture, in the carrying out of which they thought the production of smoke could not be prevented. Thus we find Mr. Siemens's furnaces employed with great success and economy in glass works, in potteries, and in iron forges, works which used to be a nuisance to their neighbours, by the large volumes of black smoke which they were constantly emitting from their chimneys. Before describing Mr. Siemens's furnace, it is necessary that I should state that, in the ordinary furnaces, only about 25 per cent. of the heating power of the fuel is rendered available in carrying out the manufacturing operations. This is due to imperfect combustion, and to the fact that only the heat of combustion exceeding that of the body treated is utilised; the remainder of the heat, in many instances, by far the greater proportion of the whole, being allowed to escape uselessly up the chimney. I shall now give a description of one of Mr. Siemens's furnaces. The gas producer and furnace are quite distinct, and may be placed at any convenient distance from each other. The gas producer is shown in fig. 3. The fuel is supplied at intervals of about two hours through the covered openings A, and descends gradually on the inclined plane B, which is set at an inclination to suit the kind of fuel used. The upper portion of the incline B is made solid, being formed of iron plates covered with firebrick, but the lower portion C is an open grate formed of horizontal flat steps. The opening under the lower step is made larger than the others, to enable clinkers to be withdrawn. The small stoppered holes F F at the front and G G at the top of the producer are provided to allow of putting in an iron bar occasionally to break up the mass of fuel and detach clinkers from the side walls. Each producer is capable of converting daily about two tons of fuel into a combustible gas, which passes off through the opening H into the main gas flue leading to the furnaces.

The action of the gas producer in working is as follows:—The fuel descending slowly on the incline plane B becomes heated and parts with its volatile constituents, the hydrocarbon gases, water, ammonia, and a small proportion of carbonic acid, which are the same as would be evolved from it in a gas retort. There now remains from 60 to 70 per cent. of purely carbonaceous matter to be disposed of, which is accomplished by the current of air slowly entering through the grate C, producing regular com-

bustion immediately upon the grate; but the carbonic acid (an incombustible gas) thus produced having to pass slowly through a layer of incandescent fuel from two to three feet thick, takes up another equivalent of carbon, and is thus transformed into carbonic oxide (an inflammable gas), which passes off with the other combustible gases to the furnaces. For every cubic foot of carbonic oxide thus produced, taking the atmosphere to consist of one-fifth part by volume of oxygen and four-fifths of nitrogen, two cubic feet of incombustible nitrogen pass also through the grate, tending greatly to diminish the richness or heating power of the gas. Not all the carbonaceous portion of the fuel is, however, volatilised on such disadvantageous terms; for water is brought to the foot of the grate by the pipe E, which, absorbing the spare heat from the fire, is converted into steam, and each cubic foot of steam in traversing the layer of fuel from two to three feet of incandescent fuel, is decomposed into a mixture consisting of one cubic foot of hydrogen, and nearly an equal volume of carbonic oxide, with a variable small proportion of carbonic acid. Thus one cubic foot of steam yields as much inflammable gas as five cubic feet of atmospheric air; but the one operation is dependent upon the other, inasmuch as the passage of air through the fire is attended with the generation of heat, whereas the production of the water gases, as well as the evolution of the hydrocarbons, is carried on at the expense of heat. The generation of steam from the water, being dependent on the amount of heat in the fire, regulates itself naturally to the requirements; and the total production of combustible gases varies with the admission of air, and since the admission of air into the grate depends in its turn upon the withdrawal of the gases evolved in the producer, the production of the combustible gases is entirely regulated by the demand for them.

The gas made in these producers has been frequently carefully analysed, and the average constituents of one hundred parts have been found as follows:—

Carbonic acid.....	4.1
Oxygen	0.4
Carbonic oxide	23.7
Carburetted hydrogen.....	2.2
Hydrogen	8.0
Nitrogen.....	61.5

99.9

The furnaces are applicable for all purposes where intense heat is required, such as for glass

houses, puddling, heating iron and steel, iron melting for foundry purposes, steel melting, muffles, and copper smelting. In all applications the furnaces are of the same construction in principle, the arrangements only varying with the different operations to be carried on in the heating chamber. The heating furnace has been selected for illustration in fig. 3. Underneath the heating chamber K, are placed transversely the four regenerators L L L L, which are chambers filled with firebricks built up with spaces between them. The regenerators work in pairs, the two under the right-hand end of the furnace communicating with that end of the heating chamber, while the other two communicate with the opposite end. The gas passes from the main gas flue through the reversing valve S into the flues R R, at the bottom of one of the regenerators L, up through which it passes to the port M. Air is also admitted through a reversing valve at the back of S (not shown in the figure), thence into the flues O O, up through the second regenerator L, to the port N, where it meets with the gas, mingles with it, and produces an intense and uniform flame, which distributes itself all over the heating chamber K. The products of combustion, together with the excess or waste heat of the furnace, instead of being passed, as in ordinary furnaces, up the stack, and either entirely thrown away or only partially utilised, are carried down into the other pair of regenerators, where they are deprived of their heat, and thence proceed through the reversing valves to the chimney by the flue T.

When one pair of regenerators has become considerably heated by the passage of the hot products of combustion for some time, and the opposite pair correspondingly cooled by the upward passage of the cold gas and air, the valves are reversed, and the currents of gas and air then pass upwards through the regenerators last heated, whereas the products of combustion pass through those opposite. The process of reversing is repeated at fixed intervals, generally every half-hour, so that two of the regenerators are always being cooled by the gas and air taking up the deposited heat and carrying it back to the furnace, and two always being heated by the passage of the hot products of combustion passing down to the chimney and depositing their heat on their way there. The flame in the heating chamber is uniform throughout, and perfectly free from all extraneous matter. Its chemical nature is also perfectly under command by means of gas and air regulating valves (not shown in the engravings), so that the most delicate operations can be carried on with great uniformity. The gas and air reach the heating chamber (after passing through the regenerators) at nearly the heat of that chamber itself, and in burning, in addition to the temperature due to their mutual chemical action, is added that they have taken up in passing through the regenerators, so that an intensity of heat is obtained, which, unless moderated on purpose, would fuse furnace and all exposed to its action. The products of combustion are so completely deprived of the heat they brought out of the heating chamber K, by passing among the regenerator bricks, that the heat in the chimney-flue is seldom sufficient to singe wood; the economy is therefore due to the fact that little or no heat is thrown away up the chimney, as in the ordinary furnaces, and also to the perfect combustion of the fuel, which is evidenced by the total absence of smoke from the stack; whereas in the common furnaces the combustion is so imperfect that clouds of powdered carbon, in the form of smoke, envelope all manufacturing towns, and gases are allowed to escape with two-thirds of their heating power undeveloped. The saving of fuel in these furnaces, as compared to the ordinary kind, ranges between 40 and 60 per cent. in weight, according to the fuel used. In many instances an additional saving can be made in the cost of the fuel by using inferior qualities, such as coal and coke dust, lignite, and peat. The intensity of the heat, purity of the flame, and the absence of cutting draughts in the heating chamber, is of great advantage for all metallurgical operations, tending greatly to improve the quality of the produce, and occasioning a saving of about 5 per cent. in the waste of the metal treated in puddling and iron re-heating furnaces, &c. The peculiarities and advantages of these furnaces are, that gas fuel alone is employed, that perfect and entire combustion is obtained, and that the heat, which is usually allowed to escape up the chimney, is here stored up to be afterwards brought back to the furnaces.

Whilst on the question of the combustion of coals and of smoke, allow me to draw your attention to a clever invention by Mr. Snook, of Manchester, which he calls an "Invigorator." The invention may briefly be described as an apparatus placed within the semicircle forming the upper portion of an ordinary register firegrate, formed entirely of cast iron, and so constructed as to be readily applied to all existing grates known as of the register form. In experiments which have been made, it has been proved that after lighting the fire (the whole of the apparatus being closed so as to act as a blower), a brisk bright fire is produced in about four minutes. A large concave elliptical plate immediately over the grate bars, suspended on end pivots, is tilted over to an angle of about 70 deg., when it is seen that the back or concave portion of the plate acts as a bright reflector, throwing out the heat rays into the room, instead of allowing them to pass up the chimney. Two horizontal plate doors, or louvres, above the reflector, are next opened, when the draught is found to be reduced to the smallest amount compatible with the continuance of combustion in the grate. The heat thrown out from the fire is considerable, and the fire itself forms a pleasant object to look at, having a warm red glow, without either flame or smoke proceeding from it.

(To be continued.)

LUNAR PHOTOGRAPHS.

At a recent meeting of the Literary and Philosophical Society, Mr. A. Brothers, F.R.A.S., exhibited an interesting series of photographs, taken during the eclipse of the moon, on the evening of Wednesday, October 4th. Commencing at 8.45, when the moon was nearly full, the negatives, twenty in number, were taken at intervals of about twelve minutes until 12.45, and they show the progress of the eclipse throughout. The effect of the penumbral shadow of the earth is distinctly visible on the negative taken at 9.15, and also on the one taken at 12.32. An attempt was made during the middle of the eclipse to obtain the photographic image of the entire surface of the moon; but it was found that the portion covered by the earth's shadow had no effect on the plate after an exposure of fifteen seconds, although distinctly visible in the telescope. It was noticed that the southern limb of the moon showed the copper-coloured tint often seen during total lunar eclipses, and to this cause may be attributed the non-actinic effect on the sensitized plate. An exposure of about one or two tenths of a second gave the fully illuminated surface of the moon perfectly, but the parts covered by the penumbra were not defined, while an exposure of three seconds gave the outline of the earth's shadow with great distinctness, and an exposure of two seconds brought out some of the detail within the penumbra. Some of the negatives were obtained almost instantaneously. The telescope with which these pictures of the moon were taken is an equatorial of 5 in. aperture and 6 ft. focal length, driven by clockwork. This telescope gives the image of the moon about 11.16ths of an inch in diameter, but by using a Barlow's lens this size is increased to 1 1/4 in., and with this addition the eighteenth negative of the series was obtained in two seconds.

PROPELLING BOATS.

By means of an invention which has been patented by Mr. John Macintosh, of North Bank, Regent's Park, and Mr. A. H. Thurgar, of Surrey-place, Norwich, the necessity of looking back to observe the direction of a boat is obviated. This invention consists, firstly, in using two rowlocks or fulcrums on each side of the boat; secondly, in using jointed oars, the joints of which work between the said rowlocks or fulcrums, so that in pulling the handles of the oars towards the stern of the boat the blades of the oars will be forced through the water in the same direction as the handles, thereby obviating the necessity of the rower or rowers turning round; thirdly, the oars are each made in two parts, and in connecting them together each flange of the joints or hinges is fastened securely to each part of the oar, and united together by a centre pin, thereby forming a hinge. The rowlocks are attached to the gunwale of the boat, the outer one projecting (about six inches) from the inner one, and the joint of the oar or scull working at about the centre between the two rowlocks. The novelty of the invention thus lies in the use of two rowlocks to

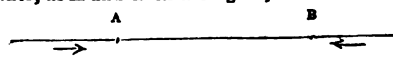
the oar instead of one, as in the old system. The oar being jointed, the inner rowlock serves as the fulcrum to the handle of the oar, the joint of the oar between the rowlocks as the point of opposition, and the outer rowlock as the fulcrum to the blade of the oar. It follows, therefore, that, as the rower pushes the handle of the oar forwards, the joint between the two rowlocks is thrown back, causing the blade of the oar to move forwards in the same direction with the handle, and consequently as the rower pulls the handle back, the blade striking the water returns in the same direction, propelling the boat forwards.

ON GRAVITATION, AND ITS RELATION TO A SUPPOSED UNIVERSAL FORCE.*

BY HENRY F. WALLING.

THE determination of the co-relation between gravity and the other known physical forces has been the object of numerous delicate experiments and investigations by many eminent physicists, but this object has not yet been attained. There is besides an apparent conflict between the law of conservation of forces and the inherent attraction theory of gravitation. It has occurred to me that the latter difficulty may be overcome by the simple supposition of a primary universal force, with which the co-relation of the other forces may hereafter be established. This universal force may be supposed to fill all space, either associated with the universal ether, or independent, and to be exerted along every possible line in both of its directions, forming rays of force passing through every point in all directions. Inert or gross matter will be acted upon by it, and the composition of all the rays of force which act upon a given body will impart motion to it in the direction of the resultant force, passing through its centre of gravity.

Let us now suppose a single atom of matter to exist in space. We shall readily perceive that there will be no resultant force, since the atom is acted upon in every direction alike, each impinging ray being counteracted by its opposite ray, producing an equilibrium, in which we may suppose the force of each impinging ray to be decomposed or developed from the atom by its counteracting ray, so that the general store of force remains unchanged. But let there be two atoms at a given distance from each other, as A and B in the figure, which we will sup-



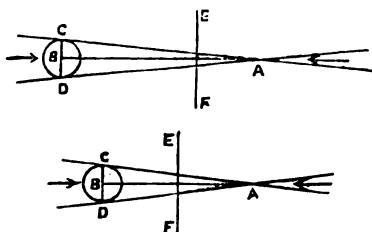
pose to be indefinitely small, so that only one line of force rays may be considered as passing through the two atoms. This line will be occupied by two forces in opposite directions, as represented by the arrows. It will be seen that each atom intercepts the ray which passes through it before reaching the other, and thus a portion of the counteracting power of the ray is removed, so that an equivalent resultant force acts upon each atom in the direction of the other. This action continues during each successive instant, producing uniformly accelerated motions of both atoms towards each other. Let us suppose one of the atoms A to be doubled in quantity of inertia, B remaining as before; then the gravitating force of each towards the other will be doubled, for A having twice the combining capacity it had before, and being otherwise under similar conditions, will absorb twice as much force, and B having a double amount of counteracting force removed, will also combine with twice as much force as before, during each successive instant of time, so that B will pass over twice the distance that A does in the same time, each having a uniformly accelerated motion towards the other.

We may consider the entire amount of force traversing any given line to be infinite, and it follows that the successive abstractions of definite amounts from it will not appreciably diminish its proportions to finite quantities. Any number of atoms, therefore, possessing equal quantities of inertia, placed along a given line, and having equal amounts of counteracting force removed, will virtually combine with equal amounts of force from the same ray in equal times. It evidently follows that any two bodies of matter placed at a given distance from each other, and acted upon by a given number of parallel force rays in the two opposite directions, will, during each successive moment, acquire equal amounts of force impelling them toward each other, proportional to the products of the units of inertia of the two bodies, the square of the velocity of each at any given instant being proportional to the mass of the other.

The proportion of the inverse squares of the distances readily follows, when we consider the relations of one body to each of the several atoms of the other. The rays which act upon the body in the direction of the atom, form a pencil centering at the atom, and the counteracting rays form another equal pencil from the same centre in the opposite direction. The aggregate quantity of power produced by each pencil at different distances will be

* From the American Journal of Science and Arts.

proportional to the area of a figure which the rays passing through a given section of the body, cutting its centre of gravity, will project upon a plane at a fixed distance from the atom, and parallel to the given section. This may be seen by inspecting the figures, in which A represents the atom, B the



body, C D the given section of B, and E F the parallel plane, at a fixed distance from A. The area of the projected figure upon E F will of course be in inverse proportion to the square of the distance A B, and since the same proportion holds between either body and each several atom of the other, it holds good between the two bodies referred to their centres of gravity.

A growing dislike to the doctrine of inherent attraction has existed since the days of Newton, who shared the feeling, as may be seen in the following quotation made by Faraday in connection with some recent remarks of his own, showing the want of harmony between this doctrine and the conservation theory. "That gravity should be innate, inherent, and essential to matter, so that one body may act upon another at a distance, through a vacuum, without the mediation of anything else, by and through which their action and force may be conveyed from one to another, is to me so great an absurdity that I believe no man who has in philosophical matters a competent faculty of thinking can ever fall into it. Gravity must be caused by an agent, acting constantly according to certain laws; but whether this agent be material or immaterial I have left to the consideration of my reader." The idea of an inherent power of matter enabling it to pull distant and disconnected matter towards it, seems somewhat analogous to the old idea of an inherent suction power in the piston of a pump, by which it was supposed to raise the water below it.

The apparent annihilation of power in the equilibrium of forces in a statical condition, and the deficiency in the total power of a resultant force, made up of forces in different directions compounded, may be accounted for by supposing the eliminated forces to be mutually decomposed from the body acted upon, and added to the general store of universal force. This takes place during each successive instant of the time in which the opposing forces continue to act. When an entire or partial removal of a given number of counteracting or modifying forces takes place, a force which would exactly counteract the resultant of the removed forces is converted from "potential" into "actual energy," and produces corresponding motion. The changes in the velocity and consequent power of motion of the heavenly bodies are therefore due to the variable amounts of force alternately drawn from, and restored to, the great reservoir of universal force.

The constant mutual transmission of the radiant forces, including light, radiant heat, &c., which apparently takes place from the surface of all bodies, across vacant spaces, or through transparent or diathermanous mediums, can perhaps be explained by supposing the universal force rays to be modified by the molecular actions going on within the bodies, which produce vibrations of such a nature, that at the surface of the bodies small accounts of counter-acting force are alternately added to, and then partially withdrawn from, the universal force rays, in minutely brief periods of time, endowing the developed or decomposed rays with the power of impressing vibrations upon the surface atoms of any matter which they may encounter, by determining the resultant force which will take effect upon them. These vibrations are equal in duration and intensity to those by which they are generated, though perhaps opposite in direction, and result in an augmentation of the centrifugal or expansive motions of the atoms, which is communicable from atom to atom and convertible into "modes of motion." The differences in the constituent parts of rays of light and heat, developed by decomposition, polarisation, &c., and due to differences in the duration, direction, &c., of the generating vibrations, are thus transmitted and reproduced with rigorous integrity, being equal in duration, direction, and intensity to the generating vibrations, and in quantity or aggregate effect, inversely proportional to the squares of the distances.

The gold coinage of Great Britain, France, and the United States, amounted in 1843 to £4,200,000, and in 1853 it was £41,800,000, or nearly tenfold as large.

Meetings for the Week.

MON.—Society of Engineers, Exeter Hall.—"Locomotive Adhesion, and certain expedients for increasing that Function," by Mr. Vaughan Pendered, 7.
WED.—Geological Society, 8.
FRI.—Architectural Association.—"Heraldry in Association with Architecture," by Rev. O. Boutell, 7.30.

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. E. A. Brooman, of 166, Fleet-street, E.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 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.—C. A. T.—M. M.—P. le N. F.—J. W.—H. B.—J. P.—T. B.—W. H. H.—R. G. W.—R. T.—Capt. N.—F. G. P.—J. H.
MAJOR PALLISER.—Your letter was received too late for insertion this week, but will appear in our next.

Miscellaneous.

Another Atlantic cable buoy has been sighted. On the afternoon of the 19th of October, and when in lat. 42 deg. N., and lon. 40 deg. W., the "Mexican" passed a large and brightly-painted buoy, with a flagstaff attached, together with a long cable. The flag at the end of the staff had been blown away, but the buoy, notwithstanding a heavy sea, appeared stationary. There can be no doubt whatever that the buoy passed by the "Mexican" is one of those placed in the ocean by the "Great Eastern" after her unsuccessful attempt to lay the Atlantic telegraph cable, and to mark the point of its separation from the big ship.

The City Corporation is going to work in earnest in reference to the gas monopoly. The Court of Common Council have agreed to a resolution, the effect of which is that all necessary steps shall be taken by the Corporation to enable them to bring in a bill in the next session of Parliament to authorise them to erect works and manufacture gas in the City. There is hope yet then for good gas at a moderate price.

It may interest intending exhibitors at the Paris Exhibition to know that the Emperor and Empress announce their intention to reserve to themselves the right of selecting their own purchases, and will not feel themselves obliged to buy any article it may have struck the maker's fancy to mark with their cypher, unless their previous permission has been obtained. This notification has been called forth by the fact that by this artful dodge at the last Universal Exhibition their Majesties were literally entrapped into paying for a host of things they neither admired nor knew how to dispose of.

Mr. Huggins states that from spectrum observations he has made he is led to believe that the stars closely resemble the sun, and that the source of their light is probably solid matter in a highly incandescent state.

The last novelty in the way of india-rubber manufacture dates from New Brunswick where, according to the *Athenaeum*, the authorities offered a bounty of three dollars for the snout of every bear killed within the colony. A large number of snouts were recently brought in, chiefly by Indians; but in course of time it was discovered that most of the trophies were imitations only, cunningly manufactured of india-rubber and gutta-percha, by clever manipulators in the State of Maine, who sold them to the Indians at half a dollar each. The profit on the trick was handsome, but as the Blue Noses (New Brunswickers) have long boasted that they could not be outwitted, the snout manufacturers are perhaps enjoying a satisfaction beyond that of mere pecuniary gain.

One good Havana cigar is found by Dr. Richardson to yield, when its smoke is condensed, a sufficient amount of poisonous matter to induce active convulsions in a rabbit, and six pipes of common shag tobacco will yield sufficient poison to destroy a rabbit in three minutes.

From British Columbia we learn that the quantity of gold raised is largely in excess of that of any preceding year. The telegraph has been completed up to Soda Creek, 300 miles from New Westminster, and it is expected that the cable under Behring's Straits will be laid early next year.

By way of rejoinder to the statements which have been made to the effect that Gale's protected gunpowder becomes unprotected by a little shaking, a letter has appeared in the daily press from Mr. Handel Cossham, who accompanied Sir Morton Peto to America, and took with him a large box filled with the protected gunpowder, for the purpose of introducing the process to the American Government. Mr. Cossham states that after as much knocking about as it could well be subjected to in a journey of four thousand miles, the mixture was as perfect and the powder as completely protected as when it left England.

It appears that an English company is in the course of formation which proposes the embankment of the whole river frontage of the Hooghly, from Prinsep Ghat to Chitpore Bridge, with landing wharves, steam and hydraulic cranes, and suitable landing sheds and warehouses. The cost of the undertaking is estimated at £3,000,000 sterling. If the works be carried out the trade of Calcutta will receive an immense impetus.

Referring to our notice of the trial of the "Bellerophon's" balanced rudder, the *New York Army and Navy Journal* observes that we omit to mention the source from which the rudder arrangement of the "Bellerophon" was obtained. "The 'Bellerophon's' stern fixture as to the balanced or equipoise rudder," continues the *Journal*, "is almost an exact copy of that of the 'Dictator'; indeed, the very first monitor we built was fitted with an equipoise rudder, the same as that of the 'Bellerophon,' and the steering qualities of the monitors are acknowledged by all to be excellent. So it seems that the very first ironclad the English have built over which the rudder has commanded, is steered by the Yankee notion, the monitor balanced rudder. We compliment Mr. Reed, the Chief Constructor of the British Navy, on his wisdom in using this efficient instrument."

The City Extension of the North London Railway was formally opened on Tuesday afternoon. Passengers can now book at the Liverpool-street Station for the north of London, instead of having to make the long detour by way of Fenchurch-street. The new line is about two miles long, and has three stations, Liverpool-street, Shoreditch, and Dalston-lane, Kingland. Between Camden and the City there is now a saving of four miles and twenty minutes in time. The new line, which has been constructed under the superintendence of Mr. Wm. Baker, engineer to the London and North-Western Railway Company, has cost, including purchased property, no less a sum than £1,200,000.

On the 19th ult., the foundation stone was laid of a new suspension bridge over the river Moldau, at Prague, which is to be named, in honour of the Emperor, "Franz Joseph's Brücke." The bridge is to be constructed from the designs of Messrs. Ordish and Le Feuvre, of Westminster, who were successful against eleven competitors from Holland, Austria, Germany, and France.

A meeting of the Royal National Lifeboat Institution was held yesterday, at its house, John-street, Adelphi, Thomas Chapman, Esq., F.R.S., V.P., in the chair. The silver medal of the Institution and £2 were voted to Mr. N. Levett, chief boatman of the coastguard and coxswain of the St. Ives lifeboat, and £16 to the crew of the lifeboat, accompanied by a vote of thanks inscribed on vellum to each man, for rescuing four out of five of the crew of the French brig "Providence." A reward of £11 was also granted to the crew of the Newbiggin lifeboat, for saving the crew of two men of the sloop "Robert Hood." Rewards amounting to £140 were also ordered to be made for different noble services by lifeboats of the Institution during the late fearful gales. The silver medal of the Institution and £2 were granted to Thomas H. Frankish, for rescuing a man in a heavy sea, at the mouth of Bridlington Harbour. Various other rewards were also granted for saving life from different wrecks on our coasts.

We understand that Mr. Culverwell, the secretary to the Great Northern Railway of Ireland, having satisfied himself by a fair trial of the superior efficiency and simplicity of Captain Norton's patented railway detonators, has ordered a large supply for the Northern line. The great advantage in these detonators is, that there are no iron nipples within to rust nor copper caps to create verdigris.

Copper can kill and copper can cure. We recently noticed Dr. Burg's visit to Toulon for the purpose of testing his copper theory in cholera cases, and we now state the results obtained with his system by Dr. Lisle, physician to the Asile at Marseilles. The formula employed was:—A solution of 5 per cent. of sulphate of copper in pure water, 1'50gms.; Sydenham's laudanum, 10 drops; sugar and water, 120gms.; one tea-spoonful every quarter of an hour in dangerous cases. The results were—out of 32 patients, 7 deaths and 25 cures. There were besides in the same establishment 36 patients treated with other methods; of these, 28 died and 8 recovered.

Captain Richer, of the French ship "Immaculée Conception," recently arrived at Havre, reports that he has discovered a source of danger in the channel which separates the Pescadore Islands from the western coast of Formosa, in the Chinese Seas. The danger consists in a very extensive line of breakers, on which the sea beats with great fury. It is situated, according to close observations taken at the time of discovery, in 23 deg. 47 min. 59 sec. north latitude, and 117 deg. 42 min. 10 sec. east longitude, from Paris. It appears that the English and French charts make no mention of the danger, with the exception of the English one of Inray and Son, which records danger at a distance of 25 miles, and 15 miles more to the north, but does so doubtfully.

A railway train has just been seized for debt on the Spanish frontier. It appears that certain iron manufacturers obtained a judgment in Paris against the North of Spain Railway Company for £4,000. As the Company had no funds in Paris the judgment was forwarded to Bayonne, where the authorities, knowing that the trains belonging to the North of Spain Railway Company pass the frontier to arrive at Hendaye, obtained assistance and seized a train composed of six travelling carriages besides the locomotive and tender. The company at once telegraphed to their agents in Paris announcing the seizure, and the following day the amount of the judgment was paid, and then only the train was permitted to continue its journey into Spain.

From the oil regions we learn that the mechanical apparatus known as a "derrick," is so called, like every other machine for hoisting things in air, after a very experienced and celebrated hangman, who once flourished there before the States were independent. The "derrick" used at oil wells, however, bears not the slightest resemblance to the form which its name implies.

Referring to the proposed South Staffordshire direct railway, Ryland's *Iron Trade Circular* says:—Suppose an announcement was made that an extra 5 per cent. would be paid for iron throughout the district. How pleasant would be the surprise, how acceptable the addition! And who would turn a cold shoulder to the customer making such an extra offer? Yet 10 per cent. on pig, and 5 per cent. on manufactured iron, would be gained by the reduction of freight to be carried into effect by the South Staffordshire and London Independent Railway—which reduction is, moreover, to be scheduled in their Act of Parliament.

An experiment has just been made at Paris with a locomotive dragging a large carriage, not unlike the diligences of the olden times, laden with passengers inside and outside. The same kind of locomotion has recently been tried in Algeria in presence of a committee who reported warmly in its favour, stating that the engine in question could easily run 12½ miles per hour on ordinary roads, and could go faster or slower, and stop or turn, with as great facility as carriages drawn by the best trained horses.

Our American friends are not behind in saving themselves trouble where they can. A few weeks since we described a pea-shelling machine; we now learn that they think it too tedious to chop up cold meat for hashing, and therefore machines have been provided to do it by power. All that is necessary is to put the meat in a case containing a number of revolving knives; then turn a handle and the hash is made. All the meat is minced before it issues from the further end, where there is a spout to allow it to discharge. This, however, appears to be nothing more than a coarse kind of hand sausage machine long used in England.

The principal novelty of Heme's patent furnaces essentially consists in introducing a great current of air on every side of the furnace, and also upon the iron itself. By this means a smaller grate is required, and a great saving of coal is effected. By these means, it is stated, the heat is more quickly raised, is kept up more uniformly, the process goes on more rapidly, the saving of coal is from 20 to 25 per cent., and a much greater yield of iron is afforded, whilst the puddler does five heats in the time it would otherwise take him to do three. These furnaces are now applied to the whole of the puddling and mill furnaces of the Eagle Coal and Iron Company, at West Bromwich.

The New Bedford and Taunton Railroad, U.S., has an arrangement for preventing brakemen being knocked off the tops of the cars by bridges while riding backward. About thirty rods distant from every bridge crossing is a bar or joist twenty feet above the track, from which a number of laths or similar small strips of wood are suspended by short cords, hanging within three or four feet of the car roofs. Persons standing on the cars cannot pass these sticks without striking some of them, and their attention is thus called to the fact that they are rapidly approaching a bridge. Considering that several deaths have occurred on English lines by guards and others coming in contact with the piers of bridges, a similar arrangement might prove useful here.

It has lately been found that sulphuric acid attacks pure lead more quickly than the same metal in an impure state—a result quite contrary to expectation.

In a paper read by Dr. Hughes Bennett, before the British Association of Science, he announced that the tendency of modern physiology was to ascribe to man a sixth sense. If there be placed before a man two small tubes, the one of lead and the other of wood, both gilded over so as to look exactly alike, and both of the same temperature, not one of the five senses could tell the man which is lead and which is wood. He could tell this only by lifting them, and this sense of weight was likely to be recognised as a sixth sense.

According to the statistics collected by Messrs. Higginson and Co., of Liverpool, the exports of coal from the various British ports during September, 1865, amounted to 802,685 tons, and from January to September inclusive 6,512,260 tons, showing an increase of 12,138 tons and 458,300 tons over 1864 in the same periods respectively.

The *Journal of Charleroi*, one of the principal centres of manufacture, and especially of engineering, in Belgium, says that a society has been formed at Gilly, in order to enable artisans to visit Paris and examine and report for themselves on the inventions and improvements to be found in the Exhibition. The subscription is only seven-pence a fortnight, and each subscribing member will have his railway ticket gratis, besides board and lodging in Paris for three days. It is said that a great number have joined the society. Similar arrangements are on foot in France.

The directors of the East of Prussia Railway are now having iron boxes made, which will be fixed in front of the locomotives, and filled with sand. By turning a cock, the driver can open them as required, and the sand falling on the rails gives the necessary purchase for the wheels. This arrangement is for the present to be confined exclusively to the mail trains.

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.—942, 958

BUILDINGS AND BUILDING MATERIALS.—940, 944, 967, 974, 989, 999, 1001

CHEMISTRY AND PHOTOGRAPHY.—958

CULTIVATION OF THE SOIL, including agricultural implements and machines.—956, 978, 996

ELECTRICAL APPARATUS.—960, 975

FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c.—948, 971, 983, 990, 993

FOOD AND BEVERAGES, including apparatus for preparing food for men and animals.—979

FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.—941, 946, 947, 950, 954, 961, 965, 977, 993, 1000

GENERAL MACHINERY.—943, 951, 955, 959, 981, 985, 1005

LIGHTING, HEATING, AND VENTILATING.—945, 972, 990, 1003

METALS, including apparatus for their manufacture.—957, 963, 968, 994

MISCELLANEOUS.—966, 973, 976, 984

ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.—962, 992, 1002

SHIPS AND BOATS, including their fittings.—964, 970, 995, 1004

STEAM ENGINES, &c.—953, 982, 986, 991

WARFARE.—952, 969, 997

940 E. BROWN. *Improvements in kitchen ranges.* Dated April 3, 1865.

The patentee claims, first, heating and maintaining a more equable temperature in the ovens of close fire ranges by the combined use of a conducting plate at the bottom, a metal or brick shield between the side of the oven and the fire, a flue passing over the top, and an air chamber surrounding the back, bottom, and side, as described. He also claims the use, for heating the ovens of close fire ranges, of a conducting plate within or at the bottom of the oven, in connection with a metal heating plate or lump exterior of the oven, and running along the side of the fire, as described. He also claims the forming of the under sides of the hot plates of close fire ranges with heat-collecting projections, as described. *Patent completed.*

941 C. YERO. *Improvements in the manufacture of felt hats.* Dated April 3, 1865.

This invention consists in a method of producing felt hats with the under sides of the brims dyed of a black or other dark colour, whilst the upper sides of the brims and the upper parts or bodies of the hats retain their ordinary colour. For these purposes the inventor applies a hot solution of bichromate of potash to the under side of the brim of a felt hat by means of a brush or otherwise. The surface is then washed with cold water; a hot decoction of logwood

or madder, or a fastio, or a combination of these materials, is then applied by a brush or otherwise. This would produce a brown, but if a black be desired a second coating of the bichromate of potash is applied, and a second coating of the decoction of logwood, and afterwards a solution of a salt of iron. *Patent abandoned.*

942 H. BROOK, J. EASTWOOD, and G. BAKER, jun. *Improvements in apparatus applicable to furnaces for smelting ores and melting metals.* Dated April 3, 1865.

This invention has for its object the application of steam (by preference of high pressure) to the lower parts of furnaces used in smelting ores or melting metals, for the purpose of producing a blast in substitution for the ordinary means of producing a blast by a fan. For this purpose the steam is applied in jets or through pipes or nozzles inserted in the lower parts of the furnace where the blast of air is ordinarily applied through tuyere pipes. The steam is introduced into the tuyere apertures which are opened to the atmosphere through short pipes or nozzles of small diameter, such pipes or nozzles being connected with the pipe or pipes for supplying the steam. By this arrangement steam from the steam pipe and atmospheric air are caused to enter the apertures leading into the furnace, and the blast is created by the jet of steam admitted into the aperture at the same time in the atmospheric air. *Patent abandoned.*

943 C. D. YOUNG. *Improvements in double acting, lift, and force pumps.* Dated April 4, 1865.

The several objects of this invention are to combine and arrange the parts of the pump together in such a manner as will admit of readily getting to any one of the valves without interfering with the others; constructing and arranging the water passages of the pump in combination with the inlet and discharge pipes, with a view to have the pipes as straight and free of bends as possible, for giving as little resistance to the flow of water through them as practicable; providing each inlet valve with an independent inlet pipe extending into the dike or well from whence the water is drawn; also each delivery valve with an independent discharge pipe extending from the pump to the tank or trough into which the water may be discharged; also the arrangements of parts by which the stroke of the pump can be increased or diminished to suit the power for working it. The general structure of the pump consists in attaching the cylinder of it to a suitable frame of iron or wood, and arranging a shaft with gearing or pulleys to the frame for giving motion to the piston of the pump through a connecting rod and slide guides, by means of horse, steam, or other power. In place of providing the shaft with an ordinary crank, it is furnished with a disc crank, which is provided with a number of holes at various distances from the centre of the shaft for attaching the crank pin; by this means the stroke of the pump can be increased or diminished to suit the power for doing the work, as before stated, or for increasing and diminishing the quantity of water pumped. *Patent completed.*

944 R. NALDS. *Improvements in locks and lining knobs and spindles for doors and latches.* Dated April 4, 1865. We cannot here quote the details of this invention. *Patent abandoned.*

945 J. R. WIGHAM. *Improvements in the means and apparatus employed for illuminating lighthouses.* Dated April 4, 1865.

One part of this invention consists in illuminating lighthouses by means of combustible gases produced from solid or volatile oils, liquid hydrocarbons, bituminous matters, shales, cannel, shale oils, or semi-liquid oleaginous compounds, and burnt without the aid of a wick, instead of burning liquid oils by means of wick lamps, as heretofore employed. Another part of the invention consists in the use in lighthouses of such description of burners for burning the before-mentioned or any other description of combustible gases as will dispense with chimney-glasses, as heretofore used. *Patent completed.*

946 G. O. THOMPSON. *Improvements in securing the doors of safes and other doors.* Dated April 4, 1865.

This invention consists in setting a number of screws upon the back or inside of the door, and in tapping as many corresponding threads as there are screws in the side or frame of the safe or other structure, and in the employment of a master-wheel, with teeth or worms on the periphery, to take into a worm on each of the shafts of the screws, so that on the door being closed and the master-wheel being turned by a key, the whole of the screws are driven into the frame or sides of the safe, whereby the door will defy all wrenching to separate it from the sides of the structure to which it is applied. The inventor does not limit himself to any precise mechanism for imparting motion to the shafts of the screws, as, for instance, racks and endless belts may be substituted for the master-wheel, the main feature of this invention consisting in causing a number of screws to be driven into the sides or frame of the structure to which the door is fitted. The inventor moves the master-wheel or main agent acting on all the screws by means of a key, and secures it by an ordinary lock. *Patent abandoned.*

947 H. JENKINS. *Improvements in the fastenings for sleeve links, solitaires, and other like purposes.* Dated April 4, 1865.

The back plate of this fastening may be so fashioned that, at one end or side, the metal is so formed that, by bending up, it will form a part of the hinge joint, while the other side or end of the back plate is raised to engage with the tongue or bar, the said tongue or bar being secured by a wire passing through it, and the corresponding part or parts in the back plate, so as to complete the hinge joint; or the joint may be formed distinct and attached by soldering or otherwise to the back plate. The detention of the tongue or bar is effected by its being bent so as to form a spring and catch in connection with the back plate within the projection or raised part before mentioned, which said projection or raised part may be round, square, rectangular, or otherwise, if preferred, so as to permit of a sufficient spring for ensuring a secure fastener. *Patent abandoned.*

948 A. and H. ILLINGWORTH. *Improvements in preparing wool and other fibrous substances and in the apparatus to be employed therein.* Dated April 4, 1865. We cannot here give space to the details of this invention. *Patent completed.*

949 W. BROOKES. *Improvements in means or apparatus for obtaining motive power by the aid of steam, gas, or other fluids.* (A communication.) Dated April 4, 1865. This invention is not described apart from the drawings. *Patent completed.*

960 C. MARTIN. *Improvements in means or apparatus for effecting the cleansing and polishing of forks.* Dated April 4, 1865.

The forks to be cleansed and polished are placed through apertures adapted to receive them in a wheel or surface capable of revolving, and they are there held by their handles in this wheel or surface by wedges, or by other suitable means. This wheel or other suitable surface is provided with a handle or holder, by which to give rotary or reciprocating motion to it, and it is placed over and so that the prongs and stems of the forks held thereby may dip into a box or receiver containing bricardust, sand, or other suitable cleansing or polishing powder, and when rotary or reciprocating motion is given to the wheel or other holding surfaces, the action of the powder on them will be to effect the desired cleansing and polishing. In order, however, to clean between the prongs, the patentee also applies distended strands or bands, between which he applies the prongs, and by an up and down, or to and fro motion, the parts between the prongs are further readily cleansed and polished. These bands or straps are supported in a compartment of the apparatus containing a small quantity of powder, which may be used as required. He also applies to the apparatus another rubber upon which the inside of the shanks of the forks may be rubbed, cleansed, and polished. *Patent completed.*

951 R. BAYNES. *Improvements in suction and force pumps.* Dated April 4, 1865.

This invention consists in the application of flexible tubing to the pumping or raising of water or other fluids in combination with rollers or other pressing surfaces, whereby the tube is collapsed and caused to force the water, the subsequent expanding of which produces a partial vacuum having the effect of sucking or raising up the water as in the suction pump. *Patent completed.*

952 W. CLARK. *An improved machine for rounding and polishing shot, shell, and other balls or spheres.* (A communication.) Dated April 4, 1865.

This invention consists of a machine composed of four, more or less, different longitudinally sliding rotary mandrels, radiating from a common centre, and provided with chucks at their inner ends, in combination with suitable mechanism to force these chucks alternately up against the ball to be turned or ground, and with a milling tool or grinding wheel, in such a manner that two of the chucks will clamp the ball at a time, and the ball is thereby turned in either direction while the grinding wheel or milling tool is held in contact with the surface of the ball by means of one or more screws, or by an adjustable weight. The force with which the grinding wheel or tool is forced against the surface of the ball can thus be regulated at pleasure. The position of the revolving chucks and the time when the same grasp the ball are governed by a double cam, and by weights or springs, and the said chucks are so shaped that they grasp the general surface of the ball, and that cavities and projections occurring on the surface of the said ball will not be able to disturb the correct central position of the same. *Patent completed.*

953 J. VAUGHAN. *Improvements in steam and atmospheric hammers which improvements are also applicable to steam engines.* Dated April 4, 1865.

This invention consists in causing the pistons of steam and atmospheric hammers and presses as they approach near the end of their upward stroke, or at any required point of their stroke, to close the exhaust passage, and thereby prevent any escape of air or steam from above the piston after it has arrived at the position described. *Patent completed.*

954 W. MOODY and W. J. HUBARD. *Improvements in stringing and tuning pianofortes and other stringed musical instruments.* Dated April 4, 1865.

The patentees claim stringing and tuning pianofortes by means of mechanism consisting of screwed stems having blocks at their ends to which the wires or strings are fixed, the said blocks being drawn by the screwed stems to a greater or less distance from the bridge of the instrument by means of screw nuts, whereby the tension of the wires or strings is increased or diminished. *Patent completed.*

955 W. E. NEWTON. *Improved apparatus for expressing liquids from pulpy and semi-fluid substances.* (A communication.) Dated April 4, 1865.

By means of this improved apparatus water or gas is caused to act directly upon the substance to be operated upon, thereby doing away with the intermediate action of the hydraulic press, or any mechanical means ordinarily employed for transmitting power. For this purpose a casing, covering, or partition is interposed between the matters to be subjected to pressure and the agent (such as water or gases) by means of which the pressure is to be applied. These casings or partitions may be made of any suitable material, preference being given to that substance which is found to possess the greatest amount of elasticity. *Patent completed.*

956 W. BULSTROKE. *Improved apparatus applicable to steam cultivation.* Dated April 4, 1865.

The object of this invention is to expedite the operation and thereby to reduce the cost of steam cultivation by lessening the loss of time incurred in shifting the snatch block at the end of each journey of the plough, or other cultivating implement employed in working on the indirect or roundabout system of steam cultivation. This object the patentee proposes to attain by enabling the anchor man to detach the snatch block from one anchor and connect it to the anchor next in advance while the implement is leaving the headland where he is stationed, instead of effecting the change during the stoppage of the implement. To this end he attaches to the draught point of common claw or other anchors which he employs, two distinct links or other connections, one of which he connects with the snatch block, and the other with a rod or bar laid transverse of the line of work, and which forms a guide for leading the snatch block, when detached from the anchor which has just received the strain of the implement, up to the next in advance, to which it is to be then in like manner temporarily attached. *Patent completed.*

957 J. PLAYER. *Improvements in the manufacture of balls, blooms, or slabs of malleable iron or steel.* Dated April 4, 1865.

This invention has for its object to facilitate forming a ball, bloom, or slab of iron after it has been deprived of a portion of its carbon and impurities by the puddling or other operations, and consists in the application of concussion caused by the sudden stoppage of the descent of the iron whilst in a semi-fluid or welding state from a height,

to cause it to agglomerate or weld together into a ball, bloom, or slab. *Patent abandoned.*

958 G. T. BOUSFIELD. *Improvements in separating fibre from vegetable materials containing the same.* (A communication.) Dated April 4, 1865.

The patentee claims the process of treating vegetable material with the substances produced by the action of nitro-muriatic acid upon carbonate of lime and iron, or their equivalents, and then subjecting the vegetable material to the action of a caustic alkali, substantially as set forth. *Patent completed.*

959 G. T. BOUSFIELD. *Improvements in the manufacture of flexible tubing or hose.* (A communication.) Dated April 4, 1865.

Considerable difficulty has heretofore been experienced in making flexible tubing or hose that would be impervious, particularly to illuminating gas, for the reason that the naphtha and other gases which are deposited by the condensation from such gas softens and dissolves india-rubber (caoutchouc) and such gums, glutinous materials, and compounds thereof, as have been heretofore employed in the construction of the tubing or hose to make it impervious as well as flexible. The first feature of this invention relates to the means by which the tubing or hose is rendered primarily impervious, and consists in the use of an animal tissue, so prepared and applied as to form an impervious sheath or covering in the structure of the tubing or hose. The second feature of the invention relates to the employment of certain means to preserve the said impervious sheath or its equivalent in a moist and flexible condition, and from a liability to injury by cracking, and consists in the use of a thin coating of any suitable metal or compound which will resist the effect of the extremes of temperature, and keep the sheath constantly moist and supple. The third feature of this invention relates to the mode of forming the exterior or finished surface of the tubing or hose, and it consists in the use of a preparation from vegetable oils in connection with other materials which is applied to the exterior surface of the tubular fabric, and when dry forms an elastic glazed covering, which is quite supple, and not liable to crack, or be otherwise injured by service. *Patent abandoned.*

960 A. MILLAR. *Improvements in certain electric telegraphs, part of which invention is applicable to other purposes.* Dated April 5, 1865.

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

961 E. STANLEY. *An improved hat ventilator.* Dated April 5, 1865.

This ventilator consists of a metallic cylindrical framework open at one end having an exterior flange partially or wholly surrounding the said open end, the other end of the said framework being closed and provided with two or more openings, which may be opened or closed at pleasure by means of a revolving disc or valve provided with corresponding pin openings, and which disc or valve works on a central pin fixed in the centre of the closed end of the said framework. The framework may be stamped out of sheet metal, and be furnished with three or more arms or lugs projecting from the flange, which arms or lugs serve the purpose of a fastener by being bent down in the interior of the hat (whilst the flange is on the outside of the hat), and, if preferred, a washer made of pearl, or of any other suitable substance, may be inserted between the interior of the hat and the said arms or lugs. *Patent abandoned.*

962 J. G. N. ALLEYNE. *Improvements in traction engines.* Dated April 5, 1865.

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

963 H. SIMON. *New or improved apparatus for separating or sorting and washing ores, minerals, coal, emery, and other substances in a granular or pulverulent state.* (A communication.) Dated April 5, 1865.

The patentee claims, first, the construction and employment of apparatus for separating or sorting ores, minerals, coal, emery, and other materials according to their specific gravity or size, in which such separating or sorting is effected by the agency of a body of water which is contained inside a vessel rotating round a vertical axis, through which vessel the ores, minerals, coal, emery, or other materials are made to fall, substantially as described with reference to the drawings. Second, the various arrangements of apparatus for separating or sorting ores and other materials described. Third, the arrangement of apparatus for both sorting and washing ores and other materials as described. *Patent completed.*

964 J. BETHELL. *Improvements in building barges, ships, and other vessels.* Dated April 5, 1865.

This invention consists in building barges, ships, and other vessels in the manner hereafter described. The patentee selects wood planks of the most porous materials, such as beech or porous tar, and he forces into them under very heavy pressure as much as possible of the heavy oil obtained by the distillation of gas tar; the pores of the wood will thus become filled with a bituminous fluid which will in time set into a solid. For this purpose he intends to use the pressure cylinders now generally used for creosoting purposes, but they will be worked at a much higher pressure. The wood thus treated will become perfectly waterproof, will resist the attacks of all sea worms, and will not be affected by dry rot. In building barges or ships he uses ribs of angle or T-iron, and on the outside he first fastens one plank (prepared as above named) by means of screw bolts and nuts; such plank may be either 2in. or 3in. thick, or any other thickness that may be desired. Then over this plank he fastens, by means of copper or mixed metal, nails, or screws, another thin plank, which may be 1in. or 3in. thick, prepared with the tar oil as above named; over this thin plank copper sheathing can be placed, which will not be touched by the iron bolts and not affected thereby. Between these planks he places some marine glue. *Patent completed.*

965 B. JOHNSON. *Improvements in pianofortes.* Dated April 5, 1865.

This invention has reference to a previous patent dated 31st July, 1863 (No. 1897), and consists in combining a flutesound accompaniment with a harmonium or organ sound accompaniment, or in combining a flute sound accompaniment in the treble with a pianoforte accompaniment in the bass. *Patent abandoned.*

966 W. TRALL, L. LEPAIGN, and E. T. SIMPSON. *Improvements in the manufacture of lubricating oil and grease.* (A communication.) Dated April 5, 1865.

This invention consists in combining or mixing petroleum or mineral oil with the grease obtained from soapbuds of soapy or greasy waters. The proportions may vary from 2-10ths to 6-10ths of the recovered grease for producing the lubricating oil, and a larger proportion of the recovered grease is used when producing the lubricating grease, the remainder being mineral oil. *Patent completed.*

967 J. I. DANKNEY. *Improvements in seats of clove.* Dated April 5, 1865.

The seat of the waterclock in actual use is usually pierced with a round hole, varying in size, but always incommensurate and often dangerous. The distance of the tangent parallel to the front is on an average 4in. backwards. This improved seat is of an elliptical shape, the two circumferences being joined by a pear-shaped neck of more or less diameter, according to circumstances or requirement. The tangent of the small curve on the fore part is, on the contrary, in projection from the front of the seat about 4in. more or less, according to circumstances. *Patent completed.*

968 G. W. DRYDEN. *An improved rabble or bar used in puddling iron.* Dated April 5, 1865.

This invention consists in forming rabbles or puddle-bars hollow and in connecting an elastic tube to the outer end communicating with pipes from a blowing engine or other source of blast. The inventor makes the rabbles hollow for the purpose of introducing a blast into and thoroughly distributing it over the metal in puddling-furnaces. The elastic tube is for the purpose of allowing the workman to work the rabble without interfering with the blast. The inventor employs a stopcock in the rabble or in the blast tube in order to regulate or shut off the blast as may be required. *Patent abandoned.*

969 C. W. LANCASTER. *Improvements in firearms, and in apparatus for extracting cartridges and cartridge cases therefrom.* Dated April 5, 1865.

This invention refers chiefly to military needle guns. Hitherto these guns have been fired by a pointed needle, which when the trigger is pulled is forced by a spring through an aperture in the fore end of the breech plug or closer, so as to enter the rear end of the cartridge and strike against detonating composition in a recess in the back of the bullet or fore part of the charge of powder. Now these improvements in firearms consist in the combination of a bolt for exploding the charge and of an instrument for extracting the cartridge or cartridge-case, as hereafter described; the bolt takes the place of and is acted upon in the same manner as the ordinary pointed needle; it is only of sufficient length to strike the rear end of the cartridge, whereby the patentee is enabled to use cartridges with metal cases or metal sockets with the detonating composition placed in the rear end thereof. The patentee's apparatus for extracting cartridges and cartridge-cases consists of a semi-annular plate corresponding to the bore of the piece and carried on the front end of a bar free to slide backwards and forwards in a groove in the bottom of the breech. The rear end of the bore has a portion removed to form a space into which the semi-annular plate fits when the breech is closed. The plate and rear end of the bore have a recess cut in them to receive the rim on the rear end of the cartridge-case. The lower side of the breech-closer is formed with a groove in which a projection on the bar of the extractor rides. *Patent completed.*

970 E. RITHERDON. *Improvements in protecting from ships and other submerged structures from oxidation and corrosion.* Dated April 5, 1865.

This invention consists in first securing harplings or ribbons of wood by means of metal plates screwed, riveted, or otherwise fixed to the structure to be protected; the patentee then screws to the harplings, taking care that the screws shall not pass entirely through them, planking, and that by preference in a diagonal direction. The patentee then caulk the planking, and covers it with felt and copper. The spaces between the metal plates and the inside of the planking may be filled in with wood, cement, cork, or other material, or not, at will. *Patent completed.*

971 F. R. ENSOR. *Improvements in the manufacture of lace in twist lace machines.* Dated April 5, 1865.

This invention is applicable to twist lace machines when working with an ordinary complement of threads; that is, one warp thread to each bobbin or carriage thread. The invention consists in forming the pillars which bound the meshes of the grounds of laces made in twist lace machines alternately of two warp threads and one bobbin or carriage thread, so that, although each pillar will be composed of three threads, one pillar of each mesh will be formed of two warp threads and one bobbin or carriage thread, whilst the other pillar of each mesh will be formed of one bobbin or carriage thread and one warp thread, in contradistinction to the descriptions of laces that are now very commonly made in twist lace machines, when using for each and all of the pillars which bound the meshes two warp threads to each bobbin or carriage thread. By thus making the pillars of the grounds of laces produced in twist lace machines, the clothwork or tabby weavings will be greatly improved as compared with those laces where the clothwork or tabby weavings as well as the pillars are composed of two warp threads to each bobbin or carriage thread. In carrying out this invention the carriages will simply swing or move from the front to the back combs, and from the back to the front combs, constantly moving in the same grooves or gates of the combs, as is well understood, whilst the warp threads, as heretofore, will be worked or governed by the Jacquard or other pattern surfaces. *Patent completed.*

972 C. REFLIN. *Improvements in apparatus for regulating the supply of gas.* Dated April 5, 1865.

In order more readily to regulate the flow of gas coming from a gas main to a building or other place where several burners are employed in the same supply, and where such burners are more or less distinct from each other, and from the supply pipe from the main, apparatus is applied in the following manner:—On the supply pipe coming from the main there is a diaphragm valve or cock; at the back of the cover of this diaphragm is applied the end of a small tube. The other end of such tube may be in any desired position in the building or place, and more or less distant from the supply pipe, depending on the locality where it may be wished to have the power of regulating the whole supply of gas without having to go to the cock or valve above-mentioned, which is on the supply pipe. In such more or less distant locality the other end of the small pipe is fixed to a vessel which is divided by a diaphragm of larger diameter than that of the valve or cock before-

mentioned. The small tube is to be full of air, or it may be other fluid. The regulation of the supply of gas is effected by causing the air or other fluid contained in the small tube to be pressed on by the regulating diaphragm acted on by means of a screw or other instrument, by which the fluid will press on the diaphragm in the cock or valve on the supply pipe, and thus the passage of the gas from the main to the supply pipe will be reduced in dimensions, and the flow of gas will be lessened. The reverse action will follow the moving back of the regulating diaphragm, as the passage for the flow of gas through the cock or valve on the supply pipe will then be enlarged. *Patent completed.*

973 R. MAYNARD. *Improvements in machinery for cutting the human hair.* Dated March 6, 1865.

This invention consists, first, in using for the purpose of cutting the human hair, or for shearing horses, a revolving knife, or a number of knives mounted on a drum, and acting against a fixed knife, the same being held to the part of the hair to be operated upon; the revolving knife or knives, coming in contact with the fixed knife, cut the hair to the length required; second, in using with the same a comb which holds the hair in a suitable position for the knives to act upon it. *Patent completed.*

974 J. BROWN. *Improvements in or applicable to boilers furnished with pipes for the circulation of water for domestic purposes.* Dated April 6, 1865.

The boilers of kitchen ranges for heating water for domestic purposes are usually supplied with pipes which are in communication with a cistern, and so long as the passage in these pipes is free, and fresh water continues to be supplied to the boiler, no accident can occur, but if, owing to severe frost, or other derangement, one or both of the pipes becomes closed, the steam generated in the boiler causes an explosion. The nature of this invention consists in preventing such explosions by the application of a safety valve furnished with a weight, or with a lever and spring weight to the boilers of kitchen ranges, or for other domestic purposes. *Patent abandoned.*

975 J. S. WATSON and A. HORWOOD. *Improvements in conducting electricity for communicating or transmitting signals and alarms in the event of burglary, fire, railway accidents, and other purposes.* Dated April 6, 1865.

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

976 E. H. NEWBY. *An improved mode of pointing or tapering the ends of metallic rods or wires, applicable to the manufacture of pins, needles, and other articles where points or tapered ends are required.* (A communication.) Dated April 6, 1865.

In carrying out this invention the pins or other metallic rods or wires to be pointed are suspended at the positive pole, and form the positive electrode, of a galvanic battery, immediately above the electrode, and as close as possible to it without being actually in contact, some existing liquor, such as dilute nitric acid, completing the circuit. *Patent completed.*

977 C. H. WILLIAMS. *Improvements in the manufacture of cornice, pole, and other rings.* Dated April 6, 1865.

The patentee claims manufacturing the said rings of shallow troughs or open tubes, the concave or hollow part of the said troughs or tubes being inwards or forming the inside of the rings, the edges of the said troughs or tubes being bent or turned inwards or outwards, and rounded either before or after the said troughs or tubes are made into rings. *Patent completed.*

978 J. BADGER. *Improvements in the manufacture of harrows, cultivators, and other similar agricultural implements.* Dated April 6, 1865.

This invention consists in the manufacture of harrows, cultivators, and other similar agricultural implements, whereby the parts of which the harrow or implement is composed are made without welding, and are fixed together by the driving in of the tines, or by a key or wedge. *Patent abandoned.*

979 M. DIOBY. *A new or improved material to be used in combination with or as a substitute for coffee.* (A communication.) Dated April 6, 1865.

This invention consists in the employment and utilisation of the locust bean or Karouba, a well-known fruit growing on both shores of the Mediterranean, as a material to be used in combination with, or as a substitute for, coffee. *Patent abandoned.*

980 G. DAVIES. *An improvement in illumination.* (A communication.) Dated April 6, 1865.

This invention consists in consuming the carbon in, and increasing the brilliancy of a flame produced by burning animal, vegetable, or mineral oils or fatty matter, or the flame of gas containing an excessive amount of carbon, by causing the said flame to decompose a supply of water conveyed to it by means of a wick or its equivalent. *Patent completed.*

981 J. H. JOHNSON. *Improvements in machinery or apparatus for drilling or boring rocks and other hard substances in tunnelling, mining, and other like operations.* (A communication.) Dated April 6, 1865.

This invention relates to certain peculiar combinations and arrangements of machinery or apparatus to be worked by steam, air, water, or other elastic or inelastic fluid, for drilling or boring rocks, and other hard substances, in tunnelling, mining, and other like operations. It is proposed to use a drill operated by steam or other elastic fluid, whose principal characteristic features are as follow:—The drill proper is composed of a cylinder containing a piston, the rod of which projects through both heads, and carries internally or externally one or more drill bars. With the cylinder is combined, as usual, a valve chamber and valves, preferably balanced to equilibrate pressure, which valves are operated automatically by connection with the piston rod or other moving part. Around each drill bar or rod (and in the rear of the cylinder and back of the piston rod (if it be hollow, and if the drill bar passes through the piston rod), there is arranged a mechanism which the inventor calls a gripper-box, the object of which is to firmly grasp and hold the bar during its reeding movement, but during part of the advance of the piston, and when at or about the end of the stroke, to release the same, thereby allowing of its self-adjustment in accordance with the penetrability of the rock. Rotatory movement is imparted to the drill rod at each stroke of the piston by means of a stud operating in a helical or oblique slot in the casing of the gripper-box, or by any other equivalent arrangement. *Patent completed.*

982 J. G. JONES. *Improvements in apparatus employed to actuate the valves of engines worked by steam, air, or other fluids.* Dated April 6, 1865.

These improvements are applicable to engines employed for giving motion to picks or cutting tools or instruments such as are used in getting coal and other minerals, and for performing other work where the length of each succeeding stroke of the engine may vary by reason of interfering causes. The arrangement of apparatus preferred for carrying out the invention is applicable when working with an engine having a horizontal cylinder. The piston rod is hollow, and has within it a rod, which, at its outer end, is connected to one end of a lever, which, at its other end is connected to a slide valve. The rod which is received into the hollow piston rod has fixed on it at one end a disc or piston, which fits, but slides very freely in, the hollow piston rod. The other end of the rod, which slides within the piston rod, passes through a stuffing or box in the cover at one end of the cylinder of the engine, and such sliding rod has a collar on it where it comes against the piston, so that when the piston of the engine is moving back, after it has performed a stroke, it forces the sliding rod back, and consequently reverses the valve; but when the piston is making the next stroke, should the piston be prevented making a complete stroke from end to end of the cylinder, then the tappet or instrument (which the patentee prefers to be a cylinder of lead lined or bushed with brass) will, by its momentum, continue its motion, and it will slide along the rod within the hollow piston rod, and will strike against the disc, and cause it and the rod to which it is fixed to slide within the piston rod, and thus move or reverse the valve. *Patent completed.*

983 J. ELLIS, O. WALKER, and W. PAXTON. *Improvements in machinery for carding wool or other fibrous substances.* Dated April 6, 1865.

This invention relates to the machine known as the scribbler or first carding engine. The improvements consist in dispensing with the cone rollers, and substituting a flap hinged under the doffer extending across the machine, and which is caused to flap or oscillate by means of a crank motion actuated from any convenient moving part of the machine, thereby constantly flapping, batting, or pressing the fibrous substances as they are doffed from the card surface during the process of twisting and drawing, or the formation of the roving, by which means breakage is prevented and the roping more evenly formed. *Patent abandoned.*

984 W. B. RICHARDS. *An improved mode of preventing corrosion, or staining of the surface of glass.* Dated April 6, 1865.

This corrosion or staining is particularly the case with glass that may be made and remained packed in boxes or stored away during the warm and moist weather of summer. The corrosion or stain appears to arise from the absorption of moisture by the alkali employed in the manufacture of the glass, particularly in the minute cells existing in the surface of the glass. The inventor makes use of very finely ground calcined plaster dust, or other similar material that will absorb moisture more quickly than the alkali of the glass, and this powder he applies as a dry dusting to the surface of the glass, sufficient adhering for effecting the desired protection to the surface against atmospheric changes or influences. *Patent abandoned.*

985 E. GARRETT, jun. *Improved apparatus for reducing wheat and other straw.* Dated April 6, 1865.

The object of this invention is to render wheat and other hard straws available as food for cattle. In order to effect this reduction of hard straws in an economical and expeditious manner the patentee subjects them to the action of a crushing roller of peculiar form mounted in a concave, so that it will be free to turn, and this concave he fits with stationary cutting blades or knives corresponding to the profile form of the roller. Into this apparatus the straw to be reduced is fed by hand or otherwise, and by it the straw will be crushed and reduced to small pieces of any desired average length. *Patent completed.*

986 P. HUGON. *Certain improvements in gas engines.* Dated April 6, 1865.

This invention relates to gas engines in which motive power is obtained by the explosion or combustion of gas or gaseous matter acting upon a piston in a cylinder, and thereby producing motive power. Hitherto such explosion or combustion has been effected by an electric spark, but this mode the patentee believes to be uncertain and irregular. The object of the present improvements is to produce the explosion or combustion with certainty and at regular intervals. For this purpose, according to this invention, he employs slide valves or other valves carrying gas burners or nozzles supplied with gas under pressure, which is lighted by outer gas burners kept constantly kindled, and either attached or not to the valves. These valves, which work against orifices in the cylinder so as to open and close them, bring the burners to and from these orifices at certain intervals, and they thus admit, intercept, and regulate the supply of working gas to the cylinder, and also permit and shut off the escape of gas therefrom after the explosion. Or separate valves may be used for these purposes. Gas or an explosive gaseous compound is admitted into the cylinder through an induction port, and at the required moment the valve brings the flame of the burner in contact with this gas or gaseous compound, so that it ignites and explodes, and thereby moves the piston, and at the proper time the valve opens the induction port and allows the residuary gases to escape. The burner is extinguished by the explosion, and is relighted by the outer burner. He injects water or other vaporising liquid in showers or otherwise into the cylinder to cool it through a passage opened and closed by the same valve as the one which carries the burners, or by a separate valve. He constructs an improved slide valve or set of valves for the purposes of the invention with burners at the ends, or at the centre, and with channels for the inlet and outlet of the gases. *Patent completed.*

987 A. MUIR. *Improvements in breechloading firearms.* Dated April 7, 1865.

This invention relates to that description of breech-loading firearms, in which the opening and closing of the breech end of the barrels are effected by movable breech plugs or charge chambers working in suitable recesses open at the top or bottom. The improvements consist in mounting each breech plug or charge chamber at its rear end upon a spindle formed eccentric with pivots or pins working in holes in metal straps forming the sides of the recess. One of the pivots extends beyond the metal through which it passes, and has an actuating lever fixed to it for

the purpose of turning the eccentric and imparting the requisite movement to the breech plug or charge chamber, there being a spring catch or its equivalent for maintaining the lever in its proper position. The breech plug or charge chamber has at the back a flat inclined surface, and is formed at the front with the ordinary shoulder or nose, and which is caused when the actuating lever and eccentric are turned one way to abut tightly against a corresponding recess formed in the breech end of the barrel, and thereby make a perfectly tight joint; and when the lever and eccentric are turned the reverse way the breech plug or charge chamber is first caused slightly to recede to free the nose or fire end from the recess in the barrel, and then to rise or fall to any required angle, for the purpose of exposing the breech end of the barrel or the muzzle of the charge chamber. *Patent completed.*

988 G. RYDILL. *Improvements in steam boilers, steam boiler tubes, sides of steam boilers, flues, and furnaces.* Dated April 7, 1865.

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

989 E. WELSH. *Improvements in fireplaces and flues and apparatus connected therewith.* Dated April 7, 1865.

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

990 J. THOMPSON. *Certain improvements in machinery or apparatus to be employed in preparing cotton and other fibrous substances for spinning.* Dated April 7, 1865.

This invention consists in a novel arrangement and combination of mechanism designed to impart the necessary movement to the comb stock and to produce the usual vibratory movement of the doffing comb. The apparatus consists of an eccentric secured on a driving shaft, which eccentric is encircled and embraced by a band or clip, from which a bar or finger projects and enters an aperture or slot on a boss at the end of the comb stock, so that as the eccentric rotates it causes the tail or finger on the clip to vibrate, and so to impart an oscillating motion to the comb stock, which is mounted on bearings as usual. The eccentric and clip and slotted boss of the comb stock are enclosed within a case on the framing of the carding engine containing a lubricant to prevent overheating of the frictional parts. *Patent completed.*

991 S. SMITH and J. W. JACKSON. *Certain improvements in governors or regulators for steam or other motive power engines.* Dated April 7, 1865.

The patentees claim imparting to the balls or weights of a centrifugal governor, a parabolically curved course in a direction to or from the central vertical shaft, in contradistinction to allowing them to partake of a course in the arc of a circle as hitherto, for the purpose of causing the centripetal force to balance the centrifugal force of the balls in their revolution at any position they may occupy, so long as the governor revolves at one uniform speed. *Patent completed.*

992 T. WILKES. *Improvements in machinery for the manufacture of railway bolts and spikes and other like articles.* Dated April 7, 1865.

The patentee claims making the hollow or mould of the said heading dies or tools in which the heads are formed with parallel sides, so that the head made thereby is of the same diameter at top as at bottom, in which said hollow die or tool a piston works, by means of which piston the end of the heated rod is compressed in the mould, and by which the heated rod is forced from the die or tool, as described. Also varying the thickness of the heads made by means of washers or adjustable rods or stems to the said piston, as described. *Patent completed.*

993 T. WHITE. *Improvements in the manufacture of the handles of nut crackers, lobster crackers, and grape scissors, which said improvements are also applicable to the manufacture of the handles of knives, spoons, and other articles.* Dated April 7, 1865.

In making the handles of nut crackers and lobster crackers the inventor constructs in metal skeleton handles or frames, consisting of a plate occupying the middle of the handle, and an ornamental edge bordering the said plate, and projecting on either side of it, which ornamental edge constitutes the edge of the finished handle. The ornamental edge described makes with the middle plate shallow recesses on either side the said plate. In finishing the handles plates of pearl, ivory, metal, or other substance of which the ornamental part of the handle is to be made, are inserted in the shallow recesses made in the manner described, and the edge of the ornamental border being turned over the plates of pearl or ivory, or other substance, by burnishing or otherwise, the said plates are fixed in their places on the flat middle plate constituting the middle of the handle, thus completing or filling up the sides of the handle. *Patent abandoned.*

994 J. BROWN. *An improved nail.* Dated April 7, 1865.

This invention consists in forming nails of steel or hardened metal, or of metal harder than that into which they are to be driven, triangular in cross section, tapering, and terminating in an acuminate point. *Patent completed.*

995 H. EDMONDS. *Improvements in apparatus for lighting and ventilating ships, part of which is also applicable for producing fresh water at sea.* Dated April 7, 1865.

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

996 W. E. and J. GRAY. *Improvements in the manufacture of ploughshares, stocks, or points for ploughs, cultivators, and scurifurrows and other implements used in the cultivation of the land where these points are used or required.* Dated April 7, 1865.

This invention consists, firstly, in the manufacture of the above-named articles of cast steel, and more particularly that description of cast steel known by the name of welding cast steel, so that the articles when partly worn out can be relaid with steel by welding it to the socket or that part of the share that is not worn out, and this can be done by means of this invention at any time required. Secondly, this invention consists in casting the above named articles in metal moulds with the use of steel or wrought iron plugs to form the socket part of the articles produced. *Patent completed.*

997 W. JACKSON. *An improved method of mixing gases and vapour, and in the machinery or apparatus connected therewith.* Dated April 7, 1865.

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

998 M. S. MAYNARD. *Improvements in machinery for preparing cotton and other fibrous substances.* Dated April 7, 1865.

This invention relates to the machines used in preparing cotton and other fibrous substances generally called roving and slubbing frames, and consists in certain improved methods of doubling the spindles. The present improvements consist in introducing a pair of sailender rollers and a talip plate in front of the ordinary drawing rollers, in the same manner as they are now employed in a drawing frame, for the purpose of winding two spindles upon one bobbin, thereby dispensing with one half of the number of spindles, and (as less twist will suffice) producing a greater weight of material. The spindles so produced are drawn in singly at the succeeding process, and in case of a roving or slubbing frame again doubled as before. *Patent abandoned.*

999 N. G. KIMBERLEY. *Improvements in locks.* Dated April 7, 1865.

This invention consists in constructing locks for safes and other purposes requiring special security with a small vertical bolt working in a slot in the break or locking end of the usual bolt of the lock, and upon the inside of the back plate or in the corresponding side of the safe the inventor fixes a catch worked by a spring, which catch, when the lock bolt is shot, presses upwards the small vertical bolt, which is forced beyond the top of the ordinary bolt, and thus affords an additional guard. The small bolt is withdrawn in unlocking, merely by the action of the key upon a lever, which brings it down flush within the lock bolt, and admits of the latter being drawn back. *Patent abandoned.*

1000 T. SKIDMORE. *Improvements in the construction of safes or receptacles for securing and protecting valuable property.* Dated April 7, 1865.

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

1001 M. HENRY. *Improvements in the mode of and apparatus for purifying smoke, which improvements are also applicable to other purposes in which gas or vapour is to be separated from substances combined therewith or held in suspension therein.* (A communication.) Dated April 7, 1865.

This invention consists in the employment and construction of apparatus in which the smoke, gas, or vapour, is led into a passage or chamber and caused to pass through it in a downward direction, and while descending it is subjected to the action of water or other liquid, or of a solid substance, such water, liquid, or solid being introduced in showers or jets, or in a finely divided condition, and caused to drop or fall through the passage or chamber so as to pass in a downward direction through the smoke, gas, or vapour therein at a greater velocity of descent than such smoke, gas, or vapour, from which in its descent it separates or expels the soot, or other solid matters combined therewith, or substances held in suspension therein, and falls with the substances so separated or expelled into a receiver at the bottom of the passage or chamber. The soot or other substances so expelled may be afterwards separated from the water or other agent in order to be usefully applied. *Patent abandoned.*

1002 W. E. GEDGE. *An improved application of steam power to locomotion on ordinary roads.* (A communication.) Dated April 8, 1865.

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

1003 H. J. SIMICK. *Improvements in mechanism applicable to frame-lifting machines for wooden matches, vases, and vases.* Dated April 8, 1865.

This invention is carried out as follows:—On the main shaft—which is driven by either hand or steam power, and is placed either at the back of the frame, or in any other convenient position—the patentee places a revolving cam wheel, so keyed and of such a throw as to push forward the splines the required distance into the frame at the proper moment. On the end of the main shaft he has a mitre wheel, giving motion to another shaft at right angles thereto, on which is either an eccentric or a crank, whereby the proper motion is given to the box containing the splines. These two movements are so regulated as to take place alternately. Each frame board on being filled is lowered by means of a rack and pinion at each end of the frame, the same being worked by a pulpit in action by an eccentric or cam on the transverse shaft which works the splint-box. By the same or a separate motion, if required, a frame board is allowed to drop on to the one previously filled. The frame is thus filled and gradually lowered about one tooth in the rack each time till the whole frame is complete. *Patent abandoned.*

1004 A. HOWEAT. *Improvements in the mode of making or forming the links of iron or steel chains and chain cables and for machinery to be used therein.* Dated April 8, 1865.

Links manufactured according to this invention have the following advantages:—Each link, whatever its thickness, has a true and regular shape; it is turned and the weld effected at one heat; the weld is made by one blow, and is as strong or stronger than any other part of the link. The patentee can at will secure an extra thickness of metal at the weld, and also weld the link on the top, the side, or the shoulder. The mode by which he forms a chain or cable is as follows:—He cuts the round bars of iron or steel of the required size into straight pieces, each sufficient for a link. He heats the ends of each piece to a welding heat in a fire with a double blast. When the ends are at a welding heat he places the piece of metal in the machine across the opened jaws, he lets the shaft fall, the bottom of the mandrel strikes the centre of the heated metal, and drives it downwards, and the jaws close upwards on each side and force the metal to clip the oval mandrel; he then lets the welding hammer fall, the die at the bottom of which strikes the two ends of the heated metal at their junction, and welds them; he raises the shaft and welding hammer, and removes the link from the mandrel and cuts off or smooths over any surplus metal which has escaped. He threads another piece of heated metal through the last formed link, and forms another link in the manner above described, and so on until the chain or cable is completed. *Patent completed.*

1005 W. WEATHERLEY. *Improvements in sizing paper, and in the machinery employed therein.* Dated April 8, 1865.

This invention is described and illustrated at page 267 of our last number. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated June 21, 1865.

1666 W. E. GEDGE, Wellington-street, Strand. An improved fire escape, applicable also to raising loads from mines and other purposes. (A communication.)

Dated July 5, 1865.

1774 W. S. PARFITT, Devizes, Wiltshire, engineer and millwright. An improved machine for the manufacture of aerated waters.

Dated July 20, 1865.

1898 J. H. WRAY, Manchester. An improved apparatus for producing sound for signals, calls, and alarms, adapted to use on vessels, railway trains, buoys, reefs, lighthouses, and in other places of danger. (A communication.)

Dated August 4, 1865.

2020 A. SLEIGH, M.R.S.L., Upper Belgrave-place, Eaton-square. Improvements in the means of and mechanism for obtaining motive power.

Dated August 9, 1865.

2066 W. ASTON, Princip-street Works, Birmingham, button manufacturer. Certain improvements in the manufacture of linen buttons.

Dated August 26, 1865.

2200 G. T. BOUNSFIELD, Longborough-park, Brixton. Improvements in folding chairs. (A communication.)

Dated August 30, 1865.

2228 J. FALLOWS, Southampton-buildings, Chancery-lane, plate worker. Improvements in sheet metal handles for spoons, saucepans, and other utensils for culinary purposes.

Dated September 1, 1865.

2260 J. LAKE, Devonport, miller. Improvements in tubular steam boilers or generators for agricultural or other locomotive steam engines.

Dated September 7, 1865.

2293 F. TOLHAUSEN, Boulevard Magenta, Paris. A new firework producing instantaneously the forms of serpents, and other forms of a like nature. (A communication.)

Dated September 12, 1865.

2336 T. D. STETSON, King-street, Covent Garden. Improvements in clothes wringing machines, the mode of communicating rotary motion, which is also applicable to other machines having similarly rotating parts. (Partly a communication.)

Dated September 16, 1865.

2368 J. K. HOYT, Chesapeake. Improvements in bobbins or spools used in spinning and winding yarns and threads. (A communication.)

Dated September 19, 1865.

2382 C. WORSAM, Commercial Wharf, Kingsland-road, engineer. Improvements in the means of, and apparatus for, consuming smoke in furnaces.

Dated September 20, 1865.

2395 J. EDMONDSON, Halifax, manufacturer. Improvements in looms for weaving.

Dated September 21, 1865.

2424 S. TROTMAN, Lyme-street, Camden Town. Improvements in the manufacture of paper.

Dated September 22, 1865.

2418 R. ATKIN, Crawford-street, Bryanston-square. Improvements in propelling vessels.

Dated September 25, 1865.

2448 W. UNWIN, Sheffield. Improvements in the manufacture of iron.

Dated September 26, 1865.

2456 N. KORABUNOFF, Birmingham, civil engineer. Improvements in the manufacture of cast iron, malleable iron, and steel.

Dated September 27, 1865.

2468 J. S. STAINES, Cook Hill, Ratcliff. Improvements in the manufacture of submarine lamps.

Dated September 28, 1865.

2470 A. FARR, Dunstable, Bedfordshire. A new or improved receptacle for tooth powder, and for conveying the same from such receptacle to the tooth brush, so as to economise the use of the powder, and to prevent the escape of the perfume with which it may be scented.

Dated September 28, 1865.

2484 C. PRICE, Wolverhampton, manufacturer. Improvements in locks and latches.

Dated September 28, 1865.

2486 M. NOPITSCH, Boulevard Sebastopol, Paris. Improvements in pencils and pencil cases having a movable lead.

Dated September 28, 1865.

2490 A. M. BENNETT, Oakfield, Gatesacre, near Liverpool. Improvements in apparatus for ascertaining specific gravities and the bulk of solids, and also for other similar uses.

Dated September 28, 1865.

2492 C. E. DAVIS, Walcot-street, Bath. Improvements in sieves or chambers for the steeping of grain in the manufacture of malt, which improvements are also applicable to other chambers or enclosures.

Dated September 28, 1865.

2494 I. SMITH and W. F. BATHO, Birmingham, mechanical engineers. Improvements in apparatus for heating, evaporating, and cooling liquids.

Dated September 28, 1865.

2496 W. E. NEWTON, Chancery-lane, civil engineer. Improvements in shoeing horses. (A communication.)

Dated September 28, 1865.

2498 R. A. BROOMAN, Fleet-street, patent agent. Improvements in sewing machines. (A communication.)

Dated September 29, 1865.

2500 J. H. PINCKROSS, Mark-lane, City. Improvements in the construction of caaks to be used more especially for the transport of oil.

Dated September 29, 1865.

2502 W. E. GEDGE, Wellington-street, Strand. Improvements in steam engines. (A communication.)

Dated September 29, 1865.

2504 G. DAVIES, Serle-street, Lincoln's Inn, civil engineer. An improved reclining chair. (A communication.)

Dated September 30, 1865.

2506 J. de WEWEINE, jun., and A. VERACHAUFFEL, Ghent, Belgium, dyers. Improvements in dyeing.

Dated September 30, 1865.

2510 J. W. HURST, Deptford, master mariner. Improvements in lifeboats.

Dated September 30, 1865.

2511 J. E. TOWNSEND, Curtain-road, Shoreditch, bedding manufacturer. A new or improved ventilating spring mattress.

Dated September 30, 1865.

2512 E. LINDNER, Old Broad-street, City, engineer. Improvements in breechloading guns, and in projectiles and cartridges.

Dated September 30, 1865.

2514 R. WILLACY, Penwortham Priory, Lancashire, land agent. Improvements in machinery or apparatus for preparing and supplying food for cattle.

3516 J. W. M. MILLER, M.D., Southsea, Hampshire. An improved process for preparing skins and hides or leather so as to render such substances waterproof and more durable than heretofore.

2518 S. FAULKNER, Blackley, Lancashire, cotton spinner. Improvements in apparatus for grinding cards for carding engines.

Dated October 2, 1865.

2522 J. W. TYLER, Abingdon-street, Westminster. Improvements in the means employed for fixing sheet metal for roofing and other purposes.

2526 H. G. JAMES, Clifton, Bristol, commercial traveller. Improvements in railway signals.

2528 S. C. SALLIBURY, civil engineer, New York. Improvements in blast furnaces.

Dated October 3, 1865.

2530 H. A. BONNEVILLE, Porchester-terrace, Baywater. Improvements in the construction of submarine telegraph cables. (A communication.)

2534 O. J. TINKER, Pontefract, Yorkshire, liquorice refiner. Improvements in the manufacture of lozenges, cakes, and other similar articles from plastic substances.

2536 R. A. BROOMAN, Fleet-street, patent agent. Improvements in preparing red and violet colouring matters, for dyeing and printing silk, wool, cotton, and other textile, vegetable, and mineral substances. (A communication.)

2538 W. E. NEWTON, Chancery-lane, civil engineer. An improvement in machinery for spinning, twisting, doubling, and winding yarns or threads. (A communication.)

2540 E. FARR, Cavendish-street, and W. TARR, York-street, Chorlton-upon-Medlock, Manchester, and L. GREGORY, F.R.G.S., Victoria Park, Manchester. Improvements in pianofortes.

Dated October 4, 1865.

2541 F. TOLHAUSEN, Boulevard Magenta, Paris. Improvements in musical reed instruments of the harmonium class said improvements also forming in combination a small instrument of a novel construction. (A communication.)

2542 J. and F. J. JONES, Birmingham. Improvements in cartridges for breechloading firearms.

2544 A. CRAIG, Leewoodhill Colliery, Mold, Flintshire. Improvements in apparatus for extracting oil from coal, shale, and other minerals.

2546 E. W. de RUSSET, Lewisham, engineer, and R. F. DALE, Shoe-lane, City, founder. Improvements in ships' waterclosets.

2548 J. DODGE, Manchester, mechanical engineer. Improvements in filecutting machines.

Dated October 5, 1865.

2554 J. C. STORIN, Whitehead's Grove, Chelsea. Improvements in cleaning cotton seeds. (A communication.)

2556 K. MARSLAND and P. WILLIAMS, Manchester, engineers and machinists. Improvements in instruments for punching or perforating leather and other materials.

2558 R. MORSON, Queen-square, Bloomsbury. Improvements in treating meat and in obtaining products therefrom.

2560 H. A. DUFFREN, South-street, Finsbury, civil engineer. A new apparatus for raising weights by means of the feet or hands. (A communication.)

2562 B. JOHNSON, Church-street, Camberwell Green, pianoforte manufacturer. Improvements in pianofortes.

Dated October 6, 1865.

2566 C. F. GERALD, Langham Hotel. Improvements in fasteners for doors.

2568 H. F. SMITH, Manchester, India-rubber and gutta-percha manufacturer. An improved composition or material to be employed in waterproofing, or rendering woven fabrics impervious to moisture.

2570 F. W. GARDINER, Belgrave-road, Leicester. Improvements in apparatus for laying telegraphic cables in deep waters.

2572 L. A. I. DAUMESNIL, Boulevard de Strasbourg, Paris. A new mechanical propelling screw toy.

2575 W. A. MARTIN, Cannon-street, City, civil engineer. Improvements in apparatus for signalling by means of combined whistles.

2578 W. D. GRIMSHAW, Birmingham, engineer. Improvements in capstans.

2578 J. CUNNINGHAM, Live-pool, civil engineer and architect. Improvements in the construction of fireproof floors for buildings.

Dated October 7, 1865.

2582 J. RODDY, Liverpool, provision merchant. An improved washing or cleansing liquor or solution.

2584 C. H. MELLOR, Oldham, Lancashire, collector. Certain improvements in telegraphic communication for the purpose of indicating danger.

2586 J. HANCOCK, Nottingham, engineer. Improvements in signals for railway trains.

2588 J. KIRBY, Preston, Lancashire, mechanic. Improvements in "pirn" winding machines for winding flax, cotton, and other fibrous materials.

2589 T. M. GIBBONS, Lymington, Southampton. Improvements in the means employed for cleansing the bottoms of ships or vessels.

2590 T. CAMPBELL, Abbey House, Kenilworth. Improvements in evaporating and distilling liquids and in the apparatus employed therein.

2591 W. HARRIS, Wimbeldon, shoemaker. Improvements in tanning or treating hides applicable for machine bands and other purposes.

2592 J. B. THOMPSON, Rothwell-street, Regent's Park-road. Improvements in coating iron and steel with gold, silver, platinum, or copper.

2594 J. HOMAN, The Grove, Camberwell, civil engineer. Improvements in constructing fireproof floors and ceilings.

Dated October 9, 1865.

2596 P. TODD and J. HOLDING, overlooker, Wheelton, near Chorley, Lancashire. Certain improvements in looms for weaving.

2600 W. E. GEDGE, Wellington-street, Strand. Improved machinery or apparatus for obtaining motive power by expansion of air. (A communication.)

Dated October 10, 1865.

2604 J. STURGEON, Barley, near Leeds, consulting engineer. An improved mode of generating steam.

2610 J. H. JOHNSON, Lincoln's Inn-fields. Improvements in the construction of steam generators, applicable also to the construction of condensers, the heating of water generally, and to the warming of buildings. (A communication.)

Dated October 10, 1865.

2614 R. WILLACY, Penwortham Priory, Lancashire, land agent. Improvements in machinery or apparatus for preparing and supplying food for cattle.

Dated October 10, 1865.

2616 J. H. JOHNSON, Lincoln's Inn-fields. Improvements in the construction of steam generators, applicable also to the construction of condensers, the heating of water generally, and to the warming of buildings. (A communication.)

Dated October 10, 1865.

2618 J. H. JOHNSON, Lincoln's Inn-fields. Improvements in the construction of steam generators, applicable also to the construction of condensers, the heating of water generally, and to the warming of buildings. (A communication.)

Dated October 10, 1865.

2612 J. E. Wiles, Upper Clapton. Improvements in submarine telegraphy.

Dated October 11, 1865.

2618 F. P. Warren, East Court, Cosham, Hampshire, Com. E.N. Improvements in bolts, rivets, and the like fastenings for connecting together pieces of metal and other material.

2620 J. Orutchett, Stroud, Gloucestershire. Improvements in the manufacture of gas.

2624 D. C. Piers, America-square, City. Improvements in the permanent way of railways.

Dated October 12, 1865.

2632 J. U. Bastier, Gower-street, civil engineer. Improvements in apparatus for raising liquids.

2634 W. C. Cambridge, Bristol. Improvements in elod crushers and chain harrows.

2636 W. Mather, Salford Ironworks, Manchester, engineer. Improvements in heating calender bowls and other cylinders or rollers.

2638 W. Barwick, St. Peter's, Thanet, builder. An improved preparation or composition for coating, covering, or colouring walls and other surfaces or parts of buildings, and for forming mouldings, cornices, and other decorative parts of houses.

Dated October 13, 1865.

2640 M. Cartwright, Tavistock-street, Covent Garden. Improvements in elastic fronts, sides, and backs for boots and shoes.

2642 W. May, Armourer Serj., 2nd Battalion Coldstream Guards, Tower Hamlets. Improvements in the construction and mode of fixing skates to the boots or shoes of the wearer.

2644 G. Marshall, Pont Blyddyn, near Mold, Flintshire, cooper. An improved mode of treating or preparing casks and other vessels to make them tight and suitable for containing hydrocarbon and other fluids.

2646 R. A. Brooman, Fleet-street, patent agent. An improved liquid compound for purifying sea and other waters. (A communication.)

2648 J. de W. Brinckerhoff, New York. An improvement in preparing paper and the surfaces of other materials for use in photography.

2650 W. E. Newton, Chancery-lane, civil engineer. Improvements in tampions for ordnance and small arms, and in stoppers for bottles and other vessels. (A communication.)

Dated October 14, 1865.

2652 J. Tangye, Birmingham, manufacturer. Improvements in machinery for cutting screws.

2654 W. J. Armitage, iron master, and F. Wooler, manager, Farley, and J. Hodgson, Wortley, both near Leeds, model maker. Improvements in the manufacture of tyres for railway wheels.

2656 J. L. Hancock, Tipton, Staffordshire. Improvements in bedsteads, seats, couches, and other articles for sitting and reclining on.

Dated October 16, 1865.

2660 A. J. Mott, Liverpool, wine merchant. Certain improvements in the production and uses of carbonic acid gas.

2662 W. Clark, Chancery-lane, engineer. Improvements in the treatment of copper ores in the manufacture of copper. (A communication.)

2666 J. B. Robertson, Dromore, Downshire, Ireland, mechanic. Improvements in sewing machines.

2668 J. L. Hancock, Tipton, Staffordshire. Improvements in wheels for common road carriages, in tyres for the same, and in machinery for bending the tyres.

Dated October 17, 1865.

2672 E. Lord, Todmorden, Yorkshire, machine maker. Certain improvements in looms for weaving.

2674 O. G. Link, Lawrence-lane, Okehampton, machinist. An improved process for purifying and preserving water.

2678 G. Davies, Serle-street, Lincoln's Inn, civil engineer. Improvements in folding chairs. (A communication.)

Dated October 18, 1865.

2680 R. Burley, Glasgow, hammer and pick handle maker. Improvements in chucks for turning lathes.

2688 T. Jones, Mason and E. K. Birmingham, saddlers. Improvements in saddles.

2690 J. W. Truman and H. Lovi, Canning Town, Essex. Improvements in block matches and in machinery for making the same.

2692 W. H. Parker, Kilmacow, Kilkenny, miller. Improvements in constructing and mounting or hanging millstones.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

Dated October 21, 1865.

2728 L. D. Girard, Faubourg Poissonniere, Paris. Obtaining sliding surfaces by the interposition and circulation of a liquid or gaseous fluid between the frictional surfaces.

LIST OF SEALED PATENTS.

Sealed October 27, 1865.

1197 L. W. Broadwell | 1203 W. Leatham
1198 T. White

Sealed October 31, 1865.

1208 H. Bessemer	1252 A. Mackie, H. Gar-
1210 C. E. Herpet	side, and J. Salmon
1213 J. C. Davis	1257 T. J. Mayall
1215 M. W. Ruthven	1260 J. Mitchell
1216 W. E. Wiley	1261 J. Wadsworth, H.
1224 R. Fenner	Duness, and J.
1227 F. Wise	M'Murdo
1229 T. Allcock	1262 J. M'Glashan
1230 C. W. Siemens	1267 W. Jackson
1231 J. Catillon	1291 D. Adamson
1232 J. B. Lavanchy	1300 J. J. Révy
1234 E. T. Read and J.	1303 B. Pokutyanski and
B. Fyfe	M. Mycielski
1238 T. W. Roe	1311 G. Mountford and E.
1243 G. Josse	Worrell
1244 E. G. Smith	1314 E. L. Girard
1245 W. F. Stanley	1317 J. Hasford
1247 G. Redrup	1390 C. and S. A. Varley
1248 F. Caldwell	1440 H. E. Newton
1249 J. Hampton	1446 W. Settle
1250 W. Roberts	1514 W. E. Newton
1251 J. Lilley	1544 J. Kennedy
1255 W. Henderson	2285 J. Pilkington

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the London Gazette, October 31, 1865.

1648 W. Olay. Ventilating railway carriages.
1652 W. E. Gedge. Elastic mattress. (A communication.)
1654 I. Bagga. Electric telegraph instruments.
1661 D. M'Glashan, jun. Sewing machines.
1664 J. Busfield and S. B. Walmsley. Combing wool.
1666 W. E. Gedge. Fire escape. (A communication.)
1669 O. T. Porter. Surface condensers.
1674 E. K. Dutton. Indicating the flow of liquids.
1682 M. D. Rosenthal and S. Gradenwitz. Imitation of ivory.
1685 W. Lusty. Needles.
1691 R. A. Brooman. Portable table. (A communication.)
1702 R. A. Brooman. Printing in colours. (A communication.)
1705 J. Whittle. Permanent ways of railways.
1708 W. E. Newton. Pianofortes. (A communication.)
1709 H. M. Kennard. Rivets.
1712 J. Spratt. Cutting hay.
1728 R. H. Leese. Bending sheet metal. (A communication.)
1739 F. Delamare-Deboutville. Drawing cotton.
1740 H. W. Rosser. Waterclosets for ships.
1742 R. A. Brooman. Tuning pianos. (A communication.)
1754 C. de Bergue. Locomotive engines. (A communication.)
1790 A. V. Newton. Superphosphate of lime from guano. (A communication.)
1808 J. Willis. Portable dark tents.
1812 J. F. Heather. Locks.
1823 F. Taylor. Fountains.
1929 J. Jukes, jun., and J. Swinburne. Boiler furnaces.
1956 W. E. Newton. Conical plug steam valves. (A communication.)
1998 J. Cream and O. J. Barr. Alarm in cases of fire.
2000 J. Pickin and R. Bailey. Alarm on railways.
2112 W. Clark. Taking measurements. (A communication.)
2211 A. V. Newton. Supplying boilers with water. (A communication.)
2265 S. Chatwood. Metallic safes.
2426 J. Davidson. Casks.
2448 W. Unwin. Iron.
2485 B. Wren. Grinding wheat.
2494 I. Smith and W. F. Batho. Cooling liquids.
2509 J. A. Mee. Telegraphic cables.
2510 J. W. Hurst. Liferails.
2516 J. W. M. Miller. Preparing skins.
2522 J. W. Tyler. Fixing sheet metal.
2559 W. H. Phillips. Extinguishing fires.
2589 T. M. Gisborne. Cleaning ships' bottoms.
2648 J. de W. Brinckerhoff. Paper.

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 has 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 250 HAS BEEN PAID.

2663 A. J. F. Vigneulle-Brepon	2908 F. A. Shanks and F. Kahn
2680 T. G. Ghialia	2923 F. L. Stott
2687 F. Lipcombe	2927 F. Gregory
2690 F. L. H. W. Blüger	2931 P. Giffard
2691 J. J. Ridge	2937 W. R. Bowditch
2692 P. E. Placet	2946 G. Speight
2694 A. Peck	2951 J. G. Marshall
2900 E. and A. Tatham	2963 J. Musgrave

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

2406 A. Heywood | 2411 W. Hall and A. Wells
2409 W. Munro

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending October 28, 1865.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
251*	0	43135	0	43155	0	63175	0	83195	1
3116	1	03136	0	83156	0	43176	0	83196	0
3117	0	43137	0	103157	0	43177	0	103197	0
3118	0	43138	0	43158	0	103178	0	63198	1
3119	1	03139	0	43159	0	83179	0	103199	0
3120	0	43140	0	43160	0	43180	0	83200	0
3121	1	103141	0	43161	0	43181	1	63201	0
3122	1	03142	1	23162	0	43182	1	03202	0
3123	6	23143	0	83163	0	103183	0	43203	0
3124	0	43144	0	43164	0	43184	1	63204	0
3125	0	103145	0	63165	1	03185	1	03205	0
3126	2	03146	0	103166	0	83186	1	103206	0
3127	0	83147	0	43167	0	83187	4	43207	0
3128	0	43148	0	43168	3	63188	1	03208	0
3129	0	43149	0	43169	2	43189	4	43209	0
3130	1	63150	0	103170	0	43190	1	103210	0
3131	0	43151	1	23171	0	03191	0	103211	0
3132	0	43152	1	63172	0	43192	1	43212	0
3133	0	83153	0	43173	0	43193	6	63213	0
3134	1	63154	0	43174	1	23194	4		

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

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

Date.	No.	Names.	Subjects of Design.
1865			
August 18,	4736	Smith and Coventry...	Tool holder
" 27,	4737	R W Winfield and Co	Fire guards
" 29,	4738	J and S Smith	Improved "back guide"
Sept 5,	4739	Whitaker and Gros-	Soap
		smith.....	
" 11,	4740	J Dean.....	Feeding trough
" 12,	4741	Barrett and Macken-	Wine glass
		zie.....	frame
" 14,	4742	C Watson	Multum in parvo shaft
			tag
" 15,	4743	W Malden	A pipe wrench
" 20,	4744	E A Rippingillie	Spring chimney
			holder
Oct 2,	4745	A Pope.....	Table cloth
" 2,	4746	W Mitchell.....	Writing cabi-
			net
" 6,	4747	W E Tilley	Cistern ball
" 13,	4748	J Ellis, jun.....	Stay hook
" 16,	4749	G Shortland and J	Self fastening
		Bushell.....	grid or cover
" 31,	4750	B. Sill, jun.....	U m brella
			holder
" 31,	4751	R Johnson	Stem of a tele-
			graph insu-
			lator

PROVISIONAL REGISTRATIONS.

Date.	No.	Names.	Subjects of Design.
1865			
August 17,	1638	C Watson	Multum in parvo shaft
			tag
" 18,	1639	R Willoughby	Lavatory and
			urinal
" 22,	1640	A Ford.....	Knife and fork
			cleaner
" 25,	1641	Lumley and Watson...	Double barrel
			crab winch
" 25,	1642	J W Bartlett.....	Sewing ma-
			chine arm
" 26,	1643	G C Astree	Scarf retainer
Sept 6,	1644	F Duffie	A portable ob-
			servatory
" 11,	1645	J Sunderland.....	Fire draught
			plate
" 14,	1646	A Lowden	Ventilator
" 16,	1647	O R Carter.....	Railway brake
October 4,	1648	W Moates, jun	Obese fork
" 14,	1649	J Roe	Smoker's pouch
" 19,	1650	T G Hack and W H	A barrow
		Showering	
" 26,	1651	O Eaton	A measure for
			liquids
" 27,	1652	H Rodriguez	Safety envelope

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

TIMBER, duty is. per load, drawback is.										
Teak -	load	£11	0	213	0	Archangel, yellow -	£12	10	214	1
Quebec, red pine -		3	5	15	10	St. Petersburg, do. -	11	0	12	0
yellow pine -		2	15	3	10	Finland -	10	0	11	0
St. John, N.B., yellow -		0	0	0	0	Memel -	10	0	10	0
Quebec oak, white -		5	5	6	0	Gothenburg, yellow -	10	0	11	0
" birch -		3	10	4	10	do, yellow -	9	0	9	10
Quebec oak, black -		3	10	4	10	do, yellow -	9	0	9	10
Danish oak -		3	0	6	0	Soderström -	10	10	11	0
do -		2	10	3	10	Christiania, per Cn.				
Memel fir -		3	10	3	10	do, by 3 by 9 in.				
Riga -		3	5	3	5	do, yellow -	10	0	11	0
Swedish -		3	0	3	0	do, yellow -	10	0	11	0
Norway, yellow pine -		10	0	11	0	do, by 4 ft. 3 in.				
do, yellow pine -		10	0	11	0	do, by 4 ft. 3 in.				
Lathwood, Dantsie, fm 7	10	8	0			FUMICAAS, per ton	0	14	1	0
do, Dantsie, fm 8	10	9	0			Oil, do.	5	0	5	0
do, Dantsie, fm 9	10	10	0			Seal, pale	pr run			
do, Dantsie, fm 10	10	11	0			Sperma body -	115	0	0	0
do, Dantsie, fm 11	10	12	0			do, do -	60	0	0	0
do, Dantsie, fm 12	10	13	0			White, 8th Sp. pal.	60	0	0	0
Quebec, white spruce 13	0	17	0			Olive, Gulf Spail -	55	0	0	0
St. John, " 12	0	14	0			Pocanaut, Coch. ton	50	0	5	0
Folow pine, per re-						Palm, fine -	44	0	45	0
assault 10						Linsseed -	26	0	8	0
Canada, 1st quality -	16	10	19	0		do, do, Eug. pal.	19	0	19	0
" 2nd -	12	0	14	0		do, do, Eug. pal.	31	0	31	0

MECHANICS' MAGAZINE.

LONDON: FRIDAY, NOVEMBER 10, 1865.

PNEUMATIC DESPATCH.

PAPIN has the credit of having invented the atmospheric mode of propulsion. However correct this may be, it is certain that his ingenious contrivances for exhausting and compressing the air led to little practical result. From his time the subject of working machinery by atmospheric pressure slept for about a century, when it was revived both in this and other countries. At one time it was thought that the locomotive system was in danger of being superseded by the atmospheric. Numerous experiments were tried, and several lines of railway were laid down upon the atmospheric principle. The alleged freedom from accident as compared with the locomotive system was the great stimulant, and Pinkus, Clegg, Samuda, and others, laboured away to perfect the system. But they laboured in vain, the great enemy to success was the ugly gap in the pipe which disturbed the vacuum by admitting air. To overcome the rupture of the pipe caused by the progress of the carriages much ingenuity was displayed in the valve arrangement, and, indeed, in every department. But the system proved radically defective, and sank into desuetude, like many other inventions on which a vast amount of time, money, and deep thought has been expended. Later times have witnessed a return to the principle, worked out, however, under very different conditions. In the pneumatic system the tube is enlarged, the carriage itself forms the piston, and, save at each end of the tube, there is no communication with the atmosphere; the vacuum is perfect. All this, like Columbus's egg, appears extremely simple now it is effected, and of course one wonders that the idea never occurred to those whose brains and pockets were alike ransacked to make the atmospheric principle of traction a success. The pneumatic system has been before the public in various ways for the last few years. Most people remember the experimental despatch line which was laid down at Battersea some four years since. Still better known perhaps is the short pneumatic railway for passengers at the Crystal Palace. The practical result of the experimental working of these two lines was manifested on Tuesday last, by the public opening of the first portion of the Pneumatic Despatch tube which will shortly connect the North-Western Railway at Euston-square with the General Post Office. The line just opened is a mile and three-quarters in length, and the cost is stated, at a rough calculation, to be some £30,000 or £35,000 per mile. From the Company's office in Holborn the tube runs southwards in a curved line under a portion of Seven Dials, thence it curves again and pursues a north-westerly course under Tottenham Court-road. It crosses over the Metropolitan Railway at the Euston-road, and then runs to the Euston Station in a north-easterly direction. This route is somewhat circuitous, forming in effect three sides of a square, but it was necessitated by the Duke of Bedford's interference. The route originally proposed was a direct line from the Euston Railway Station, underneath Woburn-place, to the Holborn Station of the company. A quarter of a mile of the tube was laid in this direction when the Duke forbade further progress on his estate. The works were, therefore, abandoned, and the line diverged, under the influence of the same obstructive that recently stopped the organ pipes at the Floral Hall Working Men's Exhibition.

The straight portions of the line are formed

of a continuous cast-iron tube, the curved portions being constructed in brickwork. The sharpest curve is that near the Holborn Station, which is 70ft. radius. The line passes beneath Seven Dials on a curve of 300ft. radius, and on leaving the direction of Tottenham-court road for the Euston Station a curve of 170ft. radius occurs. The cast-iron tube is of the horseshoe section, the internal dimensions being 4ft. 6in. horizontally and 4ft. vertically. The tube is cast in 9ft. lengths, each length weighing about two tons. In the experimental lines the rails are cast on the floor of the tube, but in the present case a wrought-iron rail is used, which is bedded on longitudinal timbers. The chief gradients on the line are 1 in 40, 1 in 45, and 1 in 60, some portions of the line being on the level. The average distance between the level of rails and the road level above is 9ft. This depth enables the tube to take a general position over the sewers and under the gas and water pipes, leaving each in the undisturbed possession of its own locality. Some slight obstruction was offered at the Euston-road by the crown of the Metropolitan Railway tunnel. The difficulty, however, was speedily overcome, and the tube brought to its proper level by cutting a slice off the crown of the tunnel and laying the tube upon it, a cast-iron trough being interposed to carry the tube. The trucks, which are about 10ft. in length, resemble in form the ordinary railway open goods waggons, the ends being raised above the sides and presenting an outline conforming to that of the interior of the tube. The edges of the truck ends are bound with an elastic medium, although a slight space is left between the trucks and the face of the tube, a perfect vacuum not being indispensable to the working of the line. It is found that no inconvenience arises from leakage, whilst, in the case of a close fit, the results of friction would prove prejudicial. The trucks are constructed of wood cased with iron; the wheels revolve in excavated circles, and are thus flush with the sides. Each truck weighs of itself about a ton, and its load is on an average one ton and a half. The trains which were run on the occasion of the opening consisted of four trucks, which with their loads represented a gross total load of ten tons. This weight was sent from Holborn to Euston with a blowing pressure of from 5oz. to 6oz. per square inch. It was afterwards drawn by exhaustion from Euston to Holborn at a pressure of from about 4oz. to 5oz., the time occupied in each journey being about seven minutes. In ordinary steady working twenty-four trains have been run in four hours, or equal to two hundred and forty tons gross load conveyed in four hours. The cost of working is found to be less than one penny per ton per mile; this includes engine fuel, and attendance, and all establishment charges. The low figure at which the prime cost comes out is highly favourable to the success of the undertaking in a commercial point of view.

The machinery by which the transit of trains is effected was designed and constructed by Messrs. James Watt and Company; it is placed in the rear of the Holborn Station, and consists of an engine having a pair of 24in. cylinders, 20in. stroke. A fan 22ft. in diameter is geared at two to one with the engine, and is worked continuously, the alternate action of pressure and exhaustion being governed by valves. 100 revolutions of the fan will give 3½in. water pressure; 200 revolutions give 13in. Pressures of 1½lb. and even 1lb. are quite within reach. In ordinary the fan works at 160 revolutions, equal to 6oz. on the square inch. The machinery at Holborn is arranged for working both sections of the line, so that when the construction of the section from Holborn to the General Post Office is completed, trains will be drawn, by exhaustion, from that point and from Euston-square to Holborn simultaneously. Arrived there they will be placed each in the tube the other has just quitted, and will then be sent by pressure to their respective destinations, con-

stant communication, if necessary, being thus maintained between Euston and St. Martin's-le-Grand. The works on the Post Office line have at present only reached as far as Ely-place, Holborn, but they are being vigorously pushed on. It is of course well known that the pneumatic line is constructed solely for the transmission of parcels and mail bags; nevertheless a worse method of transit might be devised for passengers. As regards steadiness, a run on a ballast engine would contrast unfavourably with a trip through the pneumatic despatch tube, as we experienced it on Tuesday. True, the trucks do run rather hard, but this is owing to the fact that no springs are interposed between the axles and the body of the truck. Although the journey to Euston was made in total darkness and without a knowledge of the points at which curves occur, they were easily recognised by the tilt given to the truck by the super-elevation of the rail. On the return trip we had the advantage of a lantern, and, as well as the rapid transit would permit, were enabled to examine the work, which showed very perfect finish and sound construction. The joints were cleanly made, and the junctions of the brickwork and iron tube carefully executed. The only inconvenience experienced was at the commencement and termination of the journeys, especially at the latter, when a sensation is felt in the ears very similar to that which occurs on descending in a diving bell. The time occupied in the return journey from Euston to Holborn was just eight minutes, which was rather in excess of the time taken by the train when laden with ballast only. But, in addition to the ten tons gross load to be moved, there was now the weight of some eight or ten passengers, who thus practically illustrated their confidence in the efficiency of the system.

Although at present only two lengths of line are laid down, there can be little doubt that others will follow as soon as the commercial success of the first is proved. The company possess powers under their act to lay down pneumatic tubes at any point within the jurisdiction of the Metropolitan Board of Works, and their scheme is to construct lines between the ten district post-offices and the General Post Office. They further propose to construct lines between the different railway termini and goods depôts in London, connecting with these lines the principal London markets and other important points. To effect this some thirty-five miles of tubing would be necessary, for the laying of which, as already observed, no further parliamentary powers are necessary. The Waterloo and Whitehall Railway will be constructed upon the same general principles as the foregoing, only that, being intended for passenger traffic, it will of course be on a much larger scale, and the details of the carriages will be differently worked out. The inconveniences to which we have referred will be absent on this line, inasmuch as the carriages will be closed from all contact with the outer air, except so far as is necessary for ventilation. Lamps will light up the gloom of the tunnel, and springs will render the trip agreeable. In our issue for the 16th of June last we gave the detail particulars of this railway, and we recently announced the commencement of the works. This line is engineered by Mr. W. T. Rammell, who is also joint engineer with Mr. Latimer Clark for the Pneumatic Despatch. Before concluding we would observe that the Battersea experimental line was transferred about three years ago to Seymour-street, where it has been and now is conveying mails between Euston-square Station and the north-western district post-office in Eversholt-street. The experiences of Tuesday last form the basis of a strong expectation that at no distant day the pneumatic despatch system will have extended its operations in all directions under London. That it is an engineering success none can deny, and judging from circumstances we may safely predict its commercial prosperity.

PROGRESS OF IRON SHIPBUILDING.*

THE history of the progress of naval construction since the earliest application of iron to that purpose would, if produced under ordinary circumstances, prove most interesting. But when delineated by one of the pioneers and experimentalists who first proved the value of iron in shipbuilding, it cannot fail to be also highly instructive. It is scarcely necessary for us to observe that such is the character of Mr. Fairbairn's present treatise. Embracing, as it does, his own personal experience, and embodying the practical results of many years' labour in iron, it commends itself not alone to those engaged in iron shipbuilding, but to the engineering profession at large. Although the commencement of the history of iron shipbuilding dates scarcely eighty years back, that period appears to be sufficiently remote for error and misconception to have crept in with regard to the first iron ship. Various statements have been made as to its inventor, and many claims for the honour have been advanced. Mr. Fairbairn considers it probable that the first construction of iron canal boats took place at the commencement of the present century. He observes that we have evidence of their existence in Staffordshire about the year 1812 or 1813, and that in 1822 the Horseley Company built the "Aaron Manby." In a note, however, he states that Mr. Grantham informed him that an iron barge was made in 1787. Now, although not a very important point, it is still an interesting one, and we therefore refer to an article on "The First Iron Ship," which appeared in the *MECHANICS' MAGAZINE* for the 12th of May last. Here we clearly showed that Mr. John Wilkinson, of Broseley, an ironmaster, was the originator of the idea of iron shipbuilding, he having constructed an iron vessel which was launched on the 6th July, 1787. This ship was built at Willey, in Shropshire, and traded on the Severn, and is doubtless the vessel referred to by Mr. Grantham. The "Vulcan," which was built at Faskine, on the banks of the Monkland canal, a few miles below Glasgow, was the next iron vessel, and she presented a very perfect example of iron shipbuilding for so early a date. Then followed the "Aaron Manby," the "Aglais," and the "Fairy Queen," the "Aaron Manby" being sent to London in sections, reconstructed, and navigated to Havre and Paris by the late Admiral Napier.

The experimental tests and competitive trials of locomotives which were made at Rainhill, in 1830, naturally created considerable alarm in the minds of canal proprietors, and led to the investigation of the subject of light boats for canal navigation. Mr. Fairbairn instituted experiments to determine the law of traction, and in a report thereon, in 1831, he recommended the introduction of iron vessels, and steam on the locomotive principle, in place of horses as a motive power on canals. The result of this was that four iron vessels were made at Manchester for the Forth and Clyde Canal Company. One was a twin boat having the paddlewheel in the centre; the second had the paddles recessed in the dead wood of the stern. Another vessel on this latter principle was also built at Manchester in 1831; she measured 84ft. long and 14ft. beam. About the same time iron boats were constructed for the navigation of canals in Ireland, and from that date the real practical work of iron shipbuilding commenced in earnest in all directions. It was soon clearly shown that vessels of large tonnage and great magnitude could be safely constructed of iron, and the dimensions of iron ships began accordingly to increase. They continued so to do

until they reached the proportions of the "Great Eastern," which are not likely at present to be exceeded. Although iron has been constantly applied to the building of our mercantile navy during thirty years, it is but very recently that progress has been made in this direction in the Government dockyards. There was ample experience to show the superiority of iron as a material for shipbuilding, but in the first instance strong prejudices were engendered against iron, and in the second, the dangers arising from the effects of shot on iron ships served to retard its adoption in ships of war. The Admiralty were first approached on the subject in 1834, but nothing was done for several years, until at last, under pressure, some targets were prepared. These were experimented upon by a 32-pounder smooth bore gun at only 30 yards range, and the result being condemnatory the Admiralty fell back upon the old wooden walls and thus retarded all progress. In 1855, however, the French Emperor gave a fresh impetus to the subject by the introduction of thick iron plates for casing the sides of vessels as a medium of resistance to projectiles at high velocities. From that time forward the Admiralty betook themselves to action, and hence the changes and experiments which are now in progress. What the ultimate results may be it is hard to surmise when we find the conditions of offence and defence so continually varying.

Quitting the historical section of the work—necessarily leaving unnoticed many interesting points—we turn to the second general division. This includes four chapters, and treats of the law of strains and the properties of the material. Iron is considered with reference to its disposition in the construction of vessels in order to meet the force of wind and sea. Further, how the material in the different parts should be proportioned and distributed so as to equalise their powers of resistance to the alternation of strains which the different parts undergo when the ship is afloat. In considering the natures and magnitudes of the strains to which ships are subjected when afloat, it is necessary to suppose a vessel at sea in a storm where the elevation from the trough of the sea to the crest of the wave is 24ft. The distance between the crest of each wave may be assumed as 380ft. or 400ft., and the velocity of the waves may be taken at ten knots an hour. If a large vessel be supported by two waves, one at the bow and another at the stern, her midships being partially unsupported, as if two liquid rollers were passing at the above rate under her bottom, the strains would have a tendency to crush the upper deck at a central point between the two supporting waves, and to tear asunder the hull or bottom at a point directly underneath the point of compression. Hence the necessity for increased resistance in those parts. If this position be reversed and we assume the roller to be under the centre of the vessel, the strains are also reversed, the crushing force acting on the bottom, and the tensile force on the upper deck. A third position is that where the waves have passed from the centre of the vessel half way to the stern. Here, again, the same forces are continued, and we have tension on the upper deck at a point immediately over the apex of the surge and compression directly below that point. Independently of rolling, these forms give nearly all the disturbances and variety of strains to which vessels are subjected when afloat. There are, however, circumstances where widely different forces come into operation, for instance where a vessel is stranded on a lee shore, beaten on rocks or sandbanks. The only safeguard in these positions is increased strength at midships and a sufficient number of watertight bulkheads to prevent the ship filling entirely with water.

Dr. Rankine computes the most severe straining action which can act on a ship afloat,—viz., that which takes place when she is supported midships on a wave crest,—and he finds that

the bending action cannot exceed that due to the weight of a ship with a leverage of one-twentieth of her length, and the racking action cannot exceed about sixteen one-hundredths of her weight. Applying these results to two excellent examples of ships of 2,680 tons displacement, one of iron and the other of wood, the following were found to be the values of the greatest stress of different kinds exerted on the material of the ship:—In the iron ship: tension, 3.98 tons per square inch; thrust, 2.35; racking stress, 0.975. In the wooden ship: tension, 0.375 tons per square inch; thrust, 0.293. In the iron ship it follows that the factor against bending is between 5 and 6, exactly agreeing with the best practice of engineers, and that there is a great surplus of strength against racking. In the timber-built vessel the factor of safety is between 10 and 15, which also is consistent with good practice in carpentry. The iron diagonal braces required by Lloyd's rules would only be sufficient to bear one-third of the racking strain, the friction and adhesion of the plank bearing the rest. The second example of strain to which a vessel afloat is subject, or that position in which she is supported centrally on the crest of a wave, is that in which the maximum strain appears to take place. This strain has been determined as about one-fifth of the ultimate strength of the material. But when this apparently small strain is alternately imposed and removed an indefinite number of times, it may assume the character of a destructive force. This is the more apparent when it is considered that these strains are first in one direction and then in another, or, in other words, the material in the top section—the weakest part of the section—is at one time in tension and at another in compression. The custom of distributing the load more towards the centre than towards the extremities of a ship is highly judicious, inasmuch as it reduces considerably the strain produced on the transverse section when the ship is balanced on the crest of a wave. Mr. Fairbairn gives an analysis of the experiments on the strength and other properties of plates, angle-irons, &c., which will be found most useful as a guide to iron shipbuilding. The results of this analysis are chiefly taken from his own experiments and from those of the late Professor Hodgkinson. These experiments embrace almost every known mechanical property of iron, and the knowledge thus obtained has furnished data for the construction of ships and other structures employed in the useful and industrial arts. The ultimate powers of resistance of iron to tension, compression, torsion, &c., are given, and will be found useful for guidance in the selection and distribution of the material when applied to the purposes of shipbuilding.

A most important desideratum is a perfect system of riveting, and in this department especially sound judgment and great responsibility are involved. The question of the jointing of iron plates, and the form of joints required, is carefully considered by Mr. Fairbairn. He shows the kind of riveted joint best suited for the attainment of the maximum powers of resistance in the longitudinal and transverse joints. The point to be attained is the making the joints as secure as if they were continuous and homogeneous in character. Welding would of course effect this perfectly; but, as welding cannot be resorted to under present circumstances, riveting furnishes the next best means of attaining the end. A good rivet carefully inserted becomes part and parcel of the plate, and when rivets are duly proportioned as to size and number they become equal in strength to the plate itself, minus the parts punched out for the rivets. The first point to be considered in uniting plates by riveting is punching the rivet-holes. They should be clean and well cut by a flat steel punch, and when the plates are put together the holes should be perfectly coincident. This has been done by the jacquard machine of the late Mr. Roberts with a degree of precision unequalled in self-regulating machines. The

* "Treatise on Iron Shipbuilding, its History and Progress, as comprised in a series of experimental researches on the laws of strain; the strengths, forms, and other conditions of the material; and an inquiry into the present and prospective state of the navy, including the experimental results on the resisting powers of armour plates and shot at high velocities." By WILLIAM FAIRBAIRN, Esq., C.E., LL.D., F.R.S., &c. London: Longmans, Green, and Co., 1866.

next point is the riveting. The overlap single-riveted joint has long been superseded by the double-riveted joint, which possesses many important advantages. It was at one time considered that the joint was stronger than the plate, but experiment soon showed the fallacy of the supposition. The result of a series of trials made with single-riveted joints showed a loss of 26 per cent. on the joint as compared with the plate. The result of some experiments with double-riveted joints gives, as compared with the single joint, an excess of strength of 4,047, a ratio of nearly 10:8 in favour of the double-riveted joint. With regard to the manner in which the rivets are arranged it has been found that the chain principle is by far the best. In a series of experiments upon this point it was found that out of thirty differently united joints those upon the chain principle with the rivets in the line of strain were the strongest and best application. They approximated closer to the strength of the solid plate, taken through the line of the rivet-holes, than any of the others experimented upon. But we must now leave Mr. Fairbairn's exhaustive treatise, only, however, to return to it, for there remains much important matter relating to the varied construction of iron vessels which claims attention.

NOTES ON NEW DISCOVERIES AND NEW APPLICATIONS OF SCIENCE.

The Supposed Compound Metal "Ammonium"—New Theory of the Constitution of "Ammonium-amalgam"—Remarkable Effects produced upon various Bodies by Contact with a Hydrogen-flame—Curious Proof of the Constant Presence of Sulphur in the Atmosphere—Some New Elements for Thermo-electric Batteries—The Universal Diffusion of Copper.

DOES the hypothetical metal "ammonium" really exist? That question is one of the most interesting raised by modern chemists, and its solution might throw some light upon the general problem of the constitution of the elements. Ever since Berzelius endorsed Ampère's suggestion that the constitution of the ammoniacal salts is exactly analogous to that of the salts of the ordinary metals, most chemists have regarded it as established that ammonium *does* exist: that is to say, that the ammoniacal salts have as their base a compound metal, whose formula is NH^4 , and which is thus composed of the two gases nitrogen and hydrogen, consisting of one equivalent, or fourteen parts by weight, of the former, combined with four equivalents, or four parts by weight, of the latter. Gaseous ammonia has the formula NH^3 , and thus contains one equivalent of hydrogen less than the supposed radicle, NH^4 ; but there is no known ammoniacal salt in which the existence of NH^4 is not at least conceivable, and the received theory supposes it to exist even in aqueous ammonia, which on this hypothesis is not simply a solution of NH^3 in water, but is a solution of NH^4O , or oxide of ammonium, supposed to have been formed by the combination of the gas with one equivalent of the water, NH^3 combining with H^2O to form NH^4O . The exceedingly close similarity between the properties of aqueous ammonia and those of soda, or oxide of sodium, and those of potash, or oxide of potassium, strongly confirms this theory of the constitution of the former. Whether, however, aqueous "volatile alkali" is or is not an oxide, and therefore similar in constitution to the "fixed alkalies," there can be no doubt that the constitution of the ammoniacal salts is exactly similar to that of the salts whose bases are indisputably metallic. In them all, NH^4 plays a part precisely parallel to that which the metal plays in the metallic salts. To compare them with the salts of potassium, for example, chloride of potassium is KCl and chloride of ammonium is $(NH^4)Cl$, sulphate of potassium is K^2SO^4 and sulphate of ammonium $(NH^4)^2SO^4$, nitrate of potassium is KNO^3 and nitrate of ammo-

nium is $(NH^4)NO^3$,—and so with all the other ammoniacal salts, NH^4 behaving in them all exactly as though it were a metal. That that which in these compounds behaves as a metal really is one has been supposed to be proved by the fact that it forms with mercury a compound which, alike in its mode of formation and in its properties, so closely resembles an "amalgam,"—a kind of compound which mercury forms only with *metallic* bodies,—that no one, until just now, has imagined it could be anything else. To compare ammonium again with potassium, potassium-amalgam and the supposed ammonium-amalgam are producible in precisely the same way, and have a very close likeness to each other. Thus, potassium-amalgam may be readily obtained by the electrolysis of a solution of chloride of potassium, by the weak current of a single cell having a few drops of mercury for its negative pole. The mercury gradually swells up to several times its bulk, and if the current be transmitted to it by means of a platinum wire this wire becomes amalgamated through a considerable portion of its length by the creeping up of the potassium-amalgam. When the amalgam is removed from the influence of the current, water will very rapidly decompose it, with evolution of hydrogen and formation of a solution of potash. If chloride of ammonium be substituted for chloride of potassium, the chief difference in the result will be that the mercury will swell up to a much greater extent than when the salt used is chloride of potassium. If the current be led to the mercury by means of a platinum wire, this wire will become amalgamated as in the former case, and if the wire, after it has been thus amalgamated, be itself used as the negative pole, the action will still continue, and a bulky amalgam,—or, at least, what has hitherto been regarded as such,—containing so little mercury, and being consequently so light, that it will float upon the solution, will be formed. Removed from the influence of the current and exposed to the action of water, this compound is instantaneously decomposed, just like the potassium-amalgam, with evolution of hydrogen, as in the case of the potassium compound, and formation of a solution of ammonia. There is thus the closest similarity, as regards both appearance, properties, and mode of formation, between potassium-amalgam and the compound which NH^4 forms with mercury, and this latter compound has hence been named "ammonium-amalgam," and its existence has been held to prove the metallic character of ammonium, seeing that metals are the only bodies which can yield "amalgams," or mercury—compounds having a metallic aspect and the general character, not of salts, but of alloys. It should be added that ammonium-amalgam may be formed, not only by the electrolytic method just described, but also, without the aid of an electric current, by the action of sodium-amalgam, made by dissolving sodium in mercury, upon a warm dilute solution of sal-ammoniac. When sodium-amalgam is added to such a solution, there is at once produced an ammonium-amalgam containing more mercury than that obtained by the electrolytic method, and having a spongy, pasty texture, a leaden colour, and a most decidedly metallic appearance. At a very low temperature this amalgam becomes solid, crystallising in very brilliant cubes.

Now, to use the words of an American chemist, Mr. Charles M. Wetherhill, supposing ammonium to be really a metal, "the assumption of the elementary nature of a metal is destroyed, and the ideas of the alchemists are revived; for if NH^4 be a metal and NH^3 not one, why may not other metals, esteemed elements, be also compounds?" Moreover, if NH^4 be a metal, it is impossible to avoid concluding that all the organic basic radicles, and especially the so-called "ammonium-bases," are metals also. Seeing objections to this necessary inference from the doctrine of the metallic character of ammonium, Mr. Wetherhill was led to investigate

very closely the properties of the supposed amalgam which has been regarded as affording the strongest confirmation of that doctrine, and he considers that his experiments justify him in concluding that the so-called ammonium-amalgam is not really an amalgam, or alloy of mercury with a metal, nor, indeed, a compound, of any kind, of mercury, with NH^4 , but that it consists of NH^3 and free H mechanically retained, as very minute gas-bubbles, in the pores of the mercury, which he supposes to have been rendered capable of thus retaining large quantities of those gaseous bodies by its atoms having undergone some change of polarity, greatly increasing its power of cohesion. We do not think that his experiments, a detailed account of which will be found in the last number of the "American Journal of Science," absolutely establish this conclusion, but they certainly show that the metallic character of ammonium-amalgam, and therefore that of ammonium itself, is more open to question than had been supposed.

Mr. W. F. Barrett, Professor Tyndall's assistant in the Physical Laboratory of the Royal Institution, while conducting, in the spring of this year, a series of experiments on the character of the radiation emitted by various solids heated by means of a hydrogen flame, noticed that it frequently happened that a deep blue colour arose on the surface of the substance examined at the instant of the flame coming in contact therewith. This blue colouration occurred only when the flame came into actual contact with the substance; it was restricted with great precision to the place of contact with the flame, so that it was always of the exact shape and size of a section of the flame; it was invariably of the same rich blue tint, and its production was always instantaneous, but its duration was generally short, for "it disappeared after a few seconds' exposure when the flame continued to play upon one spot, although it was immediately restored by shifting the flame to an untried portion." Mr. Barrett at length undertook a special investigation into the cause of this curious phenomenon, and accordingly applied the hydrogen flame to a great number of bodies taken at random from various places in the laboratory. He found that the blueness appeared on most of them, at the instant of contact with the flame, but not on all. "It appeared with extreme brightness on some pieces of granite and glass tubing, but was not at all confined to non-metallic bodies, as the majority of the metals presented the same appearance. Still there were several substances which showed no blueness whatever, even when subjected to the most careful and repeated examinations; and there were others on which the blueness was only faintly and momentarily seen. This latter occurred chiefly with objects taken from the cases of the mineralogical collection in the museum of the Institution." A classification of the substances experimented upon, according to the effects they gave, yielded no information as to the cause of the phenomenon, and for some time Mr. Barrett could only conceive that it must be due to a new kind of fluorescence, differing from that investigated by Professor Stokes in requiring contact of the source of rays, and in its disappearance after a short exposure to the flame, and therefore in some respects resembling phosphorescence, but differing therefrom in the sharpness of its outline, the rapidity of its appearance, and its non-persistence when the source was removed to the smallest distance. He found that the phenomenon could not be produced by either a luminous jet of coal-gas, the non-luminous flame of a Bunsen's jet, or the flames of alcohol, bisulphide of carbon, carbonic oxide, olefiant gas, or marsh gas. Bodies which showed the blueness strongly with a hydrogen flame did not exhibit the least trace of it with any of these flames, and Mr. Barrett was therefore led to conclude that it might be due to the intense heat of the hydrogen flame. This idea, however, was disproved by subsequent experiments, which showed

that bodies which evinced the blueness very vividly on contact with a hydrogen flame evinced none whatever on contact with the much hotter flame of the oxy-hydrogen blow-pipe. Another puzzling fact was that all bodies possessing the power of showing the blueness lost the power by being heated to redness, and did not recover it on cooling, but were yet found to possess it again after a few days' exposure. "For example, a piece of granite was taken which gave the blueness in every part; one spot on it was then exposed to the oxy-hydrogen flame. The granite when cold was again examined, when the blue appeared distinctly on every part except that which had been heated; here the blueness was suddenly extinguished." After a few days' exposure in the laboratory the property of exhibiting the blueness was found to have been restored to the spot which had been heated, and in all similar cases it was found that the vividness with which the blue appeared upon substances which had had their power of exhibiting it temporarily destroyed by being heated to redness was in proportion to the length of the subsequent exposure. It was also found that if a body which exhibited the blueness at all parts of all its surfaces were then broken, the fresh surfaces presented at the places of fracture were at first entirely destitute of the property of showing the blueness, but that they subsequently acquired that property.

At length it happened that among the substances which Mr. Barrett examined was a piece of vulcanised india-rubber, which was found to give the blue colouration much more intensely than any other substance that had been tried. Suspecting that in its case the blueness was caused by the combustion of the sulphur entering into its composition, Mr. Barrett took a chemically clean plate of platinum, rubbed its surface slightly with a stick of sulphur, and then exposed it to the flame. Before being rubbed with the sulphur the platinum plate had exhibited no blueness on contact with the flame, but after being rubbed with the sulphur it exhibited the blueness very vividly. Mr. Barrett took another chemically clean plate of platinum and wiped it over slightly with a piece of vulcanised india-rubber; it then not only exhibited the blueness, on the application of the hydrogen-flame, but was found, on examination with a high power under the microscope, to have all over it little spots, which were not affected when a drop of water was placed upon them, but which a drop of bisulphide of carbon instantly dissolved, thus proving them to be unquestionably sulphur. A great many experiments of this and other kinds resulted in showing that the slightest contact of sulphur, or of a body containing that element in the free state, is sufficient to impart to any substance the property of showing the blue colouration upon contact with a hydrogen-flame, and that it is invariably to the presence of sulphur that this blue colouration is due. There then arose the question, how did the sulphur get on the surfaces with which that element had not been purposely brought in contact? That the sulphur must have been derived from the atmosphere seemed the only possible answer to this question, and experiment soon showed it to be the true one. "An old block of granite was taken and examined by the hydrogen-flame: it showed the blue colouration vividly on every part of its surface. The block was now split in halves and again searched by the flame: on the newly fractured surfaces not the faintest trace of colour was seen, even in a darkened room. The two fragments were now placed on an upper shelf in a room in which no fire was ever made. Over one of the pieces a glass vessel was inverted, dust being thus excluded from it, while the other fragment was left uncovered; both had their fractured surfaces turned uppermost. After three days they were again tried by the hydrogen-flame. The upper side of the portion which had been under the glass showed, as before, no blue-

ness; whereas the other fragment was now found to give a well-marked blue colour on its upper and previously inert surface. A piece of white paper had been placed by its side, and from this it was seen that dust had settled upon the exposed piece of granite." Two plates of chemically clean platinum, similarly exposed, gave corresponding results, as also did marble and all other substances tried, and the effects were just the same whether the bodies were exposed in the laboratory, or in private dwellings, or in the open air. These results fully explain why the blue colouration did not appear on substances taken from the carefully closed cases in the museum of the Institution, and brought out the curious fact that sulphur,—whether in the free state, or combined, does not yet appear,—is invariably a constituent of atmospheric dust. Why the sulphur in such dust deposited upon solid bodies should give rise to a blue luminosity when a hydrogen-flame is applied to the bodies upon which the dust is deposited, and should not occasion any such phenomenon with any other flame, whether hotter or cooler than that of hydrogen, remains to be explained, but the explanation will doubtless be yielded by further experiments.

Until recently it was not known that any substance was more powerfully negative, as a thermo-electric element, than metallic bismuth, or any more powerfully positive than metallic antimony. Some little time ago, however, as has been duly recorded in these columns, Professor Bunsen found that both pyrolusite and copper pyrites are more strongly electro-negative than bismuth, and that the electro-positive properties of antimony are less powerful than those of an alloy of antimony and zinc. This discovery of Bunsen's has led Mr. Walter Flight to investigate the thermo-electric properties of as many of the substances which conduct electricity as he could procure, and he has found that, when arranged in such order that each is electro-negative to those below it and electro-positive to those above, the list of those of the substances he tried which yielded the best results stands as follows:—Red iron ore, copper pyrites No. 1 (locality unknown), copper pyrites No. 2 (Worthing copper mine, South Australia), galena, iron pyrites No. 1 (an irregularly shaped piece), selenide of lead, pyrolusite, copper pyrites No. 3 (Rammelsberg, near Gosslar; very pure), psilomelane, pitchblende, manganite, braunite, copper pyrites No. 4, (Dillenberg; contains twenty-seven per cent. iron pyrites), telluride of bismuth (Schemnitz, Hungary), iron pyrites No. 2 (a small cube), melted copper pyrites No. 4, peacock copper ore, arsenical iron, tinstone, magnetic iron ore, melted copper pyrites No. 1, melted copper pyrites No. 3, bismuth, melted copper pyrites No. 2, cobalt speiss, meteoric iron (Atacama), kupfernickel No. 1, nickel-antimony glance (Müssen, near Siegen), melted kupfernickel No. 1, kupfernickel No. 2, silver (artificially prepared; chemically pure), melted galena, spiegelisen, meteoric iron (Aix-la-Chapelle), alloy of antimony and copper, graphite No. 1 (very compact; used for the electric light), melted magnetic pyrites, cobalt pyrites (Müssen, near Siegen), native arsenic, nickel glance (Ems, Nassau), antimony, magnetic pyrites, melted copper glance No. 1, sulphide of iron (artificial), melted iron pyrites No. 1, copper glance No. 2, alloy of two parts antimony and one part zinc, graphite No. 2 (native), sub-sulphide of copper No. 1, copper glance No. 2 (Cornwall), sub-sulphide of copper No. 1, cobalt glance, tellurium No. 1 (chemically pure), tellurium No. 2 (prepared by Liebig), arsenical pyrites, Fahln ore No. 1, Fahln ore No. 2 (small specimen), copper glance No. 3 (Bristol County, America), Fahln ore No. 2 (larger piece), melted copper glance No. 3. Of the substances here enumerated, it will be seen that twenty-two are more strongly electro-negative than bismuth, and nineteen more strongly electro-positive than antimony. It will be seen, too,

from this list, that a much more powerful thermo-electric circuit than one of bismuth and antimony, which was the most powerful known until of late, can be formed of substances much less costly than those metals. We may look to have very cheap thermo-electric batteries by-and-bye.

A series of researches with respect to the occurrence of copper in the animal kingdom which has recently been pursued by Dr. G. L. Ulex has resulted in establishing that that metal is one of the most widely disseminated substances in nature. It has been known for some years that copper exists in the blood of some of the lower animals, especially the mollusca, but its existence in the blood of the higher animals was not established when Dr. Ulex undertook the investigations in question. Dr. Ulex, however, found copper in every animal in which he searched for it, and among these animals were mammalia, birds, amphibia, fishes, crustacea, insects, arachnida, annulata, echinodermata, entozoa, polypi, and sponges,—man, the horse, the ox, the lynx, the teal, the common fowl, the tortoise, the common lizard, the common adder, the brown frog, the eel, the haddock, the common shrimp, Spanish flies, spiders, earth-worms, star-fishes, and sea-anemones. Dr. Ulex concludes that copper exists in the bodies of all animals, and remarks: "As animals live, in part directly and in part indirectly, upon plants, it follows that it must occur in all plants; and as plants derive their mineral constituents either from the soil or from seawater, copper must be generally diffused through both those media." Copper had previously been frequently detected in soils, Sarzeau and Commaille had each failed to find any plant in which it did not occur, and both Durocher and Malaguti, and Field and Piesse, had found it in sea water. It is doubtless universally diffused,—which, indeed, can scarcely fail to be the case with every other element also.

ON THE ADHESION OF LOCOMOTIVE ENGINES AND CERTAIN EXPEDIENTS FOR INCREASING OR SUPPLEMENTING THAT FUNCTION.*

BY VAUGHAN PENDRED, C.E.

THE following is an abstract of a paper upon the above subject which was read before the Society of Engineers on Monday evening last.—The author commenced by pointing out that the subject of the paper was one of the most important connected with the locomotive, but that very little precise information existed respecting it. He then proceeded to show that the motion of the engine was not alone due to the thrust of the crank shaft on the brasses but also directly to the pressure of the steam on the cylinder lids. He then considered at some length the theories of friction, pointing out the anomalies which exist between them and the laws of adhesion as determined by Bochet. The author continued:—It would appear that if adhesion is to be relegated to the domains of friction at all, it must be classed under the head of static friction, or, as it is sometimes termed, the friction of repose. When one surface rests upon another with any appreciable weight or pressure we know that a peculiar resistance, assumed to be distinct from that due to vis inertia, will be encountered if we attempt to slide one surface over the other. There is some little difficulty met with in conducting such investigations, as it is not easy, although quite possible, to avoid confounding the resistance due to inertia with that of static friction, and for this reason, perhaps, the results obtained by different experiments manifest considerable discrepancies. As matters stand, we are told upon the one hand by Morin, Kennie, and most other writers on the subject:—1st. That the coefficient of the friction of repose is greater in all cases than that of the friction of motion. 2nd. That when no lubricant is interposed the friction of any two surfaces (whether quiescent or in motion) is directly proportional to the force with which they are pressed together; that is to say, a double pressure gives double friction, triple pressure, triple friction, and so

* It is the intention of the author of this paper to publish it in extenso.

on. 3rd. That when no lubricant is interposed, the amount of the friction is in every case wholly independent of the extent of surfaces in contact. 4th. That the friction of motion is wholly independent of the velocity of the motion. Now it so happens that it has been known in a rough way for some time that these conclusions are not borne out in locomotive practice. It is generally understood, for example, that the coefficient of adhesion increases in a more rapid ratio than the weight. Indeed, I believe George Stephenson was the first to call attention to the fact. But the character, as experimentalists and philosophers, possessed by such men as Morin and Rennie, puts it out of the question that we should dispute the general accuracy of the conclusions at which they have arrived, as given above. We shall get over the difficulty by remembering that all their experiments were confined to cases in which the surfaces did not sensibly out into or abrade each other; to pressures less, indeed, than 500lb. or 600lb. per inch, and it is, therefore, quite possible that they may be strictly accurate in their deductions as far as these went, while another series of experiments, commencing where they left off, and including great pressures, would give very different results.

The only really valuable investigation of this kind, of the existence of which I am aware, is that to which I have already alluded, as having been conducted by M. Bochet, and this finds its true value in the fact that it was carried out under such conditions as obtain in every-day railway practice. M. Bochet's experiments were conducted upon cases of sliding friction only, at all velocities between 0 and 27 yards per second, or about 56 miles per hour. They were made with various materials—iron of different degrees of polish; woods, hard and soft, wet and dry, resinous and not resinous; on leather and gutta-percha; and with contact surfaces of very different dimensions. In all cases the frictional surfaces appear to have been dragged under the known weights of certain railway waggons over the surfaces of the rails in various states, wet, dry, rough, oiled, polished. We have not time to go into the details of these experiments, I can only refer those desiring minute information to M. Bochet's memoirs addressed to the Academy of Sciences of Paris. The results, however, are very remarkable. They have been printed in a very condensed form in one of our scientific periodicals; sufficiently at length, however, to answer our purpose, and I cannot do better than give them to you as they stand in the pages of the *Practical Mechanics' Journal*:—

"1st. Friction, under conditions apparently perfectly identical, is never precisely alike, so that its amount cannot be represented by a well-defined curved line, but by a zone through which a mean curve may be regarded as the nearest coefficient. 2nd. Friction diminishes with the velocity, other things being equal. 3rd. Friction varies with the surface rubbed, other things being equal, or (and this is very important) with the specific pressure. The limits are very small when the pressure and velocity are small, but become sensible when either is great." M. Bochet's fourth statement apparently conflicts with the every-day experiences of locomotive engineers. It is simply that with iron on iron rails the friction is the same whether the rails be dry, moist, or even greased. "5th. The state of polish powerfully affects the friction of iron on iron. 6th. There is no special increase of friction on starting from rest to motion, except for wood or leather on moist or greased rails; with iron on iron rails, dry, moist, or greased, the statical friction is precisely the same as the friction of motion while the velocity is low. The statical friction is greater, however, at high velocities."

There are three physical conditions, viz., molecular attraction, roughness of surface, and speciality of abrasion in rubbing, which, acting more or less together, appear to M. Bochet sufficient to account for all his observed facts. He assumes the coefficient of adhesion to amount, in the case of smooth bright wheels on rails in the same condition, to at most from $\frac{3}{4}$ to $\frac{2}{3}$, less a third very small coefficient, depending on the quality of the metal, so to speak, and variable circumstances impossible to reduce to a general law. In other words, the coefficient of no two wheels, no matter how apparently identical, will be precisely the same. For ordinary circumstances, wherein the rails are neither very brightly polished nor very smooth, M. Bochet gives the coefficient of adhesion as varying from

$\frac{1}{4}$ to $\frac{1}{25}$. It is unnecessary that I should enter into any consideration of the numerous results which he has obtained from experiments with other substances than iron.

The author then proceeded to consider the extent of areal contact surface, and detailed certain experiments made with a view to determine its amount in the case of engines, with drivers varying from 5ft. to 6ft. 6in. in diameter, carrying loads of 5 tons to 5½ tons each, and fitted for the most part with steel tyres, if not quite new at least in fair order. The method pursued was very simple. A part of the rail being well cleaned, the engine was brought over this spot, and two slips of thin stiff paper, or, better still, thin rolled sheet iron, 1-1000in. thick, were placed on the rail, one in advance and the other in the rear of the vertical line descending from the axle through the point of contact. These slips were then brought as closely together as the wheels would permit; that is to say, they were, so to speak, wedged under the tyre until the space between this last and the rail became so narrow that metal or paper could go no further. The distance between the nearest edges was then measured, and was taken to represent the length of the area of contact with the rail approximately. Samuelson used gold leaf just as the author used sheet iron and paper. Now it must be remembered that so long as the tyre is removed from the rail by even the thickness of a sheet of paper, no contact exists; and it is also clear that the curve of the tyre near the point of contact, and the surface of the rail, very closely approximate to the condition of parallel lines; in other words, the curve of the tyre and the line of the rail subtend so small an angle, that we are justified in considering that a considerable deduction may be made from the length of contact surface as given by these experiments. Now the mean of six distinct experiments carefully enough conducted gave the distance at 1.3-8in. It is true that in one other instance the distance was as great as 2½in., but this occurred with a tyre a good deal worn; and it so happened that that part just beneath the balance weight within the rim was the place selected to rest on the rail; and here a flat existed, due possibly to the well-known influence of the weight when in rotation. After making every allowance and deduction, we may safely assume that, with a good rail well supported, and steel tyres in fair order, the contact surface does not measure more than 1in. in length, while its breadth may average 1½in.—say 2in.; these numbers multiplied into each other give us a superficial area of contact of two square inches. The loads, therefore, must in practice exceed 2½ tons per square inch as a rule. They considerably exceeded one ton, and were therefore in excess of the pressures experimented upon by Morin, Rennie, &c.; and the foregoing data fully bear out the assertion. Furthermore, the pressure over the entire contact area is not constant; it rises from nothing towards the edges to a maximum near the centre of the area, where doubtless pressures equivalent to five and six tons to the inch may exist.

The value of the coefficient of adhesion was then considered by the author, which in his opinion was usually under-estimated. In proof of this opinion he adduced several illustrations selected from the performances of engines both here and abroad. After noticing at some length the various schemes which have been advanced from time to time for increasing adhesion, such as Blenkinsopp's rack rail and Brunton's feet, &c., he came to the consideration of more modern improvements in this direction. To follow the author:—Up to the year 1835 rack rails and mechanical feet were the popular devices for overcoming the difficulty, to which we may, perhaps, add Chapman's chain—which, after all, however, is but a modification of the rack. After a time it came to be understood that smooth tyred wheels and smooth rails could alone meet the mechanical exigencies of the railway system, and to Messrs. C. B. Vignoles and John Ericsson must be attributed the honour of first practically reconciling the conditions—smoothness of gripping surface with increase of adhesion. Their patent was taken out as far back as the year 1830, but it received little or no attention at the time, possibly because racks and feet held full possession of all the favour which could be spared from the smooth tyre. Indeed, until the date of the trials with Mr. Fell's locomotive at Whalley Bridge, very few engineers knew anything whatever of the invention by Messrs. Ericsson and Vignoles

of the only system which, at the present moment, holds out a prospect of enabling locomotives to work gradients of more than 1 in 20 with economy and certainty. A very few words will explain the whole principle. The adhesion of a locomotive is a result of the forcible contact of its wheels with the rails, the force being due to the weight of the machine. Adhesion, therefore, is so far limited by the weight of the engine. But it is obvious that a wheel may be forced against a rail by other agencies as well as mere weight. Thus, a central rail being provided, two horizontal wheels may be made to grip it between them, precisely as the rolls of an iron mill seize a bar; and if these wheels are pressed together with sufficient force, and are caused to revolve, the engine will be compelled to move forward; and this pressure may be quite independent of the weight of the machine. In Messrs. Vignoles and Ericsson's engine the central rail is gripped between two horizontal wheels. On the upper end of the shaft of the larger of these is fitted a bevel wheel, taking into another bevel wheel on the crank shaft. A beam is affixed to the frame of the engine; it carries the bearings of the gripping wheels. Those of one, the smaller of the two, are fitted with a species of lever arrangement easily understood, by which it was to be forced against the rail, in order that the adhesion of the larger wheel might be called into play. The inventors proposed to employ manual power, which would be obviously insufficient for the required purpose. This fact, of course, does not affect the general principle. The author continued:—Mr. Fell had taken out a patent early in 1863, for the use of the mid rail somewhat as proposed by Vignoles and Ericsson. In saying this I do not wish to detract from Mr. Fell's originality; indeed, I think it very possible that, considering the obscurity enveloping the inventions of both Ericsson and Sellers, he believed himself to be the true and original inventor of the scheme. Shortly after he secured his patent, the subject was taken up warmly by Mr. Brassey, and Mr. Alexander, of the Canada Works, Birkenhead, was consulted on the practicability of constructing an engine on Mr. Fell's system; the result was that an order was given for the building of an engine without delay. In fact, every other consideration save promptitude was put on one side, and as often happens in those cases no time was left for working out the designs. Mr. Alexander took the matter in hand, and an engine was built. This engine weighs, loaded, 14 tons 10 cwt.; the boiler is 7ft. 9in. long, and 2ft. 9in. in diameter. It is fitted with 100 tubes 1½in. diameter, externally. There is a heating surface of 420 square feet and a grate area of 6ft. 6in. It will be seen that the engine has four cylinders; two outside 1½in. diameter, with 18in. stroke, working four coupled vertical wheels, on which the entire weight of the machine is supported, 2ft. 3in. in diameter. There is nothing remarkable in any respect about this department of the machinery, and we may therefore dismiss it without further notice. Beneath the centre line of the boiler, and at considerably higher level than the outside cylinders, two others, 11in. in diameter and 10in. stroke, are fixed facing each other. The valve chests are placed below the cylinders and the valves are put in motion by a link much the same as that ordinarily used, except that it is curved the reverse way, although movable, because the eccentrics are not both on the same shaft. Below the carriage are fitted eight axle boxes carrying four vertical shafts of great strength. On the upper ends of each of these is keyed a crank. The pins of these cranks are laid hold of by rods coupling them in pairs. On the lower ends of the shafts are keyed four horizontal driving wheels 1ft. 4in. in diameter which, as arranged, grip between them the mid rail. This rail is of the ordinary double-headed variety, bolted to suitable sleepers. The eccentrics for working the valve of the leading cylinder are keyed one on each of the forward grip wheel shafts. Those for working the valve of the after cylinder are in like manner keyed one on each of the trailing shafts. A flat iron table is bolted to the frame to support each link. The links are provided with suitable bosses to slide on these tables. Reversing is simply effected in the usual way from the footplate. The eccentrics for the outside cylinders are keyed on the leading horizontal axle, as they could not be provided for elsewhere.

(To be continued.)

The Dublin Exhibition is to be kept open a fortnight beyond the time originally fixed for closing.

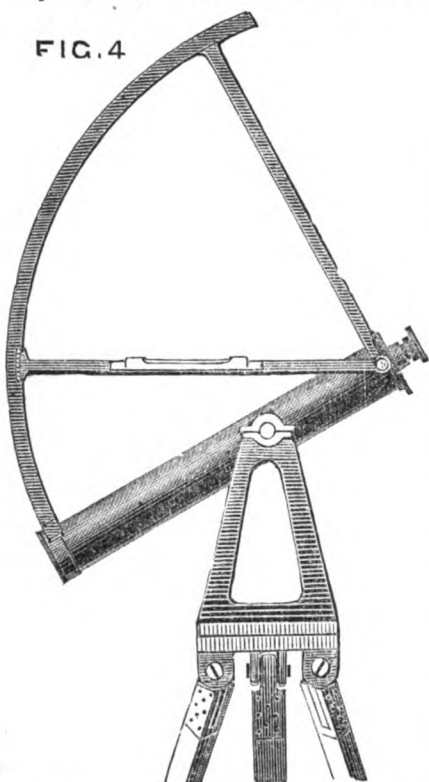
TELEMETERS OR INSTRUMENTS FOR MEASURING DISTANCES.

BY THE LATE ARCHIBALD H. BELL, M.A.

(Concluded from page 280.)

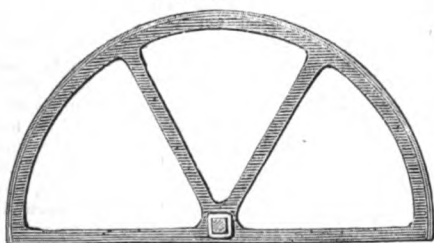
I now come to the consideration of those instruments which have been designed to meet the requirements of a particular case, viz., that of batteries in elevated positions overlooking the sea. It will be clear to everyone that this is a special case, having the peculiar advantage

FIG. 4



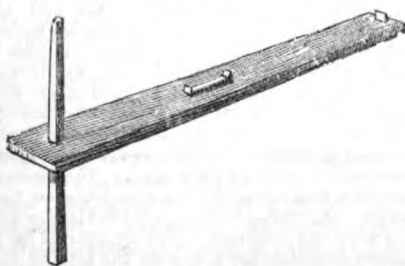
that we are enabled to make use of the vertical height of the battery above the water level as our base, instead of being limited to the few feet which can be provided by instruments such as we have just been considering, designed for general purposes. These instruments are, 1st, the Gibraltar instrument, proposed by Colonel

FIG. 5



Shuttleworth, R.A., in 1860, while in command of that station; 2nd, the Malta instrument, erected in the Fort St. Elmo, the Castle of St. Angelo, and the Fort Figuerè, at the time that General St. George was in command of Malta; 3rd, an instrument invented by Captain Jer-ningham, R.N.; and lastly an instrument of my

FIG. 6



own, which, for the sake of distinctiveness, I have called the hydroscope, and which, after a lengthened investigation, has been finally approved of and adopted into the service, it having been recommended by the Ordnance

TELEMETERS OR INSTRUMENTS FOR MEASURING DISTANCES.

FIG. 7

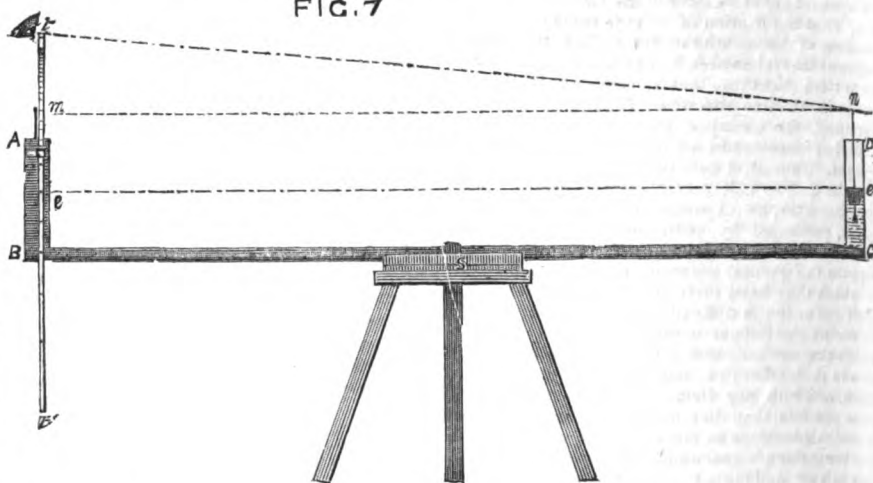
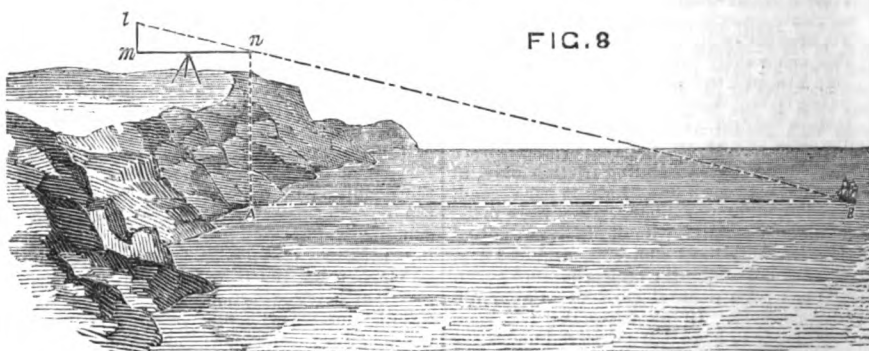


FIG. 8



Select Committee "that a hydroscope be supplied to every battery, or group of adjacent batteries, of a height not less than 100ft. above the sea."

The Gibraltar instrument (fig. 4) consists of a telescope, to which a graduated arc is attached, provided with a movable index arm, carrying a spirit level, and is mounted on a light tripod stand. The telescope being laid upon the object the index arm is moved until the spirit level shows it to be perfectly horizontal; the angle of depression is then read on the graduated arc, and the distance of the object found by reference to a table calculated for the known height of the battery.

The Malta instrument (fig. 5) is a massive semi circular frame, of 3ft. radius, firmly fixed upon a masonry pedestal, and accurately levelled in all directions, in the centre of which works a vertical tangent scale, which is to be raised until the object at sea can just be seen over the rim of the semicircle. The tangent scale may be either graduated with the angles, and reference be made from it to a table of distances, or the distances may be marked on the tangent scale itself.

Captain Jer-ningham's instrument (fig. 6) consists of a plank of mahogany, 5ft. long, having a foresight at one end and a movable tangent scale at the other, and furnished at the centre with a spirit level. Having levelled the plank first of all by little wedges or whatever may be at hand, the tangent scale is raised until the object at sea can just be seen over the foresight; the angle is then read on the tangent scale, and the distance determined by reference to a table calculated for the known height of the battery, which table, for convenience, is pasted upon the plank.

The following is a description of the hydroscope, which has been in constant use at Dover since August, 1862; it was made by a common tinman, at the cost of a few shillings, and it is only reasonable to expect that the instruments which are to be issued to the service will be in every way superior to the original, and obtain much better results than even those which have proved its practical value. (See fig. 7.) B C is a piece of common galvanised iron gaspipe, having attached to it at each extremity an upright rectangular tin tube A B and D C; the ends of the pipe at B and C are closed, but communication is open with the tubes A B and D C throughout from D and A. The pipe is clamped down by means of a small capsquare to a wooden bed

S, which rests on a three-legged stool or on the top of a parapet. Into the instrument water is poured until the upright tubes A B and D C are about half filled. In each of these upright tubes there is a tin float, carrying, at right angles to the line of the pipe B C, a small iron rod, having at the top a crossbar of copper m and n. The floats are so weighted as to ensure the upper edges of the crossbars being exactly level with each other when they float side by side in water. It will be evident, without further explanation, that, however the instrument be circled about upon its stand, the crossbars m and n must always be perfectly horizontal. The tangent scale t t' slides up and down in a brass holder, which is confined in a groove of brass soldered on to the tube A, as shown in the engraving. This scale is of mahogany, square in section, with strips of sycamore inlaid on two of its sides, which are graduated to every 50 yards, one side to be used at high tide, the other at low tide.*

To use the instrument, traverse it round until it is in line with the object, then raise the tangent scale until the water line of the object can just be seen over the top of the crossbar n, through the cross sight of the tangent scale. The distance is shown in hundreds of yards at the upper edge of the crossbar m. Explanation of the theory is scarcely needed; the distance is to the height of the instrument above the water level, as the length of the instrument is to the length of the tangent scale. (See fig. 8.)

Two instruments, one upon the Gibraltar and the other upon the Malta plan, were made by Messrs. Elliott, of the Strand, to the order of the Ordnance Select Committee, at a cost of £7 each, and were sent to Dover for trial in the spring of 1861. The Malta instrument being required to be portable, was constructed of a stout semicircle of cast iron, and furnished with a spirit level. The two instruments were placed in a battery 233ft. above low tide, and observations were taken with both of them by different officers of the Royal Artillery quartered there at the time. In thirty observations taken with the Malta instrument, at distances varying from 300 yards to 1,402 yards, the mean error was 0.050 of the whole distance, or 41 yards in the average distance of 834 yards. In the same number of observations made with the Gibraltar instruments at the same objects, the mean error

* For other states of the tide, the mean between the two scales may be taken.

was 0.045 of the entire distance, or 37.53 yards. There was, therefore, but little difference between them in point of accuracy; but all the officers who used the instruments declared their preference for the Gibraltar instrument, as being the quickest and easiest of management. It was reported, however, that it required an adjusting screw for the index arm; and the instrument got out of repair while at Dover. When it had been put in repair and the proposed adjusting screw added, the two instruments were sent to Gibraltar, where they were tested side by side in the Princess Caroline's battery, which is 557.803ft. above mean tide. They both gave good results up to 1,893 yards, there being, as before, but little difference in point of accuracy; but the Gibraltar instrument still received the preference, the Malta instrument being found "unsteady and difficult to level." The time occupied in making each of these observations was not given, and it is difficult to compare the accuracy of the results with any observations taken in England, as the height of the battery above the sea is so much greater than any in this country. Captain Jerminham's instrument was tried at Plymouth and also at Dover, at heights varying from 230ft. to 300ft. It was found to measure distances with sufficient accuracy, but the levelling of the plank was attended with great difficulty and loss of time, unless there happened to be in the battery some level pedestal for its especial use; and the moving up and down of the tangent scale was apt to shake the instrument out of its proper level. The plank was also found to bend and warp by very slight exposure to the weather.

The hydroscope has, as I have said, been in constant use at Dover since August, 1862; it has been repeatedly tested at stationary and at rapidly moving objects, and its efficiency has been practically exhibited with 40-pounder and 7-inch Armstrong guns at small targets up to 3,300 yards, from batteries varying from 150ft. to 280ft. above the sea. It was favourably reported upon by a regimental board of officers at Dover in 1862, and by Colonel Shuttleworth commanding the Royal Artillery in the western district, after trial at Devonport, in May, 1863, and has now been adopted into the service upon the recommendation of the Ordnance Select Committee. This instrument gives instantaneously the distance in yards of an object at sea, however rapidly it may be moving, from any battery not less than 100ft. above the water level. Its perfect simplicity precludes the possibility of any mistake being made in its use, and it may be used by an uneducated person after five minutes' instruction. From a battery 100ft. above the sea, distances up to 2,500 yards can be accurately measured with it; from batteries of from 150ft. to 250ft. above the sea, such as Folkestone battery, and the Martello Towers along Shorncliffe camp, we could measure 3,000 yards; and from batteries of 300ft. above the sea, and upwards, such as there are at Dover, Plymouth, Gibraltar, and many other of our fortifications, distances up to 5,000 yards may be accurately measured.

It is, of course, impossible to lay down as an established rule what the practical accuracy of the instrument is to be considered, as this will vary with the height of the battery above the sea, and also with the eyesight of the observer. At an altitude of 150ft., a good gunner, with the aid of the hydroscope, will measure 2,500 yards within 30 yards (more or less). In observations at the longest ranges, the principal cause of inaccuracy is the difficulty of distinguishing the precise water line of the object, but anyone accustomed to laying guns will usually find his most distant observation to come within fifty yards of the correct distance. The advantages which I claim for the hydroscope over all other inventions hitherto proposed for the same purpose are, the strength and simplicity of its construction, its rapidity in operation, and its cheapness of manufacture. It is confidently anticipated that these instruments will be supplied at one quarter the cost of either the Gibraltar or the Malta instrument. The hydroscope levels itself, and gives the required result without any reference to tables, or any calculations being necessary. It is thus the only instrument which can estimate at each moment the varying distance of a rapidly moving object. The instrument is not liable to accidental injury, and errors cannot be produced by contraction, expansion, or bending of the tube. It is not liable to get out of adjustment, and errors of adjustment are easily recognised, and as easily rectified. On this point the Ordnance Select Committee report:—"One of the

great advantages of this instrument is its length of radius; * an error of 0.10 inch in either of the levels will represent an angular error of only 3.5 in the total depression, and this is a far larger error than is possible without great negligence, such as an observed leak in one of the floats, or its free movement being in some way checked."

INSTITUTION OF MECHANICAL ENGINEERS.

THE general meeting of the members was held on Thursday, the 2nd inst., in the Lecture Theatre of the Midland Institute, Birmingham; Henry Maudslay, Esq., Vice President, in the chair. The Secretary (Mr. W. P. Marshall) having read the minutes of the previous meeting, a large number of new members were elected, and the officers of the Institution were nominated by the meeting for the next annual election. The following papers were then read:—

ON AN IMPROVED SAFETY VALVE FOR STEAM ENGINE BOILERS.

THIS paper was read by Mr. William Naylor, of London. The object of the valve is to prevent the steam, whilst blowing off through the safety valve, from rising in pressure beyond the limit to which the valve is adjusted. The valve is loaded by a spring acting through a lever, one end of the lever bearing upon the valve, while the other end is bent down out of the straight line to such an extent that the point of attachment of the spring, instead of being in the same straight line with the bearing points of the valve and the centre pin, is at an angle of fifty-five degrees to that line; and therefore, when the valve is lifted by the steam pressure, the depression of the tail end of the lever causes the effective leverage at which the spring acts to be shortened, simultaneously with the extension of the spring. Hence the increased pressure of the spring consequent upon its extension by the lifting of the valve when blowing off may be entirely counteracted by the shortening of the leverage at which it acts; and in practice the bent form of the tail end of the lever is so adjusted that, when the valve lifts by the steam blowing off, the load upon the valve is actually diminished, notwithstanding the increase of pressure of the spring. With the ordinary safety valves, on the contrary, loaded with levers and spring balances, the whole increased pressure of the spring is thrown upon the valve in lifting, and the increase in the boiler pressure sometimes reaches a very serious amount. Even a dead weight upon the valve, as in stationary and marine boilers, allows of considerable increase of boiler pressure when the steam is blowing off. It has therefore become necessary to devise some arrangement whereby the effective pressure of the spring upon the valve may be diminished when the steam is blowing off strongly; and this is effectually accomplished in the improved valve by the bent lever upon which the spring acts. The improved valve is thereby enabled to lift to the full extent required for affording complete freedom to the steam blowing off, without under any circumstances allowing the pressure of the steam in the boiler to increase more than 6 per cent. beyond the limit at which the valve is set to blow off. At the same time the valve closes again after blowing off strongly, without allowing any sensible fall in the boiler pressure below that limit. The improved valve is in use on a number of locomotive boilers, and it is accordingly found that a single valve of only two inches diameter gives the full area for the discharge of the greatest generation of steam that is possible; whilst with the two large ordinary valves that are generally used of four inches or even five inches diameter the pressure rises very seriously when blowing off strongly. Specimens of the valve of different makes were exhibited.

ON AN IMPROVED METHOD OF TAKING OFF THE WASTE GAS FROM OPEN-TOPPED BLAST FURNACES.

THIS paper was by Mr. George Addenbrooke, of Darlaston. An explanation was given of the principles which have to be kept in view in utilising the waste gas from blast furnaces, and the advantages of the open-topped system over the close-topped were pointed out, together with the objections that have been experienced in pre-

vious plans of taking off the waste gas from open-topped furnaces. The plan now carried out for more than a year past by the writer at the Rough Hay Furnaces, Darlaston, consists in forming a ring of openings in the wall of the furnace all round the neck, at a depth of only 4ft. below the furnace top, through which the gas is drawn off by the suction of a chimney into an external flue surrounding the neck of the furnace, whence the descending gas main conveys the gas to the steam boilers and hot-blast stoves, where it is consumed. The gas openings are formed by a series of cast-iron segments or boxes, built into the wall of the furnace flush with the lining, each casting having an inclined opening through it one foot high, sloping upwards and outwards into the neck flue. The materials in the furnace mouth are kept charged up to about 8½ft. above the top of the gas openings in ordinary working; and the opening of the gas valve which covers the descending gas main is so regulated that under no circumstances is the whole of the waste gas drawn off from the furnace, but there is always a small quantity of gas escaping through the materials above the gas openings, and turning out at the open top of the furnace. This precaution is necessary to prevent the risk of any air being drawn down by the chimney through the materials in the furnace-top; and also in order to ensure the due preparation of the materials charged, by drying and warming them in the furnace-top before they descend lower into the furnace. At the same time all excess of gas produced by the furnace beyond the quantity drawn off through the gas openings escapes with perfect freedom at the furnace mouth, the same as in the present ordinary open-topped blast furnaces, where the waste gas is not utilised. In the first trial of this plan the gas openings were constructed only of two-inch plates, as a temporary expedient by way of trial; but notwithstanding that they were exposed to a very severe ordeal, by the materials in the furnace throat being on one occasion at a red heat for two days, from the furnace failing to "drive," these openings remained in sufficiently good order to last more than a year in regular working. The strong castings that are now adopted for the gas openings, of which a full-size model was exhibited, are expected to last for many years, and probably as long as the lining of the furnace. The advantages found to be obtained from this plan of taking off the waste gas, after the experience of upwards of a year's practical working at the Rough Hay Furnaces, are, that it is very satisfactory as to yield, and there is greater regularity in making of iron, in consequence of there being fewer stoppages, whence also there is an important saving in wages. From the great strength of the castings forming the gas openings, and their advantageous situation, flush with the inside of the lining, instead of having any portion of the gas apparatus projecting into the furnace, next to no repairs are required; and there is no wear and tear from the shocks of every barrow load of materials charged, which do so much damage to a cylinder carried upon brick arches, or a bell suspended in the furnace throat. The whole height of the furnace throat is left free for charging, which is equivalent to giving additional height to the furnace in comparison with other modes of taking off the gas; while there is also the convenience of being able at any time to burn any portion or even the whole of the gas at the open furnace-top without doing any damage. The whole of the gas apparatus is of very simple construction; and being all placed below the charging platform, it is much cooler and more free for the men to get at. From the large area of the gas openings and neck flue, which allows the dust to be for the most part deposited in the neck flue, the gas apparatus is less liable to become foul; and the neck flue can be cleaned with the greatest ease whenever required, by means of doors provided for the purpose.

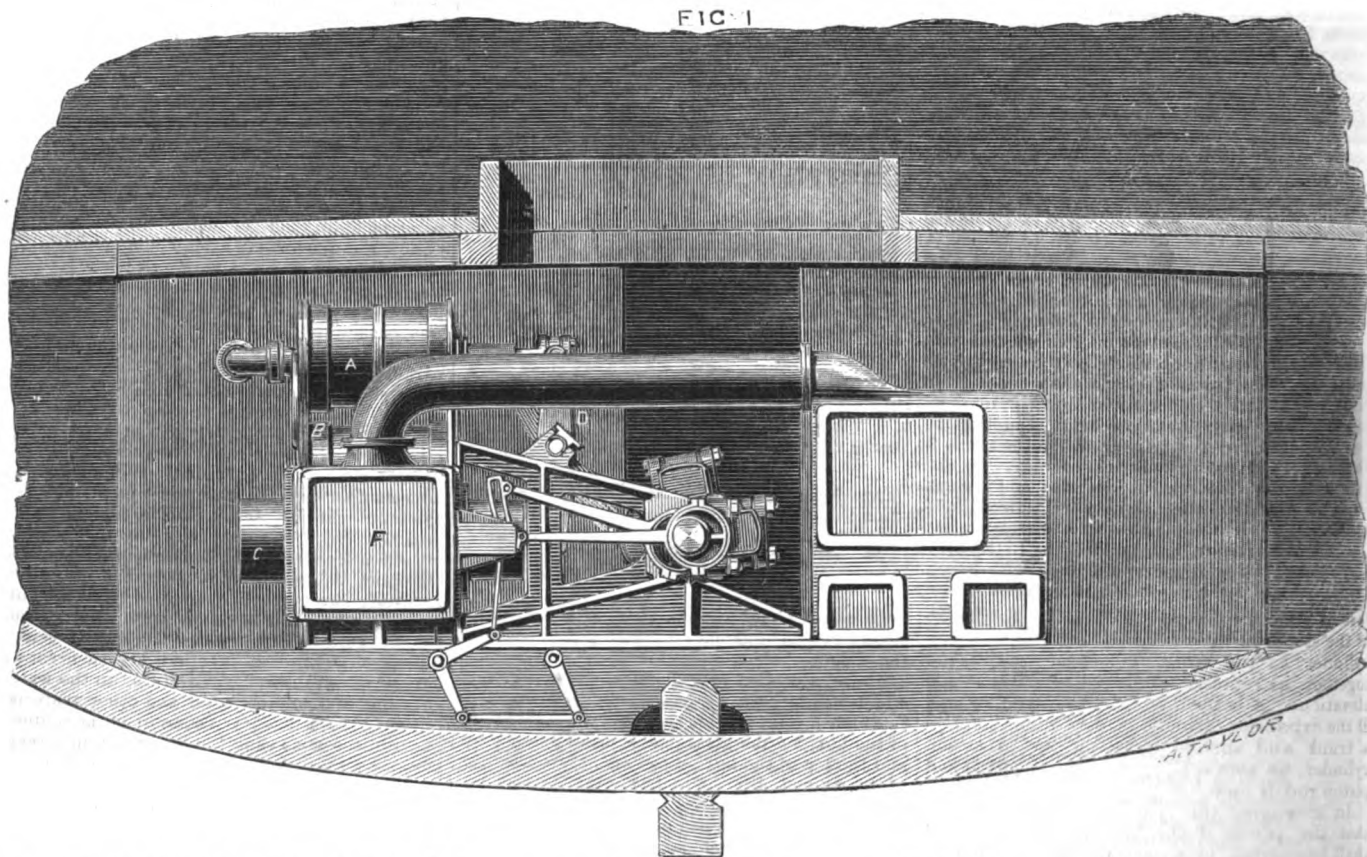
DESCRIPTION OF A GUN-METAL TUYERE FOR BLAST FURNACES.

MR. N. NEAL SOLLY, of Willenhall, read this paper. The ordinary cast-iron and wrought-iron water tuyeres at present in universal use for blast furnaces are both attended with the same defect, namely, that, after they had been at work a comparatively short time, the melted iron of the furnace mixed with cinder accumulates all round the nose of the tuyere and adheres to it, or in technical language the tuyere "irons;" and this

* 100in. has been selected as the distance between the floats.

DOUBLE CYLINDER EXPANSION ENGINE.

FIG. 1



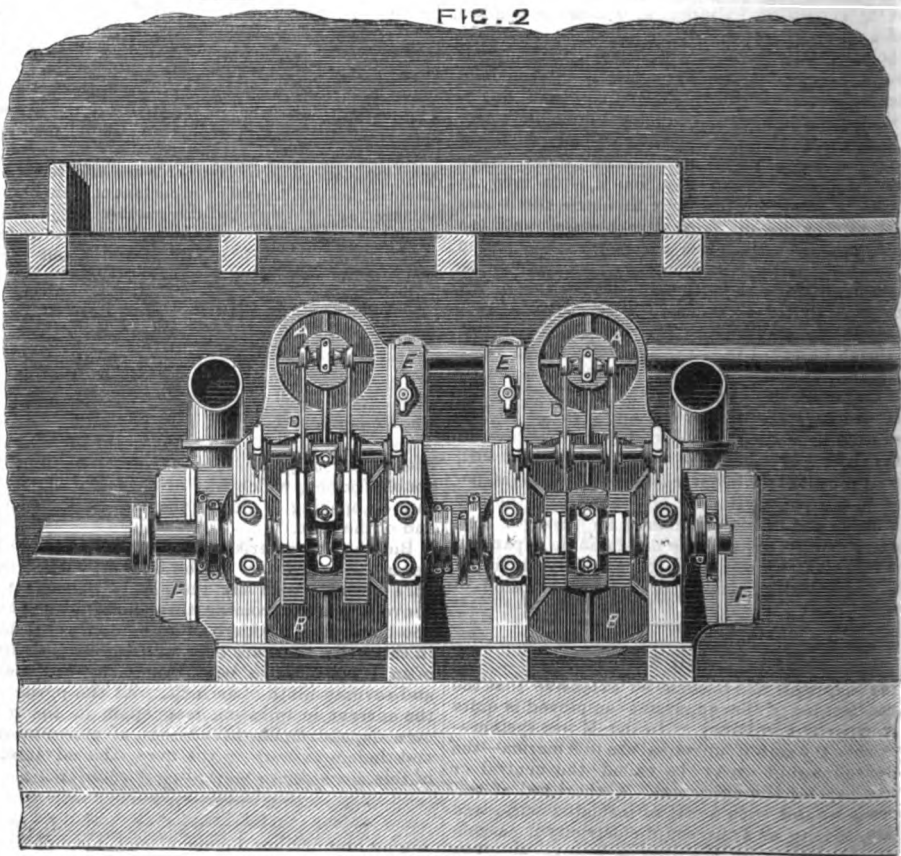
increases to such an extent as to require the tuyere to be taken out and changed, an operation requiring much labour and time. The new tuyere is made in a single casting of gun metal, an alloy of copper with a small proportion of tin and spelter; and as copper has no affinity for iron, no iron from the furnace becomes attached to the nose of the gun-metal tuyere, however long a time it may have been in the furnace. In fact, the gun-metal tuyere never "irons," and therefore rarely requires to be taken out or changed. The general form of the ordinary wrought-iron tuyere has been adopted for the gun-metal tuyere; and in order to ensure keeping the nose of the tuyere properly cool in working, an ample supply of cold water is constantly maintained to the tuyere, and the supply water pipe is carried forwards inside the tuyere to within a few inches of the tuyere nose. The first gun-metal tuyere was put to work by the writer at the Willenhall Furnaces more than nine months ago, and has been at work ever since until a few days ago, when it was purposely taken out, and found to remain in complete working order. This tuyere was exhibited to the meeting, together with a second gun-metal tuyere of slightly different pattern, which had been at work for three months without being once taken out, and was in perfect condition; and also an ordinary wrought-iron tuyere, which had required to be taken out after only three days' work, in consequence of the nose having "ironed" badly. A specimen was also exhibited of a gun-metal tuyere slotted open down the centre, to show the thickness of metal that is adopted of half an inch at the end and three-eighths of an inch in the sides. By the use of the gun-metal tuyeres the saving of time and labour in tuyering is so great that the length of time of the blast being off the furnace at casting time is shortened as much as half an hour at every casting time, as compared with the time when the ordinary wrought-iron tuyeres are used, the gun-metal tuyere being readily changed in only a quarter of an hour, instead of three-quarters of an hour; there is accordingly an important saving in fuel and wages with the gun-metal tuyeres. An important practical advantage of the gun-metal tuyeres in working is that the aperture of the tuyere retains always its full size of opening, in consequence of the entire freedom of the tuyere from any accumulation of material on the nose; whereas the ordinary iron tuyere requires frequent pricking with a rod to keep the orifice of the tuyere open for the passage of the blast, and the aperture is constantly varying in size, necessarily interfering with the uniformity

of the blast. In consequence of its superiority in this respect, the gun-metal tuyere admits of being itself employed direct as the blast nozzle, the aperture of the tuyere being bored out truly cylindrical for a few inches length from the nose, while the extremity of the blast pipe is inserted into the back end of the tuyere and secured with fireclay stopping.

It was announced that the annual meeting of the institution for next summer would be held in Manchester in the beginning of August.

From the oil land we learn that there are now in existence no less than 1,457 oil companies, with a total capital of 869,594,000 dollars.

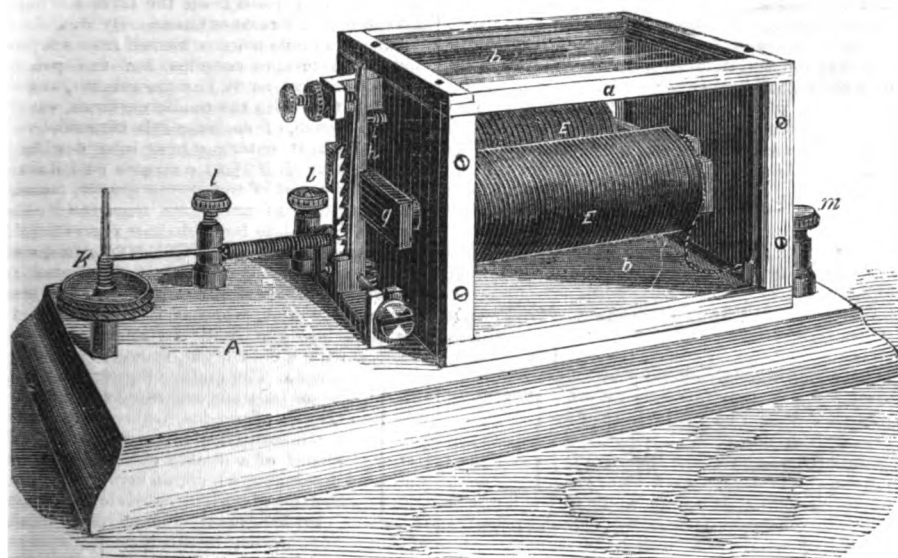
FIG. 2



DOUBLE CYLINDER EXPANSION ENGINE.

A CONSIDERABLE loss of effective power takes place in double cylinder engines owing to the manner in which the steam is conducted from the high pressure to the expansion cylinders. To remedy this defect is the object of some improvements which have recently been patented by Mr. Joshua Rooke, of 24, Charlwood-street, Pimlico. His invention consists in a new arrangement of the high pressure and expansion cylinders, and of the slide valves for admitting the steam from the boilers into and for its exit from the high pressure into the expansion cylinders. In order to prevent as far as possible the

RECEIVING MAGNET.



loss of effective power caused by the expansion of the steam in the passages which lead from one cylinder to the other, he places them close together, as represented at fig. 1, which is an end elevation. A is the high pressure cylinder and B the expansion cylinder, and he either employs a trunk and annular piston in the expansion cylinder, as seen at C, or an ordinary piston and piston rod is used.

In arranging the cylinders it is so contrived that the piston of the high pressure cylinder shall be moving in a contrary direction to that of the expansion cylinder, as is usual in engines of a similar class. This may be done either through the intervention of cranks placed opposite to each other or by means of intermediate beam levers, as shown at D, fig. 1 and fig. 2, which latter represents a longitudinal elevation. The cylinders may be placed vertically, horizontally, or at any angle with the horizontal. The valve E, fig. 2, is a many-ported slide valve in which a certain number of the ports admit and cut off the steam from the boilers, and the remainder of the ports serve for the eduction from the high pressure cylinder and induction into the expansion cylinder. By these arrangements, after the steam has acted on the piston of the high pressure cylinder it is allowed to pass through passages in the interior of the slide valve into the expansion cylinder, and after expanding in the latter, it passes to the condenser through an ordinary double-ported slide valve F, constructed to ensure the exhaustion of the steam at the right periods. By these means and with great simplicity of construction the passages between the two cylinders are shortened, thereby reducing the cubic contents of the passages, considerably diminishing the unprofitable expansion of the steam therein, and consequently obtaining a corresponding saving in the consumption of fuel.

RECEIVING MAGNET.

The telegraph has become so extensive that the manufacture of the apparatus employed is quite an important industry. In the Morse system—which is the one in universal use in America—the electro-magnet may be called the central or main part of the apparatus. A short rod of soft iron is wound with a coil of insulated wire, and then, so long as a current of electricity is passing through the wire, the iron is a magnet. The circuit may be a foot or one hundred miles in length, and any break in the wire in any part of its length of course stops the current, when the iron ceases to be magnetic. The magnet may be placed in New York and the current may be broken in Albany, and by successive breaking and re-forming signals may be transmitted. The magnet shown in the accompanying illustration is described in the *Scientific American* as the invention of Dr. L. Bradley, of Jersey City, N. J. It is wound with naked wire, the only insulation being the blank spaces between the several convolutions, the courses being separated by a wrapper of thin paper. By this modification a given length of wire gives a greater number of convolutions, and they are brought

nearer to the central core, thus, with a given resistance to the current, increasing the power of the magnet.

There are also several minor improvements which will be seen by examining the engraving, in which A is the marble base, a a the brass frame of the box, b b the glass plates forming two sides and the top of the box, d the keeper or back bar of the magnet, E E the helices, seen through the glass plates, g armature, h armature lever, i i the platinum points for opening and closing the local circuit, j small ratchet bar on which the adjusting spring may be raised or lowered, K adjusting stand, l l screw cups for the local circuit, being connected with the platinum points, m m screw cups for main circuit (only one visible in the cut), being connected with the fine wire of the helices. The anvil which receives the stroke of the armature being in one side of the box, ample sound is given to be read without the use of a local battery and sounder. The adjustments are effected with ease and facility, the most important of them being enlarged in its range by the ratchet bar j. The adjusting stand K is peculiar, having a metal tube passing through the base and about one-fourth of an inch above—that portion above being slotted. A milled-edge wheel having a hub which is nicely fitted upon the tube and resting upon the base, has a steel wire spindle which extends above the wheel for winding the cord of the spring upon and down through the centre of the wheel and hub, and through the tube. The spindle is made fast in the wheel and hub, and turns in the tube. This compound joint of spindle within the tube, and tube within the hub, gives double friction, which may be increased at pleasure by opening or closing the slot in the upper end of the tube.

But the characteristic peculiarity of this magnet is the naked wire of the helices. When the wire is wound with silk the spaces between the convolutions are from the three-hundredth to the one-hundred-and-fiftieth of an inch in width, but in this helix they are only one eight-hundredth of an inch, and have been wound one-thousand-and-seventy-ninth of an inch. As the power of the current in inducing magnetism in the iron core depends upon the number of convolutions and their proximity to the core, the advantage of this more compact winding is manifest.

ON THE DISCOVERIES IN CHEMISTRY APPLIED TO ARTS AND MANUFACTURES.

BY DR. F. GRACE CALVERT, F.R.S., F.C.S.

LECTURE II.

(Concluded from p. 284.)

The next invention to which the learned lecturer drew attention was the gas engine of M. Lenoir, which we have already fully described in our columns. He then introduced the interesting and valuable invention of one of the most learned and eminent chemists of England, Dr. J. Stenhouse, F.R.S., who has devised quite a new method of waterproofing vegetable and animal tissues and fabrics. Previously to his discovery, the modes of waterproofing consisted in using bees' wax and various kinds of drying oils, such

as linseed, the siccation of which is enhanced by boiling them with peroxides of lead or manganese. Further, you are all aware of the extensive use which has been made of caoutchouc and gutta-percha for waterproofing purposes. Dr. Stenhouse's waterproofing material is a white solid substance, having no odour, undergoing no change through the action of the atmosphere, and which has acquired of late great popularity, by the application which has been made of it as an illuminating and lubricating agent,—I mean paraffin, the discovery of which, in a commercial point of view, and its introduction into public notice, are due to Mr. James Young, of Bathgate, near Glasgow, who has now established one of the largest manufactories in the world for the production of this article, notwithstanding it was considered a commercial novelty in 1852. Dr. Stenhouse found that if he employed pure paraffin for waterproofing, owing to its tendency to crystallise, it would not adhere sufficiently to fabrics. He therefore conceived the happy idea of adding to it a few per cent. of linseed oil, which overcame the defects presented when paraffin was employed alone, effecting a better adhesion between the waterproofing material and the textile fabrics, and rendering leathers more flexible. Dr. Stenhouse melts together paraffin oil with a few per cent. of linseed as above stated. He runs the whole into cakes, and in order to apply this waterproofing agent he heats the cake and rubs the materials over with it, or spreads the melted mixture over the fabric by means of a brush. His process is applied with great advantage by Messrs. Silver and Co. to the waterproofing of soldiers' tents, and other materials of that class, to the great comfort of the soldiers, for, without increasing the weight of their tents, it renders them impermeable, and protects the men from rain and its attendant discomfort and danger. Another most useful application of Dr. Stenhouse's waterproofing material is the rendering of leather impermeable. By examining the specimens you will immediately see the immense advantage that cavalry will derive from having their saddles rubbed over with this preparation, as it renders the leather incapable of absorbing moisture, and enables the soldier to mount his horse after heavy rain with as much comfort as if it had remained under shelter. It also renders the soles of shoes quite impermeable, and at the same time communicates to them great flexibility, so that the boots of navvies and other similar articles are rendered far more useful and durable, as we all know that the constant wetting and drying of leather expedites in a marked manner its decay. There is one more application of Dr. Stenhouse's waterproofing to which I should wish to call your special attention, as it is of interest to the manufacturers of Manchester and of Lancashire generally. In those districts large quantities of what are called waterproofing materials are used in packing the goods, and preserving them from external wet or injury. Many of these materials are made by covering a coarse calico fabric with a coating of boiled linseed oil, but this class of packing is very imperfect, and loses its strength rapidly, especially in hot climates, owing to the fact that boiled oil absorbs oxygen and carries it on to the fibre, oxidising it, and thereby soon destroying its tenacity. By applying Dr. Stenhouse's process to the fabric previously to the drying oil, not only is great impermeability attained, but the fibre, being saturated with paraffin, is preserved from the subsequent oxidation which it would undergo under the influence of the atmosphere in the presence of the boiled oil alone.

I should have wished to have dwelt at some length on the interesting application which has been made of late years, especially on the continent, of another coal product, which, like most of those whose origin is due to coal, has received many valuable and beautiful applications. The one I now refer to is called bisulphide of carbon, and is applied with great success not only to the extraction of fatty matters from various seeds and fruits, such as olive, linseed, &c., but in Algiers for extracting from flowers various essential oils, commonly called perfumes, such as essence of roses, lavender, jasmine, &c. You will, no doubt, remember also the useful application which bisulphide of carbon receives in the hands of Messrs. Allbright and Co., of Birmingham, in separating the common phosphorus from the red or amorphous phosphorus now applied to the manufacture of chemical matches. I cannot conclude what I have to say respecting coal products without stating the fact that, since I had

the honour of delivering a lecture in this room in 1862, many beautiful and valuable discoveries have been made in connection with coal-tar colours. Dr. A. W. Hofmann has succeeded in obtaining some magnificent purples, by a process as curious as it is highly scientific, and such as might be expected from so talented a chemist. Since then a splendid green colour, called verdine, and which has the curious property of retaining that colour in artificial light,—yes, more than that, of increasing in beauty in the presence of that light—has been discovered by M. Eusebe. A beautiful fast black, easily applicable to the art of calico-printing, has also been devised; and lastly, in the hands of Messrs. Simpson, Maule, and Nicholson, the well-known colour called magenta, and a beautiful blue called opal, have not only been much increased in beauty, but their cost of production has been materially reduced. In fact, at the present day, every shade of colour is produced from coal-tar products; but the subject is too vast for me to attempt now to enter into details as to their mode of production and application.

I must now leave the interesting subjects which have reference to coal and its products, and pass to another class of manufacture. The first of these has reference to the refining of sugar, and among the several improvements which have been effected in this branch of manufacture during the last few years none is more important in its general bearing than that recently brought to the notice of the public by Mr. Alfred Fryer, of the well-known firm of Fryer, Benson, and Foster, of Manchester. This gentleman has published some valuable information on the composition of the sugar-cane juice, and the alterations it undergoes under the influence of heat and atmospheric air, and has conferred on the colonies a great boon by inventing an apparatus which will effect a great saving in obtaining sugars. Mr. Fryer's experiments on the cane juice teach us that, instead of only extracting 49 per cent. of the juice, as is usually the case, when the canes are worked by the old system, 61 per cent. can be obtained with a good steam engine having 24 in. rollers; and by pressing the megass a second time through the rollers as much as 70 per cent. can be obtained; and Mr. Fryer does not doubt that even 80 per cent. may be reached, if more attention is paid to the pressing of the canes through the rollers. Mr. Fryer has also published some interesting facts on the action of the oxygen of the atmosphere on cane juice. Thus he has observed that the juice rapidly darkens, and that this increase of colouration is not only an indication that the juice is undergoing deterioration, but that no amount of defecation will subsequently remove this colouration. He has further noticed that cane juice rapidly becomes acid, and the acidity increases also in a very rapid manner. He gives an instance—a pattern of too many others—where the juice, after expression, flowed down a spout 250 ft. in length, from the mill to the boiling-house, occupying in its descent about half a minute. The amount of acidity increased from 100 to 253, and the colour deepened fourfold.

Mr. Fryer has also published some very interesting facts on the influence of heat on the cane sugar, and I here take the liberty of extracting from a paper of his the following facts:—"We now come to the boiling. All heat above 140 deg. is capable of exerting an injurious effect. As regards the time, this effect is proportionate to the duration of the heat; the continuance of any syrup for two hours at any given temperature would cause just double the mischief which would be produced by its continuance at the same temperature for an hour. But as regards the heat, the mischief increases about as the square of the difference from 140 deg., the highest innocuous temperature. So at 160 deg. during any given time a certain degree of mischief would be done. To keep the same syrup for the same time at the heat of 180 deg., would give four times the mischief; at 200 deg. nine times; the difference of 180 deg. from 140 deg. being twice as great as that of 160 deg., and that of 200 deg. being three times as great." This mischief consists partly in the change of colour, partly in the change of a quantity of cane sugar or sucrose into fructose. Both these kinds of sugar are present in all neutral saccharine solutions. Sucrose is the ordinary crystallised cane sugar; fructose exists more especially in some kinds of fruit, such as grapes, gooseberries, cherries, oranges, &c., which refuse to form well-defined crystals. Further, I should remark that, under the influence of heat as just stated,

cane sugar or sucrose is converted into grape sugar or fructose, and that the presence of fructose interferes in a most extraordinary manner by preventing the free crystallisation of sucrose. Thus, for example, every particle of fructose in a mixed solution detains from crystallisation its own weight of pure sugar. In fact, it would be impossible, after mixing equal weights of loaf sugar and fructose in a solution, to recover the former in a crystalline state. The change produced by the atmosphere alone, without the action of heat, shows the necessity of proceeding instantly to raise the temperature to the boiling point, and the concentration should be continued without loss of time. The temperature should not, however, be raised beyond the lowest effectual heat.

I will now call your attention to Mr. Fryer's "concretor," as he terms the apparatus, which consists in brick inclined corrugated plates, over which the juice flows; connecting gutters for joining plates; furnace; flue under plates; tube-box heated by waste heat of furnace; supply cistern for revolving cylinder; revolving cylinder, through which the juice is passed after leaving the plates; curved blades revolving with cylinder, and exposing the liquor to the hot air; friction rollers for supporting cylinder; fan for drawing a current of air through tube-box and cylinder, engine for driving fan and cylinder; shaft for giving motion to cylinder by means of pinion; and covers for retaining around cylinder the steam given off from plates. From the further end of the cylinder a pasty mass is discharged, and, in cooling, it hardens into a non-crystalline homogeneous substance likely to be long known as Fryer's "concrete." Its material is simply cane juice deprived of its vegetable albumen and water, and, not being contaminated by molasses or caramel, is admirably fitted for the operations of the refiner, and will, therefore, command his attention. The process is easy to conduct; the apparatus is simple and self-acting, not liable to derangement; it performs a large amount of work; and therefore proves a material saving to the sugar producer.

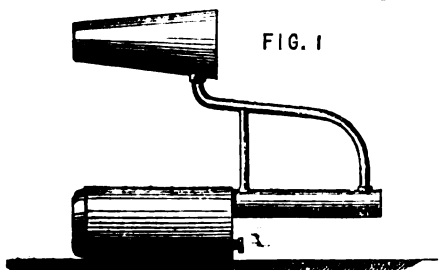
If, at the commencement of this lecture, I drew your attention to the value of intense heat produced at a small cost so as to enable our manufacturers to carry on their various processes, it now becomes my duty to inform you that of late years the cheap production and application of low temperatures has become a necessity, especially since organic products have been manufactured on an extensive scale. Three different machines for obtaining these low temperatures have been brought to public notice, viz.—First. That of Mr. Kirk, who has applied in a beautiful manner some of the physical laws discovered by Dr. J. P. Joule and Professor W. Thomson, in their researches on the mechanical theory of heat. Thus, Mr. Kirk succeeds in producing a low temperature by condensing under high pressure atmospheric air, which, on being allowed to resume its primitive volume, produces cold for the compressed air cannot resume its primitive volume without the essential for its expansion, namely, heat; and if the apparatus is properly contrived, which is the case in that of Mr. Kirk's, the heat necessary for the expansion of the compressed air is supplied to it by the body whose temperature is to be lowered. Although the construction of this machine is exceedingly costly, still it has been employed at Mr. James Young's works at Bathgate with great success to the cooling of paraffin oil to extract from it the solid paraffin which it contains. The second apparatus is that of Messrs. Harrison and Co., of London, who employ ether as the medium for producing low temperatures. The third is that of M. Carré—in my opinion the cheapest and most practicable apparatus yet invented for the purpose, the more so that it is applicable for household as well as for manufacturing purposes. Although I, like many of you, have witnessed the production of ice by it at the late Exhibition, still I was not prepared to learn that it could be applied with economy to the extraction of some of the salts existing in sea-water. Still such is the fact. M. Ballard, a well-known French chemist, after many years' study and labour, succeeded in extracting from sea-water two products, which play a most important part in most of our large chemical works, viz., sulphate of soda and chloride of potassium. To produce the first, under ordinary circumstances, extensive works are required, such as are found at St. Helens, and Newcastle-upon-Tyne, where thousands of tons of common salt are acted on by vitriol, which gives rise to

muratic acid and sulphate of soda. As to the salts of potash, the French, as well as ourselves, are dependent for it upon the forests of Russia and the native forests of Canada. By M. Ballard's discovery, France will free herself from a dependence upon foreign supplies for the potashes she may require, as well as the sulphur, and will also do away with the public nuisance, namely, the conversion of common salt into sulphate of soda. Without entering here into details, let me state that M. Ballard operates as follows:—In the early part of the spring season, considerable quantities of sea water from the Mediterranean are run into large shallow reservoirs. In the summer season the water evaporates, a certain proportion of common salt, separates and the concentrated water is stored in other reservoirs until winter, when it is again allowed to flow back into the shallow reservoirs, where it yields, during a cold night, thousands of tons of sulphate of soda. The mother liquors from which the sulphate of soda has separated are allowed to flow into Carré's apparatus, where they are subjected to a comparatively intense cold, and yield large quantities of a double chloride of magnesium and potassium, which, on being subjected to heat in a furnace, gives hydrochloric acid, magnesia, and chloride of potassium. This application of Carré's apparatus, in this instance, shows the simplicity and practicability of it. It is based on rather a different principle to those of Kirk and Harrison. To obtain a low temperature he applies heat to a vessel which contains a saturated solution of ammoniacal gas. This drives off the gas, which is made to pass into a vessel surrounded with cold water, where it liquefies itself by its own pressure. If, then, the heat be removed from under the solution, its temperature will gradually fall, and it will become again susceptible of re-absorbing the ammoniacal gas, thus facilitating its evaporation from the vessel in which it has condensed, and as it is necessary for the passage of the liquefied ammoniacal gas into its gaseous form that it should absorb the heat from the surrounding medium, let it be water or any other fluids, their temperature will gradually decrease. The following diagrams will enable you to understand better the working of this invention:—

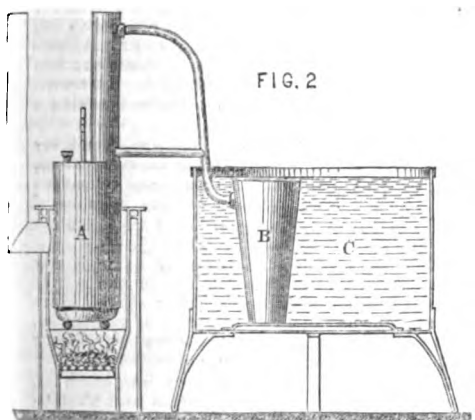
1. Before each operation incline the apparatus horizontally, and maintain it about ten minutes in the position represented in fig. 1. 2. Place the boiler A in the furnace, and the refrigerator B in a bucket filled with cold water, so that the summit of the refrigerator be covered with 2 in. or 3 in. of water. A small quantity of oil is poured into the tubewhich is placed in the upper part of the boiler, in which also a thermometer is placed. The apparatus is heated moderately until it reaches 266 deg. The apparatus is then removed from the fire, and the boiler is placed in the bucket of cold water. The hole of the refrigerator being stopped with a cork, and the tin vessel surrounded with alcohol, having previously nearly filled it with water, the congelation takes place by the evaporation of the liquid ammonia in the condenser.

Although the evening is far spent, I cannot leave you without calling your attention to a very ingenious mode, devised by M. Pelon, for warming railway carriages during cold weather. You are too well acquainted with the present clumsy and expensive method now in use to require any description from me. The only remark I shall make upon it is that it is the boon of those who are in least need of it, namely, first-class passengers, whilst those of the second and third classes have not that luxury supplied to them. To avoid loss of time, I shall not attempt to describe the various methods which have been proposed as substitutes for the one at present in use, but shall at once state that M. Pelon's method is based on the conversion of force into heat, the heat in this case being generated by friction; and from what I have stated in my first lecture you must be perfectly *au courant* of what is understood in the present day of the conversion of heat into force, and *vice versa*. All those persons who were fortunate enough to visit the French Exhibition in 1855 must have been struck with a machine, invented by Messrs. Mayer and Beaumont, which generated enough heat to convert water into steam and thus obtain a motive power; and this was effected without fuel or electricity, but by mere frictional heat, which they obtained by causing a wooden mandrel surrounded with tow to revolve with great rapidity inside a copper cylinder which itself was surrounded with a small quantity of water. The great merit of the invention of these gentlemen, and which drew upon

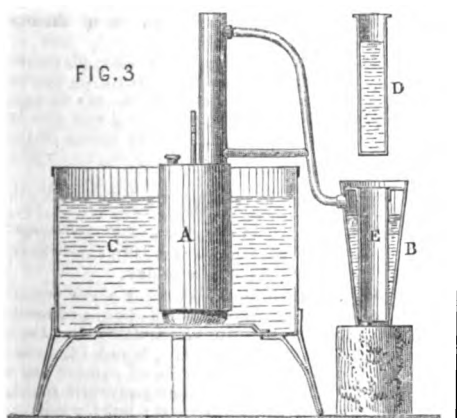
them the special attention of the Emperor, was that neither the towed mandrel nor the copper cylinder were materially injured or deteriorated after many days' working. This important end was attained by them by allowing a gentle flow of oil to run constantly through the cylinder, thus preventing immediate contact between the towed mandrel and the copper cylinder. In fact, the frictional heat was produced through the



friction which took place between the particles of oil themselves, preventing thereby all wear and tear. Notwithstanding the ingenuity displayed in this invention, still as a means of obtaining motive power it was useless, for more force was required to generate an amount of heat than could be yielded by the friction of the particles of oil. But in the application which M. Pelou has made of this invention to the heating of railway carriages, the motive



power required to generate the heat being produced without cost to railway companies, as it is caused by the very act of the travelling of the carriages themselves, the cause which accounted for the failure of the principle as a practical mechanical application, namely, the production of the force required to work it, is overcome. M. Pelou proposes to fix one of Messrs. Mayer and Beaumont's mandrels under each railway carriage compartment, and to convey the heat produced



by the revolution of the towed mandrel to the compartment itself by means of metallic conducting surfaces, which in their turn will heat the atmosphere of the compartment. We shall, I am happy to say, within a year or two, know if M. Pelou's invention will be capable of general adaptation, as it is now being practically tested on one or two of the French railways.

A number of additional mechanics and labourers have been taken on in the Royal Gun Factories to complete the Woolwich guns in course of construction, so as to enter upon a test of their merits as early as may be.

Correspondence.

COMPOUND GUNS.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—Mr. Parsons, in his letter which appeared in your issue of October 27, contradicts my statement that he did not propose to line a cast-iron gun with a coiled wrought-iron tube, but admits that he did not specify such a tube in his patent of 1860. He does not, however, state when, or where, he proposed it for this purpose, and seeing that he specified wrought iron, steel, homogeneous metal, or other suitable metal or alloy in that patent, I ask you, had he been aware of the special value of a tube formed of a bar of iron coiled round a mandrel and welded into a twist barrel, would he not have named it? Mr. Parsons does not specify such a tube in his patent of 1863 either, and it was not until after the publication of my patent, and after the successful trials of my first gun, that he mentions it, for the first time, in a pamphlet he issued in September, 1863. This pamphlet appeared some nine months after mine had been extensively circulated among persons interested in gunnery matters.

The term "wrought-iron coiled tube" implies a tube formed of a bar of iron wound round a mandrel, and welded into a large twist barrel; does it not? Mr. Parsons asserts that he commenced a patent in 1855 for making coiled tubes. Let us see what the patent was. Percival Moses Parsons, No. 496, March 6, 1855.—"Secondly, my invention consists in constructing the larger kind of fire-arms or ordnance by winding or coiling bands, strips, or bars of wrought iron, steel, or other wrought metal, spirally round a central tube forming the bore of the piece or temporary mandrel, and in forming such bands, strips, or bars of a taper form, and in rolling them with suitable grooves, tongues, or other recesses and projections to connect and hold together the coils; and in rolling round sheets or plates of wrought metal and in placing cylinders or tubes of wrought metal one within the other, and in uniting the bars, strips, bands, sheets, plates, cylinders, or tubes, by means of a solder, metal, or metallic alloy, which will fuse at a lower temperature than the welding or fusing point of the wrought metal of which they are composed."

Now, Sir, what has this soldered or tinkered cannon which Mr. Parsons "presented to the public" to do with strengthening a cast-iron gun by means of an internal barrel made of a welded wrought-iron coiled tube? I do not see that Mr. Haddon's patent of 1855 can affect the question between me and Mr. Parsons, when I have shown that I had made guns in 1854 by casting round coiled wrought-iron barrels. The 68-pounder which Mr. Parsons quotes as having sustained 75 rounds is well known to have been a most exceptional gun, for, including it, the average endurance of these guns, of 8-inch calibre, is only 50 rounds, commencing with a round shot and increasing every 10 rounds by a cylinder equal in weight to an additional shot. The gun of mine which endured 80 rounds and burst the 81st was a condemned 10-inch (No. 2) shell gun converted into a calibre of 6.5in. or rather larger than that of the 32-pounder. Externally, no doubt, it was about the same size as the 68-pounder, but I could easily have removed two tons of its weight without affecting its strength. The fair comparison would be the 68-pounder blocks bored to 6.5in., and strengthened externally. Of these there were three. —(See Parliamentary Report on Ordnance).

	Calibre in inches.	Weight in cwt.	Charge of powder in lb.	Weight of single shot.	No. of round at which gun burst.
1860. Smooth bore block of cast iron, cast specially for hooping, strengthened with wrought-iron hoops	6.5	97	16	35	36
1860. Smooth bore block of cast iron, cast specially for hooping, strengthened with envelope of gun-metal	6.5	120	16	35	22
1860. Another similar gun	6.5	120	16	35	31
1863. 10-inch gun lined with coiled tube	6.5	104	16	66½	81

Mr. Parsons, alluding to the last gun, says:—"I think anyone of common sense and judgment would have decided the attempt to strengthen them in this way was a complete failure!" I would draw attention to the unit of weight of the cylinders for testing my gun, being 66½lb. as compared with those for the other guns, viz., 35lb. To show

how little mere weight may have to do with a gun's strength,—see next table.

	Calibre in inches.	Weight in cwt.	Charge of powder in lb.	Weight of single shot.	No. of round at which gun burst.
1860. 32-pounder smooth bore hooped	6.375	60	10	32	67
1860. Another similar gun	6.375	60	10	32	59
1860. 32-pounder smooth bore, strengthened with wrought-iron jacket and hooped	6.375	76.3	10	32	81
1859. 70-pounder block, cast specially for hooping, strengthened with wrought-iron hoops	6.375	104.3	16	66½	35

These figures will sufficiently prove that I could remove 2 tons of metal from my 7-inch rifled gun without affecting its strength to any appreciable extent. In the first place, my gun is 11ft. long in the bore, which must be upwards of 2ft. longer than that of the French gun. The thickness of metal round the powder charge is 9in., that of the French gun, 7.75in. The excess of metal round the seat of the powder in my gun is thus a cast-iron ring about 1½in. thick. I ask, therefore, whether Mr. Parsons is justified in thinking that my gun should have fired 44lb. charges and 220lb. shot to be equal to his.

Mr. Parsons denies the correctness of the statement that "no rifled gun has as yet fired so many rounds with such large charges" as mine. In quoting the Ordnance Select Committee's report, he omits the word "large," and shows that the total amount of powder and shot thrown by his gun is greater than mine. This is no measure of a gun's endurance, for at the time the report was written, the Armstrong and Whitworth guns had fired nearly 3,000 rounds with 12lb. and 10lb. charges and 70lb. shot; further a cast-iron (unstrengthened) rifled 32-pounder had fired upwards of 2,000 rounds with, to the best of my belief, 5½lb. of powder and 56lb. shot and has not burst. I therefore maintain that Mr. Parsons' gun, although tested long after mine, had not, when it burst, fired so many rounds with such large charges as mine. Mr. Parsons calls his gun a 30-pounder, and says repeatedly that it weighed 3 tons. It is, however, a 6½-inch gun, i.e., a 35-pounder, and I believe, when altered, it weighed within 3 cwt. of 4 tons. I trust if I am wrong Mr. Parsons will correct me.

Mr. Parsons, referring to the 9-inch gun at present being made by casting the casing round the tube, says: "I will not give any expression to my opinion lest I should commit myself as Major Palliser did when he twice publicly asserted previous to the trial of my gun that it possessed radical defects which would be fatal to its success."

I have two remarks to make on this sentence:—First, Mr. Parsons forgets that on the occasion he refers to he stated in the *Morning Post* of the 6th October, 1863:—"The method referred to in Captain Palliser's letter of the 25th ult., as having been invented and tried by him in 1854 and the following years, and which consists in casting a cast-iron casing on to an internal tube of wrought iron, I have nothing to say in reference thereto except that I satisfied myself in 1855 that no good result could on a large scale be obtained by such a system of construction." Secondly, Mr. Parsons implies that the gun he took to France in 1865 was similar to the one I alluded to in September, 1863, namely, the one he patented in 1862, and which he proposed to the Select Committee in the early part of 1863. Now, Sir, this is a most important point, and I think the whole of Mr. Parsons' case will fall to the ground, should I prove:—(A.) That the gun he then proposed "possessed defects so radical as to ensure its failure." (B.) That these very defects were remedied in the gun Mr. Parsons lately tested in France. (C.) That, subsequent to that correspondence, Mr. Parsons took out a fresh patent in November, 1863, in which (after his attention had been called to it) he directly infringed and copied my patent in remedying these very defects. (D.) That the points in my patent which Mr. Parsons copied were bona fide inventions of mine, and involved a principle in applied mechanics which previously had not been clearly defined. To prove this at present would take up too much of your space, but I trust you will kindly afford me an opportunity of doing so on a future occasion.

I have the honour to be, Sir,
Your obedient servant,
Army and Navy Club, WILLIAM PALLISER.
November 2 1865

LIGHT DRAUGHT ROLLER SHIP.

SIR,—About a fortnight since I saw a paragraph in your paper stating that "an eminent ship-building firm is about laying down a vessel on an entirely new principle. It is described as the light draught roller ship or water chariot. The principle consists in supporting a car or vessel above the water level on axles or shafts passing through rotary hollow drums or cylinders, which are made to revolve by steam or other motive power. This car or vessel, constructed to carry passengers or freight, is supported by the buoyancy of the drums, and kept suspended above the water level." I had just matured a plan for a similar vessel, and prepared for the construction of a good sized working model, and when I read this I could not help feeling a momentary pang of bitter disappointment. I find that Mr. A. F. Osler, of Birmingham, is the patentee of a roller ship. Whether it is the one about to be built I know not; however, he has abandoned it. Every parent thinks best of his own bantling, and I confess that I consider my matured plan more likely to answer for short journeys than Mr. Osler's or the one described above, so far as we can judge from the brief paragraph published. One of the first and most important conditions I laid down was lightness of vessel and cargo. To realise this I gave up the steam-engine with all its weight of boilers, water, iron, and coal, and in its stead I projected a Lenoir gas engine to each wheel, the wheels themselves to be charged with compressed coal gas for fuel. By this means I got rid of the boiler and coals. But this did not satisfy me, I wanted a still lighter load, for the more I thought and experimented the more I was convinced of the paramount necessity of buoyancy.

My last idea, and the one I now believe most practical, is to use compressed air for the motive power. To store this compressed air at as high a pressure as possible, I would have four or more large globes made of the very best and toughest steel. I propose globes instead of cylinders because the sphere is the strongest of all forms, and steel, because with it you can get the greatest attainable strength with the greatest possible lightness. The spheres would also serve as paddle wheels and buoys. Each pair or line of globes would be connected by a strong hollow shaft running through the whole line in a similar manner to the shaft of a pair of paddle-wheels. There would be at least two of these shafts; more would be advisable. The body of the vessel must hang from the shafts, its centre of gravity being below the point of suspension, the bottom being flat and above the water. In fact, it would be a square or oblong raft hanging from the shafts of the globes. Up to nine, and perhaps to sixteen, the spheres would be best arranged in squares. There should not be more than four in the width of the vessel, any further increase would be better placed in the length on account of entering rivers, docks, &c. The greater the number of the globes the greater the burden and stability of the boat, and the less risk of capsizing, and also the less danger if one or more of the spheres were to fail. Each globe would carry two or more paddles or floats. I know there are many more floats on ordinary paddle-wheels, but my globes are intended to revolve at a very much higher speed. Behind each of the floats would be placed a pipe with one or more open ends looking in the direction the vessel is going; this pipe is brought in communication with the store of compressed air immediately on its submergence in the water, and is cut off before rising to the surface on the opposite side.

It is well known that water (and even air) offers a strong resistance to any body which strikes it suddenly and forcibly; in this case I think the reaction would send round the globe with great force. The water, which would enter some distance in the outlet pipes, would act as pistons. The intermittent communication could be made at the bearings. To reverse the direction of the vessel, a second set of propelling pipes looking the contrary way to the first set would be required. It would be easy to construct valves to regulate the pressure and others to cut off the communication, with the compressed air to stop the boat. Feathering floats would be invaluable. I believe the floats might be made to feather with the emission and stoppage of the air. A globe 20ft. diameter, made of $\frac{1}{4}$ in. steel plate would weigh about 14,000lb., allowing for rivets and overlapping. If such a globe were sunk it would displace 261,750lb. of water. Difference between sphere and equal bulk of water, 247,750lb. Take 1-3rd of this as its actual carrying power, this would be 82,583lb. A vessel of nine spheres would have an available carrying power of 743,247lb. or 331 tons. This for shafts, floats, ship, and cargo. Four times nine, or more, might be used. I will not say what pressure may be carried on the globes, but I think we may say 90lb. per square inch with perfect safety, and if 3-8th thick, probably double this pressure might be carried. Nine globes would contain over 36,000 cubic feet of compressed air at 90lb.

With such a vessel I believe it will be possible to roll over the water at a speed not yet dreamt of. There will be no sliding through the water with all its attendant friction. With a light draught, plenty

of power, and well constructed paddles, she would climb as it were on the water, and run over it as rapidly as a locomotive on the rails and much more smoothly. I do not think she could possibly upset in the roughest sea, and her light draught would enable her to go where our present vessels cannot. Her buoyancy and lightness would cause her to rise on the waves like a cork, and the same qualities would prevent the heaviest seas from harming her, unless she were fast among breakers. Ordinary ships are rooted deep down in the comparatively still water below, and when struck by a heavy sea their inertia and fixedness causes them to receive a heavy shock. I have felt such a shock on the Atlantic on board the Cunard steamer "Arabia" which has made her creak and quiver through all her timbers. My globe ship would move as buoyantly as a gull on the face of the waters, and gently allow the waves to pass under her. Her form would greatly assist her in this. She would steer in the usual manner. Every point of her surface in contact with water being curved, she would meet with little resistance in turning. Such a boat will probably be the passenger and light goods vessel of the future. Free from the heat and smell of the steamer, light and easy in her motions, and unprecedentedly rapid in her progress, it will be a pleasure to travel in her. I hope the vessel about to be built will realise my anticipations, but I fear she will not, if loaded down with the dead weight of boilers, steam engine and coals, with all the inevitable extra weight of construction attending them.

Among other experiments made in working out the idea of a globe ship, I took several ordinary fowls' eggs and blew out the contents through small holes in the ends, and made up these holes with wax. I threw these frail things in the roughest parts of the river Mersey I could find near Stockport. One was carried over a weir 5ft. or 6ft. down after heavy rain; up it rose to the surface amidst the foaming water and floated away down the stream to a sort of rapid. Here it was interesting to see how it dodged the heavy boulders against which the water rushed as though it were a thing of life. I followed it down the river and succeeded in regaining it, and was much gratified to find that it was as sound as when I threw it in. Several more I sent over another weir, but in this case they could not get away from between where the falling water first struck, and where it boiled up again. The egg-shells were continually beaten under by the tumbling water, and as often sprung to the surface amidst the foam apparently uninjured. I watched several at least fifteen minutes and then left them; on another previous occasion one had undergone this rough treatment an hour and a half when I left it.

I remain, Sir, yours, &c.,

WILLIAM BARBER.

Stockport, November 2.

Meetings for the Week.

MON.—Royal Geographical Society.—"Account of his Discovery of the Second Great Lake of the Nile, Albert Nyaaza," by Mr. S. W. Baker, 8.30.

SOCIETY OF ENGINEERS.—Discussion on Mr. V. Pen-dred's paper on "Locomotion, &c.," 7.

TUES.—Institution of Civil Engineers.—"The Telegraph to India, and its Extension to Australia and China," by Sir O. T. Bright, 8.

THURS.—Linnæan Society, 8.

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 5d. 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.—R. P. E.—Inquirer.—W. B.—T. L. P.—W. H. H.—J. B.—F. E. S.—W. P. M.—J. B.—W. P.—Capt. N.—W. H. H.—M. C.—W. H. P.—F. L. F.—A. N.—B. H. T.

J. S. MORRIS (Westminster).—We have already recorded your general claim to having invented the system of lining guns with steel or iron tubes, previously to either Major Palliser or Mr. Parsons. We would willingly insert your last letter upon the subject did it contain any evidence in support of your claim beyond that afforded by your previous communication.

J. B. (Oldham).—We do not know who are the publishers of the Transactions of the British Association of Gas Managers. Possibly the Association is its own publisher. A letter to the Secretary would doubtless lead to the information you require.

Miscellaneous.

A valuable improvement in the manufacture of flexible air tubing has recently been adopted by Mr. Ellis Lever, the original inventor. In place of bevelled or flat iron hoops he substitutes a series of rings of round iron or steel, for the purpose of keeping the tubes open. These rings, instead of being welded, are so united that when pressed they yield, and can be reduced to one-third the original size; but immediately they are released become a perfect circle of the exact size of the tube. The tubing so made is said to be lighter, stronger, and less costly than the old kind.

The St. Thomas's Floating Dock, when completed, will consist of six pontoons; three of these have been despatched from this country, and one of them is in course of construction at St. Thomas. According to the terms of the concession granted by the Danish Government, the dock should be ready to receive ships at St. Thomas on the 20th of April, 1866; but in order to prevent the possibility of disappointment, the period for completion has been extended to the 31st of December, 1866.

Professor Bomer has announced the discovery of a fossil spider, which resembles the recent genus *Lycosa*, in the coal measures of upper Silesia. The interest of this discovery lies in the fact that hitherto spiders have not been known from any rocks older than the Jurassic, and that now the existence of them in the Palæozoic period is proved.

At the fair of the American Institute is exhibited the first sewing machine invented and constructed by Elias Howe, jun. It is a very neat working model, made to turn by hand, and quite different in general construction from those at present in use. It contains, however, that essential improvement—a device for passing a second thread through a loop in the first—which stops the thread from unraveling—the idea that made mechanical sewing a practical art.

Herr Ulex, a chemist of Hamburg, has lately discovered traces of copper, and in some cases lead, in the remains of animals. He has found copper and lead in human flesh, and copper in the intestines of beasts of prey, in beef, in poultry, in hens' eggs, in fish, crustacea, insects, spiders, and snails.

A Corsican machinist, Smittier by name, is now constructing, at the Pré Catalan, in the Bois de Boulogne, an aerial ship of peculiar shape, which he maintains he can direct by means of *propulseurs*. This new balloon will possess the advantage of rising and descending without the use of ballast.

In colouring, or rather adulterating, green tea, a mixture compounded of gypsum and Prussian blue is laid on the leaves during the last process of roasting. This adulteration the Chinese do not hesitate to carry out on a systematic plan, and on a most extensive scale. Half a pound of paint or colouring material is mixed with each hundred pounds of green tea. The Chinese readily acknowledge the superiority of green uncoloured, but plead in excuse for their adulterations the wilful preference of the foreigner, by whom alone these teas are consumed.

Following the example of the English agricultural societies, the Glamorganshire Society threw open its ploughing match to all comers. The Welsh ploughmen are famous for a keen eye and going straight, but at the meeting which recently took place at Swansea, they had to yield the palm to George Brown, the champion ploughman of Messrs. Howard, of Bedford, whose ploughing was greatly admired by the Welsh. The first prizes in the other classes were won by Welsh ploughmen with Bedford ploughs.

The first of the line of steamers between North and South America was to leave New York on the 28th September. They are to make the voyage from New York to Buenos Ayres in thirty days, with a mean speed of 200 miles a day.

The American Government tried some experiments recently with cast-iron rifled guns of heavy calibre. The *Scientific American* states that these guns were of the 15-inch pattern, bored 12in., and were fired with a charge of 35lb. of powder and a projectile of 600lb. At the twenty-seventh round, unhappily, one of the guns burst; but for this occurrence the experiment would have been continued. Another gun of the same size bore, but cast on the Rodman plan, failed at the sixteenth round. After a few rounds had been fired from these immense rifles, the grooves became so filled with the residuum that it was extremely difficult to get the shot home. The Rodman gun did not burst, but failed; that is to say, it would have burst if the firing had been continued longer. It is believed, from these experiments, that cast-iron rifles, 12in. in the bore, are not desirable additions to the American ordnance.

The lesser variations of the air in the barometer are shown by putting the mercury in diagonal tubes, which will rise and fall some inches more than in the perpendicular, and the nearer the line approaches to a right angle by so much the more will the mercury show the elastic force of the air.

The English Registrar-General reports that the mean temperature of the six months from April to September, 1865, namely 59°37 deg., has exceeded any to be found in the records of the last ninety-four years. Yet the degree of heat was never equal to that of several quite recent summers. The highest of all the returns made to the Registrar-General this year was 92 deg., reported by the late Dr. Barker, of Bedford; and in 1858 the same gentleman had to report a heat of 97 deg. at that place. But in all the ninety-four years the mean temperature of the six months never before reached even 58 deg., except in five years, and in only one of these exceeded 59 deg., namely, in 1846, when it was 59°13 deg.

On Saturday night, the 7th October last, a portion of the town of Bombay was for the first time lighted with gas, and although, owing to delays, that portion is necessarily circumscribed, yet ere long there is little doubt that Bombay will be as well lighted as any English town. The lamps were lighted during the afternoon, and as the lamp-lighters went from lamp to lamp they were followed by crowds of inquisitive natives, who gazed in mute astonishment at the new Western wonder that had appeared in their midst.

The St. Dizier iron trade has been suffering from the long drought, but recent accounts state that sufficient rain has now fallen to enable the ironmasters to work, and that a great number of fires have consequently been lighted. There is likewise a great deal of work going forward in the forges and rolling-mills. It is feared that the works will be again interrupted should cold dry weather set in.

A member of the Stock Exchange has placed at the disposal of the National Lifeboat Institution a sum of £400 to enable it to place a life-boat on the coast, to be called the "Palmerston," and to be stationed at Callercrofts, near the mouth of the Tyne, in lieu of the former lifeboat there, which was becoming unfit for further service. That boat has performed some of the noblest services ever accomplished.

A very ingenious contrivance has been made by MM. Toselli and D'Allmagne, of Paris. They blow a small globe within a decanter or claret jug. This globe, which has its opening at the side of the larger vessel, serves to hold a freezing mixture to cool wine or water in summer, and in winter may be filled with warm water to take the chill off Burgundy or port.

On Saturday last a formidable addition to the Italian navy was made. The Millwall Ironworks and Shipbuilding Company launched from their yard at Millwall an iron-clad frigate, the "Affondatore." She is fitted with two cupolas on Captain Cowper Coles's plan, and will carry two 10-ton guns. From her bow projects a huge beak, which would be fatal to most ships against which it might be driven.

About six o'clock on the evening of the 3rd inst., the unusual phenomenon of a lunar rainbow was observed in Scotland. For several minutes before it arrived at perfection it appeared as if a thin column of smoke were rising from Loch Ryan. The column soon resolved itself into the shape of an arc, and for at least five minutes before disappearing the rainbow stood out in perfect relief, presenting a strange and beautiful sight.

The weekly meetings of the Institution of Civil Engineers will be resumed at the house in Great George street, on Tuesday evening, the 14th inst., at eight p.m., when a paper by Sir Charles Tilston Bright, M.P., M. Inst. C.E., "On the Telegraph to India, and its extension to Australia and China," will be read and discussed.

At the general monthly meeting of the Royal Institution of Great Britain, held on Monday, the 6th inst., Sir Henry Holland, M.D., D.C.L., F.R.S., President, in the chair, Messrs. D. Chauncy Beale and Protheroe Smith, M.D., were elected members. The special thanks of the meeting were returned for the following addition to "The Donation Fund for the Promotion of Experimental Researches,"—Professor Faraday (third donation), £20.

Anti-fouling compositions do not appear to prosper, for the condition of the bottom of the iron screw steamship "Agincourt," 26, at Devonport, has created considerable surprise, and well it might when we consider the following facts:—About six weeks since she was removed from dock after having been scoured and coated with Hay's anti-fouling composition. On recently docking her, and as the water was pumped out her bottom below the line of flotation looked, as one of the artisans described it, "like a field of grass," so regular was the growth of the weed. Some was nearly 2in. long, and it extended from stem to stern and down to the keel. It is supposed that if no composition had been applied vegetation would not have advanced to the same extent. There is no accounting for the extraordinary fact. While the ship lay in Hamoaze very heavy showers fell, and an unusual quantity of fresh water came down the harbour.

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,—1028, 1082, 1084
BUILDINGS AND BUILDING MATERIALS,—1043, 1058
CHEMISTRY AND PHOTOGRAPHY,—1009, 1011, 1018
CULTIVATION OF THE SOIL, including agricultural implements and machines,—1012
ELECTRICAL APPARATUS,—1031
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c.,—1006, 1007, 1019, 1032, 1039, 1042, 1057, 1061
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals,—1041
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.,—1010, 1016, 1033, 1034, 1045, 1047, 1048, 1050
GENERAL MACHINERY,—1013, 1015, 1020, 1026, 1037, 1054, 1060, 1065
LIGHTING, HEATING, AND VENTILATING,—1040, 1049
METALS, including apparatus for their manufacture,—1033, 1063
MISCELLANEOUS,—1027, 1044
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.,—1021, 1022, 1024, 1025, 1030, 1035, 1038, 1055
SHIPS AND BOATS, including their fittings,—1008, 1017, 1036, 1063
STEAM ENGINES, &c.,—1029, 1051, 1052, 1059
WARFARE,—1014, 1046

1008 J. ISHERWOOD. *Certain improvements in dyeing or printing upon the fabric known as "sailcloth."* Dated April 8, 1865

This invention consists in first submitting the said fabric to a solution of caustic alkali until the greasy matter is removed, after which it is to be washed and freed from the alkali, and then it is to be submitted to the action of chlorine gas, or other similar agent, which renders the surface in a fit state to receive a mordant such as sumach, with which it is to be saturated by steeping in a suitable vessel. When in this state it is to be printed upon in designs by means of blocks or cylinders, and afterwards dried, and if required pressed between hot rollers, which produces a glazed and polished surface, and the fabric so treated may be used as carpeting or drugging; or previously to mordanting the surfaces may be covered with a composition of oil and body colour, which is to be smoothed by rollers and then printed upon in oil colours by means of blocks or cylinders. *Patent abandoned.*

1007 G. DAVIES. *Improvements in buttons and in devices for securing the same to fabrics.* (A communication.) Dated April 8, 1865

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

1008 G. DAVIES. *An improved composition for preventing the fouling of ships and other vessels.* (A communication.) Dated April 8, 1865

This composition consists of arsenic, acetate of copper, acetate of zinc, linseed oil, spirits of turpentine or benzine, or other equivalent substance, and the residuum of palm oil or tallow after distillation. These substances are mixed in about the following proportions:—Residuum of palm oil, 15 parts; acetate of copper, 20 parts; acetate of zinc, 10 parts; arsenic, 20 parts; spirits of turpentine, benzine, or equivalent substances, 25 parts; linseed oil, 10 parts; total, 100 parts. In order to coat any surface such as that of the bottom of a vessel, with the composition, that portion to be coated should first be painted over with two coats of the residuum of palm oil or tallow after distillation. This effectually prevents the water from coming into contact with the metal, and, consequently, precludes any galvanic action or oxidation. A coating of the composition is then applied over the tallow or palm oil. *Patent abandoned.*

1009 V. A. PROUT. *Improvements in photographic cameras.* Dated April 8, 1865

Panoramic views have heretofore, in some cases, been taken by photography, the camera being adjusted first to take a portion of the view, and this being effected it is shifted or turned partly round, and the plate or sensitive surface moved forward for the next portion of the view to be taken, and so on. Great difficulty, however, is experienced in avoiding the appearance of join lines between the different parts of the compound picture. To overcome this difficulty the patentee employs a screen which may conveniently be placed a short distance in advance of the plate or sensitive surface; this screen, which limits the size of the portion of the picture which is taken at each operation, is so made as to shade off, as it were, the edges of each portion of the picture, spreading, so to speak, the join lines between the several portions of the picture over a surface of some width, instead of allowing the join to take place at a line of inappreciable width. This the patentee does conveniently by making the sides of the screen of a zig-zag form, like saw teeth, and these are so arranged that the points at the one side correspond to the centre of the notches on the other side. *Patent completed.*

1010 J. DEBAM. *Improvements in the means of ornamenting linen cuffs and collars.* Dated April 8, 1865

This invention consists in printing the designs at once on to the collar by the application of lithography. The inventor produces any kind of design on a printing stone from which he prints in an ordinary lithographic press, using for the purpose the same colouring matters and mordants as are now used in the printing of similar designs for application to cuffs and collars, as aforesaid. *Patent abandoned.*

1011 A. G. HUNTER. *Improvements in the manufacture of soda and potash.* Dated April 8, 1865

The object of this invention is to effect the conversion of sulphate of soda into caustic soda, or of sulphate of

potash with caustic potash, by decomposing sulphate of soda or sulphate of potash by mixing therewith caustic lime to combine with the sulphuric acid it contains, and subjecting the mixture to sufficient pressure (either hydraulic, steam, or mechanical pressure), whereby sulphate of lime is formed, and caustic soda or caustic potash liberated. *Patent completed.*

1012 S. MOORE. *Improvements in electro-magnetic engines.* Dated April 8, 1865

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

1013 T. TUKTON. *Improvements in machinery for cutting files.* Dated April 8, 1865

This invention consists in the application of a fixed bed or stithy block over which the blank of a file to be cut together or not, as the case may be, with a strip of lead, type metal, or other suitable metal, is made to pass, and upon which it firmly rests during the operation of striking the chisel. The hammer and chisel with the necessary adjuncts are mounted upon a movable frame which takes the said bed or block for its centre, and by its means they are easily and simultaneously adjusted to any of the various angles required to be obtained in the process of forming the teeth on the file and still retain their connection with the driving power. *Patent completed.*

1014 J. B. HAUSMAN. *An apparatus for supporting and steadying the arm in rifle shooting.* Dated April 8, 1865

This apparatus consists of a leather strap or band of metal fastened with a strap and buckle to the left leg of the person shooting; it may be fastened either above or below the knee, and is furnished with a socket of steel, iron, leather, or any other suitable material, for the purpose of receiving the end of a hollow tube of iron, steel, or tin, in which slides a graduated rod of iron or steel, so as to be adjusted to any required height, and which may be retained in position by a spring working into graduated cuts; or the tube may have a slit down the side, with side cuts for the reception of a stud on the sliding rod; or the iron or steel rod may be adjusted to the required height by being made to screw up and down in the tube, or by other means and appliances. The top of the aforesaid sliding rod is furnished with a semicircular piece in which the arm of the shooter may rest. Or it may be made to grasp a ring which is riveted to a solid piece of leather or other material which is fastened round the arm with a strap and buckle. When not in use the sliding rod is pushed to the bottom of the tube, which may then be either slung to a belt or strapped to the arm. *Patent abandoned.*

1015 J. WAITE. *Improved hand drilling machine.* Dated April 8, 1865

This invention consists in the use of a bed plate and socket, the former to serve as a firm base for the machine, or as a support for the article to be drilled, and the latter to hold the upright standard, to which is affixed the working machinery. This consists of an axle fixed in a frame securely attached by bolts or otherwise to the said upright standard; on the said axle is securely keyed a bevel wheel, which works into another bevel wheel fixed on an upright revolving spindle, secured in the upper part of the aforesaid upright standard, and in the before-mentioned frame. The upper portion of the upright spindle is formed into a screw with a lever at the top, whereby the drill may be lowered so as to operate on the article to be drilled. The lower portion of the above-mentioned spindle is formed into a socket for the reception of the drill. A guide may also be supplied to ensure the vertical motion of the drill when actuated by the before-mentioned lever, and, if thought desirable, the upright standard and socket may be made in one piece, whereby lightness and rigidity may be obtained. *Patent abandoned.*

1016 A. STEWART. *Improvements in apparel.* Dated April 10, 1865

This invention has for its object the support of the lower abdominal muscles, the penis, and the scrotum. The abdomen is supported by a bandage buckled round the pelvis, held in situ by a brace which pulls up the front only of the bandage. The scrotum is held above the level of the perineum by a case attached to the abdominal supporter, kept in situ by a tubular elastic strap running in a case attached at each side of the perineum, passing round the thigh to fasten on the front of the abdominal passage. The penis is supported by a flap which is a continuation upwards of the scrotal case and fastening upon the abdominal passage. *Patent abandoned.*

1017 C. F. GHEERBRANT. *An improved mode of and apparatus for deepening the bottom or bed of rivers, canals, harbours, or other similar places.* Dated April 10, 1865

This apparatus consists of a sort of movable dam or breast wall constructed of timber or other suitable material, and sufficiently strong for resisting the impetus of the water, and provided with the necessary means for allowing the dam to be fixed by posts, anchors, or other similar means, at any spot where the bottom or bed is to be deepened, suitable open spaces being left between the lower edge of the dam and the bottom or bed for the purpose of causing the water in passing through these open spaces to be forcibly obliged to impinge on and deepen the bed or bottom, and, by the powerful current thus obtained, carry along with it gravel, sand, mud, or other similar obstructions, whilst, after having thus procured the required depth of water, the dam is removed to another spot where the same operation is again to be performed. *Patent abandoned.*

1018 R. A. BROOMAN. *An improved method of forming tapered rods and bits.* (A communication.) Dated April 10, 1865

This invention consists in forming rods and bits tapered by means of the biting action of a chemical bath, instead of by grinding or filing as heretofore. Thus the patentee forms cylindrical rods of circular or polygonal cross section into tapered or conical rods by causing them to descend and rise at uniform or differential speed, and to fixed or variable depth in an acid bath, which dissolves the metal; the vertical motion of the rods may be imparted mechanically or manually. The vessel containing the bath is by preference placed under glass to allow the progress of the operation being watched. *Patent completed.*

1019 R. FERGUSON and W. RALSTON. *Improvements in machinery for finishing yarns or threads.* Dated April 10, 1865

According to this invention, in place of finishing yarns or threads by subjecting them to pressure alone between a pair of rollers, the patentees construct machines for finishing yarns or threads, when in the hank or skein, in such a manner that the yarns or threads are at the same time that they are subjected to pressure between a pair of rollers also

subjected to friction, and this they accomplish by causing the metal roller to revolve at a greater or less surface speed than the roller around which the bank or skin passes, and towards which the metal roller is pressed. The metal pressing roller may either be a plain roller, or the surface of the roller may be engraved or fluted with lines passing around its surface; the roller may also be heated, if desired. *Patent completed.*

1020 W. BROOKES. *Improvements in heating files and file blanks.* Dated April 10, 1865.

For the purposes of this invention, in place of heating files and file blanks by direct contact with a fire, as is usually the practice, each file or blank is placed in a highly heated tubular or hollow chamber heated externally, and it is desirable that the hollow tubular chamber should not greatly exceed the dimensions of the files or blanks which are to be heated therein. Although it is not essential, it is preferred that there should be several tubular chambers, each suitable for receiving a file formed in the same block or mass, which it is preferred should be of cast iron coated externally with fireclay. These tubular chambers are set over a fire or furnace, and are heated thereby as evenly from end to end as may be, so that the files introduced therein may be uniformly heated from end to end. These tubular or hollow chambers are usually closed at their back ends, and open in front. *Patent completed.*

1021 G. VOIGT. *Improved mechanical arrangements for stopping or retarding railway carriages, waggons, and trucks.* Dated April 10, 1865.

This invention consists in causing the buffer rods to work the brakes, to accomplish which the inventor lowers the buffers and buffer rods to a level with the axes of the wheels, so that the brake blocks, which are affixed to the ends of the buffer rods, come directly opposite the flanges of the wheels. In order that the buffer rods may be so lowered, the main framing of the carriage should be prolonged downwards, and the buffer rods made to work easily through bearings placed in the said projecting portion. To prevent the carriages from rushing upon each other, distance pieces may be fitted to the back and front framing of each carriage, and may be made to fold up out of the way when not required, the said distance pieces being of such a length that the brake blocks may come against the flanges of the wheels when the buffers of any carriage are pressed by the previous or following carriage or carriages. As soon as the train is stopped, or a uniform retarded speed is obtained, the carriages adjust themselves, and so relieve the wheels from the action of the brakes. *Patent abandoned.*

1022 J. J. MYERS. *A compensating wheel to be used with locomotives, carriages, and other vehicles on railway and tramroads, in conjunction with or without the wheels now used, in order to obtain at curves and other parts of the road a rolling instead of a sliding motion now effected by wheels in present use on railway and other tramroads.* Dated April 11, 1865.

In performing this invention the inventor uses, first, a disc or circle of metal or other materials (of a less diameter than the wheels now in use on railway or other tram roads), to be built of one or more pieces, which disc or circle is to be keyed fast on the same axle at the opposite end to another fixed wheel, similar to that now used on railways, and which wheel the inventor proposes still to use in connection with, and alternately with, this invention; and in order to equalise the sizes or diameters of the disc with the other wheel, he uses (outside the said disc, but connected with it) a loose tyre, periphery, or circle of metal, with an outside flange to suit the shape of the rail, and to overlap the rail on one side. He also uses a flange or flanges in the inside part of the said loose tyre, periphery, or circle of metal, which is to fit and work inside one or more grooves or recesses formed or built in the disc or inner circle by means of two or more metallic plates or circles fastened or bolted together. The inner disc and the outer tyre or periphery are thus strongly connected together, but are at liberty to move independently of each other, and obey the demand at curves to revolve or roll at variable speeds suited to the eccentricities of the other fixed wheel and the road. Secondly, he uses the loose tyre, periphery, or circle of metal, with one or more recesses or grooves internally, and without the flange in the inside, and he constructs and builds, or casts, the inner disc or circle, which is keyed on the axle of the carriage, and which revolves inside the loose tyre, in such a manner that he may use plates or studs, or pieces of metal inserted or bolted, or both, to be fitted into the recesses or grooves of the loose tyre, periphery, or circle of metal, in order to connect and prevent separation from each other when in use. He also uses lubricating means to prevent firing or adhesion of the inner disc and outer loose tyre, and to assist their proper and intended simultaneous or independent action, as may be required with and of each other. *Patent abandoned.*

1023 C. VAUGHAN. *Improvements in the manufacture of iron and steel.* Dated April 11, 1865.

The patentee claims, firstly, subjecting the iron or steel either immediately it is withdrawn from the puddling furnace, or after the reheating of the said puddled iron or steel, to the combined action of a steam or other hammer, or stamp, or pressing machine, and a blast or blasts of air directed upon the said iron or steel, whereby the high temperature of the iron or steel is maintained and the scoria effectually removed as described. Secondly, directing a blast or blasts of air upon the iron or steel during the process of rolling the same, in order thereby to maintain the high temperature of the iron or steel, and enable the rolls to effectually remove the scoria from the said iron or steel, as described. *Patent completed.*

1024 S. WRIGHT. *Improvements in carriage and other wheels, and in connecting or fixing the said wheels to their axleboxes.* Dated April 11, 1865.

The patentee claims making metallic hubs of the said wheels of a hollow cylinder or barrel which is fixed in the axle box, upon which hollow cylinder or barrel are situated a fixed and movable plate or cheek, or two movable plates or cheeks, between which plates or cheeks the spokes of the wheel are fixed by the screwing home of the said movable cheek or cheeks, or making the said cheeks or plates of the hub upon the axle box instead of upon a hollow cylinder or barrel. Also making the ends of the spokes fixed in the said hubs of a taper or wedge figure, and of greater strength at the said taper or wedge part than at any other part. Also making the said tyres of bars of iron or steel having flanges on one or both sides, substantially as described. *Patent completed.*

1025 W. CLARK. *Improvements in horseshoes.* (A communication.) Dated April 11, 1865.

The patentee claims, firstly, a sectional jointed horseshoe, which is so constructed that it can be expanded or contracted in width either at the heel or at an intermediate point between the heel and toe, or at both of the said points, at pleasure, as described. Secondly, a sectional jointed horseshoe, which is constructed with one or both of its heel sections jointed to forward jointed sections, as described. Thirdly, so constructing the pivot pins of the sectional jointed horseshoe that they constitute a part of the underlapping portions of the sections, as described. Fourthly, the use of certain projections applied to a sectional jointed horseshoe in such manner as to strengthen the sections at the joints, and to constitute calks for preventing the horse from slipping, as described. *Patent completed.*

1026 D. PAYNE. *Improvements in printing machinery.* Dated April 11, 1865.

This invention consists, firstly, in an improved mode or means of obtaining a longer traverse of the reciprocating table without increasing the throw of the ordinary crank of the driving wheel, or increasing the dimensions of the machine. The invention consists, secondly, in improved means of giving a uniform or even supply of ink or other colouring matter to the type or block. The invention consists, thirdly, in an improved mode or means of gripping and holding the papers to be printed on cylinder machines without requiring the feed boards to move up and down. We cannot here quote the details of the invention. *Patent completed.*

1027 R. A. BROOMAN. *Improvements in apparatus for storing petroleum and other inflammable liquids of less specific gravity than water.* (A communication.) Dated April 11, 1865.

This apparatus consists of a well or tank of metal or masonry, in which is placed a metal holder similar to a gasholder, and with space between its sides and the outer tank; the holder is open at the bottom, and is secured by flanges and bolts from rising. A dome rises from the centre of the cover of the holder, and the top of the dome is provided with a manhole. A tube carrying a float is carried down through the cover of the holder, and at a level above the cover of the holder there is a water outlet provided with a tap. The petroleum is admitted into the holder through a pipe entering the upper part of the dome on the cover; outlet takes place through another pipe furnished with a tap and connected to the lower part of the dome. There is a channel at the bottom of the tank for receiving all matters deposited, and for allowing a person to enter the holder to clean the inside when the tank and holder are empty. Water fills the tank and the holder; then, to charge the holder, remove the cover from the float tube, close the manhole and open the water outlet tap, and open the petroleum inlet tap; the petroleum falls on the water in the holder and drives it out from the bottom thereof and from the outlet from the tank. Then close the water outlet and fill up with water, covering the petroleum inlet and outlet pipes. To draw off petroleum, open the petroleum outlet tap, when the pressure of the water will cause it to run out through the outlet pipe. *Patent abandoned.*

1028 R. A. BROOMAN. *A new method of applying suction and blast and the apparatus employed therein.* (A communication.) Dated April 11, 1865.

The patentee claims applying suction and blast in metallurgical furnaces in manner and by apparatus based upon the employment of suction or vacuum acting by inversion from top to bottom, as described in contradistinction to apparatus which act by impulsion from bottom to top. *Patent completed.*

1029 J. H. JOHNSON. *Improvements in steam generators, applicable also to condensers or coolers.* (A communication.) Dated April 11, 1865.

This invention relates to a peculiar mode of constructing steam generators, which is also applicable to the constructing of condensers or coolers, and consists in the employment of a number of hollow slabs or chambers of cast iron, each slab or chamber being composed of any desired number of hollow spheres, cast together with curved necks, so as to establish a free communication between all the spheres in each hollow slab or chamber. A number of these hollow slabs or chambers are disposed side by side in any desired form or arrangement, according to the desired contour or form of the generator or condenser to be erected, and they communicate with each other by cross connections made at one or more of the corners of each slab or chamber. *Patent abandoned.*

1030 J. H. JOHNSON. *Improvements in railways, and in the means for communicating between the passengers and guards of railway trains, or between two or more different situations.* (A communication.) Dated April 11, 1865.

The patentee claims the combination of one continuous main or line extending throughout the length of a train, or between any two or more situations, with branch connections or cords leading to the localities whence signals are to be given, and operating upon spring discs or other equivalent indicators, such branch connections or cords being so arranged with respect to the main line that the action of any one branch does not affect any of the others, as described. *Patent completed.*

1031 W. E. NEWTON. *Improvements in the construction of submarine telegraph cables, and in the mode of submerging or laying them in the water.* (A communication.) Dated April 11, 1865.

This invention relates to the construction of submarine telegraphic cables, the object being to render them sufficiently light to float in the water, and at the same time of such a strength as will enable them to resist any strain or violence to which they may be subjected, and also sufficiently elastic to allow of their stretching when required, and also of being made to follow any desired curves. *Patent completed.*

1032 A. TURNER. *Improvements in looms for weaving.* Dated April 11, 1865.

This invention relates, firstly, to an improved method of actuating the batten of the loom, so as to shorten its motion and obtain a "dwell." By means of this "dwell" of the batten the patentee is enabled to take off the greater part of the friction of the reed upon the warp threads during the passage of the shuttle through the shed. The second part of the invention relates to a novel mode of constructing the shuttle-plank or batten of looms for the weaving of narrow fabrics of, say, from 2 in. to 6 in. or 8 in. wide, and consists in the adaptation to the shuttle-plank,

or to a place attached thereto, of antifriction rollers or small trucks for the purpose of holding up the shuttles in a horizontal position while they are being driven through the shed. *Patent completed.*

1033 L. B. PHILLIPS. *Improvements in watches.* Dated April 11, 1865.

This invention is more particularly applicable in making what are known as keyless watches. According to this invention the top plate is made deeper than usual, so as to admit of being recessed or having sinks made therein, so that the bottom may work in a sink or recess in the top plate, and by preference the barrel also may work in another recess in the under surface of the top plate. The pillar plate is made solid, with sinks or recesses for receiving the wheels, keyless mechanism, and escapement. The "potence," which receives the lower end of the arbor or staff of the balance, is dispensed with, and in place thereof such staff or arbor is received into the pillar plate, and a cock on the upper surface of the top plate. *Patent abandoned.*

1034 B. W. L. NICOLL. *An improved flexible spring sole for boots and shoes.* Dated April 11, 1865.

At the waist and between the inner and outer sole leathers, or in a groove in the former or latter, of a boot or shoe, the inventor forms a bed or space to receive a metal arch and abutment, which he makes fit and fix in the following manner:—He makes the metal arch flexible, by preference, of tempered or spring steel, and at a short distance from the toe end he forms a slot with an enlargement or eye therein, which end he wholly or partly encloses in a flat metal sheath or case, consisting of a plate or plates of metal cut and raised so as to receive the slotted end of the spring, and allow room for it to slide backwards and forwards therein, the other or abutting end being made of increased width, and riveted to the heel of the inner sole of the boot; the forward end of the spring is held in position by a stud fixed to the sheath or plate. This sheath is fixed to the sole by riveting, the stud being passed through the eyelet in the spring when so doing. *Patent abandoned.*

1035 J. DADLEY. *Improvements in couplings for railway carriages, waggons, trucks, and other vehicles.* Dated April 11, 1865.

This improved coupling consists of a hook and eye, one of each being attached to each end of the carriage, waggon, or truck. The eye, which is composed of iron or steel, is made to rise and fall back by means of a hinge when not in use, so as to prevent the carriages or waggons from uniting when not desired. The hook, which is composed of the same material as the eye, is made with a sloping point turned down at the extremity, so as to catch the eye when let down—when the carriages are desired to be united, the eye sliding up the hook and falling into the recess. Let the distance between the carriages, waggons, or trucks should not in every case be exactly the same, so that the eyes might not fall into the hook; and in order to screw up the carriages or waggons or trucks after the coupling is effected, he makes the hook to screw out or in by means of a star nut, which may be clamped by means of a pin or otherwise. *Patent abandoned.*

1036 R. TURNER. *Improved chain or iron cable shackle.* Dated April 11, 1865.

This invention consists of a twin coupling shackle so constructed as to be of the ordinary shape of the links of chains and iron cables, and will not as such, especially in the open chain wheels patented by Harfield, July 23rd, 1859 (No. 1,726), and further improved by him under letters patent granted December 15th, 1860 (No. 2,860), and May 23rd, 1860 (No. 1,347). The present inventor constructs this shackle of two ordinary shackles with oval, or any other shaped, eyes, but bent eccentrically so as to fit each into the other interpositively. The outer or apparent eyes are deeply countersunk to receive the head of a suitable iron or steel bolt, which is passed through them and secured by a steel pin fitted into the inner or lowermost eyes of the shackles. The two shackles are by these means securely fixed together. *Patent abandoned.*

1037 G. W. ROTHLES. *Apparatus or mechanism for flying through the air.* Dated April 12, 1865.

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

1038 J. HAWORTH. *An improved mode of brushing and cleaning horses and other quadrupeds by mechanical power.* Dated April 12, 1865.

This invention consists in brushing and cleaning horses and other quadrupeds by means of a rotary brush, or other suitable instrument, to which rapid motion is given by steam or other power. The brush or other instrument is fixed to the end of a pole furnished with loose handles, and with a roller or pulley, around which pulley passes the band or strap from the driving power. The brush is capable of being moved up and down and from one side to another, and it is guided by the attendant over the surface of the animal that is to be brushed and cleaned, thereby economising manual labour and performing the operations expeditiously and effectually, and removing the sand and other impurities without the use of the curry comb. *Patent completed.*

1039 H. BRIDSON. *Improvements in clamps for stretching frames and other purposes.* Dated April 12, 1865.

These improved clamps are formed with a series of tongues or holders either of a cylindrical or a segmental form, hung eccentrically on a spindle; these tongues or holders hold the selvage of the fabric or other article to be secured against the lower holder of the clamp, which is also of a cylindrical or segmental form. When these improved clamps are applied to a stretching frame, each series of tongues or holders with their lower holder form one link of an endless chain, and the fabric is held between two such chains; or the stretching frame consists of a pair of circular revolving plates furnished with a number of tongues or holders set in the form of a circle. *Patent completed.*

1040 O. BOBCHAN, J. BINDNER, and W. CAFFOU. *Improvements in lamps for burning petroleum, naphtha, or other mineral oils.* Dated April 12, 1865.

The peculiar features or the main principles of this invention consist in, first, causing the bidden, or, at least, intended for selling, carrying, or containing the petroleum or other mineral oil to be made use of in this lamp, and to be constructed in such manner that the said bidden, or, or cruet may serve as an oil vessel for the lamp, be readily affixed thereto, and when empty removed therefrom and replaced by another suitable can already filled with oil. Secondly, in preventing any possibility of a reversion or impinging down of the flame towards the oil vessel, and

thereby setting fire to the oil contained in this latter, by intercepting according to Davy's principle any direct communication between the flame and the said vessel, by causing the wick to fill up as tightly and completely as possible the section or aspirating tube in which the same is contained, besides which the upper part of the wick is formed of tightly compressed asbestos and connected by metal hooks. *Patent completed.*

1041 F. P. WARREN. *An improved cooking utensil.* Dated April 12, 1865.

In performing this invention the patentee makes use of two vessels, one of which contains water, and may be subjected to the direction of the fire, or may be otherwise heated in the manner of an ordinary glue pot; and the other one, intended to contain the flesh or other food to be cooked, is formed so as to be partially contained within the former, and to partly project above it, and is fitted with a suitable cover, so that the steam or vapour given off during the process of cooking may be condensed by coming into contact with the internal surface of such projecting and less heated portion of the vessel. The steam generated in the outer vessel may be carried off by a groove or channel formed in or upon the exterior of the inner vessel, or in any other convenient or suitable manner. *Patent completed.*

1042 H. SIKES and G. JARMAN. *Improvements in treating wool in order to cleanse it from burrs, seeds, and other foreign matters.* Dated April 12, 1865.

In performing this invention the patentees steep the wool for from ten to twenty minutes in a mixture of hydrochloric acid and water, the said mixture being made by adding one measure of hydrochloric acid of a specific gravity of 1.14 to from 6 to 8 measures of water being heated to about 200 deg. Fah. They then slightly wash or rinse the wool in water before drying, so that the greater portion of the acid may be removed from the wool, enough acid being still left in the burrs or other foreign matters to render them sufficiently friable after the wool is dried to admit of their being separated from the wool during the rolling or crushing and beating and blowing processes. In treating wool by means of sulphuric acid, they steep the wool for from ten to fifteen hours in a cold mixture of water and sulphuric acid in the proportion of from 4 to 6 percent. by volume of acid of a specific gravity of 1.85; they then remove the wool and treat it in the manner described, with reference to wool treated by means of hydrochloric acid. *Patent completed.*

1043 J. WALKER. *Improvements in door locks and latches.* Dated April 12, 1865.

Although this invention is principally applicable to latches having a sliding motion, it is also applicable to latches which have a rising and falling motion. The invention, as applied to the sliding latch of a door lock, is performed as follows:—On the inside of the case of the lock, and underneath the sliding latch, is an axis on which a lever turns. The two arms of the lever are at right angles to one another, one being vertical and the other horizontal. The end of the vertical arm engages with the sliding bolt by means of a pin or other connection, and the horizontal arm has at its end a hole through which a lock or latch spindle passes at right angles to it, that is, parallel to the axis on which the lever turns. In the two sides of the lock case, and near the end of the horizontal arm of the lever, are two vertical slots in which the spindle works. The knobs are fixed on the ends of the spindle. Underneath the horizontal arm of the lever is a spring which presses up the lever and maintains the latch in its shot or projected position. By pressing down either of the knobs, the latch is withdrawn, and by removing the pressure from the knob, it rises and the latch is shot forward. The position of the parts described may be inverted, and the withdrawal of the latch be effected by pressing the knob upwards instead of by pressing it downwards. *Patent completed.*

1044 G. A. MONTENAT. *A new apparatus for ejecting and spreading liquids and powder.* Dated April 12, 1865.

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

1045 J. M. HART. *Improvements in bolting and locking arrangements for safe and other doors.* Dated April 12, 1865.

For the purposes of this invention the axis of the handle or other mover of the bolt is provided, not only with a follower for following and fixing the bolts, and an arm or surface to give motion to such bolts, or with a series of such arms or surfaces to operate a series of bolts, but also with another arm or surface, or series of them, to act upon and place in position a sliding abutment or a series of them for holding the bolts in position. The patentee forms each of the levers (sometimes called tumblers) of the locks with a series of gratings, and the bolts with a corresponding series of stamps at various regular or irregular distances apart, and each of these levers has also other slot openings or notches to receive other stamps from the bed or other fixed or stationary plate of the lock, so that in the event of the axis, or of any one or more of the stamps, being cut or forced away, the parts may still be held together by others of them, so as to prevent the withdrawal of the bolt or bolts. These levers may be of various regular or irregular shapes. The belly or that part of each of the levers acted upon by the key (when the bolt or a series of them is not operated by such key) is formed with a projection acting as a stop to enable the key to hold the levers in position during the locking or unlocking by the means employed to operate the bolts. *Patent completed.*

1046 T. J. MAYALL. *Improvements in firearms, and in cartridges to be used therewith, and with other firearms.* Dated April 12, 1865.

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

1047 F. BAPT and E. B. SAYERS. *An improved guide applicable to sewing machines.* Dated April 12, 1865.

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

1048 G. JACKSON. *Improvements in rests or supports for cues or other similar instruments used for billiards or other similar games.* Dated April 12, 1865.

This invention consists in making a movable rest or support for billiard cues, or other similar instruments, capable of being conveniently used during the delivery of a stroke. In constructing the movable rest, the patentee uses a block, bar, axle, or frame mounted upon a roller or rollers, or upon a wheel or wheels. In or upon the upper part of the block he mounts a hole or recess suited to receive the playing end of the cue, which is allowed to rest in it in such a manner that it may be easily connected with

it, or disengaged from it, at the will of the player. In order that the motion of the cue may be guided freely in any required direction where nicety of adjustment is desirable, he mounts the block or frame upon an axle, or joints, or pivots. *Patent completed.*

1049 J. S. BICKFORD. *The manufacture of an improved safety fuse.* Dated April 12, 1865.

The fuse employed in the ordinary Bickford's patent fuse, as described in the specification of letters patent, dated the 6th September, 1831, specially prepared so as to prevent the fire from bursting through the coating, so that it shall ignite a charge only at the end of it. The means the patentee employs for the accomplishment of this object are as follows:—The fuse is first varnished with the usual tar varnish, and then covered with another layer of yarn. It is then passed through a varnish composed of 17 parts of fine potter's clay, 1 part of glue, 1 part of red lead, and 1 part of alum by weight. The glue and alum are dissolved together in hot water, and then mixed with the clay and lead, with sufficient water to form a thin paste. The fuse is then passed through this composition, and again coated with another layer of yarn, and this process is repeated six times or more, according to the thickness of external covering or the degree of protection required to prevent the fire breaking through. *Patent completed.*

1050 W. E. NEWTON. *Improvements in elastic binders for boots and shoes.* (A communication.) Dated April 12, 1865.

This invention consists in the employment or use, in place of the ordinary non-elastic shoe string or lacing, of an elastic binder, in combination with hooks, buttons, studs, or other suitable fastenings, so that a short string or binder nut, much longer than the shoe for which it is used, will be sufficient to tie the shoe, and the operation of tying the shoe will be considerably facilitated, and the elastic cord will be enabled to accommodate itself to the motion of the foot and ankle. The invention consists, further, in the use of bell-shaped buttons in combination with a spring, lacing, or binder, so that the operation of lacing up a boot or shoe can be effected simply by winding the string successively round the buttons, and the tedious operation of passing the end of the string or lacing through eyelet holes will be avoided. The invention consists, finally, in the use of a tubular clasp in combination with the elastic cord, and with a button ball or other check at its end, so that, when the tubular clasp is secured to a boot or shoe, the cord can be readily attached to the same, or detached therefrom, simply by springing the same into the clasp, or removing it therefrom, and the operation of replacing an old or torn cord will be materially facilitated without removing the shoe from the foot. For some cases, particularly for heavy shoes, it will be convenient to make the cord partly of elastic and partly of non-elastic cord. *Patent completed.*

1051 A. V. NEWTON. *An improved construction of "Giffard injector."* (A communication.) Dated April 12, 1865.

This invention consists in using the overflow water to control the admission of the water or steam, or both, to the injector, so that the presence inside the chamber caused by an overflowing jet shall diminish the supply of water or increase the supply of steam, or it may effect both, whilst the water which has escaped at the point of overflow to produce this effect, being retained in contact with the jet, will be drawn in again whenever the supply of water is too small or the supply of steam too great, and thus produce a partial vacuum in the overflow chamber, reverse the previous operation, and readjust the instrument to the new condition without any waste at the point of overflow. *Patent completed.*

1052 H. LEONHARDT. *A new motive power engine.* Dated April 12, 1865.

The action of this new motive power engine is based upon the property of solids or bodies of a certain specific gravity when immersed in a fluid of greater specific gravity to rise or ascend to the surface of such fluid. We cannot here quote the details of the invention. *Patent completed.*

1053 G. ROUSSELET. *A system of motive power to be applied specially to ships and boats.* Dated April 12, 1865.

This invention consists in forming at any desired depth, but which must be regulated by the draught of the vessel, and by preference towards the forward part thereof, an aperture capable of being opened or closed at will. There is a pipe in the interior of the vessel, and in communication with the aforesaid aperture, to convey water to buckets or floats on the top side of a hydraulic wheel, whereby rotary motion is communicated to the same, its axis transmitting a similar movement to one or two screws or paddle wheels, and to pumps or other mechanical arrangements for carrying back the expended water into the sea, river, or other water on which the vessel floats. One or two small steam engines may be used to assist in raising the used water. The arrangement is such that the water cannot be distributed or thrown out into the vessel, and while on the one hand its admission can be stopped when desired, on the other it is raised from the interior of the vessel, and always kept at a lower level than the bottom of the hydraulic wheel. Several wheels may be applied to a vessel to obtain measured power and speed. *Patent abandoned.*

1054 G. MOUNTFORD. *An improved metallic preparation or composition for cleaning, sharpening, burnishing, and grinding articles of cutlery, edge tools for cutting instruments, and for grinding the cards or rollers of carding engines and the surfaces of cylinders and covering rollers for various kinds of woollen and cotton machinery.* Dated April 12, 1865.

The metals or substances the inventor proposes to use for the purposes of this invention are principally zinc, spelter, blende, lead, and copper, with the addition of charcoal. These materials may be mixed in various proportions, and a satisfactory result may be obtained even when one or two of the ingredients is or are omitted. *Patent abandoned.*

1055 A. WESTHEAD. *Improvements in apparatus for signalling on railway trains.* Dated April 12, 1865.

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

1057 W. S. TATES. *Improvements in machinery for f.l.d-ing fabrics for pressing.* Dated April 12, 1865.

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

1058 C. F. COTTEKILL. *Improvements in pipes for conveying water and gas, and for other like purposes, and a new or improved composition for joining the said pipes and other similar pipes.* Dated April 12, 1865.

According to this invention the pipes are joined by means of a conical socket, or conical loose collar or thimble, in which the end or ends of the pipes are inserted, the said socket or loose collar being provided with a hole through which the lead, or other filling composition, is introduced into the space between the socket or loose collar and the end or ends of the pipes inserted therein. The composition is composed of pitch and sand. *Patent completed.*

1059 S. DAWSON, J. BURGESS, and J. WILSON. *Certain improvements in metallic pistons.* Dated April 12, 1865.

This invention relates to a novel method of effecting an even expansion of the metallic packing rings of metallic pistons employed in the cylinders of steam or other engines, and consists in the application, employment, and use of a helical, coiled, or other spring acting with a downward pressure, so that when compressed by the cover of the piston and its screws they act upon and impart a lateral pressure to the ordinary V ring employed to expand the packing rings, which pressure may be received by an extra ring encircling the piston block, and be thereby transferred to the ordinary V ring to press the same outwards to keep the packing rings in contact with the interior surface of the cylinder. When one spring is employed it encircles the piston block, and is forced down by the screw acting on the cover of the piston, and presses upon the aforesaid extra ring, the inner surface of which fits and slides upon the piston block, its extra surface being inclined or wedge-shaped, and acts against the inner surface of the ordinary V ring and presses it outwards. *Patent abandoned.*

1060 J. RIVROX. *Improvements in apparatus for lubricating spindles, shafts, or other frictional surfaces.* (A communication.) Dated April 12, 1865.

The patentee claims the employment or use of a chamber containing cotton or other fibrous material, so placed that the oil in passing from the cup or reservoir to the surface to be lubricated shall be compelled to pass through the said cotton or other fibrous material, as described. *Patent completed.*

1061 C. TURNER and T. BOOM. *Improvements in looms for weaving.* Dated April 12, 1865.

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

1062 R. A. BROOMAN. *Improvements in apparatus for feeding boilers, raising water, and propelling vessels.* (A communication.) Dated April 12, 1865.

This invention consists of an apparatus which draws and discharges cold water by producing a vacuum above hot water by means of steam or dilated air, and by employing in preference as a distributor a self-acting float which regulates the introduction and escape of the steam. Thus, by alternately producing pressure and vacuum on the surface of hot water, the inventor forms a liquid piston with hot water for drawing and discharging cold water; this is the characteristic feature of the invention. *Patent completed.*

1063 T. BENNETT. *Certain improvements in the manufacture of hoop iron, and which said iron produced from these improvements is also applicable for other purposes.* Dated April 12, 1865.

This invention refers entirely to hoop and strip iron about and below 1 in. in width, and will be understood from the following description:—The general size of rolls used in the manufacture of hoop iron, the power of the engine, workmanship, and other manufacturing incidental expenses, are all comprehended for broad hoops, and to use such power and appliances for the manufacture of narrow strips necessarily causes a waste, and increases the cost of production, in proportion to the narrowness of the strips produced. To avoid this waste and useless expense the patentee proposes reducing the iron necessary for his purpose to the desired thickness by the ordinary process of rolling, without particular regard to the width of the strip so produced, which, in a general way, he proposes to be 1 in. or 3 in. wide, more or less, as convenient, and strips thus prepared and rolled to the proper thickness he proposes reducing into narrow widths, using for this purpose (by preference) rotary shears, slitters, or cutters. *Patent completed.*

1064 W. BEARDMORE. *Improvements in furnaces.* Dated April 12, 1865.

This furnace consists of a hopper or chamber in which the fuel is placed in the green state; the chamber being situated above the fire door, as the coal descends, it becomes coked, and in this state is burned in the body of the furnace. *Patent abandoned.*

1065 J. M'DOWALL. *Improvements in apparatus for shaping oorks.* Dated April 12, 1865.

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

PROVISIONAL PROTECTIONS.

Dated August 18, 1865.

2133 P. LAWRENCE, Basinghall-street, City, merchant. Improvements in boots and other coverings for the feet, which improvements are also applicable to trunks and other articles for the purpose of strengthening, preserving, or protecting them. (A communication.)

Dated September 6, 1865.

2292 A. W. PARKER, Bow, chemist. Improvements in ice houses and in glaciers or skating places, and in baths.

Dated September 11, 1865.

2322 W. HEWITT, Pimlico. An improved composition for preventing incrustation in steam boilers.

Dated September 21, 1865.

2412 H. A. DAVIS, Camberwell. Improvements in apparatus for affixing postage stamps and other labels to letters and documents.

Dated September 22, 1865.

2425 G. B. M'NICOLL, Glasgow. Improvements in apparatus for obtaining motive power.

Dated September 23, 1865.

2437 J. DONNELL, Liverpool, merchant. Certain improvements in machinery for cutting or mincing meat, and stuffing the same into skins or intestines for forming sausages. (A communication.)

Dated October 3, 1865.

2532 W. B. LAKE, Southampton-buildings, Chancery-lane, consulting engineer. An improved sewing machine. (A communication.)

Dated October 4, 1865.

2549 J. WEBSTER, Birmingham, engineer. Improvements in gas meters.

Dated October 5, 1865.

2552 H. Hughes, Homerton, engineer. Improvements in machinery for shaping metal and other substances.
2553 R. W. Fraser, M.A., Edinburgh. Improvements in the propelling and steering of steam ships or other vessels, and in the machinery or apparatus employed therefor.

Dated October 6, 1865.

2555 L. R. Whitehead, Birmingham, merchant's clerk. A new or improved date and other indicator, together with an improved method of arranging the date papers thereon.
2559 O. O. Crosby, New Haven, Conn., U.S. Improvements in ruffles or frills composed of strips of fabrics, and in the machinery or apparatus employed for their manufacture.

Dated October 7, 1865.

2582 J. Priestley, W. Whitworth, and J. Sutcliffe, Sowerby Bridge, near Halifax. Improvements in apparatus for grinding corn, seeds, and minerals.

Dated October 10, 1865.

2603 W. Cooke, Park House, St. James's. Certain improvements in window fittings.

2605 F. T. Hubert, Amersham Vale, Deptford. Improvements in submarine electric telegraph cables, and in apparatus connected therewith.

2608 W. E. Gedge, Wellington-street, Strand. Improvements in the construction of billiard tables, and improved apparatus for ascertaining the degree of elasticity of the cushions and the strength of the cloth. (A communication.)

2614 R. Abell, Cambridge-terrace, Pimlico, carpenter. Improvements in trapping and ventilating sewers.

2616 D. Gallafant, Stepney, engineer. Improvements in paraffin lamps.

Dated October 11, 1865.

2622 W. E. Gedge, Southampton-buildings, Chancery-lane. Improvements in double or single action pumps. (A communication.)

Dated October 12, 1865.

2629 R. Longdon, Atlow Mill, Ashbourne, Derbyshire, miller. Improvements in hurdles for fencing or dividing grass and other lands, and for other like purposes.

2631 J. B. Edge and E. Hird, Bolton, Lancashire. Certain improvements in machinery or apparatus for twisting or doubling cotton or other yarns.

2633 H. H. Williams, Buckingham-street, Westminster. Improvements in saws for projectiles.

2635 G. and A. Dealandes, Jersey, shipbuilders. An improved method of working windlasses.

2637 H. H. Craigie, New York. An improved overflow for basins, sinks, and baths.

2639 W. E. Newton, Chancery-lane, civil engineer. Improvements in centrifugal governors. (A communication.)

Dated October 13, 1865.

2643 W. H. G. Jones, Crosby-square, City, solicitor. Improvements in machinery employed for crushing, amalgamating, and washing gold, quartz, and other minerals or matters containing gold or other metal. (A communication.)

2646 H. H. Williams, Buckingham-street, Westminster. Improvements in breechloading firearms. (Partly a communication.)

2647 W. Robertson and J. G. Orchar, Dundee. Improvements in apparatus for finishing textile fabrics.

2649 G. B. Woodruffe, Cheapside, mechanical engineer. Improvements in sewing machines.

Dated October 14, 1865.

2653 W. J. O. McMillan, gutta-percha shoemaker, J. Mason, examining officer in H.M.'s customs, and J. V. Scarborough, gutta percha shoe manufacturer, Sunderland. A certain composition having antiseptic and antifouling properties for the preservation of, and keeping clean the bottoms of, iron vessels, and also for the preservation of iron submerged and iron structures exposed to the action of the atmosphere or water.

2655 J. L. Hancock, Tipton, Staffordshire. Improvements in apparatus for polishing and brushing.

2657 J. O. Ridley, Newcastle-on-Tyne, mechanical engineer. Improvements in apparatus for applying carbonic and other gases to iron and other metals in a molten state.

2658 O. A. Elliott, Kensington. An improvement in blinkers for horses and other animals.

2659 R. Stephens, Green-street, barrow maker. An improved barrow for use by builders and contractors, and also for general purposes.

Dated October 16, 1865.

2661 F. Wise and E. Field, Chandos Chambers, Adelphi, consulting engineers, and E. H. Aydon, Wandsworth, civil engineer. Improvements in steam boilers and other apparatus applicable to the heating and evaporation of liquids, parts of which improvements are applicable also to other purposes.

2663 O. H. Murray, Loman-street, Southwark, machinist. Improvements in the construction of skips for raising ballast, coal, minerals, and other matters in bulk.

2664 J. Orrin and T. Geer, Little Britain, City, bookbinders. An improved fastening for books, portfolios, despatch boxes, and other similar articles.

2665 J. S. A., G. E., and F. F. Reading, Birmingham, jewellers. Certain improved methods of manufacturing or arranging the spring bolts and attendant part of sleeve links and other like articles where the means of a portable connection are required.

2669 H. Skinner, Worcester, signal inspector. Improvements in apparatus for working railway switches, points, and signals.

2671 T. M'Grah, William-street, Sheffield. Improvements in the means of securing the handles of table knives and forks and other similar articles.

Dated October 17, 1865.

2673 A. Fenton, Redditch, Worcestershire, machinist. Improvements in machinery for the manufacture of fish hooks.

2675 R. A. Brooman, Fleet-street, patent agent. Improvements in caloric or hot air engines. (A communication.)

2676 F. G. Sicardo, civil engineer, Boulevard St. Martin, Paris. A new or improved steam consuming apparatus, or an apparatus intended to make available as fuel all or part of the steam actually evolving from engines into the atmosphere and also to absorb the smoke resulting from the combustion.

2677 A. H. Hassall, M.D., Wimpole-street. Improvements in the preparation of meat for food.

2679 E. Beanes, Kilburn. An improvement in treating animal charcoal.

2681 H. E. Newton, Chancery-lane, mechanical draftsman. Improvements in machinery for weaving the covering of blind cord and other tubular fabrics. (A communication.)

Dated October 18, 1865.

2683 I. Gregory, F.R.G.S., Victoria Park, Manchester, E. Farr, Cavendish-street, and W. Farr, York-street, Chorlton-upon-Medlock, Manchester. Improvements in pianofortes, harmoniums, and organs.

2687 J. Rock, jun., Hastings, carriage builder. Improvements in common road carriages, and in brakes for the same.

2689 C. H. Cope, Birmingham, civil engineer. A new or improved sifter for sifting cinders, slack, and gravel, and for other like purposes.

2691 T. Catohpole, Lever-street, St. Luke's. Improvements in reeds for weaving cocoanut, jute, and other fibres.

2693 J. Taylor, jun., Christchurch-road, Streatham. Improvements in tiles for roofing.

2694 T. King, Park-road, Holloway. Improvements in the manufacture of chemical toys known as "Pharaoh's serpents."

Dated October 19, 1865.

2695 J. Penton, Sheffield, engineer. Improvements in forging and sawing steel and iron wheel tyres, and in the apparatus or tools employed for that purpose.

2697 G. R. Ghiselin, West Strand. An improved apparatus for forming or repairing the mouths of boiler and other tubes. (A communication.)

2699 J. Ballard, Patent Galvanised Iron and Zinc Works, Buckland, Dover. Improvements in window blinds and screens.

2701 W. Clark, Chancery-lane, engineer. Improvements in printing or impressing and dyeing fabrics and tissues. (A communication.)

Dated October 20, 1865.

2703 A. L. M'Gavin, Bucklersbury. Improvements in desiccating the leaves and flowers of plants and other vegetable substances, and in the apparatus to be employed therein. (A communication.)

2707 F. Thompson, Birmingham, saddler. Improvements in satchels, and in the manufacture of the gussets of leather satchels, bags, and purses, and of the gussets of other articles made of leather.

2713 W. Sumner, Ashton, near Preston, Lancashire. Improvements in machinery or apparatus known as "roving," "intermediate," "slubbing," and "throstle" frames and "doubblers," and also in winding machines used for preparing, spinning, and winding cotton, wool, flax, silk, and other fibrous substances.

2717 R. Biessy, Trinity-square, Southwark. Improvements in apparatus for splitting and preparing cane.

Dated October 21, 1865.

2725 J. H. Dickson, Great Dover-street, Southwark, flax machinery manufacturer. Improvements in the process of, and machinery for, preparing flax, hemp, jute, China grass, and other analogous vegetable fibres for spinning.

2727 J. W. Lea, Arundel-street, Westminster. Improved apparatus to be fitted to windows when cleaning, painting, or otherwise.

2731 W. Parsons, Toronto-terrace, Brighton. Improvements in mortising machines.

2735 A. Parkes, Birmingham. Improvements in electric telegraph conductors.

Dated October 23, 1865.

2735 J. Orvis, West Roxbury, Mass., U.S., manufacturer. Improvements in the construction of braces for bits, applicable also as stocks, handles, or holders for holding tools and other articles to which stocks, handles, or holders are applied.

2737 W. E. Gedge, Southampton-buildings, Chancery-lane. An improved axle box for supplying oil to the journals of railway vehicles. (A communication.)

Dated October 24, 1865.

2745 H. Bateman, Barnes, surveyor, and E. G. Garrard, Vauxhall, wine merchant. Improvements in the construction of pumps for raising or forcing water or other liquids or fluids.

2747 D. G. and S. Staigbt, Charles-street, Hatton Garden, merchants and manufacturers, and J. Cheverton, Elm Villa, Turnham Green. Improvements in the manufacture of keys for pianofortes and other musical instruments requiring such keys, and in parts connected with such keys.

Dated October 25, 1865.

2749 W. Clark, Chancery-lane, engineer. Improvements in bath apparatus. (A communication.)

2751 G. L. Scott, Manchester, moulder. Improvements in apparatus for moulding toothed or other wheels or pulleys on portions of circles for casting.

2753 G. A. Huddart, Brynkr, Carnarvonshire. Improvements in buttons and in attaching buttons to garments or fabrics.

2755 A. B. Blackburn, York-buildings, Adelphi. Improvements in apparatus to facilitate signals being made by passengers in railway trains.

LIST OF SEALED PATENTS.

Sealed November 3, 1865.

1270 J. Buchanan	1288 C. S. Baker
1273 J. Casey	1315 E. Cordonnier
1274 J. H. Johnson	1328 T. Craig
1276 R. B. Cooley	1333 H. J. Burt
1277 P. Welch	1335 W. Clark
1283 T. J. Mayall	1348 H. A. Bonnevillie
1290 S. L. and A. Fuller	1357 R. Leddicot
and C. Martin	1370 W. R. Williams

Sealed November 7, 1865.

1278 J. C. O. Halkett	1318 T. Smith and H. James
1284 G. Hartley	1329 T. Parkinson and W. Snodgrass
1291 H. W. Hart	1345 H. Besley
1297 J. Forbes	1346 J. Daulish
1298 J. Melvin	1361 G. Walton
1299 P. Brash and R. Irvine	1362 A. Chavanne
1304 J. G. G. G. G.	1363 T. Marsden
1305 J. H. Johnson	1417 T. Calvert and D. Montgomery
1307 W. Jamieson	1465 H. Tipper
1309 T. J. Mayall	1507 W. Clark
1312 D. Ellis and M. H. H.	2269 T. Nicholson
1313 A. Parkes	2337 W. J. Murphy
1327 T. Davis	

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the London Gazette, November 7, 1865.

- 1693 P. A. le C. de Fontainemoreau. Horseshoe nails. (A communication.)
1896 C. R. Bamber. Magnesium light.
1700 M. Ashby. Distillers' refrigerator.
1701 J. E. Spanoghe. Motive power.
1710 H. Shaw. Retarding railway carriages.
1714 J. H. Johnson. Cotton gins. (A communication.)
1716 H. G. Fairburn. Forming coal dust into lumps.
1727 W. Botham. Feeding boiler tubes.
1731 J. Cox. Oars.
1733 A. Prince. Self-acting apparatus for feeding high furnaces. (A communication.)
1737 W. Schofield. Gas retorts.
1744 W. H. Davey. Washing machines.
1746 L. Faure. Railway carriages.
1747 G. Davies. Knitting machines. (A communication.)
1749 J. Atkins. Metallic tubes.
1758 G. and D. Hurn. Mats.
1760 M. Benson. Steam pumping machines.
1770 R. A. Brooman. Dissolving pitch. (A communication.)
1771 W. E. Gedge. Circular endless railway. (A communication.)
1779 H. Emanuel. Ornaments for personal wear.
1783 J. H. Smith. Harmoniums.
1784 W. Thomson and C. F. Varley. Electric telegraphs.
1794 P. M. C. Béziel. Chains.
1795 A. F. Morelle. Pocket gas generator.
1796 E. H. Waldenström. Metallic bolts.
1866 J. P. B. le Patourel. Ventilators.
1893 R. C. Bristol. Slide valves.
1913 W. E. Newton. Valves. (A communication.)
1916 M. P. W. Boulton. Motive power.
1948 R. Mortimer. Impressing railway tickets.
2092 W. E. Newton. Burglarproof lock. (A communication.)
2108 J. Brown. Revolving firearms.
2212 E. Davies and R. H. Taunton. Drill brace.
2223 W. Clark. Propelling vessels. (A communication.)
2260 J. Lake. Tubular steam boilers.
2296 J. Dawson. Supplying charcoal to sugar decolorising vessels.
2344 J. P. Woodbury. Locomotive car.
2380 G. A. Keene. Feathering paddlewheel.
2437 J. Donnell. Mincing meat. (A communication.)
2534 C. J. Tinker. Lozenges.
2584 C. H. Mellor. Telegraphic communication.
2585 H. A. Bonneville. Tanning skins. (A communication.)
2631 J. B. Edge and E. Hird. Doubling cotton.
2636 W. Mather. Heating calender bowls.
2643 W. H. G. Jones. Washing gold. (A communication.)

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

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

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

2669 W. Clark	3006 H. Griffin
2671 D. Scattergood	3010 C. O. Hovl
2678 J. M'Kean and T. Greenall	3013 T. Greenwood and J. Schofield
2685 J. Shirt and C. Briggs	3052 A. Graemiger
2687 A. C. Dewies	3075 E. Kirby
2698 J. Petrie, jun., and J. Teal	3111 J. B. Edmondson, J. Carson, and J. Baylock

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

2429 G. Davies	2449 N. S. Dodge
2458 J. Fowler, jun., R. Burton, and D. Greig	2460 E. Fielding
	2481 H. N. Penrice
	2505 J. L. Jullion

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending November 4, 1865.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
3167	0	3237	0	3242	1	3247	0	3252	0
3233	0	3238	0	3243	0	3248	0	3253	0
3234	0	3239	1	3244	1	3249	0	3254	0
3235	0	3240	4	3245	0	3250	1	3255	0
3236	1	3241	0	3246	0	3251	1	3256	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 to the Post Office, High Holborn, to Mr. Bennett Woodcroft, Great Seal Patent Office, 25, Southampton-buildings, Chancery-lane.

THE
MECHANICS' MAGAZINE.

LONDON: FRIDAY, NOVEMBER 17, 1865.

STEAM BOILER EXPLOSIONS.

NOTWITHSTANDING the horrible list of deaths and mutilations from steam boiler explosions which every year—nay, every month—produces, there appears to be little or no increase in care and circumspection in these matters, and, as a consequence, no diminution of catastrophe. If accidents from this cause are not on the increase they certainly are not on the decrease, nor can they be expected to decrease while carelessness, indifference, and parsimony prevail. The two chief evils accompanying the use of boilers are recklessness and incompetency, and these are at the bottom of most accidents. If we take up the monthly reports of the Boiler Insurance engineers, we rarely find explosions accounted for by any other than circumstances of the most culpable neglect or the grossest ignorance and inefficiency on the part of those in charge. Often, too, does the parsimonious spirit of the proprietor lead to disaster, when he higgles and bargains about a new boiler. He cuts down the price below the figure at which a respectable house will take the job; he, however, gets it done—by whom and how only occur to him when a coroner's inquest is sitting. But parsimony does not stop at the boiler; the attendant is bargained with and beaten down for a few shillings a week, and sheer ignorance often goes to take charge of an explosive machine which the greatest care and knowledge alone should control. But it is the old story, and some men never seem to know that if they want a good article they must pay a fair price for it, and that a respectable maker's name, whether on a boiler or a coat, is the best guarantee for its wear. Of course, this assumes proper use; a coat will soon be shabby by careless usage, and a boiler will as soon deteriorate if badly tended. Two cases in point occur in Mr. Fletcher's last report to the Committee of the Manchester Boiler Association, one having reference to neglect, the other to incapacity, and both involving parsimony. The first case was the explosion of an ordinary Lancashire mill boiler, having two furnace tubes and being internally fired. Its length was 30ft. 6in., its diameter in the shell 8ft. 2in., and in the furnace tubes 3ft. 1in., while the thickness of the plates varied from 3-8in. to 7-16in. in the shell, and was 7-16in. in the furnace tubes. The ordinary working pressure was about 40lb. on the square inch, which is not too high for this class of boiler if well made and well kept.

The boiler was a mere wreck, and the premises were seriously damaged; we need hardly add that there was loss of life and injury. There could be no question as to the cause of the explosion: the flues were not faulty, and there were no signs of overheating of the plates through shortness of water. The explosion simply arose from the rupture of the shell in consequence of the plates being reduced in many places by external corrosion to the thickness of a sheet of paper. The boiler was a cheap one in the first place, and had been at work about eight years; there was constant leakage, constant repairing, and constant administration of a dose of horse-dung. Of course the story was that this medicine was for the water and not for the boiler—to soften the former, not to stop the leaks in the latter. But considering the condition of the shell, and the general purpose for which horse-dung is put into boilers, it is not hard to assign the true function to the dose which was given after every cleaning. What makes this case worse is the fact that the boiler was well known to be in an unsatisfactory condition, so much so that a boilermaker had been in negotiation to replace it by a new one last Whitsuntide. But

probably the proprietor, mindful only of self, could not bring the boilermaker to his terms, and so resolved to use the old kettle a little longer to balance matters. However this may be, and whatever may have been the qualifications of the attendant, this certainly was a case of the most flagrant neglect, and one which could not have occurred under competent inspection.

The second case occurred with a converted marine boiler, of the steam-tug class of construction. It was a second-hand affair, and had seen some service afloat before it was set to do duty on land. The shell was cylindrical and internally fired, but the flue, instead of going straight through from the front to the back, as in the ordinary Cornish boiler, returned in a horseshoe shape to the front end, and passed out through the bottom of the shell into an underneath brickwork flue leading to the chimney. In steam vessels the return flue of these boilers passes out through the top of the shell by means of an uptake, on which the funnel is planted. In adapting this boiler for its new work, however, this uptake had been removed and exchanged for the downtake leading to the brickwork flue above referred to. The boiler was about 13ft. long, 5ft. 6in. in diameter, and the plates generally about $\frac{3}{4}$ in. thick. Here was a boiler badly constructed, badly used, and badly tended, a boy only fourteen years of age having been appointed engineer a few hours before the explosion occurred by which he was killed. Comment is surely superfluous here. The poor little fellow, in his ignorant anxiety to get up steam, had only lashed *three bricks* on to the lever of the safety valve in addition to the ordinary ball weight! The actual load amounted to 100lb. per square inch on the crazy old concern. The pressure does not appear to have reached this point, however, for it is stated that the gauge only registered 50lb. a minute or so before the explosion. But the boiler was so badly constructed that even this pressure was quite sufficient to account for the explosion, as may be inferred from the fact that the return flue tube was oval in shape, measuring 2ft. 6in. vertically, and 1ft. 4in. horizontally. This form is weak, and in fact any departure from the cylindrical in furnace and flue tubes materially impairs their strength, if the difference is only 2in. In the present instance the flue departed as much as 14in. from the circular shape, and, besides this, was not of a true oval, but was flat or wall-sided for a height of 18in. from end to end. The form of the downtake also was weak, one side presenting a flat surface of 2ft. 6in. square, the plate at that part being only 5-16in. thick. In short, the boiler was utterly unfit to drive a non-condensing engine at a pressure of 40lb. or 50lb. per square inch, although it might have jogged on for a time with a condensing engine at 20lb. pressure. What with the weak construction of the boiler and the way in which the safety valve was overloaded, there is no difficulty in accounting for the explosion.

The question which naturally arises is, how many of these rickety, badly tended machines are there about us, and where will the next mine be sprung? That there are such there can be no doubt; their whereabouts may only be developed by the coroner's inquest when it again sits on a few more atoms of parboiled humanity. It is an outrage upon society that men should not only be allowed to place these engines of destruction in our midst, but that they should be under no responsibility as to the tending of them. If no sense of moral obligation exist, it is time for authority to interfere and enforce those conditions which the wellbeing of the country demands. We cannot conclude without referring to the ignorance manifested by some boilermakers. This is especially observable in the case of the explosion last alluded to, where the maker who converted the boiler from a marine to a stationary could not account for the explosion, neither could a second maker by whom it had been repaired,

and considered perfectly safe. The hydraulic test—the general adoption of which is so much to be desired—was not applied at the time of the alterations, or the weakness of the flat-sided flue would have been apparent and the explosion averted. But the best-constructed boiler could never stand such a reckless overloading of the safety-valve as that above recorded. If owners will not learn the lesson of responsibility of themselves, they will have to be taught it in a way the least palatable to liberty-loving Englishmen.

PNEUMATIC VERSUS LOCOMOTIVE RAILWAYS.

THE accomplishment of the longest distance in the shortest time is the great mechanical problem of the present age, which theoretically aims at the virtual annihilation of time and space, whether relating to the transit of words, materials, or individuals. With respect to the first of these, the electric telegraph has not only theoretically, but, we may even say, practically, accomplished the solution of the problem. The steps made towards accelerating the transit of the second and third are measured by the average maximum speed attainable on our railways by the goods and passenger trains. For some years back there has literally been no progress made on our railways. By progress we do not mean the mere extension of the railway system or the multiplication of lines over the kingdom, and in fact over the whole world in general, but that increase of speed which we are now entitled to expect should have taken place since the introduction of railways, but which certainly has not. When Stephenson, in the first competitive trial of locomotives, carried off the prize of £500 with the "Rocket," he drove it for a portion of the way at the rate of twenty-five miles an hour; and every railway traveller is well aware that the ordinary passenger trains do not even reach this. It is evident, with respect to the speed attainable on our railways, that we now and for some time past have reached a climax and are precisely in the same comparative position as the old mail coaches when they reached a speed of about eight or nine miles an hour. There they stopped, and there they would have stopped until the end of time. So it is with our railways. A certain speed has been reached—say, a maximum of fifty miles an hour and no more. Nor will a higher velocity be obtained on our present lines or on any others constructed in a similar manner, and on what now seems to be the orthodox principle, which entails the adoption of sharp curves and steep inclines as an indispensable accompaniment of railway construction. It is not that the necessary motive power could not be obtained, for, leaving out of consideration the enormous expenditure and the questionable nature of the advantages attendant on a large increase of locomotive power, any degree of speed might be produced, but the manner in which our lines are constructed does not admit of more than a certain speed consistent with safety. That speed has been already attained, and it is in vain to suppose that a higher one can be reached on any line constructed on the present system. If, then, the locomotive principle is to be adhered to in our future railways, the roads themselves must be altered before that degree of speed is attainable which will before long be demanded by the exigencies of modern advancement. It is worthy of remark that when railways superseded the mail coaches the first operation necessary before the improved method of locomotion could be introduced was the alteration of the road on which the locomotion was to be conducted. We do not at present propose to enter upon a subject so vast and comprehensive as the alteration of our present railways in order to afford the desired velocity. There is another principle, viz., the pneumatic, which although only on its trial gives fair promise of supplying the above desideratum. The experiments made last year at the Crystal Palace have demonstrated beyond a doubt that it is possible in an

engineering point of view to apply the principle to passenger traffic. Nor will the cost be found to be so excessive as is generally imagined. The first item, and often the most serious in the construction of a railway, is the purchase of the land. This item is reduced to a minimum in a railway on the above principle, firstly because it is a continuous tunnel or tube (although not necessarily underground), and secondly because it admits of very steep inclines which would have the effect of reducing the cuttings and embankments to very insignificant dimensions and cause the line to approximate more to a surface line. It is not at first apparent why the pneumatic principle admits of inclines and curves which could not obtain on the locomotive lines, for the resistance to be overcome is the same. It is because on the latter principle the whole motive power is directly affected by the construction of the road, whereas on the former it is altogether independent of it. A locomotive consumes a large amount of its power in moving itself, the expenditure of which increases rapidly in proportion to the gradients and curves. Leaving out of consideration the difference in expense between stationary and locomotive engines, the adoption of the former will yet considerably reduce the cost of the permanent way. It is asserted by the managers of ironworks that every additional order they receive for rails is for a heavier description than the preceding ones. Rails of 80lb. and 90lb. to the yard are the only weights which will stand the terrific pounding of the driving wheels of an express engine, while others of 50lb. or 60lb. would be sufficiently heavy for the traffic of carriages and waggons alone, and last very much longer.

In comparing the first cost of the two principles, we have thus at the outset a direct saving in favour of the pneumatic, respecting the important items of land, earthwork, rolling stock, and permanent way, items which are common to both. Against this, however, must be set the cost of the peculiar construction of the pneumatic railway, of which the heaviest portion is the tunnel or tube in which the carriages are conveyed. On the supposition that the tube would be made of brickwork, the cost would not exceed that of those portions of the Metropolitan line which are continuous tunnels. It is probable that it would fall within this amount, as, in consequence of the locomotive being dispensed with, less headway would suffice, and thus the sectional area of the whole tunnel would be reduced, and a corresponding saving effected in the quantity of material employed. In the experimental trial at the Crystal Palace quoted above a headway at the crown of the tunnel of 10ft. allowed the largest carriages on the Great Western line to pass. The least headway allowed on the South-Eastern Railway, from level of rails to soffit of crown of any arch, is 13ft. 6in., or about one-third more. On the other hand, it is questionable whether an iron cylindrical tube would not form the best enclosing medium. It would possess decided advantages when the line crossed a river, supposing circumstances did not permit of its passing under the surface of the water, for, by being made additionally strong, it would serve the purpose of a bridge not only in this particular instance but wherever any intervening space required to be spanned.

There is no necessity for the tube being continually underground, as might be supposed, judging from the short pieces of line constructed. In fact, it would be impossible that it should be so in applying the principle to railways in general. The most advantageous cross section of road would probably be a cutting just deep enough to cover the tube all over and so protect it from the influences of the weather. We have before stated that, in consequence of the motive power on the pneumatic principle being unaffected by the resistances of the road, it will be able to afford a velocity greater than our present railways can give. It must not, however, be inferred from this that steep inclines and sharp curves are of no con-

sequence on a pneumatic railway, for, no matter what the motive power may be, they virtually put a limit, and a most effectual one, to the speed which may be ultimately acquired. This principle will soon be applied to a passenger line, the construction of the Waterloo and Whitehall Railway having been recently commenced. The promoters, however, should bear in mind that, unless the new railway gives the public something which the present ones do not, there is no valid reason for supposing that, when the novelty has once worn off, it will have any advantage over those now in existence. Next to a lower fare from one place to another there is nothing the public appreciate more than being able to travel by the quickest way and in truth the quickest way, although it may in some cases be the dearest, provided the difference be not too great, pays the best in the long run. Many a railway has been irremediably spoilt and the dividends reduced almost to nil by too great a parsimony in the first cost. It is considered by some a clever piece of financial policy to keep the first cost low by introducing heavy gradients to lighten the expense of deep cuttings and embankments, and sharp curves to avoid the purchase of houses and other property. When, however, the profits of the line are swallowed up by the expenses attending the working of these inclines and curves, and the cost for additional repairs of the rolling stock and permanent way, the error becomes apparent, and the fallacy of such parsimonious calculations but too evident. In the construction of a railway, like everything else, the best way is the cheapest in the end, and it is to be hoped that the promoters of the pneumatic passenger railway will have a due regard to this fact when laying out their first line, and not ultimately incapacitate themselves from developing a high velocity by any inherent fault in the construction of their roads, which is unfortunately the case with nearly all our present lines.

PROGRESS OF IRON SHIPBUILDING.

WE last week took temporary leave of Mr. Fairbairn's treatise on the above subject at the point at which he discusses the details of construction. We now resume our remarks at the third division, which treats of the comparative merits of wood and iron built ships. In the earlier days of the use of iron for shipbuilding the combination of iron frames and ribs with wooden sheathing was highly appreciated. But a consideration of the properties of the two materials shows the system to be ineligible; in fact, for sea-going vessels it is entirely at variance with sound principles of construction. Lake or river boats may perhaps form an exception to the rule, but there is neither economy nor safety in adopting this method of construction in large ships. Many large vessels, however, have been thus built, and there is one point in which they have the advantage of iron-plated ships: they do not become so foul, but in point of strength they are far inferior to those composed of iron. Attempts have been made to strengthen them by the introduction of plate stringers riveted along the ribs at various parts of the sides, decks, and bottom, but from their position very little strength is gained. A comparison of such a vessel with one of similar dimensions composed entirely of iron leads to the inevitable conclusion that wood sheathing will not stand comparison with closely riveted iron plates. In support of this view Mr. Fairbairn gives the results of numerous experiments upon the comparative strength of iron and wood to a tensile strain; upon their comparative resistances to compression, and their comparative powers of resistance to pressure. From these experiments it appears that box and ash stand first as regards resistance to tensile strain; Spanish mahogany, oak, sycamore, and birch follow next. After these come red deal and pine—the timber chiefly used in sheathing ships,—which are only 500lb. per square inch short of the last three. If we take

English oak for comparison, we have the two materials in the ratio of their relative strengths as 1 : 3·84; or, in other words, iron is a little above three and three-quarter times stronger than oak.

The second point is the resistance offered by plates to a crushing force, such as exhibited by vessels when stranded on rocks, or taking ground upon uneven surfaces. Experiments in this direction prove that the strength of dry English oak to resist a crushing force is 4·24 tons to the square inch, whereas wrought iron, according to Rondelet, requires a pressure of about 31 tons per square inch. The resistance of wrought iron to a crushing force is therefore about 7½ times greater than that of oak. According to Mr. Fairbairn's table of experiments, it appears that the resistance of wrought-iron plates to a force calculated to burst them, follows a different law to that of oak. The resistance of iron is directly as the depth, and that of oak as the square of the depth. In whichever way the matter is considered, there can be but one conclusion, and that is in favour of iron; its superior strength, as compared with the best oak or teak, is sufficient to establish its claims as the material for shipbuilding. But beyond its mere fitness in point of strength, is its adaptability for union in construction. From the way in which the parts are united, and the form in which the junction of the plates is made by riveting, the principle of homogeneity is introduced in the sheathing, so that its strength falls not far short of that of the solid plate. No other material is capable of producing a ship so uniform in its powers of resistance as iron. Composite ships embody a weak and unsatisfactory principle of construction, and where strength is required they cannot be looked upon as safe. This is evident when we consider the widely different character of the materials, which, by their union, produce a very unsatisfactory source of weakness, and renders vessels thus constructed unworthy of comparison with those made exclusively of iron, or even with those formed entirely of wood. The only conditions under which the composite principle is admissible are those where the vessel is to be used for special purposes, where great lightness is required, and where there is an abundance of suitable timber. It is true that vessels of this class may be strengthened by stringer plates, and diagonal bracing, but this is by no means a good way of obtaining the required strength. A far better and a cheaper job would be made by constructing the ship entirely of iron, and altogether dispensing with the wood sheathing. Owing to the weakness of jointed timber, and the great difference between the resisting powers of iron and wood, no combination, however well arranged and executed, can be said to ensure the requisite strength for vessels subject to severe strains such as are met with in ocean service.

Mr. Fairbairn devotes considerable space to the question of ordnance and armour plates referring copiously to his own experiments and to those of the Iron Plate Committee. This question has, however, been so frequently discussed in these columns that we may be excused for passing it by with the slight reference, and proceeding to consider the practical construction of iron ships. Vessels may be divided into three classes—sailing vessels, steamers, and ships of war; and to all these vessels the same principle of construction appertains as regards strength. But they differ widely when considered with regard to the object for which they are intended, thus in sailing vessels adapted as clippers for speed and cargo, where a large surface canvas is necessary, a fine entrance at the bows, and a sharp run at the stern, including capacity at midships, are essential points. This class of vessel, adapted for long voyages, the cellular construction and the double bottom are points of great importance as regards security and strength. As an example, Fairbairn shows a framing in which

double bottom is divided by longitudinal girders 3ft. deep extending the whole length of the ship, or until they unite on each side of the central interior keel, or intersect each other as they converge upon the lines of the ship at the stem and stern. The keelson is composed of a plate 3-8in. thick and 3ft. deep, chain-riveted at the joints, and attached to the bow and sternposts; the angle-irons are 5in. $\times$ 3 $\frac{1}{2}$ in. $\times$ 5-8in. below, and 3 $\frac{1}{2}$ in. $\times$ 3-8in. above. The longitudinal girders on either side of the keelson are composed of 5-16in. web plates, and 4in. $\times$ $\frac{1}{2}$ in. angle-iron below, and 4in. $\times$ 3-8in. angle-iron above. The ribs are formed simply of 5in. $\times$ 3 $\frac{1}{2}$ in. $\times$ 5-8in. angle-iron extending from the upper deck on each side till they join the longitudinal frames to which they are riveted. The same strength of angle-iron is maintained between all the girders, forming rectangular cells. These cells may be transversely open between the bulkheads, which are plated and made watertight, from the bottom of the cells to the lower deck on each side. At the point where the cells terminate and where the double frames commence, a plate riveted to angle-iron closes up the cells, and renders the whole watertight throughout the length of the ship. Gusset-plates are riveted to the angle-iron ribs, connecting them securely with the longitudinal keelson and double bottom. Additional value is imparted to this form of construction from the fact that the cells may be converted into water tanks. Between the main ribs—which divide the cells transversely into four-feet spaces—are intermediate ribs of T-iron, 5in. $\times$ 3in. $\times$ $\frac{1}{2}$ in., riveted to the sides. They extend from the termination of the double bottom to the upper deck, their work being to stiffen the sides between these two points. The plating or sheathing would vary in thickness from 7-8in. at the centre keelson to 5-8in. up the sides to the last plate on the top, which should be $\frac{3}{4}$ in. or 7-8in. thick in the middle, in order to give increased resistance to the upper sides of the ship. In order to resist tension as well as compression, the transverse joints of these plates should be chain-riveted. On the upper deck a similar mode of construction is observed, powerful stringer plates, not less than $\frac{3}{4}$ in. thick, being introduced. A vessel proportioned as above will have a sectional area of iron on the upper deck, and down to a depth of 8ft. on each side, equivalent to 450 square inches. This, as Mr. Fairbairn observes, added to the resisting powers of the wooden deck, will give the required section to match the double bottom of the hull, and closely approximate to the balance of the two resisting forces, on which depends the ultimate strength of the ship. This arrangement forms a strong and substantial vessel carefully protected from absolute loss in case of accident, if stranded on a lee shore. It would also successfully resist the strains imposed by pitching and rolling in the heaviest sea.

Ships of war involve many important considerations besides those of strength and sea-going properties, inasmuch as they are applied to peculiar purposes, and have to encounter resistances other than those to be provided for in the class of vessels we have just been considering. Berths are required for several hundred men within a limited space, engine and boiler room has to be provided, and stowage must be found for coals. Then there are the heavy guns the vessel has to carry, besides some hundreds of tons of armour-plates and a heavy beak. With all this she must have speed both for offence and defence,—for chase and, if overpowered, for escape. The chief considerations in this class of vessel are their tonnage or magnitude and their general principles of construction. When the Iron Plate Committee left off their labours it was found that guns could be made to perforate plates much thicker than it was possible to apply to ships of ordinary size. It was then recommended that our ships of war should be sufficiently enlarged to enable them

to carry armour-plates of any required thickness. But the "Great Eastern" has afforded practical proof of the difficulty of managing large ships under some circumstances, and previous experience showed that vessels of 2,000 or 2,500 tons are much more active, and large enough to carry armour-plates of sufficient thickness for protection except at close quarters. The medium would be a vessel of 4,000 tons burthen, which would give a good-sized ship, capable of carrying armour-plates from 5in. to 6in. thick, placed in her most vulnerable parts. The armament of such a vessel Mr. Fairbairn places at twelve 350-pounder guns, two at the bows, two at the stern, and eight of the same weight at midships. This would give a double broadside of 2,800lb. including 800lb. from the bows and 700lb. from the stern, making a total of 4,300lb. The next point is that of defence, and to render her shot-proof she would have to be clad with thicker plates than she could carry; but by a system of partial plating, which would give security to the vessel, and protect the men at the guns, her plates might be 6in. thick at midships, gradually tapering to 4in. at stem and stern. This covering would extend 4ft. below and 2ft. or 3ft. above the water-line, forming a belt of from 6ft. to 7ft. in depth round the vessel. To protect the bottom of the vessel, and the men at the guns, Mr. Fairbairn proposes to construct shields, one near the bows, another lighter one at the stern, and one on each side. The bow and midship shields to be of 5in. plates, and that at the stern only 3 $\frac{1}{2}$ in. The improved means of security, according to our author's views, appear to be embodied in the "Penelope," a vessel well adapted for securing not only her own safety, but that of the men at the guns. In going into the calculations of weights, displacements, &c., it appears that such a vessel would not be overburdened with weight, but would meet nearly all the requirements of security and speed.

The next points to be discussed with regard to ships of war are the principles of construction, and here again Mr. Fairbairn refers to the "Penelope" as embodying to a great extent the views he entertains on this head. He considers this vessel to be an improvement upon the "Bellerophon," inasmuch as a considerable part of the weight of the iron armour plates has been dispensed with, on the principle previously recommended. The "Penelope" is a convenient and moderately sized vessel, carrying eight broadside guns of large calibre at midships, with two more guns at the bows, and two at the stern. This vessel is surrounded with a belt of armour-plate 6in. thick, to a depth of 4ft. under the water line, and 18in. above, terminating at the height of the top of the lower deck. The 6in. plates are carried along each side, with teakwood backing placed against the skin and frames of the ship. This affords secure protection to the vessel under the water-line, and the plating may diminish in thickness as it approaches the bow and stern. At midships the guns are surrounded with 5in. armour-plating, and by an improved arrangement the four midship guns next the bows and stern can be fired as broadsiders, or at right angles to the line of the keel, or they may be discharged through the portholes at an angle of 15 deg. with the line of the keel. To sum up, our author observes that the "Penelope" appears to be one of the best-designed vessels yet introduced into the service. She embodies all the elements of security as regards the safety of the ship, and is a sound, and—as far as is possible—perfect ship. With regard to her interior arrangements, we may observe that the fore and aft decks are covered with $\frac{3}{4}$ in. plates, and immediately beneath are watertight compartments. There are seven bulkheads in the whole length of the ship, three of them being watertight from the outer skin of the hull up to the lower deck. There are three more bulkheads with transverse armour-plates to protect the battery, the engines, and

the boilers from being raked by a longitudinal fire, and the upper deck is entirely covered with steel plate 5-16in. thick. The next vessel considered is the "Bellerophon," which was the first vessel of war built on the new principle of double-bottom and longitudinal cells, and which principle is highly eulogised by Mr. Fairbairn. This vessel has of late been so much before the public that we need not now follow our author through his interesting detailed description. Moreover, our limited space forbids this, as it also does further reference to other portions of the work, the last division of which comprises a valuable treatise by Mr. Tate on the strength of materials considered in relation to the construction of iron ships. As already observed the greater portion of Mr. Fairbairn's book has been written from his own practical experience. He seeks throughout to inculcate sound principles of construction, and to urge the necessity of carrying them out, in order to perfect the system of iron shipbuilding.

NOTES ON NEW DISCOVERIES AND NEW APPLICATIONS OF SCIENCE.

DIRECT PRODUCTION OF CAUSTIC SODA FROM SULPHATE OF SODIUM BY MEANS OF LIME.

"THE ever-memorable discovery, by the illustrious Leblanc,"—so wrote Dr. Hofmann, some little time ago,—“of the process now everywhere in use for manufacturing carbonate of sodium from common salt, stands distinguished in the annals of industry, not only as by far the most important of all chemico-industrial inventions, but also (a signal fact) as having been created perfect. All the other great chemical industries have been slowly worked out by the toil of successive inventors; but Leblanc's process, the greatest of all, remains to this day what it was when he first gave it to the world—the best and simplest method of effecting the most valuable of all known transformations. Though eighty-six years have elapsed since this splendid discovery was made, and innumerable researches have been undertaken with a view to its improvement, the original indications of Leblanc are all but universally followed, with merely a few comparatively unimportant modifications.” Leblanc's process, which has been most truly described as having been the means of creating “incalculable wealth for the world,”—albeit its inventor wanted bread himself, and, “after endowing mankind with cheap soda, that is with the inestimable blessings of cheap glass and soap, cheap light and cleanliness, and a hundred collateral advantages, was suffered, to the shame of Europe, to end his days in a hospital: having lingered there, a wreck in fortune, health, and hope, until reason gave way at last, and he perished by his own hand,”—consists essentially, as generally practised now, of the following five operations:—1. The conversion of chloride of sodium into sulphate of sodium by heating it with sulphuric acid, the chlorine of the chloride of sodium combining with the hydrogen of the sulphuric acid and so being evolved as hydrochloric-acid gas. 2. Furnace treatment of the sulphate of sodium so obtained in admixture with lime and coal, and the conversion thereby of the sulphate of sodium partly into carbonate of sodium and partly into caustic soda, the coal removing oxygen and the lime removing sulphur from the sulphate, and the products of combustion supplying carbonic acid. 3. Lixiviation of the furnace product, or “black ball,” as it is called, in order to the separation of the carbonate of sodium and the caustic soda from the other constituents of that product, which are for the most part insoluble, and evaporation to dryness of the solution so obtained, this evaporation yielding the solid product, consisting of a mixture of carbonate of sodium and caustic soda, which is known as “soda-salt.” 4. Calcination of the “soda-salt” in admixture with sawdust, in order to its complete conver-

sion into carbonate of sodium. 5. Purification of the carbonate of sodium by dissolving it in water, evaporating the solution down to a certain point, and then allowing it to crystallise. The attempts which have been made to supersede this process, either wholly or in part, are almost countless, but until now they have been invariably unsuccessful, and all the improvements which have been actually effected in the soda-manufacture have consisted simply in improved methods and appliances for managing the operations originally prescribed by Leblanc. Now, however, Mr. A. G. Hunter, of Rookliffe Hall, near Flint, has achieved a discovery which seems likely to lead to a most valuable modification, not in the methods or means of carrying out Leblanc's process, but in the actual process itself. It has long been known that caustic baryta will separate the sulphuric acid from a solution of sulphate of sodium, forming therewith an insoluble precipitate of sulphate of barium, and leaving caustic soda in solution. The decomposition of sulphate of sodium by caustic baryta is thus a far simpler and readier process than its decomposition by Leblanc's method, but caustic baryta has hitherto been, and is still, far too costly to permit of its use for the decomposition of sulphate of sodium on the great scale. Many attempts have been made to obtain it at a cheap rate from sulphate of barium, or "heavy spar," which is a sufficiently abundant natural product, but they have all been utter failures, and hence inventors have sought sedulously for some other and cheaper reagent, capable of acting, as regards sulphate of sodium, in the same way. Mr. Hunter has found a very cheap one indeed. He has discovered that lime, by far the cheapest of all alkaline bodies, will separate the sulphuric acid from sulphate of sodium in solution, *provided that the solution, after the lime has been added to it, be subjected to a pressure considerably exceeding that of the atmosphere.* He states that "either hydraulic, steam, or mechanical pressure" will answer equally well. Unless the application of the necessary pressure, on the large scale, should prove to be attended by greater difficulties than there seems any reason to anticipate, his discovery will revolutionise the soda-manufacture, and, by-and-bye, all the carbonate of sodium produced will be obtained by the direct combination of caustic soda with carbonic acid, the caustic soda being obtained by a process embracing only two operations,—(1) the decomposition of chloride of sodium, or common salt, by sulphuric acid, as in Leblanc's process, and (2) the decomposition of the resulting sulphate of sodium by lime.

SYNTHESIS OF FORMIC ACID.

In a recent week's "Notes" particulars were given of some improvements in the process of obtaining formic acid from oxalic acid by the aid of glycerine, rendering that process practicable, with great economy, on the manufacturing scale. We have now to record the discovery of a method, some modification of which may be found to be industrially available, by which formic acid may be produced synthetically, by the combination of an equivalent of hydrogen with one of carbonic acid. It consists in digesting powdered metallic zinc and carbonate of zinc together in hot potash lye. The potash seizes the carbonic acid of the carbonate of zinc, liberating oxide of zinc; the metallic zinc, under the influence of the potash, decomposes some of the water, combining with its oxygen and setting its hydrogen free; and the hydrogen thus liberated combines, at the moment of its liberation, with the carbonate of potassium formed by the union of some of the potash with the carbonic acid of the carbonate of zinc, thereby converting this carbonate of potassium into formate. Maly, the discoverer of this process, points out that it is capable of many modifications, the essentials to the synthesis of formic acid, on its principle, being simply (1) hydrogen in the nascent state, (2) carbonic acid at the moment

of transference, and (3) the presence of a powerful base.

SUGGESTED EXPLANATION OF THE AFFINITY OF IRON FOR CARBON AND SILICIUM.

M. de Cizancourt has followed up the paper on the allotropic conditions of iron, with the substance of which our readers were made acquainted some weeks ago, by a communication to the Academy of Sciences on the transformations and modifications which the two forms of iron, ferrous and ferric, undergo in the various processes of practical metallurgy. He commences this communication by pointing out the curious fact, which does not seem to have struck any previous student of the metallurgy of iron, that two of the bodies with which the iron-metallurgist most certainly has to do, namely, carbonic oxide and silicium, and a third, nitrogen, which has been supposed to be intimately concerned in some of the processes of his art, have each an atomic weight bearing a very simple relation alike to that of ferrous and that of ferric, the atomic weight of carbonic oxide being 14, that of nitrogen also 14, and that of silicium 28 (according to M. de Cizancourt: it is more usually, however, considered to be 27.5), while that of ferrous is 28 and that of ferric 56, and suggesting that this simplicity of relation between the atomic weights of carbonic oxide, silicium, and nitrogen, and those of ferrous and ferric, permits the conception that the special properties which the first-mentioned three bodies seem to exhibit in their relations towards the two forms of iron may be due to relations of synchronism between their molecular vibrations and those of ferrous and ferric. This suggestion is exceedingly ingenious; but there is not much else that is new in M. de Cizancourt's second paper.

NEW SOURCES OF THALLIUM.

Two new sources of thallium, both yielding that metal in greater abundance than any of the sources of it previously known, have been discovered within the last few months. At Juliusshutte, near Goslar, the water which has been used for washing the pyrites of Ramsberg is evaporated in immense quantities for the sake of the sulphate of zinc contained in it. Bunsen has found that this water contains about 0.05 per cent. of chloride of thallium, and that the thallium can be readily extracted from it. If sheets of zinc be immersed in the water, as the zinc dissolves there is obtained a metallic deposit which consists of cadmium, copper, and thallium, in the proportions, per 100 parts of zinc dissolved, of 8 parts thallium, 22 parts copper, and 57 parts cadmium. On treating this deposit with dilute sulphuric acid, the copper remains unacted upon, but the cadmium and thallium dissolve, with evolution of hydrogen, and on adding iodide of potassium to the resulting solution of the sulphates of cadmium and thallium a precipitate of pure iodide of thallium falls. The other new source of thallium is an ore of manganese which has recently been examined by Professor Bischoff, of Lausanne. This ore contains not less than 1 per cent. of metallic thallium, but the locality in which the ore occurs is unfortunately not known. All that is needed for the extraction of the thallium from it is to dissolve the ore in sulphuric acid and treat the solution with metallic zinc. The same ore contains also appreciable quantities of vanadium and lithium.

CURIOUS APPEARANCE PRESENTED BY TIN ON CONTACT WITH A HYDROGEN FLAME.

The blue colouration, due to the sulphur contained in the atmospheric dust deposited on them, which, as recorded in last week's "Notes," Mr. W. F. Barrett has found to be presented, on contact with a hydrogen flame, by all solid bodies which have been exposed for some little time to the atmosphere, is not the only curious phenomenon which that gentleman has observed to result from the contact of

a hydrogen flame with solid substances. He has found that contact of the flame of that gas with some metallic surfaces gives rise, not only to the blue colouration which appears to be produced by such contact on all bodies whatever, provided only that they have been exposed for some time to the air, but also to "a second appearance, sometimes succeeding, sometimes accompanying, the blue colouration. This is a bright scarlet spot encircled by a green ring of light, forming together a section of the flame." Among the comparatively few substances which Mr. Barrett has found to present this phenomenon, tin seems to hold the foremost place. On this metal, or any of its alloys, the scarlet spot and green ring are seen brightly, and they also appear momentarily on any surface which has been rubbed with that metal, or with any alloy containing it. "With a piece of thick and tarnished tin-foil," says Mr. Barrett, "a beautiful experiment may be made. Scraping the foil in places, and bringing it into contact with the hydrogen flame, the blue colour is seen on the dull parts, and the scarlet and green light appears on the bright surfaces, the latter remaining until the foil melts. The colours may sometimes be made to commingle, and a lovely purple is the result." Mr. Barrett found some clean pieces of lead to present the same phenomenon for a little while, but it soon faded away, and seemed to be due to the presence in the lead of some foreign substance. Clean zinc did not present it, but it appeared very vividly, though only for an instant, on a piece of zinc which had had a piece of tin drawn over it. Like the blue colouration, the scarlet and green appearance cannot be produced by either a coal-gas flame, an alcohol flame, or the flame of the oxyhydrogen blow-pipe. Mr. Barrett hopes that an examination by the aid of the spectroscope will throw some light upon its nature.

SOME NEW CASES OF PHOSPHORESCENCE.

Mr. Barrett has also noticed that many solids phosphoresce brilliantly after having been held for a short time in contact with a hydrogen flame. This is especially the case with marble, lime, selenite, granite, and sand-paper. "On sand-paper, if the hydrogen be suddenly extinguished, a phosphorescent image of the flame is observed. Chalk gives a brilliant greenish light, which changes into a still brighter yellow as lime is formed, the mass glowing throughout on continuance of the flame."

COLOURATION OF BURNING HYDROGEN BY ATMOSPHERIC AIR, AND BY CARBONIC ACID.

Having obtained so many curious results by exposing solids to the hydrogen flame, it occurred to Mr. Barrett that the contact of that flame with gases might produce phenomena worth observing. He accordingly tried carbonic acid, and "found that the presence of this gas instantly changes the colour of burning hydrogen from a yellowish brown to a pale lilac, the whole of the hydrogen flame becoming thus tinged. The same change of colour may be observed by allowing the products of combustion from a small and lightless gas flame or alcohol flame to pass through a jet of burning hydrogen." A very small quantity of carbonic acid is sufficient to thus change the colour of burning hydrogen, the change being producible by simply breathing on the hydrogen flame. Mr. Barrett suggests that the lilac colour may be due either to the heat of the hydrogen flame rendering incandescent the molecules of the carbonic acid, or, more probably, to the combustion of carbonic oxide, set free by the partial decomposition of the carbonic acid by the hydrogen. In the paper in which he records all these phenomena, Mr. Barrett adds that he has observed that when hydrogen is burnt in an inverted vessel its flame is generally accompanied by the blue colour described in last week's "Notes," this blue colour being chiefly seen around the upper part of the flame, at the

places of contact with the sides of the vessel, but that if the hydrogen be mixed with about a third of its bulk of air the blue colour is very much fainter than when the hydrogen is pure, and there is always a dark space above the burning gas, surmounted by a flame of a light green colour. Both this curious phenomenon and that of the "kind of luminous stream to be seen stretching itself some distance above the tip of the flame when hydrogen burns in a darkened room," would doubtless repay further investigation.

USE OF GLYCERINE FOR MOISTENING MODELLING CLAY.

The last number of "Cosmos" records some experiments on the use of glycerine instead of water for moistening modelling-clay. Clay first well dried and then rendered plastic by admixture with glycerine was kept in a hot room for two months, at the end of which time its plasticity had not in the least diminished. Clay rendered plastic by glycerine would seem to be capable of being used over and over again indefinitely, just like wax, with the advantage over wax of always retaining the same consistence and degree of plasticity, neither being hardened by cold nor softened by heat.

MODIFICATION OF THE LENOIR GAS-ENGINE.

A very valuable improvement in the Lenoir gas-engine has been effected by M. Hugon, of Paris. Hitherto, the explosion of the mixture of coal-gas and air employed in these engines has been effected by means of a voltaic spark, but M. Hugon effects it by a contrivance which is at once somewhat cheaper and much more regular in its working. To the slide or other valves regulating the admission of gas and air into the cylinder he attaches little burners, supplied with gas under pressure, and he so arranges that the flame from these burners shall explode the mixture in the cylinder at the proper time. These little jets are blown out by the explosion, but are afterwards re-lighted by an outer jet, which is kept constantly burning. This simple improvement seems likely to considerably diminish the uncertainty and irregularity which have hitherto characterised the action of the gas-engine.

USE OF WATER AS FUEL.

There have just been published some results of some recent American experiments as to the practicability of a notion which many persons have at various times found very fascinating, that of the use of water as fuel. If it be true that as much heat is absorbed during the decomposition of a compound as is liberated during the combination of its elements, it is difficult to see how the hydrogen of water can ever be of much use to us as a generator of heat, since it would follow that we must expend at least as much heat in liberating it from the association with oxygen in which it exists in water as it would afterwards give out in burning, or combining with oxygen again. There can be no disputing, however, that it does happen, under some circumstances, —how, or why, is not at present very clear,—that advantage is gained by passing the vapour of water into a furnace, so that it can be decomposed by the incandescent fuel, and the hydrogen liberated by its decomposition be afterwards burnt. Thus, Mr. Siemens makes careful provision for water being part of the fuel supplied to his "regenerative" furnaces, and in the American experiments just referred to it was found that a stove which, with coal as its only fuel, evaporated only 3.82 pounds of water per pound of coal consumed, evaporated 5.49 pounds of water per pound of coal when steam, generated by the same fire, but not being derived from the water the quantity of which evaporated was taken as the measure of the quantity of heat given out, was injected into the midst of the burning fuel.

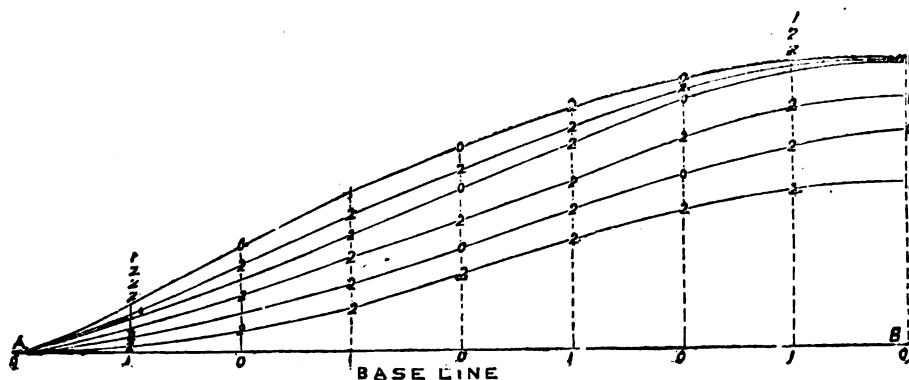
ON A RAPID MODE OF FINDING A SHIP'S DISPLACEMENT FROM THE DRAWINGS.

By CHARLES W. MERRIFIELD, F.R.S.*

It has occurred to me that by combining Dr. Woolley's rule with actual measurement, and by effecting such an arrangement of the process as to entirely obviate all confusion, it would be possible to attain the very desirable object of getting out a displacement by a few minutes' work, with a very fair degree of approximation. I have succeeded in devising a simple arrangement which answers the purpose admirably, where the drawings are so arranged as to be ready for the ordinary process of calculation. My only claim of novelty is for the practical arrangement and combination of the processes. No one step is new, except, perhaps, that of writing down the multipliers on the draught. Dr. Woolley's rule may be thus stated:—If we take a set of ordinates arranged in a rectangle containing an odd number each way (say 9×7) and affect them with the following multipliers, of which the law is easily seen,—

0	1	0	1	0	1	0	1	0
1	2	2	2	2	2	2	2	1
0	2	0	2	0	2	0	2	0
1	2	2	2	2	2	2	2	1
0	2	0	2	0	2	0	2	0
1	2	2	2	2	2	2	2	1
0	1	0	1	0	1	0	1	0

then the volume is the sum of the ordinates so multiplied, and also multiplied by $\frac{1}{3}$ ds of the product of the intervals between the ordinates one way and the other. Now, let us suppose we have either got the planking into the half-breadth plan, or else that we want the moulded capacity, and let us mark the intersections with Woolley's multipliers, as in the subjoined sketch, which is supposed to represent the after-body of which the displacement is required. These numbers may be written on the draft in pencil without injuring it. Where the multipliers get too crowded by the level lines coming close together, they may be written over the l. w. l., as in the engraving.



Next, take a long strip of drawing paper with a clean edge, and a sharp hard pencil, and measure off upon it every ordinate which has a number at the head of it in the plan, taking twice those marked 2, and neglecting those marked zero. Each measurement is to begin on the strip where the previous one ends, so that the whole length on the strip will represent the sum of the ordinates with their proper multipliers. The measurements are got by actually applying the strip of paper to the ordinates. A strip of moderate length will do, if the repeated markings have a distinguishing sign. It only remains to multiply the total length of the strip (to scale) suc-

cursively by $\frac{1}{3}$ ds, by the length interval, and by the depth interval, and then we have the displacement in feet. The process is very much easier to follow than to describe, and the result is quite as accurate as the measurements on the draft. The draft requires to be a fair one, with all the intervals equidistant, and an odd number of ordinates each way. If this be the case, the displacement may be got out in a few minutes. If there be any eccentricities of form or arrangement, these must be dealt with separately, as in ordinary work. I have satisfied myself upon trial that the process is most satisfactory, as far as quickness is concerned. Dr. Woolley's rule is too well understood to leave any doubt as to accuracy.

ON THE ADHESION OF LOCOMOTIVE ENGINES AND CERTAIN EXPEDIENTS FOR INCREASING OR SUPPLEMENTING THAT FUNCTION.*

By VAUGHAN PENDRED, C.E.

(Concluded from page 296.)

RETURNING to the inside cylinders, we find that the piston rods are provided with crossheads running in guides, although these last are hardly required, each piston driving two connecting rods. The piston rod of the leading cylinder is exactly over the mid rail, and, of course, opposite to that of the after cylinders. Thus, neither of the cylinders is in line with the shafts they have to drive. But the two connecting rods from the forward cylinders proceed right and left to the two horizontal cranks on the forward vertical shafts and put them in motion precisely on the well-known system used by Cartwright, in Watt's time. The connecting rods from the after cylinder, however, do not take the crank pins of the actual trailing wheels, but instead they are forked and jointed on to the side coupling rods. The result is rather a singular motion, not very easy, perhaps, to trace out through all its stages and speeds, but giving in effect a result equivalent to that which would be produced if the cylinders worked on cranks at right angles to each other, and thus dead points are eliminated. Each of the vertical shafts is supported in two boxes, and these boxes are made to approach each other in order to regulate the amount of grip on the rails in the following manner:—Across the engine, between the leading and trailing vertical shafts, runs an endless screw carrying outside the frame a worm wheel, into which a vertical screw gears. By causing the screw to revolve by means of a hand wheel, the transverse screw can also be put in motion. The brasses of the vertical axes are carried in cast-iron boxes pro-

vided with grooves, which slide on suitable ribs placed across the engine. Exactly over the mid rail are located two horizontal worm wheels, gearing with the transverse screw before mentioned. These wheels turn on axes fixed in the frame. To each is keyed a pair of eccentrics or cams projecting in opposite directions. These rotate within a pair of boxes, one for each eccentric, and these boxes are connected by rods with the lower boxes of the vertical wheels, strong helical springs being interposed in such way as to produce an elastic strain on the grip wheels. In order to make the wheels compress the rail, the transverse screw is caused to revolve, thus putting the large worm wheels in motion, and with them the eccentrics, which, in time, cause the low boxes to approach each other across the engine in pairs, and this motion is communicated to the four upper boxes through the medium of four ver-

* Principal of the Royal School of Naval Architecture.

tical rock shafts and links. All this is very complex, it must be admitted, and has been greatly improved upon since; but we shall do well to bear in mind that this engine accomplished all it was designed for, which was to take 16 tons up inclines of 1 in 12 or 13 at speeds of 7½ miles per hour or thereabouts on straight roads. The engine being completed was almost immediately afterwards tested at Whalley Bridge, on the Cromford and High Peak Railway, on a short piece of line expressly laid down for its gauge—3ft. 8in. The first trial took place on the 5th of January, 1864. There were two inclines on the line—one 200 yards long, with a gradient of 1 in 13; the other 550 yards long, on a grade of 1 in 12, with curves of about two chains, or 132ft. radius. The engine easily surmounted these, with four waggons, containing 26 tons of ballast—a performance which was at the time unique, considering the weight of the machine. In order to realise its exact character it may be remarked that these inclines are half as steep again as Holborn-hill at its steepest part.

Shortly after this engine had been finished Mr. Alexander was instructed to prepare designs for a second, which differs in many important particulars from the first one. All the arrangements are much simplified; the boiler power is increased, and the results obtained have been much more satisfactory. All the experience gained in the construction of the first has been made use of, and, although the machine is not yet quite what it should be, it is at least comparatively perfect, and has proved itself safe and efficient. Built partly of steel, its nett weight is 33 tons, and loaded 16 tons 17 cwt., inclusive of the extra machinery of the horizontal wheels, weighing 2 tons 13 cwt. The boiler is 8ft. 4½in. long, and 3ft. 2in. diameter, and contains 158 tubes 1½in. external diameter. The total heating surface amounts to 600 superficial feet, that of the grate being 10ft. There are only two outside cylinders, 15in. diameter, and 16in. stroke, which work both the bearing and gripping wheels as follows:—Across the forward end of the framing, in advance of the smoke-box, is placed a species of box girder, carrying at the middle of its length two bearings. Bolted to the side frames are two cast-iron boxes bored out to receive each a rock shaft, the inner ends of which are carried by the bearings in the box girder. The outer arms of these rock shafts are coupled to plungers or rods working in guides, which are coupled to the outside wheels by ordinary forked connecting rods. Each piston has, so to speak, two rods, one proceeding through the forward end of the cylinder, the other through the back. The forward rod carries a crosshead working in guides, the crosshead being fitted with a pin taking into a box working in a slot in the second arm of the rock shaft. This is rather a roundabout way of driving the bearing wheels, but it works very fairly, and is susceptible of improvement in the matter of proportion more than anything else. Thus the crank pins are needlessly long, and the outer rocker arm too heavy. The inner wheels are united as before by coupling rods, the arrangements being much the same as those in the first engine. The inner piston rods drive the farthest crank by means of ordinary connecting rods, working horizontally of course. It will be seen, however, that so far no connection whatever exists between the pair of horizontal wheels at the right-hand side of the rail and those at the left. It was at first thought that no difficulty would be experienced in getting over the dead points, the engine once in motion. This was not the case, and gearing is used to couple the two systems. Instead, too, of the excessively complex compressing gear used in the first engine, a single right and left handed transverse screw, taking into deep bosses formed on longitudinal bars, is employed. These bars rest on helical springs interposed between them and the two sliding frames carrying the bearings of the gripping wheels. The engine has been built by Mr. Cross, of St. Helens, who deserves much praise for the skill and care displayed in the construction, and I may add the design of this engine.

The next system claiming our attention is the "auxiliary steam tender" of Mr. Sturrock, engineer of the Great Northern Railway. It consists simply in the application of a pair of cylinders to the ordinary tender, which are supplied with steam from the boiler of the engine through a copper pipe, bent to easy curves, and therefore sufficiently elastic to permit of a flexible connection between tender and engine. The

scheme is not strictly novel, steam tenders having been used to work the coal traffic between Rive de Geir and St. Etienne, from 1845 up to 1853. These engines were built by Verpillieu for a 40lb. rail, and being found too light for their work, cylinders were added to the tenders and, with this addition, they conducted the traffic on an incline of 1 in 60 with considerable success. Verpillieu's arrangement was clumsy as compared with Mr. Sturrock's, the steam pipe to the tender being lead overhead across the footplate, while stuffing-boxes were employed to compensate for its rigidity. Forty-six steam tenders are now at work on the Great Northern, but they are not yet fully employed; as certain engines to which they are intended to be fitted have not yet been delivered to the company. The waste steam from the tender cylinder is led through a few tubes placed within the tank, in order to raise the temperature in the feed water, by which a considerable saving in fuel is effected. The coal traffic of the Great Northern is worked at the high average speed of twenty miles per hour, including stops; and as the line abounds in inclines of 1 in 200, several of them three and four, and one as much as eight miles long, while the weight of the train averages 280 tons, it is evident that a good deal of power is necessary. The steam tender engines have 16in. cylinders, 24in. stroke, and six coupled wheels 5ft. in diameter. It was found in practice that these engines made more steam than they had adhesion to work up in winter though not in summer. The auxiliary tenders have cylinders 12in. diameter, 15in. stroke, and six wheels all coupled 4ft. 6in. diameter. They weigh full twenty-nine tons. After they had been in use a short time it was found that the boilers in their normal form did not make sufficient steam for the additional adhesion. The fire-boxes were therefore removed, and replaced by others of larger size, the inclined grate being carried above the trailing axle. The grate surface is thereby increased from 17½ft. to 26½ft., the weight of the engine being increased by 10 cwt. Engines thus altered take, I understand, gross loads of 450 tons, their normal load being increased from thirty waggons, containing 7 tons of 21 cwt. to the ton in each, to forty-five waggons, or 315 tons nett, up inclines of 1 in 173. The tenders are in use but a couple of years, during which time they have run 1,011,963 miles up to the 26th of last August, 430,000 of these having been run during the six months ending 30th of June. The system has, I believe, proved thoroughly successful, the power of the engines being increased by about 50 per cent. in return for an expenditure of £450 to £500. The tenders weigh empty about 18 tons, or half as much as the engine, so that the consumption of coal and water while running does not practically affect the adhesion. The entire idea thus embodied will be seen to correspond in many respects with those of Flachot and other continental engineers. The details have been worked out with so much care that we must accord Mr. Sturrock a fair proportion of the credit due to an original inventor.

I have said that I would refer to the different modern systems of supplementing or increasing adhesion in the order of their importance. I must add that I measure this importance, not by the skill or talent of the inventor or by the originality of his views, but by the degree in which these have been reduced to practice, and the specific object they are intended to subserve. It is possible that the system to which I now beg leave to call your attention is more strictly novel, if not remarkable, than either of those we have just considered. Mr. W. B. Adams, well known for his inventions in connection with railways, has produced an engine for sharp curves, which also embodies a means of supplementing adhesion well worth attention. The idea of coupling chairs by the aid of friction wheels has been broached before, but never in the form which Mr. Adams has given it. According to this arrangement the whole weight of the engine is supported upon all the wheels as driving power, and that while permitting the engine to roll round curves of as small a radius as a chain and a half, with a total wheel base of 20ft. to 24ft. This is effected by applying friction wheels between the two pairs of central and end wheels, their axles passing between the boiler and frame. The two pairs of middle wheels are applied in the ordinary way with axle guards, one pair having a crank axle attached to a pair of inside cylinders, and connected by side rods

to the other pair of wheels, both pairs having inside bearings. The end wheels have outside bearings giving a wide spring base which steadies the engine. The axle-boxes are of the ordinary kind, and they have no hornplates, which would be in the way. The bearing springs swivel on a centre pivot, and support their load from long rods attached to balls and sockets, connected with scroll irons or brackets on the frame. Thus free movement is given to the leading and bearing wheels and axles, both forward, backward, laterally and diagonally. But it is essential to control this movement, so that the axles may only move in a true radius with the curves of the rails. To accomplish this the whole axle between each pair of wheels is fitted with a curved bed struck from a centre, equal to one-fourth the total wheel base. This curved bed works on a curved frame, corresponding to it in form, fixed to the inside frame of the engine. Thus these end axles with their wheels work in the curve, impelled by their flanges against the rails; and this curved frame takes all the thrust caused by the pressure of the friction wheels between the lower wheels. This pressure can be increased or diminished at the pleasure of the driver by levers acting on volute springs, or the wheels may be lifted altogether from contact. The three pairs of wheels at each end thus act simultaneously, the driving power at the crank axle impelling the whole. On a straight line the gravitating action of the spring shackles keeps them vertical; on the curve the pressure of the flanges places the end wheels at an angle, so that in the inside of the curve the end wheels approach the centre and on the outside go further apart, their axle reclining from the horizontal position to one side or the other. The friction wheels work independently on their axle, and the tyres are provided with flanges to interlock them with the centre and leading or trailing wheels. If the connected wheels were rigid on their peripheries there might be a tendency to jump and slip, as with all rigid wheels, and so lose their hold. To ensure against this defect the wheels are all provided with springs underneath their tyres, which allow them to fit each other and ensure adhesion. The engine is fitted with a pair of steam cylinders on each side of the frame, the pistons being pressed down by spiral springs inside to keep the brake out of use, and when the steam is admitted the springs are overpowered and the brakes are lifted into contact with the wheels. In order to increase the adhesion for very steep gradients the flanges of the wheels are made V form, and enter a corresponding rail, travelling on the ordinary rails when not on steep inclines.

This paper has already extended to such a length that I can do little more than glance at the last section of my subject—the application of magnetism as a means of increasing adhesion. It happens, however, that the idea, although often tested on a large scale, has resulted in nothing; nor is it likely that it will ever be resorted to in practice. It may, in short, be regarded more in the light of an ingenious abstract mechanical device than in that of a practical expedient likely to serve a really useful purpose. I believe the idea is very old, M. Weber being the first to suggest it, while Liebig mentions it in many of his earlier letters; but the first patent taken out, in this country at least, bears date 1850 only. It was secured by M. Amberger, to whom the credit of the invention, such as it is, is due. Its history is very simple. In or about the year 1850, the Austrian Government appointed a commission to inquire into the best means of providing sufficient adhesion to work the Semmering incline, with grades averaging 1 in 47. The commissioners applied, among others, to M. Amberger, an engineer of some eminence, who suggested the plan of magnetising the driving wheels by electricity. Amberger's suggestion was adopted by the commission, and funds were placed at his disposal to make experiments. He called in the assistance of an electrician, M. Nicklés, and after some models had been constructed, and the fact demonstrated that it was possible to increase the coefficient of adhesion, they proceeded to test the scheme on a large scale. For this purpose an engine on the Lyons Railway was placed at their disposal. The engine weighed 80 tons, supported on six wheels, of which four were coupled. It was found, however, that this engine had more adhesion, thanks to the coupling, than it had cylinder capacity to work up, and therefore the coupling rods had to be removed. The mag-

netising apparatus consisted simply of a coil of insulated copper wire wound on a species of brass bobbin surrounding the lower part of the wheel. The battery consisted of 64 Bunsen elements, and the length of the wire was about 1,700 yards. The force of attraction equalled, when the train was at rest, 639 kilogrammes, or 12 cwt. 2 qrs. 11 lb. for each wheel; and so far it is obvious that there was a decided gain. But a very singular phenomenon, and one altogether unanticipated, supervened the moment the train was put in motion, which was simply that as soon as the wheel began to revolve the force of attraction diminished. Thus, at thirty revolutions per minute the force of attraction fell off from 12½ cwt. to 5 cwt.; while at sixty revolutions it fell to but 8 cwt. 27 lb. Without entering deeply into the theory of the electro-magnet, this may be easily accounted for in the following way:—The top of the wheel is converted into one pole of the magnet—say the north—the bottom of the wheel into the south pole; but the south pole is more strongly magnetic than the north, because it is next to the coil. As the wheel revolves, however, the south pole continually becomes the north, and vice versa. But it is well known that electro-magnets retain small charges of magnetism after the current is broken, while any change of polarity requires a little time to be fully accomplished. When the wheel or wheels revolve rapidly this time is not allowed, and the result is a species of confusion in the polarities, and a consequent weakening of the magnet. Nicklés then produced another system, in which the coil is disposed in the same plane as the wheel, with which he obtained better results, the magnetism not being affected by the revolution; but the arrangement is inapplicable to engines of the ordinary construction, with high drivers, and must interfere so considerably with the entire design of the engine in any case, that I cannot think it likely that it will ever find its way into practice. Indeed, the best results Nicklés obtained only gave an increase of adhesion equal to 8·5 per cent.—a very poor return indeed for the trouble and expense incurred in the construction and manufacture of a complex electrical apparatus. The idea is still being worked out, I believe, both here and in America. Sir Charles Fox, for example, has recently tried many experiments on the Great Eastern Railway, which have ended in nothing, except in proving that a few handfuls of sand enabled the engine to surmount inclines with a given load which it was unable to cope with even when the wheels were powerfully magnetised.

STREET RAILWAY BRIDGES.

There are degrees of ugliness, even in iron railway bridges. Those by Mr. Hawkshaw seem on the whole to stand highest in the scale, and that masterpiece of his which forms a sort of triumphal arch at the main entrance to the City of London is confessedly unrivalled. Utilitarianism itself can hardly beat the iron tank in Wellington-street, Southwark. Modern progress can surely go no further in that direction—for the bridge in question might have been planned in one machine and executed by another; and the substitution of machinework for human thought and labour is the thing above all others for which the nineteenth century is never tired of glorifying itself. "Practical men" everywhere should unite to give Mr. Hawkshaw a testimonial for having carried their principles to absolute perfection, and for having ignored the existence of mind in any shape whatever. Those unpractical people, however, who look on town railway bridges as nuisances to be diminished as far as possible, naturally welcome any example whose hideousness is somewhat modified. There is one just finished in the neighbourhood of Brixton, slightly better than the average. The main girders, instead of being above, are kept beneath the line of rails; the transverse girders are also visible and are of the lattice form. The soffit, instead of the common surface of bulging and apparently sagging iron plates, thus presents contrasting masses of light and shadow. The design is far enough from being beautiful, but the display of construction gives something of interest to it, and suggests arrangements that might be made effective. Of course the system is only available where there is considerable headway beneath; but cases often occur where it might be further developed with advantage.—*Building News.*

FALL OF TWO AEROLITES.

On the 7th September last a well-authenticated case of the fall of two aerolites within half a mile of each other took place at Muddoor, in India. It was in the daytime, and three loud reports, like the explosion of shells in the air, were heard by many people. Three natives, immediately after the reports, saw the fall of the stones, which raised a great quantity of dust. They were at first frightened, but called others to their assistance, and dug out the stones. Their depositions were afterwards taken. The first of them, named Kenda, was very much frightened: "he did not go close to it, because he thought some calamity had fallen there from the heavens." The second, Channay Gowda, "did not go close to the spot, thinking that some devil or evil had come down from the heavens." The third, Mallay Gowda, did not go to see it, "because he thought that some calamity or *Mary* (meaning his deity of evils) had come down on the land to ruin the community." A large number of persons, including the police, were brought by these natives to the spots, and the two stones on being dug out in a broken state were found to be identical in appearance. Ali, the resident almidar, took down the statements in writing, and sent the whole at once to Mr. L. B. Bowring, Commissioner for the province of Mysore.

AGRICULTURAL RAILWAYS.

MR. RICHARD WINDER, of Abingdon-street, Westminster, engineer, has just obtained letters patent for an improved method of and apparatus for laying single-line articulated railways and a method of propelling thereon particularly applicable for agricultural purposes. This invention comprises a jointed way consisting of lengths of sleepers and rails forming a single road on which a portion of the weight of a travelling boiler and engine is supported, and in a method of propelling engines and carriages or implements attached or connected to it along such road. The invention further consists in a method of and apparatus for raising the road after the engine leaves each portion thereof, and for placing the road in readiness for the next journey or course of the engine. The invention is intended more particularly for agricultural purposes. The inventor prefers to employ a vertical boiler supported upon a frame having a central and two ordinary wheels, and an engine with a pair of cylinders upon a similar frame and wheels. He lays down the articulated sleepers and rails and forms a single line, which is central between the ordinary wheels of the frames carrying the boiler and engine. Two mitre wheels are connected to a central double mitre wheel keyed upon the main shaft of the engine; the two mitre wheels are keyed upon vertical shafts extending downwards and carrying at their lower ends two grooved pulleys made to grip the sides of the rail and kept in contact therewith by means of a right and left screw thread on a rod working into collars through which the vertical shafts pass. Or, instead of grooved pulleys, spiked wheels are used, the spikes on which take into the sides of a flexible jointed rail. To the rear of the engine is connected the inner part of a triangular frame, the inner end of which is kept raised from the ground by resting upon a bent axle carried by small wheels; the outer end of the straight side of the triangular frame carries an axle upon which a disc wheel is free to revolve. The side of the frame just alluded to follows in a central line and immediately behind the line of railroad. The frame is bent or angled at right angles or nearly so to the side before described, and is carried out laterally to any required distance, say 5 ft.; its outer end is armed with a friction roller, and the third side of the triangle forms a shoe and extends from the laterally projecting end to the fore part of the triangular frame. The frame is provided with a travelling wheel, and the shoe carries friction rollers. The action is as follows:—The central wheels of the boiler and engine frames travel upon the rail, on propulsion being given by the engine through the grooved clip pulleys or spiked wheels. As soon as the first jointed portion of the rail and sleeper is liberated or freed from pressure, the point of the triangular frame raises the rear end of the sleeper, when the shoe takes the sleeper and rail, and so on for each succeeding length of sleeper and rail until the first length leaves the further end of the shoe, and the others following in succession are placed in a straight line assisted by the friction roller on the lateral arms of the triangular frame,—whereby a

line of railroad is provided for the next course or return journey. Two of the above-described frames are used, one at each end of the engine and boiler frames. The agricultural implement, carriage, or weight to be drawn is connected to the engine frame and follows the triangular frame. Instead of using the method described of propelling carriages on the articulated single-line railway, the inventor sometimes adopts the system of rope or chain traction described in the specification of an invention for which provisional protection was granted to him the 9th Feb., 1865.

The accompanying engravings clearly illustrate the manner in which this invention is carried into effect. Fig. 1 is a side elevation, and fig. 2 a plan of one of the apparatuses complete; fig. 3 is an elevation of the jointed sleepers and flexible central rail showing one of the spiked pulleys working therein; fig. 4 is a plan showing both spiked wheels set for working the machine forward along the flexible central rail; fig. 5 is an elevation of one of the jointed lengths of the sleeper; fig. 6 is a plan of the same; fig. 7 is an elevation of one double link and one single link of the flexible central rail; fig. 8 is a plan of the same; fig. 9 shows the complete apparatus at work. A A is the central rail formed of links with lateral spaces between them. The rail is fastened by countersunk bolts to the jointed sleepers O, one bolt in the centre of each length of sleeper. It is likewise fastened at each headland to anchors of any simple kind travelling upon wheels or discs, as shown in the view fig. 9, where X X are the anchors. The central rail carries the chief portion of the dead weight of the machine upon the grooved wheels L L L, fig. 1. B B are two pinions or wheels having projections or spikes upon their peripheries. These spikes fit in between the links of the flexible central rail, and being caused to revolve propel the machine forward. C is the main shaft of the machine. D D are the cylinders of the engine. E is the boiler. F F is the steam pipe leading from the boiler to the cylinders. G G' are the high wheels that carry a portion of the dead weight of the apparatus when ploughing, and the whole of the weight when it is used as a traction engine; these wheels run loosely upon their axles. H H H are cog wheels which drive the spiked wheels B B by the vertical shafts I I. These shafts are fitted with long feathers or keys so that they can work freely up and down through the horizontal cog wheels H H, in order to compensate for any unevenness of the ground passed over. The shafts are also coupled together, the coupling having in the centre a right and left handed screw, so that by turning the screw one way the spiked wheels are forced further apart, and thus thrown out of gear with the rail, and by turning it the reverse way the spiked wheels are brought closer together and placed in gear with the sides of the rail, and by screwing together still closer, additional friction is obtained by pressing the wheels against the sides of the flexible rail, and in place of the coupling above described an elastic or spring coupling is sometimes used. K K is the frame of the apparatus made in two parts, the more equally to distribute the dead weight to be carried over the land and to allow of its accommodating itself to the inequalities in the surface of the ground. One part of the frame carries the boiler, the other part the engines, main shaft, and other working parts. L L are the grooved wheels which run on the top of the central rail A. Springs are provided to allow these wheels to adapt themselves to the unevenness of the ground passed over. M is a grooved pulley on the lower part of the boiler around which the rail may be coiled for transport. This pulley can be made either to take off altogether, or be raised up outside the boiler out of the way when not required for use. It is either worked by a cog wheel attached by a connecting rod to the engine, as shown in the engravings, or it can be worked by hand. N is the frame for shifting the central rail and sleepers to the new position ready for the apparatus to travel upon in the return journey. The frames are raised alternately out of the way, and lowered into their work, according to which way the machine is travelling. At N, figs. 1 and 3, the frame is shown in work, and at N' it is shown raised up out of its work. When the apparatus is at work the frame N in work is shifting the central rail at the same time the apparatus is travelling across the field drawing the plough or other implement after it. Upon arriving at the headland this frame N is raised up out of the way, and that on the opposite end of the apparatus is lowered ready to shift the central rail to the re-

AGRICULTURAL RAILWAYS.

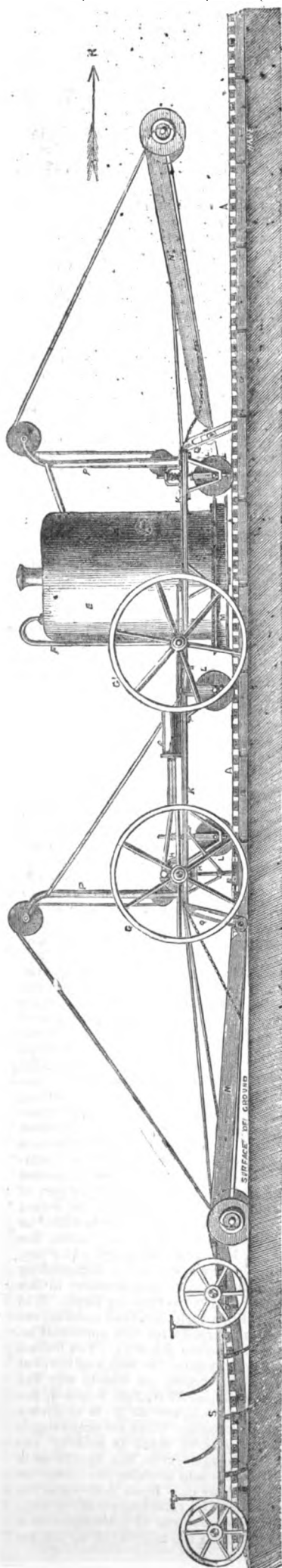


FIG. 1.



FIG. 3.



FIG. 4.

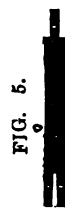


FIG. 5.

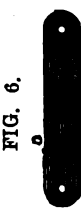


FIG. 6.

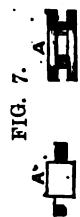


FIG. 7.



FIG. 8.

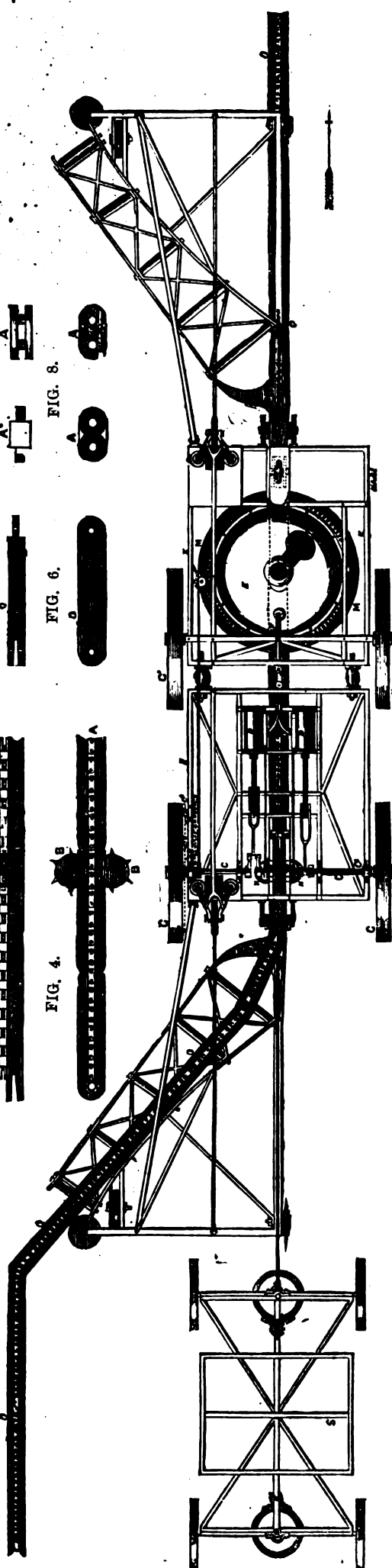


FIG. 2.

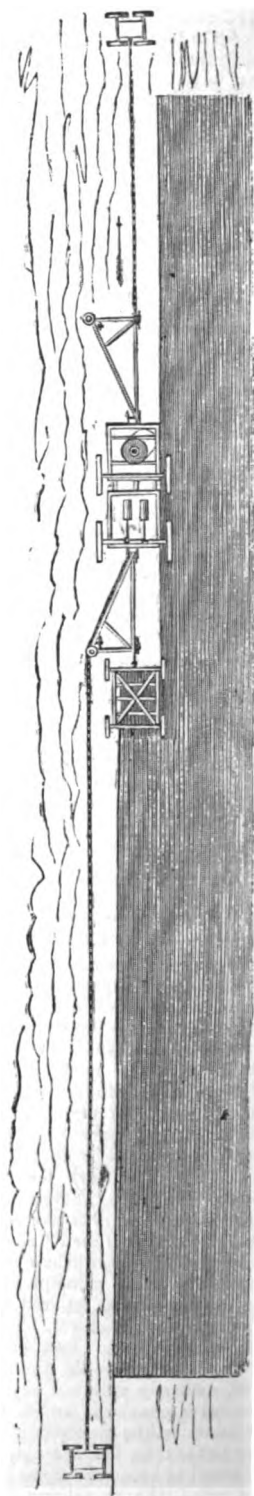
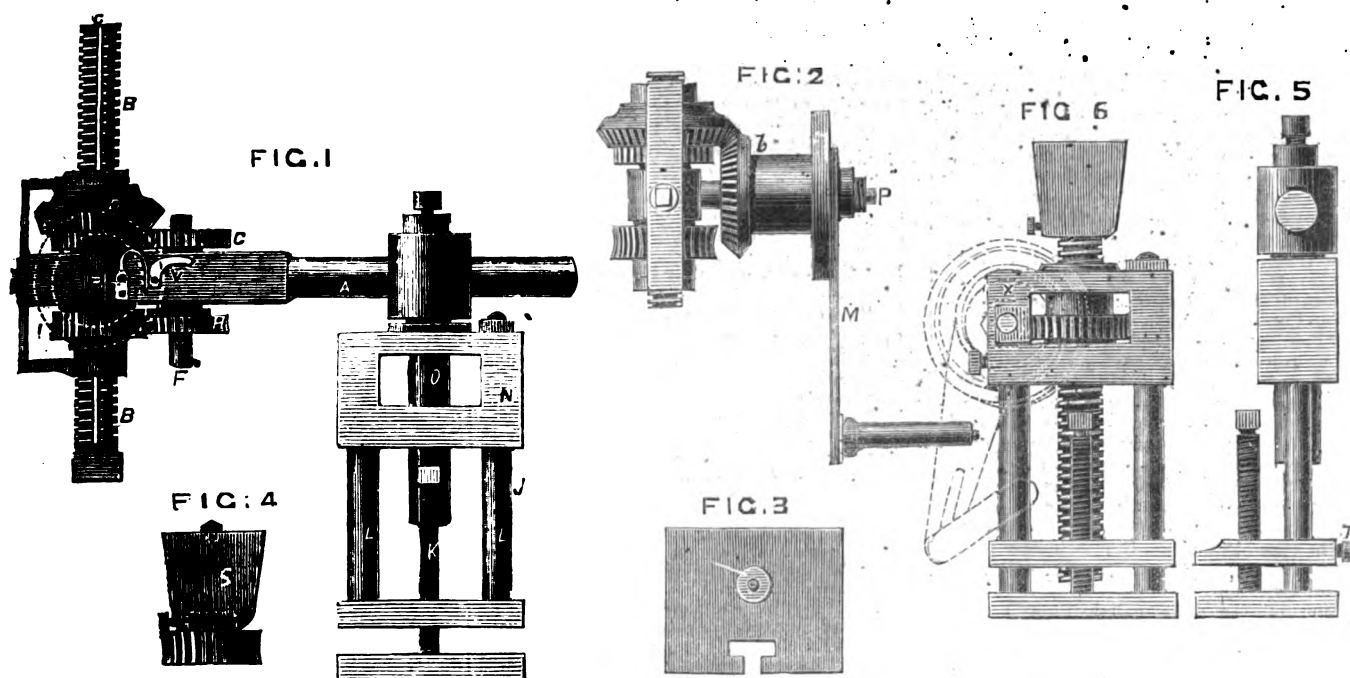


FIG. 9.

COMBINED DRILL, VICE, AND LIFT.



quired new position, while the machine is making the return journey; thus the frames N and N' are raised and lowered alternately, shifting the rail each time to the required distance sideways until the whole field is finished; neither engine nor any other part of the machine turns at the headlands. O O are jointed sleepers to which the central rail is fastened. Play is left at the joints to allow the sleepers to adapt themselves to the unevenness of the ground. P P are standards and gearing for raising the guide frames N and N' when not in use. Q Q are guides fitted with a recess to hold up the end of the guide frame free of the central rail when not in use. S is the cultivator or plough frame fitted with steering apparatus at each end and with rocking bars to which are fixed tines or shares. This implement does not turn at the headlands.

COMBINED DRILL, VICE, AND LIFT.

Messrs. GEORGE HODGSON and JAMES PITT, of Cleckheaton, Yorkshire, machine makers, have obtained letters patent for an invention which has for its object improvements in apparatus for boring, drilling, and other purposes. The various parts are so arranged and accurately fitted, that by changing one to another they can be readily adjusted for four different motions and form a combination of drill, rack drill, vice, and screw jack, applicable either for hand or steam power. The accompanying engraving exhibits an apparatus in which this invention is carried out; fig. 1 being a front elevation of the drill; fig. 2 a front elevation of the driving motion; fig. 3 a plan of lower or fast jaw; fig. 4 the drill holder and worm wheel set for rack drill; fig. 5 a transverse section of stand and jaws; fig. 6 a front elevation of the lifting jack. Similar letters of reference indicate corresponding parts in the several figures. The drill consists of a lever A, through one end of which works a grooved spindle B B, capable of sliding thereon, which spindle or screw has also a longitudinal groove C. At the bottom of the spindle or screw the drill is fixed. The lever carries two wheels D E, one a mitre wheel and the other a spur wheel; and a stud on the lever shown at P, fig. 2, carries a hollow shaft, on which is fixed another mitre wheel b, fig. 2, which gears with the first-named mitre wheel D, at fig. 1. The lever A also carries a short vertical spindle F, having a spur wheel G and H at each end. The upper spur wheel G gearing with the spur wheel E on the lever, and the lower one H gearing with the worm wheel I, fixed in a collar below the lever in which the drill, spindle, or screw B B works. The grooved spindle or screw B B is driven by means of a fast key in the boss of the mitre wheel D, which works freely on the longitudinal groove C. Wheels E, H, and I are of one size, while the wheel G is one cog larger, so that at each revolution of wheel E, which is fast to the mitre wheel D, wheels G, H, and I lose one cog. By

so doing worm wheel I, with a thread in the boss fitting the grooves of spindle B B, presses down the drill with perfect regularity at each revolution of the grooved spindle. The apparatus when in use is fixed to a stand J, having two jaws; the lower one fixed (fig. 3) and the upper one working by means of a set screw K, with a collar on its point on the under side of the fast jaw, which gives it the advantage of fastening the apparatus in any position required, while the fast jaw has a T-headed slot hole, shown at fig. 3, thereby allowing the apparatus to be secured by either bolt or jaws. The upper or loose jaw works on two uprights L L, which support a crosshead N, through which passes a round vertical shaft O, capable of being raised or lowered or moved sideways. The vertical shaft has a round hole through its thickest part to carry the arm of the lever A. The vertical shaft O, and the lever A, are both adjustable by set screws, and by this means the drill will bore at any point of a circumference vertically, the extreme radius being the full length of lever A; also, the drill will bore at any angle formed by turning the lever A in its rest in the shaft O, and by removing the shaft O from the crosshead N, the drill will bore horizontally by placing the lever A in the vacant place in the crosshead N. Motion is given to the apparatus by means of a slotted handle M, fig. 2, the radius of which may be increased or diminished as required, according to the size of the hole to be bored; and is adjusted and fixed on the loose shaft carried by the stud of the lever P, and when worked by steam power a pulley is fixed thereto instead of a handle, and driven direct from the engine by a band or strap. The rack drill is used without the stand J and the vertical shaft O, the round arm of the lever A serving as a handle. It is formed by removing the worm wheel I from the collar below the lever A, placing it in a cap or drill holder S, fig. 4, also the small set screw T, fig. 5, then fixing them on the top of the drill spindle or screw B B, to set up the drill, and bringing into gear a paul or catch V, fig. 1 (fixed on the lever A), which is kept in and out of gear by a spring. The stud P, fig. 2, carrying the loose shaft is removed from the lever. To form the lifting apparatus the worm wheel I is taken from out of the cap or drill holder S, and placed in the hollow of the crosshead of the stand, as shown at fig. 6. The drill spindle B B, inverted, is passed through the crosshead, and the stud P (fig. 2) carrying the loose shaft and having the mitre wheel on with worm attached is then easily fixed in a suitable hole in the crosshead at X, fig. 6. The grooves of the worm attached to mitre wheel b work in the worm wheel fixed in the crosshead. The cap or drill holder S is also placed on the top of the drill spindle, as shown at fig. 6. The vice is formed by fixing the stand J horizontally to any convenient place by means of a bolt passing through the T-headed slot hole in the lower or fast jaw fig. 3.

INSTITUTION OF CIVIL ENGINEERS.

THE opening meeting of the Institution of Civil Engineers was held on Tuesday evening last, the President, Mr. J. R. M'Clean, in the chair. Sir C. T. Bright, M.P., M. Inst. C.E., read a paper on "The Telegraph to India, and its extension to Australia and China." After referring to the previous attempts to establish telegraphic communication with India by the Red Sea, and alluding to the causes of the failure of that enterprise, the author proceeded to describe the steps taken by the Government to carry out the line through Mesopotamia and by the Persian Gulf to Kurrachee, which is now in daily operation, connecting England with Calcutta, Bombay, Madras, and all the principal towns of India, and extending as far to the eastward as Rangoon. A description was given of the manufacture, laying, and electrical tests applied to the submarine cables between the head of the Persian Gulf, Bushire, Mussendom, Gwadar, and Kurrachee, the engineering and electrical superintendence being carried out for the Indian Government by the author and his partner Mr. Latimer Clark (M. Inst. C.E.). The cables in question belonged to the class of shallow water cables, the depth being generally about 40 fathoms, and the bottom being principally sand and soft mud, circumstances the most favourable for the deposition of submarine lines. The core was composed of 225lb. of copper and 275lb. of gutta-percha per nautical mile, the gutta-percha being applied in four separate coatings; over this was laid a bedding of hemp, covered by twelve galvanised iron wires, the whole being coated with two layers of a compound of bitumen and silica, applied in a plastic state, in combination with two alternate servings of hemp laid in opposite directions. In the construction of the conductor four segmental pieces of copper within a copper tube were used, by which the mechanical advantages of a strand were preserved, while the electrical efficiency was added to, in consequence of the cylindrical form of the exterior. The elaborate system of electrical tests taken during the construction and laying of the cable, and a series of experiments determining, for the first time, the differences of conductivity of gutta-percha and india-rubber at various temperatures, were fully described, a formula being given as a guide in calculating the effect of changes of temperature upon the insulation of submarine cables. A new method of testing the joints in the core separately was introduced, whereby a considerable gain in insulation was attained. The conductivity of the whole of the copper wire used was measured, and all wire below an established standard was rejected. By this means a high degree of conductivity was arrived at. The total length manufactured was 1,234 nautical miles, weighing in all 5,028 tons. Five sailing vessels and one steamer conveyed this mass of submarine cable to Bombay, and the submersion was commenced by the author on

the 3rd February, 1864, at Gwadar on the coast of Beloochistan, the whole being completed by the middle of May in the same year. The cables were laid for the first time successfully from sailing vessels towed by steamers, by which a considerable saving was effected, compared with the cost of sending the cable round the Cape in steam vessels. It was expected that the Turkish land line, between Bagdad and the head of the Gulf, would have been completed simultaneously with the submersion of the Persian Gulf line. In this, however, much disappointment was experienced, owing to the Arabs, on a portion of the route, in the valley of the Euphrates, being in revolt against the Turks. In consequence of this, the opening of the entire line between Europe and India was delayed until the end of February, in the present year, when a telegram was received in London from Kurrachee in eight hours and a half. This was speedily followed by numerous commercial messages to and fro, and a large and remunerative traffic was now daily passing. The author, however, complained of the delays and errors arising upon the Turkish portion of the line, between Constantinople and Belgrade; the service on the portion of the line worked by the Indian Government, between India and the head of the Gulf, being performed rapidly and efficiently. The difficulties encountered by Major Champain, R.E., in the construction of the Persian telegraph between Teheran, Ispahan, Shiraz, and Bushire, were described, and the loss of the late Colonel Patrick Stewart, R.E., and his devoted services, were feelingly alluded to.

In considering the extension of telegraphic communication from Rangoon to China and Australia, the author entered upon a narration of the advantages and otherwise of the several plans proposed; and considered, although part of the line in the Malay Peninsula, and elsewhere, might be taken by land, that the speediest and most reliable means of carrying the object into effect would be found in the submergence of submarine cables, if properly constructed and laid. The regularity of the working of a good system of cables would, in his opinion, soon compensate for the additional outlay involved over such sections of the line. It was thought that a line might be carried, in a comparatively short time, from Rangoon to Singapore, thence to Batavia, joining the Dutch land lines there, and passing from the south-eastern extremity of Java to Timor, onwards to the Australian coast, whither the Australian land lines were rapidly advancing, and would be erected to meet the cable. From Singapore a line could be carried to China, touching at Saigon, or the peninsula might be touched at Mergui, and the sea line be carried thence across the Gulf of Siam.

Correspondence.

LIGHT DRAUGHT ROLLER SHIP.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—The announcements on this subject display such an amount of ignorance in naval engineering that Mr. Barber's "bitter disappointment" and the "eminence" of the shipbuilding firm who have undertaken to build the monstrosity, are likely to excite only the risible faculties of your readers. I may, however, congratulate Mr. Barber on refraining from going beyond "egg-shell" experiments, and would ask him to repeat them, and to observe that every egg-shell takes a fast course to leeward and keeps on the lee-side of every wave. A vessel designed for navigation is "usually" formed to take any course that may be required. It is immersed in two fluids, the upper part in air, the lower part in water; both these fluids have motions of their own. If we increase the bulk of the upper works the vessel is subject to great leeway; if we decrease the size of the upper works the vessel becomes dangerous and unseaworthy for want of buoyancy. The happy medium is attained in the fine specimens of naval architecture which are now quite common. The celebrated yacht "Moequito" draws about 11ft. of water aft, with a breadth of beam of about 15ft. and 60ft. length, yet she is only 6ft. above water at the head and 4ft. at the stern, but she can claw off a lee shore with the greatest ease, and of course she can go to leeward readily enough if required. Some years ago I used to visit the Adelaide Gallery very frequently, and I remember a model of a craft there which had four light hollow wheels sufficiently bulky to sustain, by their displacement, the deck and rigging, when immersed to about a third of their diameter. They were not "globes" but "broad wheels." This was designed for a similar purpose as that now announced, viz., to roll over

the water; but somehow the wheels would not turn round on their axes and no amount of coaxing could get them to do so. The reason is sufficiently obvious: the friction of the water is less than the friction of the axle, thus proving that there is no necessity for wheels, globes, rollers, or anything of the kind. As it is clear that the only course such a globular ship could take would be dead to leeward, why have engines or any other motive power than the wind? and as its hold on the water is to be so very small, why not dispense with contact with water altogether, and make use of Mr. Coxwell's balloon instead?

I remain, Sir, yours, &c.,
T. MOR.

1, Clifford's Inn, November 11, 1865.

"SAFETY" LUCIFER MATCHES.

SIR,—The subject of lucifer matches having for some time past created an interest in the public mind, permit me to make a few remarks on the matter, connected with the invention of Messrs. Bryant and May, which was supposed by many to have reduced to a minimum those calamities which were rendered so frequent by the use of the old-fashioned match. The invention, looked at critically, far from does away with the danger which attaches to the old match. If one of these patent lucifers be struck against the prepared paper, a small explosion takes place which frequently results in the head of the match becoming detached, and falling red hot, and even flaming, on the floor. Put such a match in the hands of an uneducated and careless person and what will be the result? undoubtedly in many cases severe accidents. This is not the only fault of an invention that is faultless in its ingenuity, but which is of small practical value. The prepared paper with which the boxes are supplied is so soon exhausted that it has frequently to be turned, or a new piece put in its place, from the fact that some of the ignitions cause a partial destruction of the paper by fire, which it is extremely difficult to put out. Is this an article for general household use? or is it not rather an ingenious toy? Again, a match is not always so handy when it cannot be used away from its box, which must necessarily be moved about, and often in that case mislaid by careless people, a class which unluckily is not altogether rare. To compare the new with the old, the former has only one distinct advantage, which, indeed, can hardly in some cases be viewed as such, namely, its incombustibility except in connection with its own box, which may be stood in some damp place and totally impaired. Nowhere the old match has the advantage inasmuch as it may be struck on any rough surface, and if done with any amount of care, seldom drops a spark. If these few lines contain sufficient interest to admit of their insertion in your valuable paper, it will considerably oblige,

Yours, &c.,
INQUISITOR.

London,
November 4, 1865.

THE ACTION OF ACIDS ON METALS.

SIR,—I see in a late number of your excellent journal, allusion to some interesting experiments by Dr. C. Calvert, on the action of acids on metallic alloys, &c. Will you allow me to state that in 1858 I published two papers in the "Journal de Medecine," of Bruxelles, entitled "Action of Sulphuric Acid on Zinc and Iron." The most remarkable result arrived at in my experiments was this, namely, that concentrated sulphuric acid has no action at ordinary temperatures upon pure zinc, consequently that monohydrated sulphuric acid might be transported without danger in vessels of pure zinc.

I am, Sir, yours, &c.,
T. L. PHIPSON, PH.D., F.C.S.
4, The Cedars, Putney, London, S.W.,
November 4.

CAST-IRON RIFLED CANNON.

SIR,—In the *Scientific American* of the 21st October, 1865, there is a report of experiments with cast-iron rifled cannon which were partially a failure owing to the grooves of cannon becoming clogged by the residuum from firing. My patented cast-iron cannon, being on the elliptic principle, has no grooves to become clogged by residuum, neither has the elongated shot any projections on it suited to the grooves; its hollow base takes the elliptic form from the explosion of the charge, which imparts the rotation to the longer axis of the shot, which idea I borrowed from the hollow base of the Malay tube, dart, or arrow, as far back as the year 1818.

Yours, &c.,
J. NORTON (late 34th Regt.)
Bray Club, Bray, November 7.

THE USE OF PARAFFIN.

SIR,—In your remarks on Dr. Grace Calvert's lecture on the discoveries in chemistry applied to arts and manufactures in your issue of the 10th inst., you observe that the learned lecturer drew atten-

tion to a new method of waterproofing vegetable and animal tissues and fabrics by means of paraffin, devised by the learned and eminent chemist, Dr. J. Stenhouse; and that this process has been applied with great advantage by Messrs. Silver and Co. to the waterproofing of soldiers' tents and other materials. It is gratifying to find so great an authority as Dr. J. Stenhouse advocating the use of this valuable material, which possesses besides its illuminating and lubricating powers and its preservative and waterproofing qualities, other most useful properties. For electrical purposes it is the best insulating material known as regards both insulation and induction; it is also unalterable by chemical agencies, and, from its unlimited supply, promises to enter largely into the arts and manufactures of this country. The process, however, of rendering materials waterproof by the use of paraffin, as applied by Dr. Stenhouse, is not the original discovery Dr. Grace Calvert's observations would imply, for I used paraffin many years ago for waterproofing fabrics, and for preserving stone, iron, &c., and in 1860 I obtained letters patent for insulating, and for preserving the outer coatings of telegraph cables by its means. I would, therefore, be obliged by your giving insertion to this letter.

Your obedient servant,
J. MACINTOSH.

10, Strand, W.C., November 15.

COMPOUND GUNS.

SIR,—In my former letter I undertook to prove four propositions:—(A), That the gun patented by Mr. Parsons, in 1862, possessed defects so radical as to ensure its failure. This proposal is illustrated in fig. 1, which I have cut out of the pamphlet he issued in September, 1863. It shows a 68-pounder cast-iron gun strengthened as patented by Mr. Parsons, 5th June, 1862. The dotted lines *a* show the weak spot where the breech would break off. He describes this method of construction in his final specification, December 4th, 1862, in the following words:—"I bore out a recess, by preference of a conical form, at the breech end of the gun, larger in diameter than the intended finished size of the bore, and I fit into the recess a tube of wrought iron, steel, homogeneous metal, or other suitable material, accurately turned to the shape and size of the recess, and secure it by a breech plug screwed into the breech of the gun." With reference to the shrinkage upon the tube, he says:—"I consider that a fair fit without much pressure will effect the object desired;" and, alluding to the longitudinal strength, he says:—"The recess to receive it" (the tube) "being taken out of the centre, the sectional area of the body of the gun is so slightly reduced that it will still possess ample longitudinal strength to support the lining tube, &c. I am aware that it has before been proposed to line cast-iron guns with tubes, and to this of itself I lay no claim. This part of my invention consists in constructing and applying to cast-iron guns, tubes of wrought iron, steel, homogeneous metal, or other suitable material inserted at the breech end into a suitable recess and secured therein by a breech screw," &c.

This method of introducing the tube from the rear was the one previously followed in the manufacture of wrought-iron guns. It necessitates that the female screw thread which receives the breech plug should be cut out of the substance of the gun. In wrought-iron guns the breechpiece (i.e., that portion of the body of the gun which receives the breech screw) is made of what is termed a solid forging, so that the grain of the wrought iron may run in a longitudinal direction, and thus that the full strength of that material may be developed in resisting the longitudinal strain of the discharge. A wrought-iron gun whose breech was closed in this manner blew out its breech plug, which carried with it the surrounding portion of the breech piece, which was shorn in a plane passing through the last complete turn of the female screw thread. This is roughly illustrated in fig. 2, which was lithographed for me by Day and Sons, in December, 1862. My attention was called to this circumstance by the breech breaking off a cast-iron lined gun in a private experiment of my own, and having just previously witnessed the rupture in the wrought-iron gun at Shoeburyness, I made the experiments with screw bolts, which I shall quote further on, in order to ascertain the cause. I allude to this gun which I subsequently submitted to the Ordnance Select Committee, November 11th, 1862, in my "Treatise on Compound Ordnance," in the following words:—"The tube is perfectly sound except the breech plug, which is blown off. This plug was screwed into the tube in the ordinary manner. Had the breech end of the tube been closed in the manner shown in fig. 3, I think the plug would not have blown out." In the early part of 1863 I submitted some experiments I had made upon screw bolts (to which I shall refer under proposition D) to the Ordnance Select Committee, and pointed out that the reason the breech came off was the same as the one which caused the nuts to break off the screw bolts, namely, that in the gun the female screw, being cut out of its substance, defined a weak spot,

COMPOUND GUNS.

FIG. 1

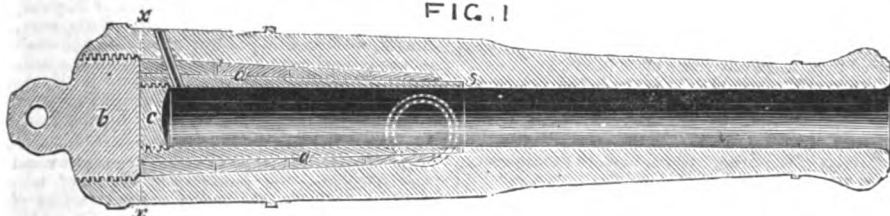


FIG. 2

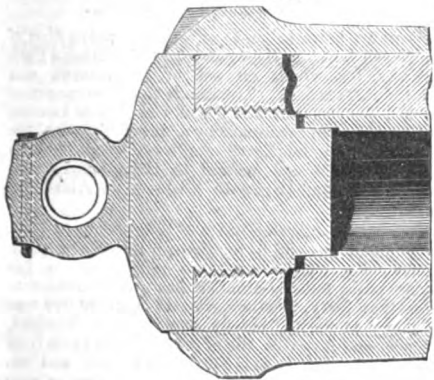


FIG. 3

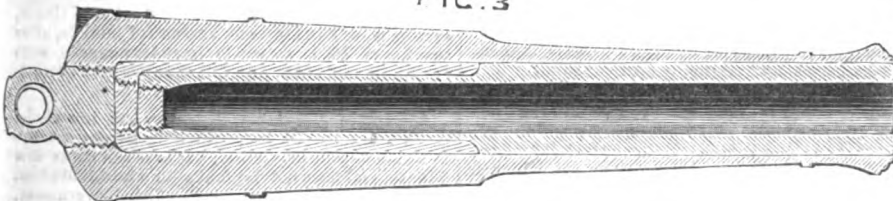
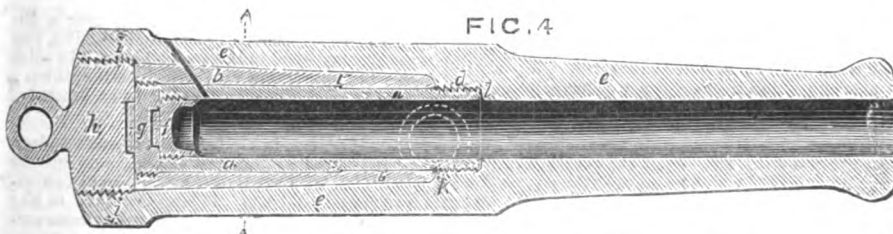


FIG. 4



in the same manner as the male screw thread, cut out of the substance of the shank, did in the screw bolt, and that hence the longitudinal stretch due to the impulsive strain, instead of being distributed in the one case along the bore of the gun and in the other along the shank of the bolt, was confined to the weak spot in each, and that, therefore, rupture took place there. The Committee shortly after gave directions that the female screw thread in the breech of every nature of muzzle-loading gun should be thrown into relief, and that the inner barrel should in consequence be introduced from the muzzle. It was, therefore, not to be wondered that they declined Mr. Parsons' proposal to line a cast-iron gun in the manner they had already discarded in wrought-iron guns. Had the inner tube been solid-ended or had it been closed by a plug taking into screw threads thrown into relief on the interior, and had it been put in from the front, so as to bear the longitudinal strain itself, the breech would then be sufficiently strong not to break off. The proposal, however, was to insert a conical tube without much pressure from the rear, the consequence of which would be that the whole longitudinal strain would fall impulsively on the cast iron, and would most certainly have broken the breech off, for it is most certain that a method which had proved fatal to a wrought-iron gun could not have succeeded in a cast-iron one. These were the defects I alluded to in September, 1863, and which I stated would be fatal to the success of the proposal.

I now come to proposition (B), "That these very defects were remedied in the gun lately taken by Mr. Parsons to France." The inner or A tube of this gun was a solid-ended steel one, and was introduced from the muzzle of the gun; the outer or B tube overlapped it at the breech end, and thus contributed its longitudinal strength to the inner tube. This gun, therefore, was very different from the one I alluded to in 1863, and hence the statement of Mr. Parsons—"I will not give expression to my opinion lest I should commit myself as Major Palliser did when he twice publicly asserted previous to the trial

of my gun that it possessed radical defects which would be fatal to its success;" implying as it does that this gun was similar to the one I alluded to—was calculated to mislead. I shall now show that Mr. Parsons became aware of the defects I alluded to; and (C) "That subsequent to that correspondence he took out a fresh patent (17th November, 1863), in which (after his attention had been called to it) he directly infringed and copied my patent in remedying these very defects." In my provisional specification dated November 11th, 1862, I said:—The breech end of the wrought-iron tube is closed by means of a screw plug the edges of which are cut with a screw. Another tube of wrought iron may be placed over the first and similarly closed by a screw plug so as to bear its own longitudinal pressure. The diameter of the screw portion or breech end of each tube is to be smaller than the diameter of the bore of the tube, in order that the extension due to the longitudinal strain may not occur in the screw threads." Before taking out my final specification, I foresaw that an attempt might be made to

embody my principle, and at the same time evade my patent, by increasing externally the thickness of metal round the screwed part. I therefore worded my final specification in general terms, which would include either an internal or external increment of metal at the breech, in the following manner:—"The next part of my invention relates to the closing of the breech end of the barrel or of guns generally. I make the barrel thicker at the breech end and run a female screw thread into it so that the distance from the bottom of the screw thread to the exterior of the barrel should be at least equal to the thickness of the tube. I then screw in a plug. When two or more concentric tubes are employed, I close each of them by a separate plug. Each plug is made to bear up against the plug in front, and thus each tube performs its share of the longitudinal work." Fig. 3 illustrates the general features of a 7-inch rifled gun, as described in this patent.

Six months after the publication of this patent, and two months after he had alluded to it, Mr. Parsons took out a fresh patent on the 17th of November, 1863, in which he says:—"I so arrange the form and dimensions of the cast-iron casing at the breech and reinforce that the area of its transverse section will be the same throughout a sufficient length thereof, and when a breech-screw is used behind the lining tube, I increase the external diameter of the metal round it sufficiently to ensure the area of its cross section being fully equal to the area of the largest part of the reinforce, so that the extension due to the longitudinal strain may be distributed over a sufficient length and not strain the metal surrounding the breech screw, or any other part injuriously."

Fig. 4 represents a cast-iron gun strengthened as patented by Mr. Parsons, November 17th, 1863. It shows (as do all the plans of this patent) "the diameter of the screw portion of the breech end of the inner tube smaller than the diameter of the bore of the tube"—these are the words of my patent. He also shows a plug screwed into his B tube, and says:—"The plug is screwed into the breech end of the tube b b, so as to bear

against the end of the inner tube a a; in like manner another tube may be added, &c. It will be seen that the effect of this arrangement will be to impart to the inner tube the longitudinal strength of those surrounding it," &c. Mr. Parsons thus not only copies the principle I laid down, but actually makes use of the same terms in expressing himself as I had done.

Next, as to proposition (D), "That the points in my patent which Mr. Parsons copied were bona fide inventions of mine, and involved a principle in applied mechanics which previously had not been clearly defined." There is a common saying that "the entire strength of a chain is to be measured by the strength of the weakest link." This is true when the chain is opposed to a statical strain, but it does not convey the whole truth when the strain becomes impulsive; and I propose to show if there be two chains, of which the one has an uniform ultimate strength of 16 tons in each link, and the other an ultimate strength of 25 tons in one link, the strength of all the other links being 36 tons, that although when subjected to a statical strain, their final strengths would be as 16 to 25, still that the strength of the first chain will be many times that of the second chain, when both are subjected to impulsive strains, such as are sometimes thrown on the cable of a ship at anchor in a gale of wind. I trust you will consider this subject of sufficient interest and practical use to excuse my commenting upon it at length. I shall therefore quote the following extracts from some "experiments" I made "On the strength of screwed bolts subjected to impulsive strains. Dublin, November 37th, 1862.—The power was applied by means of a weight of 97lb. which had a hole bored through it passing through the centre of gravity. The bolts were severally attached to a rigid iron cross beam at their upper ends and hung vertically downwards. The weight was threaded on each bolt, on the lower end of which a screw nut (larger than the hole through the weight) was subsequently screwed. The weight was lifted up the bolt until it touched the cross beam and then allowed to fall freely down the bolt till checked by the nut at the lower end." Your space would not admit of all the experiments, I shall therefore select a few:—"November 28th, 1862. No. 11. Thickness of bolts $\frac{1}{2}$ in. increased in thickness at the screwed part and screwed with 5-16 in. screw tap. First fall 1' in., did not break; stretched $\frac{1}{2}$ in. This bolt sustained seven full falls of the 97lb. weight, and broke in the shank at the eighth; it stretched in all 2 in. The falls of the weight thus varied in height from 11 in. to 13 in. No. 12. Bolt 3-8 in. in diameter screwed with 5-16 in. tap. Fall of weight 6 in. Broke first fall in last turn of screw thread. No. 13. Same as last. Fall of weight 5 in. Broke first fall in last thread of screw. December 1st. No. 23. Bolt same as No. 11, $\frac{1}{2}$ in. thick. First fall not measured, probably 14 in., permanent stretch not taken; second fall 15 in., stretched 1 in.; third fall 16 in., stretched $\frac{1}{2}$ in.; fourth fall 16 in., stretched $\frac{1}{2}$ in.; fifth fall 16 in., stretched $\frac{1}{2}$ in.; sixth fall 17 in., stretched $\frac{1}{2}$ in.; seventh fall 17 in., broke in shank of bolt. Nos. 11 and 23, bolts of an uniform thickness of $\frac{1}{2}$ in., thus sustained without breaking respectively seven and six blows of the 97lb. weight, falling on an average in the first case 12 in., and in the second about 15 in.; while the two 3-8 in. bolts, each reduced at one point to 5-16 in., broke, the first, under the first blow of the weight falling through only 6 in., and the second under a fall of only 5 in. On the other hand, the last two named bolts would be stronger when subjected to a statical strain than the first two in the proportion of 25 to 16, and yet when the strain becomes impulsive the latter prove to possess upwards of ten times the endurance of the former. I think it will be admitted that these facts involve a principle in applied mechanics that had never been previously clearly defined. The strain applied to the screw bolts was of the same nature as that which is thrown on the breech of a gun when it is fired; and the remarkable loss of strength entailed by cutting a groove round the inside at the breech end was not known until I pointed it out.

It was the knowledge of this principle and of the necessity of uniformity of longitudinal strength in a cannon, that enabled me to say in the daily press in September, 1863, "Judging from the results of my own experiments I do not think it possible that Mr. Parsons can have constructed and tested a single gun strengthened on the method he now advocates, as it contains radical defects that would be fatal to its success." Nor was the statement a rash one, since all Mr. Parsons could say in reply was—"I do not care to argue the point as to the radical defect Captain Palliser asserts my guns to possess. If he had had as much experience in dealing with metals as I have during my practice as a civil engineer for the last twenty years, he would have known better than to have hazarded such an opinion."

It is easy when a principle of this kind is clearly pointed out to apply it in many ways in practice;

thus a solid-ended steel tube would possess the same longitudinal strength as one closed by a screw plug of smaller diameter than the bore of the tube; neither is it difficult to repeat in 1865 what had been done in 1863. But I think I have shown that in 1863, at the time my gun was successfully tested, Mr. Parsons was ignorant of the proper mode of making one, and now, having coolly copied my patent, he has tried to raise a cry against me, of being a favoured individual who had been allowed to copy his invention.

I have the honour to be, Sir,

Your obedient servant,

Army and Navy Club, WILLIAM PALLISER.
November 9, 1865.

[We will afford space for Mr. Parsons to reply upon this question, but there the controversy must end.—ED. M. M.]

Meetings for the Week.

Mon.—Society of Engineers.—Discussion on Mr. V. Pennard's paper on "Locomotive Adhesion and Certain Expedients for Increasing and Supplementing that Function," 7.

Royal Institute of British Architects, 8.

Tues.—Institution of Civil Engineers.—Discussion on Sir O. T. Bright's paper on "The Telegraph to India, and its Extension to Australia and China," 8.

Wed.—Geological Society.—The following papers will be read:—1 "On Impressions of Selinite in the Woolwich Beds and London Clay," by Mr. P. Martin Duccan. 2 "On the Relation of the Fluvio-marine Orag to the Chillesford Clay," by the Rev. O. Fisher, 8.

Fri.—Architectural Association.—Reports and discussions on the Rev. O. Bonelli's paper on "Heraldry in Association with Architecture," 7.30

TO CORRESPONDENTS.

The *MECHANICS' MAGAZINE* is sent post-free to subscribers of 12s. 6d. 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 5d. 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 Editors, 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, nor necessarily for insertion, but as a proof of good faith.—ED. M. M.

RECEIVED.—W. P.—Messrs. H.—B. and T.—J. H.—J. N.—W. W.—Sec. Astronomical Soc.—W. P.—R. W. B.—R. S.—P. M. P.—T. A.

Miscellaneous.

At the Kew Observatory they have made their own standard barometers, and during some fifteen years have manufactured many standard thermometers, which have been distributed among scientific societies and the leading opticians.

We understand that a stratum of graphite has just been discovered near the Sea of Azoff, equal in quality to that of Siberia. A petroleum spring has also been found in the government of Archangel, near a stream falling into the river Betchora. The oil obtained can easily be conveyed into the interior of the empire by the ordinary roads as far as the Kama, and thence to all the governments through which the Volga passes.

The blood contains, or ought to contain, iron of which no physiologist has been able, hitherto, to define, but Mr. James Bruce writes us to say that the red particles in it are caused by phosphate of iron, for by adding this preparation of iron to blood, or to the white of an egg beaten up with distilled water a beautiful red colour is produced. Mr. Bruce further states that its presence in the blood serves the purposes of heating and thinning it, promoting its intestine motion, as well as helping it through its passages (from its superior gravity) by increasing its weight and force against them, and, therefore, any obstruction in the glands or capillary vessels must sooner be removed by such metallic particles than by those which are lighter. Iron (he adds) is the only metal friendly to the human constitution, but its use, where iron medicines are called for, must not be persevered in for any length of time, as any large excess in the blood would only serve by its pressure against the sides of the vessels to cause internal hemorrhage. This last fact was evidenced in the treatment of the cattle plague, the excrements of the cows being mixed with blood, where large doses of iron were administered, and which is not one of the recognised symptoms of the epidemic.

Some interesting facts respecting yeast have been brought before the Academy of Sciences by M. Béchamp, in a note "On the Physiological Exhaustion and Vitality of Beer Yeast." The author washed and washed globules of yeast until they appeared to be mere envelopes of cellulose, and found that they still retained the power of changing cane-sugar into glucose, and setting up the alcoholic fermentation, which proves, he considers, that the property of setting up fermentation resides in the properties of the living cellule, and is a consequence of the act of nutrition of this cellule.

A committee will shortly be appointed to experiment upon coal-cutting machines.

Some rails are being executed in Belgium for an English line now in course of construction. A contract for 1,150 tons of rails required for the Belgian State system has been let to MM. de Dordodot at £6 3s. 3d. per ton; the competition was limited to Belgian firms.

A number of ancient coins have been discovered in the course of the excavations adjoining the Bristol Cathedral. One of the officials has in his possession several Roman copper coins of a very ancient date, one of them being A.D. 117. Nearly all of them are in very excellent preservation, considering their age, and exhibit well the beauty of the coinage of such a remote time.

The much-discussed question of the locality of the Great Western Railway new Carriage Works appears to be settled at last. Negotiations have been completed with the Oxford authorities for the purchase of Cripple Meadow. The Mayor of Oxford stated at the Town Council meeting on the 9th inst. that the compact between the railway company and the Corporation had that morning been sealed. The ground at Cripple, from its low position, will have to be raised considerably before the works are erected upon it, but, in consequence of the local improvements recently effected with regard to drainage, it will only be necessary to raise it about one-half the height originally contemplated.

At Kew a magnificent spectroscope is enabling the Director of the Observatory to map the remarkable variety of lines seen in the spectrum of the sun and that of other bodies. To keep the light of the sun in the field of view of the instrument, which is placed upon a large table facing a window, a clock is made to move a reflector so as to keep the light of the sun thrown upon the object glass.

The failure of the Great Low-water Basin has led the Mersey Dock Board to initiate a new plan of dock works at Birkenhead. It is therefore intended to promote a bill to close the woodside basin, to convert the low-water basin into a wet dock, and to excavate the foreshores at the northern entrances, Birkenhead. The alterations in the basins are estimated to cost £167,000. What the excavations will cost it is impossible at present to estimate, as the foreshore at 14ft. deep comes upon solid rock; and the last bill obtained by the board provided for a depth of 17ft. It is hoped, however, that some modification of the previous act may be obtained as to depth, and thus an enormous expense avoided.

At the last meeting of the Academy of Sciences, M. Lami de Nozan sent in a paper on submarine telegraphy, in which he recommended that a tin sheath should be used to protect the core of the cable, and that this sheath should in its turn be protected by a coating of amianthus. This, he thought, would increase the duration of the cable tenfold, a matter of some importance, since a cable, as it is now manufactured, never lasts longer than fifteen months.

Deposits of hematite iron ore have been discovered in a bed of mountain limestone at Penally and Jameston, Pembroke-shire. The ore resembles the hematite deposits of West Cumberland, in which district it is found in pockets that appear to be isolated from each other, but in some instances they are connected by fine mineral veins. Samples of the ore have been analysed, and they yielded 50 per cent. of iron, which is about 10 per cent. below the yield of the Cumberland ores.

We recently referred to the hardness of the rock upon which the Mont Cenis tunnel operators had come, and we now regret to learn that a serious accident has been caused from this quality of the material. Mining has continually to be resorted to, and the stone strikes fire at the least blow. There were several miners at work, and one of them was filling a hole with gunpowder, when a spark struck from the rock, and a violent explosion took place. The fire reached several other mines ready to be exploded, and a number of the miners were killed or wounded. Such an accident, however, could scarcely have occurred without carelessness on the part of the operators.

The number of Cornish pumping engines reported for September is 31. These consumed 1,904 tons of coal, and lifted 137 million tons of water ten fathoms high, the average duty being 48,600,000lb. lifted one foot high by the consumption of 112lb. of coal. Fifteen engines exceeded the average duty.

For several years past numerous attempts have been made to discover a vein of lead which was supposed to exist at Brennard, in the forest of Bowland, and contiguous to Whitewell. All efforts were, however, unsuccessful; at any rate, although small portions of lead were here and there found, a sufficient quantity could not be obtained to justify the continuance of operations. A short time ago some men, employed in draining on the Brennard Farm, struck upon the long-looked-for vein of lead.

The French Government steam transport vessel "Dir Dôcembre," is receiving a cargo of telegraphic cable from the newly-erected factory of Messrs. Siemens, Brothers, at Charlton. The cable, the whole of which is completed, is sixty miles in length, and is intended to form the line of communication between Leghorn and Corsica.

Steps are being taken to effect the construction of the North London, Highgate, and Alexandra Park Railway, for which an act of Parliament was secured last session. The line is to commence near the Caledonian-road Station of the North London Railway, and to terminate by a junction with the Edgware and Highgate Railway, from whence running powers are secured to the company over the Edgware and Highgate Railway to Alexandra Park.

The paper manufacturers of Belgium have been very much benefited by the repeal of the paper duties. Formerly there were only four or five paper mills, but the number has now increased to more than forty, producing more than 20,000 tons of paper annually, chiefly exported to England, France, and America, the exports having risen from 1,675,527f. in 1861, to 5,559,184f. in 1860, and annually advanced since the last official statistics were taken.

It is said that the phrase "by hook and crook" originated in the fact that Messrs. Hook and Crook, surveyors, of London, were arbiters of bounds, after the fire of 1666, by which boundary marks were destroyed, and their just decisions rendered resort to law unnecessary.

A Captain Hagström, a Swede, has invented a new sort of needle-gun, which is to cut out the Prussian needle altogether. It fires ten shots in a minute, and does not get foul after a hundred shots. It has been accepted by the Swedish Government, and is to be introduced into the army.

The journey from Paris to Madrid, over a distance of 1,450 kilometres, or 906 English miles, may now be accomplished in thirty-six hours. In olden times, yet within living men's recollection, it was a feat not to be forgotten, and rather to be boasted of for a lifetime.

Mr. A. H. Allen, in a letter in the *Chemical News*, complains of the red-tapeism and mismanagement in connection with the South Kensington examinations in science and art. It appears that in May last, he came up from Sheffield for the express purpose of passing the examinations and obtaining an exhibition to the Royal School of Mines. He received notice of his success in the different subjects towards the end of June and beginning of July. After the commencement of the session, which began on October 2nd, he received a list announcing the medals he had obtained, but still no word of success or failure; so he imagined he had been unsuccessful, and entered into other engagements. A fortnight after the first lecture had been delivered, however, he was informed by letter that he had obtained a royal exhibition! It is something more than disappointing that candidates should be unable to have the reward of their exertions and expense because of the dilatoriness of some lazy Government official.

Great improvements are going on in the dockyard of Toulon. A new machine for shipping masts is being fitted up in the arsenal of Castigneau. This new apparatus, composed entirely of cast metal, rises 120ft. above the level of the sea. The longest masts may be projected by machinery a distance of 50ft. beyond the quay, and the boilers of the largest steam ship-of-war may be raised and moved in any direction by a small steam engine of 40-horse power.

During the past summer, a gentleman in Naples, Abbate by name, published an article asserting that, as the Neapolitans had not then the cholera with the actual amount of electricity in the air, and as that amount would probably increase in the autumn, they would probably escape. He now writes again to say that the electrometer shows a considerable diminution of electricity as compared with the state of the atmosphere in the summer, the presence of cholera in Naples proving the correctness of his scientific predictions, though in an unfortunate sense.

The project of a tunnel through the Alps between Switzerland and Italy, and which will also greatly facilitate the intercourse between the latter country and Germany, appears to be rapidly ripening, and it is confidently affirmed in official quarters that within a very few months the work will have begun on the side of the St. Gothard.

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 solely 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—

BOILER AND FURNACES,—1066, 1095, 1133
BUILDINGS AND BUILDING MATERIALS,—1033, 1096, 1190, 1135
CHEMISTRY AND PHOTOGRAPHY,—1076, 1098
CULTIVATION OF THE SOIL, including agricultural implements and machines, —1104, 1123, 1124, 1134
ELECTRICAL APPARATUS,—1089
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c.,—1070, 1014, 1086, 1087, 1094, 1116, 1126, 1127, 1129, 1142
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, —1077, 1105, 1118
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.,—1069, 1073, 1080, 1089, 1106, 1110, 1121, 1128, 1140
GENERAL MACHINERY,—1085, 1099, 1119
LIGHTING, HEATING, AND VENTILATING,—1072, 1074, 1109
METALS, including apparatus for their manufacture, —1081, 1082, 1100, 1122
MISCELLANEOUS,—1068, 1101, 1111, 1117, 1126, 1132, 1137, 1139, 1141
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.,—1075, 1078, 1090, 1091, 1097, 1113, 1114, 1115, 1120, 1131
SHIPS AND BOATS, including their fittings, —1067, 1083, 1107, 1118, 1138
STEAM ENGINES, &c.,—1079, 1112
WARFARE,—1071, 1092, 1102, 1103, 1136

1066 J. M. COURTAULD. *An improved safety apparatus for steam boilers.* Dated April 15, 1865
This invention consists in the employment of a copper or other suitable metal tube carried through the upper part of the boiler, and descending below the proper working water level therein, and in connecting to the upper part of the tube carried to a greater or lesser height from the top of the boiler a rod which, by the expansion of the tube, acts upon a safety valve when the water falls below the proper level, and allows steam to escape from the boiler. *Patent completed.*

1067 C. R. FISHER. *A new and useful or improved mode of connecting a gaff to the mast of a navigable vessel.* Dated April 15, 1865
This invention relates to a peculiar mode of applying a gaff to the mast of a vessel, and consists in encompassing the mast with an annular or band, and so connecting the gaff to such band that it (the gaff) may not only be freely turned in either a horizontal or vertical plane, but during the act of either raising or lowering the sail, the said band shall be caused to maintain, or nearly maintain, its concentricity with the mast, whereby not only a great amount of friction, time, and physical power is saved in working the sail, but a great saving in the wear and damage both to the mast and gaff is effected. *Patent completed.*

1068 W. CLARK. *Improvements in the manufacture of a compound or material to be used as a substitute for india-rubber.* (A communication.) Dated April 15, 1865
The patentee claims the use of resins or balsamic substances (as copal, pitch, tar, or their equivalents) with sulphur or its vapour, and the application of heat, in combination with gish or gelatinous substances, whether with or without other ingredients, for the purpose of vulcanising or solidifying such gish or gelatinous substances or compositions, in order to impart to them qualities similar to vulcanised india-rubber, as described. *Patent completed.*

1069 T. E. HARDING. *A new or improved table and support for invalids.* Dated April 15, 1865
This invention relates to the construction of a new or improved table and support for use by invalids, to enable them to rest in bed in an inclined position, and to employ the table for the purpose of writing or reading, needle-work, and other such like objects of amusement. The inventor proposes to construct these supports in such manner that they shall fold close up into a flat and compact body, and also to dispense with cushions as forming part of the support as manufactured. *Patent abandoned.*

1070 M. SMITH. *Certain improvements in looms for weaving.* Dated April 17, 1865
This invention consists, first, in means for remedying the stoppage of the loom simultaneous with the action of the weft motion; second, in combining with the weft motion a driving pulley loose on the driving shaft, and connecting it thereto by a clutch box. The lever which gives the lateral motion to the driving pulley applies a brake to the crank shaft, thereby suddenly stopping the loom when the weft breaks; third, in making the jacks with an open slot fitting on the fulcrum stud, and in holding the jacks by a pin acting on the top part thereof. By this means the jacks can be removed from the loom when requisite without taking the whole set of jacks down. The invention further comprises improvements in the loom for weaving figured or plain leno, and other crossed fabrics. *Patent completed.*

1071 A. HENRY. *Improvements in breechloading firearms.* Dated April 17, 1865
We cannot here give space to the details of this invention. *Patent completed.*

1072 T. NEWSTING AND A. HINDLE. *Improvements in wet gas meters.* Dated April 17, 1865
This invention consists in making the box or case enclosing the index or registering mechanism tight against the atmosphere, or so as to prevent the air enclosed in it from escaping, which will thus resist the gas pressure, and will prevent the water in the meter from rising up the tube which encloses the shaft giving motion to the registering mechanism. *Patent completed.*

1073 J. J. MATTHEWSON AND H. L. R. SCHLEE. *Improvements in rotary aerial swings.* Dated April 17, 1865

This invention relates to swings which rotate in a vertical direction upon an axis mounted horizontally in vertical supports or standards, and consists, first, of an improved mechanical arrangement for imparting rotary motion thereto. Upon the ground, and concealed within an ornamental Swiss cottage, the inventors arrange a system of wheel-work worked by a winch handle, and in connection therewith they arrange a pulley, over which, and also over another pulley fixed on the axis of the swing, they pass an endless band, by which they transmit a rotary motion from below to the swings above. A further improvement in rotary aerial swings consists in adapting over each of the several cars of the swing a small balloon having an airtight cover fixed over a light framework, and they either inflate the said balloons or not. The use of these balloons is to allow the wind to act thereon, and assist in turning the swing upon its axis. *Patent abandoned.*

1074 L. DE ST. OMER. *Certain improvements in gas-ammoniacal engines.* Dated April 17, 1865

This invention consists in certain improvements in ammoniacal gas engines, whereby the same water is used again and again. *Patent completed.*

1075 E. AND G. H. MORGAN. *Improvements in apparatus for covering railway trucks or vans and other carriages.* Dated April 17, 1865

For this purpose the ends of a truck or van, or other carriage are, by preference, made semicircular at the top, and to stand up considerably higher than the sides, but this is not essential in all cases. On these, or other suitable ends, are centres or axes; each centre or axis has on it two radial arms, which are connected together in pairs at their outer ends by two horizontal bars passing from end to end of the truck, or van, or other carriage; thus two frames are formed, and to these are fixed the tarpauling, or other covering material, which is divided into two sheets, one edge of each sheet being fixed all along the horizontal bar of one of the frames; the other edge of each of the covering sheets is fixed along the upper edge of the side of the van, or truck, or other carriage. Thus it will be seen that, when the radial arms are down in their lowest position on each side of the van, or truck, or other carriage, the covering sheets are folded up close against the sides of the van, or truck, or other carriage, which is then open; but when the radial arms are raised to an upright or vertical position, or somewhat beyond, the two sheets meet over the middle of the van and form an arched roof over it. The ends of the covering sheets are retained by having rings fixed upon them, which rings slide along guide rails or cords fixed to the ends of the van. *Patent completed.*

1076 J. DOUGLAS. *Improvements in apparatus for distilling hydrocarbons from coals, schists, and other minerals.* Dated April 17, 1865

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

1077 A. W. HALE. *Improvements in machines for cutting or mincing meat, suet, and other substances.* Dated April 17, 1865

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

1078 G. W. GARROD. *Improvements in the means of communicating and signalling between the passengers, guards, and drivers of railway trains.* Dated April 17, 1865

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

1079 F. O. BAKWELL. *Improvements in cushions for steam cylinders.* (A communication.) Dated April 18, 1865

The patentee claims the use of a movable disc or independent piston seated in the steam cylinder above the working piston, with a steam space between it and the cylinder head, through and into which the live steam from the boiler is caused to pass on its way into the steam chest of the engine, for the purpose of forming a steam cushion and to increase the efficiency of the steam engine or steam hammer, as described. *Patent completed.*

1080 J. O. A. HENDERSON. *An improved manufacture of ladies' skirts.* Dated April 18, 1865

This invention consists in means of constructing ladies' skirts, whereby the metallic hoops may be extended or diminished as required. *Patent abandoned.*

1081 J. J. JENNIS. *Improvements in the manufacture of tin and terra plates.* Dated April 18, 1865

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

1082 J. TODD. *An improved machine for straightening, bending, curving, and circling beams, bars, and plates of iron or other metals.* Dated April 18, 1865

The patentee constructs these machines with vertical shafts and changing rolls, the latter having grooves, channels, or hollows in their peripheries formed as the shape or transverse section of the iron or metal to be operated upon may require. The rolls are keyed on to vertical shafts, two of which, carrying a roll each, revolve in vertical fixed bearings, and are turned by wheels or screws driven by steam or other power, and one of which shafts, carrying a third roll, revolves in vertical sliding bearings, so that the last named shaft and roll are adjustable to a greater or less distance from the first mentioned shafts and rolls by screw gearing and hand wheel. The top and bottom bearings are housed in metal frames which, by preference, are connected by pillars of wrought iron. The upper bearing frame forms a table upon which the beams, bars, rails, and the like rest as they are passed between the adjusting rolls on one side and the fixed rollers on the other towards and backwards, by which motions the required circle, curve, or bend is formed, or the straightening operation is effected. *Patent completed.*

1083 W. BEDDER. *Improvements in the construction of ships or vessels.* Dated April 18, 1865

This invention consists in supporting a can or vessel above the water level on axles or shafts passed through rotating hollow airtight drums or cylinders which, are caused to revolve on their axles by steam or other motive power. The car or vessel to carry passengers and freight is supported by the axles or shafts of the drums or cylinders, which, by their buoyancy, keep the car or vessel suspended above the level of the water. *Patent completed.*

1084 T. WHITEHEAD AND N. NUSSEY. *Improvements in machinery for combing, preparing, and drawing wool or other fibrous materials.* Dated April 18, 1865

This invention relates to a novel construction of feeding head, from which the fibres are carried by a nipper or other holder to and placed upon a circular comb of the ordinary construction, from which they are delivered or drawn off in the separated forms of top nippings and noil. *Patent completed.*

1085 J. GARDNER, R. LEE, G. H. WAIN, S. AND C. HANCOCK, and S. HANCOCK, jun. *Improvements in the manufacture of malleable iron sheaves and bushes for pulley blocks.* Dated April 19, 1865

In performing this invention the patentees cast from patterns of the required shape, in malleable cast iron, a sheave or bush, provision being made in each case for the section of a series of rollers, which rollers are placed in the body or centre of the sheave or bush, and revolve upon the sheave pin, and are kept apart in the following manner:—They make use of two metallic rings, with cone or other centres cast on to correspond with concave or hollow rollers, and protected by grooved plates in which they revolve. *Patent completed.*

1086 J. E. H. ANDREW. *Certain improvements in looms for weaving.* Dated April 19, 1865

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

1087 R. A. BROOMAN. *Improvements in machinery for the manufacture of lace.* (A communication.) Dated April 19, 1865

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

1088 R. A. JONES AND J. HEDGES. *Improvements in and apparatus for communicating intelligence by means of electricity.* Dated April 19, 1865

The patentees claim, first, a board or frame of suitable non-conducting material, which they call a "tablet," having its surface inlaid with pieces of metal, representing the "dots" and "dashes" of the "Morse" alphabet, or the dots, dashes, and long strokes of our characters, the said pieces of metal being in connection with the electric or magnetic battery or batteries used in sending the message. Second, the use of a long stroke in conjunction with the dot and dash used in forming the Morse alphabet, as described. *Patent completed.*

1089 J. MERRITT. *Improvements in inkstands.* (A communication.) Dated April 19, 1865

This invention consists in combining with an ink reservoir a diaphragm valve, flexible, so as to be capable of assuming a convex or concave form, for withdrawing the ink from, or forcing it into the dipping cup. Also in forming the diaphragm valve for operation as above referred to, of a concave or convex vulcanised india-rubber disc, in combination with a central knob, the whole being secured in a suitable metallic or other frame. *Patent abandoned.*

1090 W. RIDDELL. *Improvements in the means of covering railway trucks, vans, and other carriages.* Dated April 19, 1865

This invention consists in the use and adaptation of flexible or revolving shutters for covering railway trucks, vans, &c. *Patent abandoned.*

1091 F. W. GILBERT. *Improvements in "pulleys" used by brewers and others for lifting and lowering weights into and out of casks, waggons, or trucks.* Dated April 19, 1865

This invention consists in adapting to brewers' pulleys rollers, furnished each with a rack and pawl at one or both ends thereof, the said racks and pawls being so arranged as to allow the aforesaid rollers to rotate only in one direction if necessary. *Patent abandoned.*

1092 G. T. BOUSFIELD. *Improvements in breechloading firearms.* (A communication.) Dated April 19, 1865

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

1093 M. VOGL. *Improvements in machinery for cutting and dressing stones and other hard substances.* (A communication.) Dated April 19, 1865

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

1094 J. HALL, W. DUNKERLEY, AND S. SCHOFIELD. *Improvements in machinery for carding cotton and other fibrous substances, and for doubling yarns.* Dated April 20, 1865

Provisional protection has not been granted for this invention.

1095 J. HOCKING, jun. *Improvements in apparatus for preventing explosions in steam boilers.* Dated April 20, 1865

Provisional protection has not been granted for this invention.

1096 H. K. TAYLOR. *Improvements in indicators and fastenings for waterclosets and other purposes.* Dated April 20, 1865

This invention consists in mounting a sliding door, shutter, or screen in a suitable frame to close an aperture or window formed in the door, wall, or other part of a closet or other private room or place to which this invention is applied. When the closet or room is unoccupied, the sliding door, screen, or shutter is kept back by an india-rubber spring, or by other means, so as to uncover the aperture or window through which the interior can be seen. To the sliding door or shutter a catch, latch, bolt, or other fastening is applied, which is the means employed for fastening the door of the room or closet when occupied, the act of fastening the closet door being also the means of closing the aperture or window by closing or drawing the door, screen, or shutter over it, the word "engaged," or other suitable device, placed on the exterior thereof indicating to those outside that the place is occupied. *Patent completed.*

1097 D. HANCOCK AND T. EVANS. *Improvements in apparatus for communicating and signalling between passengers, guards, and drivers of railway trains by day or night.* Dated April 20, 1865

This invention consists in a method of placing, by preference upon the roofs of railway carriages, a whistle which is set in action by the movement of bellows, and in indicating to the guard or driver of the train the particular carriage from which the signal is made by means of coloured glasses or plates at the sides of the carriages. *Patent abandoned.*

1098 E. SMITH AND O. SIEBERG. *Improvements in obtaining colouring matters.* Dated April 20, 1865

This invention consists in obtaining colouring matters which yield various shades of violet by dissolving one part by weight of rosaniline, or of a salt of rosaniline, in a mixture of about two parts by weight of alcohol or methylated

spirit, and about two parts by weight of iodide of the radiol of acetone, and heating the whole in a closed vessel to from 215 deg. to 250 deg. Fahr. for four or five hours. The colour is of a bluish shade the longer the heating is continued. The iodide of the radiol of common acetone, such as is obtained from acetate of lime, is preferred, but iodides of other radiol of the acetone series will also answer. Bromides of the same radiol may also be used instead of iodides. *Patent abandoned.*

1099 M. HOUTSEPIAN. *Certain improvements in pumps.* (A communication.) Dated April 20, 1865.

The invention is designed for the purpose of obtaining the suction required in pumps without friction by means of the rise and fall of an inverted bell or cylinder in an annular cylindrical space containing mercury. The novel arrangement and construction of apparatus constituting the pump consists of an annular space formed by two hollow vertically-fixed cylinders surrounding each other in which a column of mercury is contained, and into which is lowered and placed the open end of an inverted bell or hollow cylinder, which is caused to rise and fall by being attached to the working connecting rod of the pump; the inner fixed cylinder is closed at the top by a valve, as also is the inverted bell or hollow cylinder, the action of which, when being raised, causes the mercury on its outer surface in the annular space to be depressed by the atmosphere, and to rise in the annular space formed between the inner fixed cylinder and the inverted cylinder, thereby (through the medium of the air and watertight joint so formed) producing a vacuum in the interior of the inverted and inner fixed cylinders, which being in connection with the suction pipe of the well, fills with liquid, so that, when the inverted bell or cylinder descends or falls, the valve immediately closes on the top of the inner fixed cylinder, and the water is ejected through the valve in the cover of the inverted bell or cylinder into the outer fixed cylinder, from which it is finally discharged through an outlet in the same in one continuous stream. *Patent completed.*

1100 T. HAMPTON and J. ABBOTT. *Improvements in casting and working so-called "Bessemer steel ingots."* Dated April 20, 1865.

The patentees claim the casting of Bessemer steel ingots in rectangular parallel-sided moulds, divided lengthwise at diagonally opposite corners, by which they are enabled to remove the ingot easily from the mould, and to divide and cut the same up into lengths directly after the metal has sufficiently set, and whilst it is hot, so as to obviate the necessity for reheating the ingot for the purpose of dividing the same. *Patent completed.*

1101 W. CLARK. *Improvements in taps or stopcocks.* (A communication.) Dated April 20, 1865.

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

1102 F. A. ABEL. *Improvements in explosive compounds.* Dated April 20, 1865.

This invention has for its object to assimilate, and consists in means for assimilating, the physical condition of gun cotton as nearly as possible to that of gunpowder, by mechanically converting it into a solid conglomerated state, and imparting to it either a granular or other suitable form that will present the exact amount of surface and compactness required for obtaining a certain rapidity or intensity of combustion. *Patent completed.*

1103 W. HALE. *Improvements in rockets.* Dated April 20, 1865.

The patentee accomplishes one of these improvements by dispensing with the central aperture described in the specification of a former patent granted to the present patentee, from which the egress of the gas has no other effect than to propel the rocket forward, and thus a great part of the force of the gas is ineffectual to give rotary motion; and in the arrangement previously patented the three apertures with half tubes projecting had to be placed so far distant from the axis of the rocket, as to render it necessary to rivet in the cast-iron base (having the three apertures and central aperture formed in one piece) after the rocket was charged, an operation which was liable to loosen the composition from the inside of the case, and so materially injure the rocket. In the present invention, by dispensing with the central aperture, and bringing the three apertures with the half tubes near the axis of the rocket, and making this part a separate casting, the patentee is able to rivet in the base of the rocket before charging. The central part of the base is previously bored out and tapped to receive the separate casting, upon which a thread is cut to suit, and thus the separate casting can be screwed in at any time after the rocket is charged. In charging the rocket, a plug the thickness of the base is inserted in the central aperture for the purpose of filling up this aperture for the time, and it is afterwards withdrawn, and the rocket bored up in the ordinary way. By adopting this plan, the composition after being driven remains perfectly undisturbed, and the difficulty referred to as existing in the former patent is entirely obviated. *Patent completed.*

1104 D. GREGG. *Improvements in machinery for cultivating land and cutting crops.* (A communication.) Dated April 20, 1865.

The patentee claims combining certain implements in such manner that the times when at work come one behind the other, so that no time is working in solid land by which much less power is required for working the implement. *Patent completed.*

1105 W. BEAVER. *Improvements in apparatus for screening, sifting, or riddling corn, grain, and seed.* Dated April 20, 1865.

For these purposes the perforated or reticulated surface of a screen, sieve, or riddle used in screening or separating corn, grain, or seed, is formed with alternate ridges and furrows which run in a direction from one end to the other of such surface. The corn, grain, or seed is fed or supplied at one end of the surface, and any grains or substances which do not fall through the screen, sieve, or riddle are delivered at the other end. A to-and-fro or shaking motion is communicated to the screen, sieve, or riddle in a transverse direction to that in which the grain or seed moves from end to end of the surface. On the under side of each of the ridges a flap is suspended, so as to hang downwards, in order that in the to-and-fro motion given to the screen, sieve, or riddle, the flap on each ridge may alternately strike first against one side and then against the other side of the angular ridge below which it is suspended. *Patent completed.*

1106 W. ROBINSON. *Improvements in jacks used when seating and baking.* Dated April 20, 1865.

For the purposes of this invention a crank or its equivalent is applied to the last axis or wheel of an ordinary

train used in the construction of such jacks. To this crank or instrument a connecting rod is attached, which, at its other end, carries a screw nut which, with the connecting rod, is guided by suitable guides in the to-and-fro motion communicated to the connecting rod. The screw nut is thus moved to-and-fro along a screw shaft or axis, by which such shaft or axis receives an alternating rotary motion. To one end of the screw shaft or axis the ordinary suspending yarms are attached, and to the other end of the screw shaft or axis the ordinary suspending apparatus for the meat or other article is attached. *Patent completed.*

1107 H. CAUDWELL. *Improvements in the construction of ships of war and floating batteries, part of which improvements is applicable to land fortifications.* Dated April 20, 1865.

This invention relates to the construction of the broad-sides of vessels of war and land or floating batteries, in such a manner as to deflect all projectiles that strike them, and causes such projectiles to pass through or into passages provided for the purpose, so that they may pass over, under, or through such passages without penetrating to the interior or habitable part of the vessel or fortification. By means of this peculiar construction of broadside greater strength in vessels of war is ensured, so that they will be enabled to resist the effects of side waves. The invention also relates to means whereby the destructive effects of galvanic action upon armour plated vessels may be prevented. Other improvements relate to the application to certain parts of such vessels of the attractive force of magnetic electricity; also to improved means of steering such vessels. *Patent completed.*

1108 J. Y. BETTS. *Improvements in the baking of bread, biscuits, and other farinaceous articles.* Dated April 20, 1865.

The patentee secures several advantages by the introduction and use of steam in a peculiar way in the oven, which should be a close one, and may be heated in any well-known or approved manner. *Patent completed.*

1109 F. WISE. *Improvements in gas regulators and valves for the same.* (A communication.) Dated April 20, 1865.

This invention consists, firstly, in the use in gas regulators of a holder of the tapering form described hereafter, so that as the said holder falls the pressure of gas in the outlet pipe shall be increased to compensate for the increased friction of a large amount of gas demanded for a large number of burners in extended gasfittings. The invention consists, secondly, of a valve having a stem or tail, in which are formed two or more excavations or depressions of different lengths, and arranged so that on removing the valve from its seat, the longest excavation may form the communication for the passage of fluid prior to the fluid escaping along the shorter excavation. The improved valve will thus prevent for the escape of the gas openings increasing in number and area as it (the valve) is removed from the seat. *Patent completed.*

1110 T. GREAVES and J. S. WRIGHT. *Improvements in the manufacture of buttons.* Dated April 21, 1865.

This invention consists, firstly, in the construction of bar brace buttons, as hereafter described. The patentees take a brace button made in the ordinary and well-known manner, having a bar across the centre, over which bar they place a separate piece of metal, which loose piece of metal they close or turn over on the under side of the bar, so as to form a tube or roller encircling the bar. This tube or roller presents a smooth surface over which thread is sewn when attaching the button to the garment. The invention consists, secondly, in the application of a covering piece of metal to brace buttons having three or more holes, as follows:—They take a thin piece of metal cut to the requisite shape, and force the edges through the holes, and close or turn them down on the under side of the button; by these means they cover the sharp edges of the holes, and obtain a perfectly smooth surface for the thread to pass over. *Patent completed.*

1111 D. S. BUCHANAN. *Improvements in protecting letters, numerals, and ornamental designs on glass.* Dated April 21, 1865.

According to this invention letters, numerals, and ornamental designs of gold, or other metallic leaf, or of paint secured to or formed on sheets of glass in the usual way, and through which they are to be seen, are coated over with copal or other varnish or other adhesive substance. They are then covered over with or protected by letters of tinfoil or other thin sheet metal cut to the desired form, and when the varnish or other adhesive substance has "set" the edges are cleaned off. *Patent completed.*

1112 E. T. HUGHES. *An improved packing for steam cylinders, stuffing boxes, and closed vessels containing water, air, or gases, and for other similar purposes.* (A communication.) Dated April 21, 1865.

This improved packing is intended to replace with great advantage and economy that now in use composed of hemp or tow, and soaked in grease or oil. The packing is formed of bands of paper of a circular or other suitable form, and the bands are soaked in boiling water until perfectly softened, after which they are placed one upon another around the piston and in the stuffing box to the required thickness. Thus prepared, this packing requires neither oil nor grease, and it is also much cheaper and more durable and efficient than any other known packing. *Patent abandoned.*

1113 E. WILSON. *An improved lamp or signal for calling cabs or other vehicles by day and night.* Dated April 21, 1865.

This invention consists in the employment of a lamp or signal constructed in the following manner:—The patentee forms a metal frame of an oblong shape, the sides of which are composed of glass, talc, or other transparent material, while both ends are of metal, one of which is hinged to act as a door. The base of the lamp is made of metal, by preference perforated, and on its inner side it carries a tapering guide, on or in which a holder for the reception of oil or other liquid capable of burning and affording light or supporting a candle is free to slide. To the outer sides of the base plate he attaches wires, which are bent into a circular form and grasp each corner in order to afford a firm support for the lamp. When set on a stand or other resting place, he prefers wires for the sake of lightness, but plates may be used. The upper part of the frame of the lamp carries a canopy with a handle on the top, and hooks on each side, the latter being used for suspending the lamp. The glass or talc sides of the lamp are coloured differently, say red on one side and green on the other. On the canopy over the red colour he writes "Hansom Cab," and paints a large H on the red glass.

On the other side of the canopy, and over the green colour, he writes "four-wheeled cab," and paints a large O on the glass. *Patent completed.*

1114 W. DAY. *Improvements in wheels, and manner of applying the same to railway carriages for passenger and guards' traffic, as also the leading wheels for locomotives.* Dated April 21, 1865.

This invention principally consists in a method of so mounting or arranging the wheels of railway carriages that they may revolve independently of each other. *Patent abandoned.*

1115 A. C. HERMANN. *A balance with index for weighing railway passengers' luggage.* Dated April 21, 1865.

The apparatus consists of a vertical beam resting by means of wedge-shaped bearings or knife edges on two horizontal steel bearings. An arm projects perpendicularly from the beam at a point just below its bearings, and is provided with a similar knife-edged rest, from which a rod descends with a hook for carrying the scaleboard or tray and article to be weighed. A counterweight is set at the lower end of the vertical beam, and thus the centre of gravity of the whole of the moving part of the apparatus is just above the counterweight. A slot is formed in the upper part of the beam in which a pulley or roller is arranged and fastened to a travelling carriage supported on a horizontal rail, the upper part of which is formed of a rack into which a pinion gear, carrying a pointer or hand on the face of an index. When the horizontal arm is weighted, the vertical beam assumes an angle in proportion to such weight, and the traveller is moved accordingly, thus moving the index pointer to the divisions of the indicator, and showing the weight of the article in the scale. *Patent completed.*

1116 J. CHAMPION and J. B. SHEERMAN. *Preparing, spinning, and doubling cotton, flax, wool, silk, and other fibrous material.* Dated April 21, 1865.

This invention is carried out as follows:—In the spindle, bobbin, bolster, or lifting rails are fixed tubes or bolsters in which the spindles revolve, and in or on the collars of the said tubes are formed or placed round or square cups in which the bottom ends of the bobbins revolve. Or a bush projecting below the end of the bobbins, running in the round or square cups, is formed or placed in or on the bobbin, bolster, or lifting rails. By these means the inventors gain speed and a better drag on the yarn. *Patent abandoned.*

1117 W. SCARBATT and W. DEAN. *Improvements in taking impressions from the grain of wood, and in transferring the same on to various surfaces.* Dated April 21, 1865.

For these purposes, supposing a board of oak or other wood is to be employed, its surface is to be evenly planed, and it is coated over on both sides with a solution of pearl ash, composed of one ounce of American pearl ash to one quart of hot rainwater; or other caustic material which hardens the same and opens the pores may be used. The surface from which the impressions are to be taken is then to be sand-papered and well rubbed over with raw linseed or other oil, when it will be in a fit state to print from. The pores of the wood are cleaned and kept open by brushing the surface of the wood to be printed from with a common scrubbing or other brush, using therewith mineral turpentine or naphtha or common turpentine, or a mixture of any of these articles. If the pores or grain on the surface of the board should clog up or fill with the printing material by being printed from, so as not to give off clear sharp impressions, it is cleaned as above, and then well rubbed with sawdust, which effectually cleanses and opens the pores of the wood. Again, if through neglect the colour should set in the pores of the board, it must be coated over with soft soap and a solution of soda or pearl ash; it must remain on eight or nine hours, and then the board must be well scrubbed with hot water. *Patent completed.*

1118 R. GRIFFITHS. *Improvements in apparatus for propelling vessels.* Dated April 21, 1865.

This invention consists, first, in mounting a series of blades or vanes behind the screw-propeller upon which the water driven aft by the screw impinges and acts, so as to impart rotary motion to such blades or vanes. The power thus obtained by the action of the water driven backwards from the screw-propeller in an angular direction from the line of the screw-shaft or axis, is transmitted from the boss or axis of the blades or vanes by means of toothed wheels or other suitable gearing to the screw-propeller shaft, so as to aid in propelling the vessel. The second part of the invention consists in forming the forward edges of the blades or vanes of corresponding contour to the contour of the back of the blades of the screw-propeller, so that the back of the screw may revolve in close contact with the edges of the blades or vanes, in order that the water may act upon the face of the vanes at the same time as it is driven by the blades of the screw-propeller. *Patent abandoned.*

1119 G. WILLOCK. *Improvements in oiling cans.* Dated April 21, 1865.

This invention has for its object the combination of an oil feeding can with a light, to enable engineers and others to oil machinery in the dark. With this view the inventor places a small oil or other burner in the front part of the can, and immediately behind the burner he places a small reflector; the nozzle or duct through which the oil is poured is in front of the light, and, consequently, the light is always thrown forward on to the part of the machinery to be oiled. The reservoir of oil is placed behind the light, and is furnished with a suitable handle and spring stop, and the supply pipe to the nozzle passes from the reservoir under the light to the front of the apparatus; a small chimney over the light provides for the escape of the smoke. *Patent abandoned.*

1120 H. E. NEWTON. *Improvements in invalid carriages.* (A communication.) Dated April 21, 1865.

The object of this invention is so to construct carriages, omnibuses, and other vehicles, as to make them impervious to the exterior air, and thus to preserve in the interior air more or less compressed, as may be thought advisable for the transport of certain classes of invalids. To effect this the carriage is made of strong and tenacious wood, the different parts of which are strongly jointed and screwed together, and then covered with sheet iron of a sufficient thickness to resist a considerable pressure. Where the iron and wood join, caoutchouc or other like suitable material may be introduced, so as to render these parts completely airtight. Caoutchouc or other suitable material is also put round the doors and windows of the vehicle for the same purpose. *Patent completed.*

1121 G. G. W., and J. BETTMANN. *Improvements in cases or receptacles for matches, stamps, cards, and other articles.* Dated April 21, 1865.

This invention consists in constructing cases or receptacles for matches, stamps, cards, and other articles of two cylindrical, oval, or other conveniently shaped cases, one of which is made to slide within the other. The outer case is closed at one end, and the inner case at both ends; a recess is formed in that end of the inner case which comes against the closed end of the outer case, to receive a spiral or other spring. A portion of the side of the inner case is removed in order that matches, stamps, cards, or other articles may be placed therein and taken out as required. One of the cases carries a pin or stud which slides in a slot in the other case and acts as a guide. To close the case the inner case is pushed into the outer case to the further end thereof, when a spring catch takes into a hole in the inner case and holds it; to open the case a button or stud is pressed down to release the catch, when the spiral or other spring will force out the inner case and expose the articles therein; the slot before mentioned does not extend to the end of the case, so that the inner case is prevented coming out altogether. *Patent abandoned.*

1122 R. CANNAN. *Improvements in machinery for moulding and making cores for moulding or casting metals.* Dated April 21, 1865.

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

1123 O. HALL. *Improvements in engines, machinery, and implements employed in ploughing and tilling land.* Dated April 21, 1865.

This invention is described and illustrated at page 266 of the present volume of this journal. *Patent completed.*

1124 O. C. EVANS. *Improvements in digging machinery.* Dated April 22, 1865.

This invention has reference to a former patent. The patentee claims the mode and manner of forming the inclined plane of the chain by means of only one roller to each drum wheel; the flanged discs for purposes to which they are applied; the method of securing the teeth in the links; and the general construction of the machine, as described. *Patent completed.*

1125 E. LORD. *Improvements in machinery for preparing and spinning cotton and other fibrous substances.* Dated April 22, 1865.

This invention consists in an improved mode of constructing rollers for opening and preparing cotton and other fibrous substances in an unmanufactured or manufactured state. The rollers are made of two-end discs fixed on an axle, and a series of intermediate rings which are tenoned together and to the two-end discs; on these discs or rings are cast or fixed sets of teeth, which are hardened by chilling, or otherwise; the teeth are set on the rings and discs so that they set at different parts of the circumference of the roller, and they are square at each end, so that, when blunted by wear, they can easily be ground to sharpen them. In long rollers one or more intermediate discs may be applied to increase the strength. The axles of these rollers revolve in bearings having a shoulder or projection at each end to retain the oil or other lubricating material, and the necks of the axle are increased in diameter where they fit in the bearings. This increased diameter of the neck prevents the lateral motion of the axle, in the same manner as the collars usually applied to the axle. *Patent completed.*

1126 E. S. BEAUX and E. PANNIFER. *A new process of tanning leather and other skins.* Dated April 22, 1865.

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

1127 J. H. WILSON. *Improvements in spools or bobbins to be used in certain frames for preparing fibrous materials for spinning.* Dated April 22, 1865.

This invention relates to stubbing, roving, or jack frames or to preparing machinery where the sliver is wound upon the bobbin or spool by a flyer, and more particularly to such frames as wind the material into a form having taper or conical ends which is the result of shortening the length of the traverse as the material enlarges in diameter, and consists in making the bobbins or spools of larger diameter at that part where the absent layer occurs to such extent as will compensate for the deficient layer, so that the second layer will be wound in its entire length of traverse upon a surface of uniform diameter, by which means the slack winding will be obviated. *Patent completed.*

1128 J. EMART. *Improvements applicable to capes, paletots, overcoats, and other such like garments.* Dated April 22, 1865.

This invention relates to certain improvements applicable to capes, paletots, overcoats, and other such like garments, and consists in attaching inside the garment, and below the collar or neck, a supplementary band or strap of similar fabric to the garment, or of leather, silk, or other convenient fabric. This band or strap is provided at the extremities with a button hole or other fastening for the purpose of securing the garment to the body of the wearer when the ordinary fastenings are undone or left loose with a view of allowing the garment to fall back behind the shoulders, so as merely to cover or be suspended from the back of the wearer. By this means the necessity of entirely removing the garment and carrying the same on the arm when the temperature requires only a partial covering, is avoided; or if, during exercise, the wearer finds a close garment unnecessary warm, he has simply to loosen the ordinary fastenings in the same manner. About midway between the attachment and the extremities of the band or strap a button hole is formed on such band, and corresponding buttons are sewn to the interior of the collar piece of the garment, in order to limit the extent to which the garment may fall open or back. *Patent completed.*

1129 C. J. and J. A. KERNAN. *Improvements in the manufacture of articles of lace or net fabrics.* Dated April 22, 1865.

In order to produce mittens, gloves, and similar articles in the lace machine, the patentees so work the machine as to produce simultaneously a front and back fabric, one half of the bobbin or carriage threads and one half of the warps working in each fabric; thus, if the machine work with a single tier of bobbins, every alternate bobbin, say the even numbers, will work to produce the front fabric, and the odd numbers the back fabric. These two fabrics are united together at intervals, to form tubes by warps threads working into both the fabrics. In this way a series of tubes are formed, each, say, of a diameter suitable for the upper part of a mitten or glove, and these tubes are connected together into a sheet from side to side of the

machine. If a mitten or glove is to be produced, it is necessary, after working for a sufficient time at the upper part, to divide up this tube into smaller tubes, to receive the thumb and fingers, and this is readily done by means of warp threads, made for the time to work with both fabrics. If it be desired to contract the mitten, glove, or other article, at any point, it may be done by increasing temporarily the tension of the warps, or by diminishing or increasing the number of the warps. In order to finish off the article at the top and bottom, the pillars are worked so as to form separate cords, and when the articles are out of the pillars these are knotted and then worked in by hand to form an ornament on the edge of the fabric. This method of finishing the top and bottom is also applicable to articles of lace, and not produced in working in the ordinary manner. *Patent completed.*

1130 A. GRAINGER and O. M. GIRDLER. *Improvements in the manufacture and application of devices and representations to tombstones, and in other public or exposed situations, for various purposes.* Dated April 22, 1865.

This invention consists in the preparation of portraits or likenesses of any person or thing, or device of any kind, in an earthenware material, suitably glazed and burnt in, as is well understood in the manufacture of pottery, and the adaptation and application of such manufactures to tombstones, or for other purposes where they may be exposed to the action of the weather, or otherwise subject to deteriorating influences. *Patent completed.*

1131 W. BUSEER. *Improvements in the construction of the permanent way of railways.* (A communication.) Dated April 22, 1865.

This invention relates to improvements in the construction of longitudinal sleepers of wrought iron, to be employed in combination with a rail fixed thereon by rivets, bolts, or otherwise, the pairs of sleepers and rails thus combined being connected together by transverse tie bars of angle iron bolted thereto. The rails and sleepers thus combined and connected together are laid upon a simple bed of gravel, concrete, or other suitable ballast, and thus complete the permanent way of a railway. *Patent abandoned.*

1132 G. HASELTINE. *An improved implement for removing corks from the interior of bottles and other vessels.* (A communication.) Dated April 22, 1865.

In carrying out this invention a spring loop or holder, consisting of a strip or ribbon of steel, or other suitable metal, is made of such a form and size as to pass easily down the neck into the body of the bottle or other vessel, and is capable of expanding therein and forming a loop sufficiently large to pass freely over the cork which is to be removed. At the end or bottom of this loop is fixed a button or disc of metal, or other suitable substance. This button is formed with a channel or groove across its back, and through this groove the ribbon or strip of metal forming the spring loop or holder is inserted and secured by riveting or otherwise, and the ends of the strip of metal forming the said loop or holder are fastened to a shank or rod having on its extremity a handle made of any suitable form and material. When it is desired to remove a cork from the interior of an empty bottle or other vessel, the sides of the spring loop are pressed together; it is then inserted into the body of the bottle, and the bottle is turned with the neck downwards; the cork will then fall within the loop or holder. The latter is then withdrawn by means of the handle on the end of the shank, and while being withdrawn the button or disc is caused to press against and force the cork out of the bottle. *Patent abandoned.*

1133 A. V. NEWTON. *Improvements in the fitting of surface condenser tubes and in the tubes to be used therein, and in the means of retarding corrosion in steam boilers.* (A communication.) Dated April 22, 1865.

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

1134 J. HOWARD and E. T. BOUSFIELD. *Improvements in motive power machinery for cultivating land part of which improvements is applicable to driving machinery generally.* Dated April 22, 1865.

The documents relating to this invention cannot at present be seen, as a petition may be lodged for an extension of time for filing the final specification.

1135 W. WILLIAMSON. *Improvements in constructing portable hot rooms or chambers for drying clothes and other articles.* Dated April 24, 1865.

For this purpose the inventor constructs apparatus consisting of a chamber, in the lower part of which are placed horizontal heating flues or pipes, and in the upper portion are placed frames in which are bars for the articles to be laid on to dry. These frames are carried on wheels which run on suitable rails placed on the lower part of the drying chamber, so that they with the articles to be dried may be readily moved into and out of the chamber. In order to heat the chamber he employs a stove of any suitable kind, to which the heating flues or pipes are connected. The sides, ends, and tops are constructed in the following way:—He employs a series of cast-iron frames of any suitable size, similar to the sash frames of a window, and the spaces between the bars are fitted with panels composed of a sheet of felt held firmly between two thin sheets of metal. A panel thus constructed is fitted in any suitable manner into each of the spaces between the bars composing the frame of the drying chamber, and by this means the radiation of heat will be prevented. The bottom of the stove and the bottom of the drying chamber are on the same level, so that they can be on a floor without lowering any portion of the floor for the stove. *Patent abandoned.*

1136 P. A. LE O. DE FONTAINEMOREAU. *Certain improvements in firearms.* (A communication.) Dated April 24, 1865.

This invention relates to the manufacture of breech-loading firearms in which the barrels are movable in the direction of the axis of the butt end. For this purpose the barrel is provided with a slide forming part of the breech, and working in a groove prepared in the butt. To load the gun, the slide is made to hit against the piece on the butt, without which the barrel would be moved from its normal position; it has only to be moved the required distance in the direction of its length for the insertion of the cartridge. The slide in order to be sufficiently solid should be made in one piece with the breech piece; it is furnished with a piece of metal on the side which is placed in a groove in such a manner that the sides which serve to fix it to the slide give at the same time strength to the under side of the breech piece. The latch is jointed and its key forms an arm, and fits into the latch when it is fixed and holds it

firm. By means of this jointed latch the key can be adjusted with precision in the mortice made to receive it in the breech piece, and in the end piece soldered on the barrel. This latch with its stop can be dispensed with if required in the ordinary firearms, but it is very useful for preventing the recoil of firearms in which the bullets are rammed in. Another jointed latch is placed behind, and the spring which moves it is placed in a groove under the rod of the latch after the slide, because in this position it has less space to move in, and is consequently sufficiently flexible, no matter what pressure it receives. When the slide is very thick, it is necessary to make oval the hole of the key, in which is placed the pin which holds it to the latch, so that in working the latch shall not push the key, which ought to be perfectly adjusted in its mortice. The two springs of the latches can be in one piece. *Patent abandoned.*

1137 H. A. BONNEVILLE. *Improvements in dissected maps and charts.* (A communication.) Dated April 24, 1865.

This invention consists in a new or improved system of cutting out, fitting, and illustrating maps and charts for the study of geography, orography, geology, hydrography, and other analogous sciences. This method of cutting out and fitting allows of rendering movable whole maps in one single piece, comprising only elements of the same nature, and of placing these maps or pieces of maps one in the other to any number desired or required by the subject. The invention consists in having on each map a part in relief representing any particular element, which part is cut out from the others, and reciprocally, so that the superposition of a series of maps or parts of maps thus prepared and fitted one into the other forms a complete map, showing the distinct elements of the superposed charts; thus, for geological study, for example, each map comprises and shows only one or part of one of the strata composing the surface of the globe, so that all the maps of the series form together a complete geological chart. The method of illustrating consists in placing out at the back of each detached piece representing a state, territory, county, town, or other division, and in the space circumscribed by a projecting flange or band applied at the back of such piece and around its outlines for fixing it into the piece placed below it, a note or manual, or printed or written book, concerning this state, territory, province, county, or other natural or political division. *Patent completed.*

1138 R. H. DART. *Improvements in propellers adapted for propelling vessels in water.* Dated April 24, 1865.

The object of this invention is to enable the paddles to maintain a perpendicular position in their passage through the water, thus obtaining a backward or forward pressure without elevating or depressing the water. The parts are, first, a pair of circular sides with equidistant perforations, just within their circumference to receive the axles by which the paddles are suspended. Second, a ring of the same circumference as the sides, and perforated to correspond with the sides. Third, each paddle is formed of two parts connected at their lower edge by an axle. Fourth, each paddle has an axle projecting from each of its upper outer corners. The sides being fixed on shafts as usual in paddle wheels, the paddles are suspended by their upper axles from and between the sides. The ring is suspended from the paddles by passing the lower axles through the perforations in the ring, by which means the perpendicular suspending weight of the paddles is combined. *Patent abandoned.*

1139 H. O. BUTCHER. *An improved cigar cutter.* Dated April 24, 1865.

In performing this invention the inventor cuts a piece of steel plate or other metal about three inches long by about three-eighths of an inch wide, and the thickness of a four-penny piece or thereabouts. He hollows out each end of this plate to a semicircle, leaving points on each side of the semicircle. He grinds the edges of the said semicircles sharp in opposite directions and both in bevel. To prevent the ends when placed in proper position from swerving from such position, which would render the cutter comparatively useless, he either makes four slits in the steel behind the semicircles, or he makes a pair of loops inside and behind the semicircle which is to be undermost; or he makes a lug on each side of the semicircle, which is to be uppermost; or he effects this object by other contrivances. He finally bends the plate into form, which is that of an ordinary keyhole, so that one end overlaps the other, the two semicircles then forming a circle. The cutter will then have a sharp edge bevelled downward, and another bevelled upward. The cutter now fully formed is to be held between the end of the thumb and side of the forefinger of either hand; the end of a cigar is introduced into the circle, and, on pressure, the edges will meet and pass each other, when the cigar end will drop. *Patent abandoned.*

1140 W. E. GEDGE. *Improved apparatus for administering nourishment to the sick or infirm.* (A communication.) Dated April 24, 1865.

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

1141 W. E. GEDGE. *An improved pessary.* (A communication.) Dated April 24, 1865.

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

1142 C. and G. EASTWOOD. *Improvements in self-adjusting templates for looms.* Dated April 24, 1865.

This invention relates to apparatus for holding on the selvages of fabrics during the process of weaving, so as to resist the action of the shuttle or the drawing of the warp threads, and thereby maintain the fabric at a uniform width throughout its length. Heretofore spike rollers have been employed for this purpose of various constructions and arrangements, but by the mode of application thereof they do not hold on the fabric sufficiently close up to the edge of the cloth or to the last shoot of weft where the drag is. The improvements consist in mounting such rollers in frames so constructed and applied as to be capable of sliding and being adjusted at the point of nip to hold on the last shoot of weft at the time the pick is being made, and then caused to recede a little by the action of the lathe or batten at the beat up thereof to avoid coming into collision or contact with the reed. An adjustable finger projects from the movable frame which is set so that the front of the batten or shuttle beat will strike against it just before the lathe arrives at the end of its stroke, forcing the template back against the pressure of a spring, which, on the return of the lathe, presses the template into position again ready for the next shoot of weft. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated July 4, 1865.

1766 J. Dale, manufacturing chemist, and R. S. Dale, B.A., chemist, Manchester. Improvements in the production of pigments suitable for printing upon paper and woven fabrics.

Dated July 15, 1865.

1863 A. H. Platt, Philadelphia, physician. Improvements in lamps.

Dated July 21, 1865.

1908 J.W. Robertson, St. James's-square. Improvements in the construction of needle cartridges.

Dated August 25, 1865.

2188 E. H. Woodward, New York. Improvements in saws for sawing and cutting marble and other analogous substances.

Dated September 13, 1865.

2358 S. Fox, Stockbridge Works, Deepcar, near Sheffield. Improvements in the manufacture of umbrellas and parasols, and in the apparatus employed therein.

Dated September 16, 1865.

2378 F. Carlier, M.D., Boulevard de Strasbourg, Paris. Improvements in the arrangement and fittings of the apparatuses for extinguishing fires.

Dated September 25, 1865.

2463 W. E. Newton, Chancery-lane, civil engineer. An improved construction of engine, which can be used either as a motor or for pumping. (A communication.)

Dated September 26, 1865.

2466 A. V. Newton, Chancery-lane, mechanical draftsman. An improved mode of decarbonising retorts. (A communication.)

Dated October 2, 1865.

2524 D. Greig and Robert Barton, Steam Plough Works, Leeds, engineers. Improvements in travelling cranes.

Dated October 3, 1865.

2537 W. E. Newton, Chancery-lane, civil engineer. Improvements in pneumatic ways for the transmission of letters, merchandise, and passengers. (A communication.)

Dated October 6, 1865.

2564 J. Holiday, Huddersfield, manufacturing chemist. Improvements in preparing violet, blue, and red colouring matters.

Dated October 9, 1865.

2598 J. Robertson, Langham Chambers, Portland-place. A new or improved colour slide and case for the use of artists and painters.

Dated October 10, 1865.

2602 W. Cooke, Park House, St. James's. Improvements in apparatus for the regulation of the up and down currents of air, and for the prevention and cure of smoky chimneys.

Dated October 12, 1865.

2628 J. H. Selwyn, Capt. R.N., Woodland Crag, Grasmere, Westmoreland. Improvements in cartridges for certain kinds of breechloading firearms.

Dated October 14, 1865.

2651 G. A. Ermen, Eccles, Lancashire, manufacturer. Certain improvements in machinery or apparatus for preparing and spinning cotton and other fibrous substances.

Dated October 16, 1865.

2670 R. E. Kaulbach, Grove-road, St. John's Wood. The improvement of the means of and apparatus for laying submarine electrical telegraphic wires, lines, cables, or other contrivances of a like sort.

Dated October 18, 1865.

2685 W. Schofield, Heywood, engineer, and J. Smith, Baxenden, Lancashire, turkey red dyer. Improvements in machinery for hanging fabrics in stores or chambers.

2686 W. Schofield, Heywood, engineer, and J. Smith, Baxenden, Lancashire, turkey red dyer. Improvements in rollers for washing yarns and fabrics, and for other purposes.

Dated October 19, 1865.

2696 J. Everard, Birmingham, packer and warehouseman. Improvements in rollers for roller blinds, and in roller blind furniture, and in fixing roller blinds at any required height.

2700 T. Adams, engineer, and G. J. Parson, Duke-street, Adelphi. Improvements in and applicable to slide valves, pistons, and glands.

Dated October 20, 1865.

2704 W. Johns, Milner-street, Obelisk. A new or improved double acting safety stirrup bar.

2706 E. E. Middleton, Duke-street, St. James's-square. An improved method of laying submarine telegraphic cables or wires.

2706 C. D. Abel, Southampton-buildings, Chancery-lane. Improvements in rotary pumps. (A communication.)

2706 S. R. Rowe, Birmingham, coach body maker. Improvements in wheels for carriages and other vehicles.

2709 J. and G. H. Needham, Piccadilly, gunmakers. Improvements in central fire breechloading firearms and in ammunition for the same.

2711 W. B. Haigh, Oldham, Lancashire, machine maker, and W. Bissell, Wolverhampton, iron merchant. Improvements in machinery or apparatus for moulding or cutting moulds and planing wood and other similar materials.

2712 J. White, Thornes-lane, Wakefield, enginedriver. Improvements in the furnaces of and means of heating the feed water for steam boilers.

2714 T. Cooke, Southampton-street, Strand, astronomical instrument maker. Improvements in aneroid barometers.

2715 G. Musnell, Linslade, Buckinghamshire. A new self-adjusting apparatus for railway signals, applicable also to other purposes.

2716 M. L. J. Lavater and J. Kershaw, Persan-Beaumont, Seine et Oise, France. Improvements in the manufacture of covers applicable to drawing or printing rollers and as endless blankets.

Dated October 21, 1865.

2720 A. Bankart, Braughing, Hertfordshire. An improved apparatus for calcining copper ore, and for treating the products of copper ore when being calcined.

2721 W. H. Kitchen, Newcastle-upon-Tyne. A new or improved apparatus for producing artificial respiration.

2722 C. Boyd, Ironmonger-lane, City. Improvements in cotton presses. (A communication.)

2724 J. D. Frazer, Wednesbury, Staffordshire, railway clerk. Improvements in railway chairs.

2728 I. Roberts, Liverpool, contractor. Improvements in

machinery for screening, tempering, and moulding clays and earths into bricks, tiles, and other articles.

2730 H. A. Dufrené, South-street, Finsbury, civil engineer. Improvements in machinery for the manufacture of lozenges, wafers, or pastilles of pasty materials. (A communication.)

Dated October 23, 1865.

2734 H. Newman, Aston, near Birmingham, manufacturer. Improvements in suspending or supporting window sashes and sliding shutters.

2738 A. Chaplin, Adam-street, Adelphi, engineer. Improvements in steam boilers.

2740 W. Clark, Chancery-lane, engineer. Improvements in sewing machines. (A communication.)

Dated October 24, 1865.

2746 C. Matthews and H. B. Southwick, iron merchants, and J. Fereday, engineer, Wolverhampton. Improvements in the construction of furnaces and boilers for the consumption of smoke.

Dated October 25, 1865.

2752 W. M. Scott, Birmingham, gunmaker. Improvements in breechloading firearms.

2754 W. E. Newton, Chancery-lane, civil engineer. Improvements in the preparation of photographic papers. (A communication.)

Dated October 26, 1865.

2757 A. Krupp, Essen, Prussia, cast steel manufacturer. Certain improvements in projectiles.

2759 E. Hunt, Serle-street, Lincoln's Inn. Improvements in steam engines.

2761 G. Davies, Serle-street, Lincoln's Inn, civil engineer. An improved mode of and apparatus for cleaning the tubes of steam boilers. (A communication.)

2763 H. B. Barlow, Manchester. Improvements in mules for spinning and doubling. (A communication.)

Dated October 27, 1865.

2769 E. Heywood, Sackville-street, Manchester. Improvements in calendaring and finishing woven fabrics, and in apparatus employed therein.

2771 T. Greenwood, Leeds, machine maker. Improvements in the manufacture of wheels for railway carriages, and in the machinery to be employed therein.

2773 J. Garnett, Windermere, Westmoreland, printer and stationer. Improvements in driving or actuating machinery.

Dated October 28, 1865.

2775 G. Clark, Napier-street, Dover-road. Improvements in packing and labelling bottles, jars, and other fragile articles.

2779 J. H. Kitson, Leeds, and J. Kirby, Hunslet, near Leeds, engineers. Improvements in apparatus for producing accelerated motion for driving purposes.

2781 S. Cotton, Leeds, machine maker. Certain improvements in machinery for hawking flax or other fibrous substances.

2783 J. Buckingham, Westmoreland House, Walworth Common, engineer. Improvements in screw wrenches. (A communication.)

2785 C. E. Goodman, Euston-road. Improvements in machinery employed in the manufacture of boots and shoes.

Dated October 30, 1865.

2789 W. Whittle, Harborne, Worcestershire, engineer. Certain new or improved machinery for the manufacture of nails.

2791 R. D. Dwyer, Liverpool, civil engineer. An improved coating for covering the bottoms of iron and steel ships and other navigable vessels and marine works, to prevent oxidation and the adhesion of animal and vegetable matter thereto.

2793 E. Meldrum, Bathgate, Linlithgowshire. Improvements in the distillation of coal and shale, and in the apparatus employed therein.

Dated October 31, 1865.

2797 G. E. Donnicthorpe, Leeds. Improvements in machinery for combing wool and other fibres.

2799 D. B. White, M.D., Newcastle-upon-Tyne. Improvements in ventilators for windows and other like openings.

2801 G. Robinson, M.D., Welbeck-street, Cavendish-square. Improvements in the manufacture of caustic soda.

2803 R. Cassels, ironmaster, and T. Morton, manager, Glasgow. Improvements in furnaces.

2805 C. Emmet, Dalton, near Huddersfield, engineer. Improvements in steam hammers, and in means of applying them to the manufacture of boilers and tubes.

2807 W. E. Newton, Chancery-lane, civil engineer. Improvements in transmitting motion to propelling shafts. (A communication.)

Dated November 1, 1865.

2811 A. Jackson, J. Clough, and C. Ashley, Salford, Lancashire. Improvements in looms for weaving.

2815 S. Solomons, Albemarle-street. Improvements in transparent slides for magic lanterns and other similar purposes.

2817 A. V. Newton, Chancery-lane, mechanical draftsman. Improved machinery for dressing millstones. (A communication.)

2819 A. H. Gilmore, Bursledon, Hampshire. Improved means or apparatus to be applied to doors and windows for the purpose of supporting or maintaining them in any required position when open and in securing them when shut.

2828 B. F. Brunet, Rue des Bourdonnais, Paris. An improved apparatus for ascertaining the degree of torsion and resistance in the threads of textile substances.

Dated November 7, 1865.

2872 G. A. Jasper, Middlesex, Mass. Having reference to the cleansing or bleaching of sugar, which invention may also be applicable to other purposes of like character.

LIST OF SEALED PATENTS.

Sealed November 10, 1865.

1321 R. Winder	1349 H. A. Bonneville
1322 W. Chubb and S. Fry	1355 P. O. Lafont
1326 J. Eddy	1363 C. O. Crosby
1340 G. Ennis	1381 G. H. Brookes
1341 W. Deakin and J. B. Johnson	1403 A. G. Bigorie
1342 C. J. Appleby	1421 H. A. Bonneville
1343 G. Elliot and S. B. Coxon	1517 T. Pritchard
1344 R. and H. Harrild	1553 J. Howarth
	1598 T. L. Jowett
	1718 J. K. Farnworth

Sealed November 14, 1865.

1356 R. A. Brooman	1423 G. Ashcroft
1358 W. Montgomerie	1428 J. Frith
1365 W. Haig	1436 J. Gjers
1367 H. Rushton	1460 L. Moser
1369 C. S. Billups	1498 T. Sammerson
1379 O. Copus	1528 A. Lancaster
1384 H. de Mornay	1545 O. H. Wansbrough
1385 T. Richardson and M. D. Rucker	1574 J. de Hemptinne
1393 J. A. Coffey	1707 W. E. Newton
1395 W. and G. B. Smith	1884 G. Nimmo
1405 J. H. Johnson	1942 W. E. Newton
1407 J. M. Clements	1949 W. E. Newton
1410 P. A. le C. de Fontainemoreau	2010 P. Cato
1411 E. McNally	2333 J. Macintosh
	2363 A. V. Newton

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the London Gazette, November 14, 1865.

1743 J. Keighley. Looms.	1759 J. Naveaux. Retarding railway carriages.
1761 L. H. G. Ehrhardt. Vices.	1764 W. Clapperton and A. L. Cooper. Setting up cranks.
1766 J. and R. S. Dale. Pigments.	1767 J. Harrington. Carriages.
1769 J. E. Wilson. Locomotive engines.	1774 W. S. Parfitt. Aërated waters.
1775 J. and A. Longbottom. Carpets.	1777 J. W. Gray. Cleaning rice.
1791 L. Peel and W. Hargreaves. Greases.	1800 T. F. Hanley. Stuffing seats. (A communication.)
1801 F. A. Wilson. Breechloading ordnance.	1803 J. Bullough. Looms.
1807 G. Kentman. Paints.	1810 W. E. Newton. Retarding carriages. (A communication.)
1816 H. A. Dufrené. Circulation of volatile liquids. (A communication.)	1817 O. O. Papenagouth. Ships.
1822 D. Cowan. Lifts.	1825 J. Jones. Making up trousers.
1842 J. E. Wilson. Permanent way of railways.	1865 J. Thornton. Strengthening wool.
1896 J. H. Wray. Signals. (A communication.)	1908 J. W. Robertson. Needle cartridges.
1924 J. Rigg. Railway carriages.	1975 J. Ramsbottom. Hoops.
2293 F. Tolhausen. New firework. (A communication.)	2360 T. and T. L. G. Bell. Roasting copper.
2414 W. z. Lake. Hoisting machines. (A communication.)	2436 T. V. Lee. Peat.
2463 W. E. Newton. Engine. (A communication.)	2463 O. M. Kernot and N. Symons. Railway plant.
2503 O. F. Cotterill. Stopping pipes.	2584 D. Greig and R. Burton. Travelling cranes.
2549 J. Webster. Gas meters.	2747 D. G. and S. Staignt and J. Overton. Keys for pianofortes.
2759 E. Hunt. Steam engines.	

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 notices appear, by leaving at the Commissioners' office particulars in writing of the objection to the application.

PATENTS ON WHICH THE STAMP DUTY OF £40 HAS BEEN PAID.

3308 J. A. Fallarton	3049 J. Faulding
3011 W. Clark	3051 J. A. Dumas
3021 E. Sonstadt	3053 A. Twaddell
3022 G. Kent and E. P. Griffiths	3077 A. and H. Illingworth
3034 T. G. Ghialin	3060 R. and P. Sykes
3035 G. F. Lyster	3097 O. W. Harrison
3038 W. Palliser	3113 G. A. Buchholz
3013 W. and J. Galloway	3165 A. V. Newton
3047 T. Bradford	

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

2607 A. Henderson

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending November 11, 1865.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
2014	a. d.	13	a. d.	26	a. d.	39	a. d.	52	a. d.	65	a. d.
1	1	14	10	27	10	40	10	53	10	66	10
2	1	15	10	28	10	41	10	54	10	67	10
3	1	16	10	29	10	42	10	55	10	68	10
4	1	17	10	30	10	43	10	56	10	69	10
5	1	18	10	31	10	44	10	57	10	70	10
6	1	19	10	32	10	45	10	58	10	71	10
7	1	20	10	33	10	46	10	59	10	72	10
8	1	21	10	34	10	47	10	60	10	73	10
9	1	22	10	35	10	48	10	61	10	74	10
10	1	23	10	36	10	49	10	62	10	75	10
11	1	24	10	37	10	50	10	63	10	76	10
12	1	25	10	38	10	51	10	64	10		

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, 26, Southampton-building, Chancery-lane.