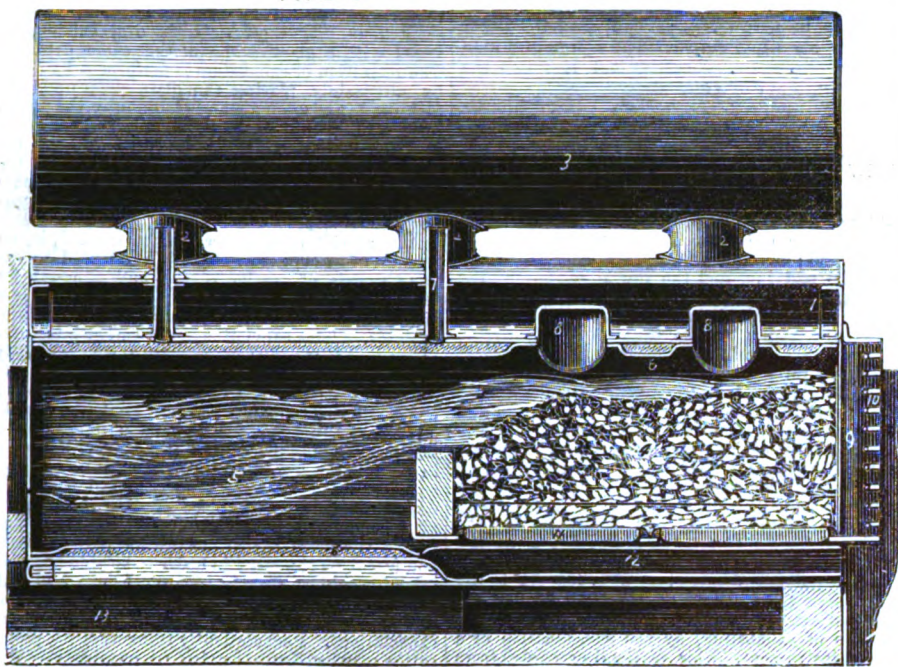


HEATING STEAM BOILERS.

FIG. 1



AN invention, having for its objects the improvement of the action of steam boilers, has been patented by Mr. Alexander Monro, of Glasgow. He aims at the diminution of the requisite heating surface and fuel, the producing of steam in a quiet and uniform manner, and in a superior condition, and the lessening of the wear of the boiler. His invention consists in communicating the heat to the boiler through the medium of a substance which is fluid at the working temperature, but which does not readily evaporate or become decomposed, whilst it is capable of supplying the necessary heat without being so hot as to injure the boiler shell. Lead is a suitable and convenient substance for the purpose in view, and in carrying out the invention that substance is applied between the fire and the boiler proper, being put in a bath, jacket, or shell, of a form adapted to whatever class of boiler may be used.

In the accompanying engraving figs. 1 and 2 are longitudinal and transverse vertical sections of a land steam boiler, which comprises a horizontal cylindrical portion 1 above, and communicating with which by three connections 2 is a horizontal cylindrical steamchest 3. The boiler proper 1 somewhat resembles a common internally fired two-flued boiler, but with the bottoms of the two flues united, and forming a U-shaped flue 4 5, the front end 4 of which forms the furnace; this flue 4 5 is enclosed or surrounded by two shells, which separate it from the water, and the space 6 between these two shells is to be filled with lead, which can be introduced in a melted state by pipes 7, provided for the purpose. The space or vessel 6 containing the lead should be as much as possible in actual contact with the fire, that is, with the ignited fuel, so as to receive the heat directly therefrom instead of receiving it from gases, which from their rarefied condition can supply it but imperfectly. With this view ducts 8 are formed through the upper part of the boiler 1, so as to communicate with the tops of the vertical parts of the U-shaped flue or furnace space 4, and the coals can be introduced by these ducts, and can be maintained at as great a height as may be found desirable in practice. The cooling ducts 8 are fitted with doors, whilst a vertical grating 9 is adapted to the front end of the furnace, and a series of plates 10 are fitted in front thereof for the purpose of regulating the admission of air required for combustion. The coal rests on horizontal fire-bars 11, of the ordi-

nary kind, and beneath these there is the usual ashpit 12. The arrangement of the external flues is, in this example, supposed to be such that the gases leaving the back end 5 of the internal flue diverge and pass forwards along the sides, and then descending return by bottom flues to the chimney 13.

The best method of sharpening mill picks, which is said to be the result of thirty-five years' experience in making these and similar tools, is given in an American contemporary. To sharpen a mill pick, heat it evenly to a bright red, no matter how quick, so that it is evenly heated; then do all the hammering on the edge first, so as not to strike it on the edge after it is brought down thin, or the corners will be liable to crack off in hardening. Then, with light blows, reduce it to a proper thickness, hammering on both sides alike, dipping the hammer frequently in water. Do not strike it hard when too cold; file the pick to an edge; then heat evenly, as before, though not quite so hot, and plunge into water, not too cold, for a distance of three-fourths of an inch. Continue to sink the tool gradually for an inch more, or it will be liable to jump off at a line between the hard and soft steel, then let the temper run down until the colour begins to change, just enough to toughen but not materially soften the steel; after this cool it off.

CLEANING IRON SHIPS AFLOAT.

By MR. JOHN HARRISON.

THE following paper was read at a meeting of the Scottish Shipbuilders' Association:—Since the change of building ships of iron instead of wood, the superiority of the former material has never been questioned, and had the iron only possessed the quality of preventing the attachment to its surface of marine mollusca, or had it but admitted of being covered with yellow metal or copper, or could any other method of preventing fouling have been found out, the building of wooden ships would long ere now have slumbered among the sunny memories of past events, and the modern method of constructing vessels of iron frames and wooden planking would never have seen the light. Long as the wooden walls of old England have held their supremacy upon the mighty deep, iron, after all, if it is less poetical, is the more practical material of the two. In this country the rise and progress of iron shipbuilding has been extremely rapid, and in our own locality my present audience needs not the information that it has extended itself until its proportions have become gigantic. I find, from an excellent article lately published, that during the year 1851 only 41 iron ships were built upon the Clyde, amounting to 25,322 tons. I also find that during the seven years ending in 1862 the number of iron vessels built at Glasgow, Greenock, and Dumbarton was 636, with an aggregate tonnage of 377,176, being an average of 91 vessels each year, and an annual tonnage of 53,882. In the year 1862 we thought we had done something wonderful when 122 vessels with an aggregate tonnage of 70,000, were finished and launched during the year. In 1863, however, the number still farther increased to 170 vessels, containing a tonnage of 124,000. But in 1864 the grand total for the year was 205 sailing ships and steamers, with an aggregate tonnage of 179,508—the steamers being supplied with engines to the amount of 27,205 horse power—so that the mere increase in 1864 over the amount of 1863 numbered nearly as many ships, and more than double the amount of tonnage, as were built altogether on the Clyde in 1851, the increase being 35 ships with a tonnage of 55,500. These ships have been built for every purpose to which ships are applied, to orders from nearly every part of the habitable globe. During the last year more than 40 vessels, with an aggregate of upwards of 27,000 tons, and engines of 6,650-horse power, were sent forth from the Clyde to run the blockade. Indeed, the Clyde may now fairly claim to be the greatest shipbuilding river in the world. For nearly 20 miles its banks are covered at intervals with that iron chain of ships that go forth to encircle the earth, and employing in their construction about 20,000 men, representing a population of 100,000 souls. I mention these statistics of the building of iron ships in our own neighbourhood to show the importance of any invention which is calculated to facilitate their progress on the ocean, for in this iron age speed is time and time is money.

I need not mention in detail the many plans that have been tried to obviate the one grand defect of iron as a shipbuilding material, namely, its liability to receive a deposit of molluscan animals of several varieties, but chiefly composed of two, namely—the ship's barnacle proper, the *Pentalasma anatifera* of the men of science, or "the five-plated goosebearer;" and the Acorn-shell, or the *Balanus*, both of these belonging to a class of molluscs that are called *Cirrhopoda*, on account of the *cirri* or ciliated arms which form their chief characteristic. The former is called *pentalasma*, or five-plated, because its shell is composed of five distinct portions curiously arranged, and between them the *cirri* are protruded, as seen in the drawing. The word "goose-bearing" is given to it because an old writer, named Gerard, who lived in 1636, discovered, or thought he discovered, that the bernicle goose (*Bernicla Leucopsis*) was produced from the ship barnacle. Along with these, the seeds of several varieties of seaweed also attach themselves to the bottoms of iron ships, and between them they very much impede the sailing of the vessel by the hold they take of the water. Paints of nearly every kind of composition have been tried to prevent this accumulation on the bottom. They have been mixed with grease, with the idea, I suppose, of rendering the plates so slippery that the barnacle should find no footing. They have been compounded with poisons of every degree of virulence, till the resources

of the mineral and vegetable kingdoms have been well nigh exhausted, but to no purpose. I say to no purpose, inasmuch as none of those yet tried have stood the test of a ten or twelve months voyage in southern latitudes. Nor does it seem to me that they will ever be more successful in this direction. With the *Balanus*, especially, I cannot see that poison can have any effect. By examining the specimens now on the table it will be observed that it is the shell and not the animal that adheres to the ship. Between him and the ship he builds up this strong calcareous wall, and attaches it so firmly that no grease can slide it off, and so thick as to be impervious to the most virulent poison. Let us look for a few minutes at the natural history of this cunning architect.

The *Balani* and their sub-class of *Cirripedia*, are described by naturalists as animals that are soft and without heads and eyes—until the researches of Darwin had proved that this was a fallacy, and that they have both—that they are covered with an adhering shell. They are hermaphrodite and propagate themselves. They are extremely prolific, for even in those northern latitudes the rocks between high and low water mark may be seen completely covered with a crust of the *Balani*. With us they are very small, but in the warm waters of the tropics they grow to an immense size, and there, as here, they take, as it were, possession of the seashore, and cover everything that enters their dominion, till every rock, stone, wooden pier, or ship's bottom bears a thriving colony of these industrious fishermen. The *Balani* are never found in deep water. It is only between high and low water mark, and a few fathoms deeper, that they abound, and consequently it is not when the ship is in mid-ocean that she gets them on her bottom, but only while she is lying in the shallow waters unloading or taking in cargo. And we see, from the fact that all the large *Balani* are dead and out of the shell before they come home here, that they die as soon as the ship gets into deep water on her passage home. Now, the question occurs, can we do anything to prevent them from settling down on an iron ship's bottom, or can we poison them when they do settle there, in the earliest stages of their existence? From each of these myriad beds of *Balani* a stream of minute *Sessilia* is constantly issuing till they darken the very water as a cloud of locusts darken the air. For a time, after leaving the parent shell, they are crustaceous, such as the lobster, and are very active in the water, searching for an inch of empty space to serve as a location. When the time for their last metamorphosis arrives, in this respect they are in nowise particular, and frequently do make awkward selections, such as upon other shells and on the shells of each other. But even at this early stage of their existence, the infant *Balanus* carries with him the nucleus of his future home. When his preparatory stages have been gone through, and he becomes ready for attaching himself to some foreign object, he is furnished with two calcareous discs, as seen in the drawing, and these discs are furnished with glands and ducts that secrete a highly adhesive cement, with which he attaches himself to the place of his choice. This is the foundation of his future castle; and of such material is it that it effectually protects the living animal from actual contact with any poison that may be compounded with the paint upon which he may happen to settle down. But suppose that he was affected by the poison, and that soon after he adheres to the vessel he dies; say that the first colony of settlers all die, another colony, just as numerous, would immediately settle down on their remains, and before that two or three such had perished, the ship would present a perfect covering of them, which would preserve the last comers from harm, so that, even in that case, we should still have a bountiful crop on the ship. Then, his position is always at right angles with whatever he has attached himself to, so that really he is in little danger of even coming disagreeably near it. In a very short time his shell is complete, and he sets up as a fisherman on his own account, for he really is a fisherman, and the manner in which the *Cirrhopoda* fish is very remarkable. Some animals, like the *Sea Anemones*, hang out a net and await the approach of prey, and whatever happens to touch them, if not too large, they will fold up without discrimination, and stuff it in their stomach; other creatures hang out fishing lines, like the fresh-water *Hydra*; others, again,

chase their prey through the water, and capture it by superior swiftness or cunning; but the *Balanus* employs none of these methods. He is furnished with a veritable casting-net, which ever and anon he throws, expanded, into the water and retracts when closed. The action of a man throwing an ordinary casting-net is much the same as that of the *Acorn-shell*.

(To be continued.)

NEW FORM OF MERCURIAL AIR-PUMP.*

By PROFESSOR POGGENDORFF.

THE mercurial air-pump, which has recently been brought into use again, is essentially a very old instrument; for only a few years after Otto Von Guericke had invented the piston air-pump, the members of the *Accademia del Cimento*, apparently unacquainted with his invention, employed for all their experiments on the behaviour of bodies in the vacuum a straight barometer tube, of greater length than was needed for measuring the pressure of the atmosphere, and expanded at the top into a sort of receiver, which they filled with mercury and then inverted in a vessel of that metal. The numerous defects of this rough contrivance, which we may nevertheless regard as a mercurial pump, and especially the wonderful progress which has been made in the construction of piston air-pumps since the times of Boyle and Papin, during the whole of the eighteenth and nineteenth centuries, have caused the idea of the Florentine Academicians to fall completely into oblivion. It is not until more than fifty years later that we find the proposal made to revive the use of mercury for the purpose of exhausting, by the construction of a special instrument. This proposal proceeded from the celebrated theosophist, Emmanuel Swedenborg, who has described it in his *Miscellaneous observations circa res naturales et præsertim circa mineralia, ignem et montium strata*, published at Leipsic in 1722.

Swedenborg's pump consisted essentially of a little table with three long legs, which carried the glass bell-jar that was to be exhausted, and was connected below with an iron vessel, from which descended perpendicularly an iron tube which was joined by a flexible tube of leather with a second iron tube. By placing this movable tube upright or laying it down, the mercury, which filled both tubes, was made to rise and fall, and thus the iron vessel, which was provided with the needful valves, was alternately filled with the liquid metal and emptied. This is the same principle as that employed by Joseph Baader in his second mercurial pump; he, however, improved the construction by substituting a metal elbow-joint for Swedenborg's leather tube, but does not appear to have had any knowledge of the idea of the latter. In his first pump, which he had described in 1781 in Hübner's *Physikalisches Taschenbuch*, the descending and ascending tubes were connected together immovably, and the lowering of the mercury in the exhausting-vessel was caused by letting the proper quantity of the metal run out through a cock placed at the lower part of the bend of the tubes. By pouring into the upright tube, after shutting the cock, the mercury that had run out, and opening the exhausting vessel so that the air which had been drawn in might escape, the original state of things was reproduced. These pumps, however, which, so far as appears, were never constructed by their originators, have not met with the acceptance of physicists; and the same remark applies to all the pumps which have been successively either proposed or actually constructed by Hintenburg, Michel, Cazalet, Kemp, Edelcrantz, Patten, Ochsle, Romershausen, Uthe, Mile, Kravog, and others, in most of which the mercury was moved by means of a piston.

It is only lately that the mercurial air-pump has obtained a better reputation, since the skilful glass-worker, Geissler of Bonn, has employed it in the preparation of the exhausted tubes with which his name is connected, and has by means of it obtained a more perfect vacuum than could be produced by the best piston-pump. Geissler's pump, which first became known to the general public through Dr. Theodore Meyer's pamphlet on the stratified electric light, published in Berlin in 1855, does not differ in principle from Swedenborg's, but its form is better adapted to its special purpose. With the exception of the caoutchouc tube, which is substituted for Swedenborg's leather joint, it is made entirely of glass; and in all that relates to the connection with the pump of the tubes to be exhausted, and the introduction and drying of different kinds of gas, its construction displays great neatness and skill. The contrivance for raising and lowering the movable tube, however, is but rough and liable to be easily put out of order. This operation was at first performed entirely by hand; but the use of a glass tube and a charge of from 30lb. to 40lb. of quicksilver being found too troublesome and dangerous to be managed in

this way, it was afterwards done by help of a windlass. Quite recently Geissler of Berlin has constructed pumps of a smaller pattern, containing only 15lb. of mercury, in which the two glass tubes are replaced by a long and strong tube of caoutchouc, which connects the oval exhausting-vessel with a glass globe of the same capacity. The operation of exhaustion is performed by hand, by alternately placing the glass globe upon the footboard, and upon a stand placed near the pump. This arrangement is certainly simple, but must excite some apprehension as to how long the caoutchouc tube will last; besides, working the pump requires the exertion of a not inconsiderable amount of force, and may easily expose the apparatus to danger.

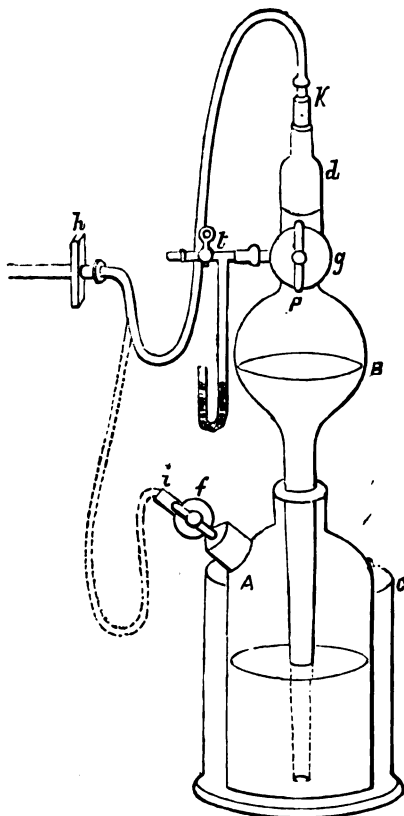
A mercurial pump, however constructed, is, on account of its slow working, only adapted to exhaust vessels of small capacity, and although for these it may afford a better vacuum, it will never displace the common air-pump from physical cabinets. This conviction, together with the circumstance that nowadays every physicist is already provided with an air-pump, induced me in the course of last summer to consider whether it was not possible so to modify the mercurial pump as to make it an appendage to the common pump, which might, according to circumstances, be either used in conjunction with or separated from it. The execution of this idea presents no practical difficulty, does not increase the price of the instrument, allows it to be constructed of any required size, and makes the operation of exhaustion perfectly easy and free from danger. In order to be able to speak upon the subject from experience, I have had such an auxiliary instrument made as a trial, and as was to be foreseen, it has completely fulfilled my expectations. I consequently think that its publication may be of some service to physicists. The body of the instrument consists essentially of two parts namely, (1) a glass bottle A, with a rather wide neck, and a tubulus at the side. In my instrument this bottle is about 12in. high and 6in. in diameter. (2) An egg-shaped glass vessel B with a short neck above and a long one below, which is ground so as to fit into the neck of the bottle A, and reaches nearly to the bottom of it. An iron cap provided with a passage which opens on the outside by the nozzle *i*, and can be closed airtight by the cock *f*, is cemented on to the tubulus of the bottle A. In like manner the upper neck of the egg-shaped vessel B is provided with an iron cap, the opening of which can be closed by the cock *g*. This opening leads in the first instance into the little bottle *d*, which has the iron nozzle *k* cemented on to its neck. The last-mentioned cock *g* has a threefold purpose, and is correspondingly bored. When its handle stands vertically with the end *p* below, it establishes a communication from the vessel B to the small bottle *d*, and, provided the nozzle *k* is open to the air outside. If it is inclined at an angle of 45 deg. it completely cuts off the vessel B, and when placed horizontal with the end *p* towards the left, it makes a communication between this vessel and a lateral passage *l*, with which whatever is to be exhausted is connected airtight. In the engraving this lateral passage is represented, for the sake of clearness, as placed at right angles to the cock *g*; it is better, however, to place it in a line with the axis of the cone of the cock, and to give it a double boring like that of the cock *h* of the air-pump. In this way the quicksilver is prevented from getting into the passage *l*.

This apparatus is connected with the air-pump by means of a caoutchouc tube, provided at both ends with a hollow conical metallic plug. One of these plugs is put into the hole which the main-cock *h* of every air-pump is already provided with, for the purpose of either shutting off exhausted vessels from the pump, or of filling them again with air, and the other plug is put alternately into one of the nozzles *i* and *k*. When the apparatus is to be worked, it is necessary first of all to fill the bottle A with quicksilver nearly up to the tubulus; in my instrument forty pounds are required for this purpose. The main cock *h* of the air-pump must then be turned so that the caoutchouc tube connected with it communicates with the barrels. The other plug of the caoutchouc tube is next put into the nozzle *k*, the handle of the cock *g* is placed vertical with the end *p* downwards, and the pump is set in motion. Two strokes of the pistons of my pump are sufficient to bring the mercury to the required height, that is, not only to fill the vessel B completely, but also to drive it through the cock *g* into the small vessel *d* placed above it, as is needful to ensure the complete displacement of all air. When this has been done the cock *g* is turned through 45 deg. with *p* towards the left so as to close the vessel B. The plug of the caoutchouc tube is then taken out of the upper nozzle *k* and put into the lower one, and the pumping is continued. Four strokes of the pistons of my pump suffice to empty again the vessel B of mercury, notwithstanding its considerable size, and thus to produce therein a vacuum such as cannot be surpassed without boiling the mercury.

In order to employ this vacuum for the required purpose, the handle of the upper cock *g* is placed

* From the "Philosophical Magazine," August, 1865.

horizontal with the end *p* towards the left, whereby the lateral passage *l* and the tubes or other pieces connected with it, are put into communication with the exhausted vessel *B*. The bottle *A* may for the sake of safety be previously closed by the cock *f*, although this is not necessary so long as the connection with the pump is maintained. When the exhaustion is completed, the vessel *B* must likewise be closed again by turning the cock *g*. This is in general the course of the exhaustion, which must of course be repeated as often as needful. It requires, as is easily seen, no great expenditure of strength, and is moreover not attended with any danger, besides which the apparatus is placed in a strong wooden vessel, large enough to hold the whole quantity of quicksilver in the scarcely conceivable case of an accident. Every repetition of the operation is begun by separating the bottle *A* from the pump, and by carefully turning the cock *f* allowing the quicksilver to mount slowly up into the vessel *B*. In consequence of the usually small capacity of the pieces to be exhausted, this vessel fills again almost completely of itself, so that, after opening the cock *g*, only a small quantity of air has



to be removed from below the upper nozzle. It is obvious that this apparatus, when carefully constructed, is capable of performing the same services as Geissler's pump, and that, in fact, it differs from this only in the way in which the emptying of the mercury is effected.

I will here mention only one of the preliminary experiments which I have made with it—an experiment which is calculated to refute the common opinion that an absolute vacuum is to be attained by means of the mercurial pump. This consisted in trying whether the vessel *B*, after being emptied of quicksilver, would allow a current of electricity to pass. This I found to be really the case. If the iron caps of the apparatus are connected with the poles of an induction coil, an iron wire being put through the cock *f* into the quicksilver in the bottle *A*, the well-known luminous phenomena are obtained most beautifully developed. As already remarked, the apparatus that has been described is specially applicable for exhausting small vessels which can be directly connected with the lateral opening *l*. It can, however, be employed also for pumping out larger vessels, such as bell-jars, which require to be placed upon a plate. This is effected by putting the side opening *l*, by means of a flexible metallic tube, into connection with the air-pump through the cock which, in Pistor's air-pumps, leads to the Hawksbee's barometer-gauge, and is provided for this purpose with a second perforation similar to that in the main cock *h*. By first of all placing the cock *h* so as to establish a communication from the pump-barrels to the bell-jar standing upon the plate, this can be exhausted as far as the pump allows; and by then turning the main cock through a right angle, and connecting it by the caoutchouc tube with the mercurial apparatus, the exhaustion can be continued by means of the operations previously described, so as to produce a more

perfect vacuum. This, however, of course, requires that all the joints should be perfectly airtight, and even in that case it becomes a tedious matter if the capacity of the bell-jar to be pumped out is at all considerable in comparison with that of the exhausting vessel *B* of the mercurial pump.

Correspondence.

THE ATLANTIC CABLE.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—Having read in your Magazine several letters relative to the cause of failure of the laying of the Atlantic cable, and suggestions to prevent similar occurrences in the future, permit me to say, however true the cause of failure may be, I do not think a practical suggestion has been offered, whereby one might calculate a success the next time, without great risk of another failure. At the time the first cable was about to be laid, I had a long conversation with the late Mr. Latham, of the Gutta-percha Works, on the subject of not only paying out the cable, but of making it; and as to whether gutta-percha was the best insulator for deep water. I contended then, as I do now, that to coat or cover copper wire with any substance which when pierced cannot perfectly close so as to prevent imperfect insulation or the water getting to the wire, was not a fit material for insulating telegraph wires for deep water. It is well known that, on piercing gutta-percha, perfect unity is severed in the part pierced, which pressure alone will not unite. I hold that the wire to be used for telegraph purposes in deep water must be coated with a water and heat-proof gum which will adhere to the wire and never change; it must then be imbedded in a material which cannot be injured by external pressure, but which should be one on which the greater the pressure exerted the better should be the insulation. The external covering can be applied, but on no account should a metallic covering be used, neither should pitch, tar, and such like materials which are subject to shrink, wash, or squeeze out from or off the bodies on which they are laid. The cable should be flexible, water and heat proof, and not liable to kink in paying out.

As to paying out the cable over the stern of the vessel, particularly in a sea-way, it has, I think, been satisfactorily shown that a greater error cannot be committed. This the late attempt of the "Great Eastern" has practically solved, and I also think the failure may be in a great measure attributed to that cause. Paying out the cable over the stern not only subjects the cable to an incalculable amount of straining, chafing, and disturbance, but subjects the electricians to a great deal of unnecessary unpleasantness, by being exposed to all weathers, night and day, during the time the paying out is going on, and if any little defect which might otherwise be detected passes unnoticed, it cannot be wondered at—how can it be otherwise when in the dark or when rainy and stormy, perhaps blowing a stiff gale? Why not obviate all this risk and inconvenience by having a convenient cabin fitted up, with a proper well hole as near as possible in the centre of the vessel, and passing through the bottom; by such means the cable would not be subjected to the destructive strain and chafing which is caused by rising and falling and the rolling of the vessel, when payed out over the sheaves in the stern of the vessel; the cable would also be saved from the lashing of the waves and wind, which must be very severe on that part between the sheave at the stern and the water. Paying out from the bottom would completely avoid this danger, and great advantages could be gained by the peculiar arrangement at the mouth of the well at the bottom, to avoid undue strain and friction. I have no doubt that eventually, when proper appliances are obtained, laying a rope across the Atlantic will be effected with as little trouble as is found in making and winding a ball of cotton, which would be a very difficult matter without proper machinery.

I am, Sir, your obedient servant,
August 29. C.

SIR,—Allow me to offer two suggestions relative to the new Atlantic cable about to be made. First, it will add greatly to its strength if steel wire be laid on instead of iron as a covering to take the strain. Second, that the cable be not laid in coils in the "Great Eastern," but wound on reels, and payed out by the reels revolving, the action thereof being retarded by brakes on the reels and not by a bight on the cable. It is quite possible that in paying out the cable in deep water the crush in passing through friction pulleys may be sufficient to cause the wire to cut the gutta-percha in some weak part to an extent sufficient to admit the water, and so destroy its insulation. Besides, there is the chance of crushing foreign matter through it, as was the case with the last one when the two pieces of wire were forced into it.

August 29.

Yours, &c.,
J. HOPE.

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 5ld. per line for 6 insertions, 8d. per line for 13 insertions, 4ld. for 26 insertions; and 4d. a line for 52 insertions. Each line consists of about 10 words. Woodcuts are charged at the same rate as type. Special arrangements made for large advertisements.

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

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

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

RECEIVED.—W. W.—J. B.—G. S.—W. W.—W. E.—J. H.—J. H. P.—J. H. T.—J. D.—J. N.—G. S.—T. S. R.—T. H. E.—L. H. P.—C.—J. K.—R. T.—J. F. M.—O. D. K.—C. W. H.

T. S. REEVE (Plymouth).—For all practical purposes in the operation of raising the Atlantic Telegraph cable at appointed miles from the western extremity, both ends may be taken as fixtures. You will observe that your observations are anticipated in our article on the subject last week.

R. HARRISON (Brighton).—We cannot inform you where you will find a description of Mr. Cobbold's process for the preparation of peat fuel. If it is patented the specification will describe it fully, and this may be seen and purchased at the Patent Office. A description of the condensed peat manufactured by Buckland's process will be found in the MECHANICS' MAGAZINE for the 27th January last, at page 52.

Miscellaneous.

Eggs again! But this time a method for preserving them which is recommended by M. Bournouf in a French agricultural journal. Dissolve in two-thirds of warm olive oil one third of bee's-wax, and cover each egg completely with a thin layer of this pomade with the end of the finger. The egg-shell by degrees absorbs the oil, and each of its pores becomes filled with the wax, which hermetically seals them. M. Bournouf affirms that he has eaten eggs kept two years in this manner, in a place not exposed to too great extremes of temperature. He thinks also that the germ may in this manner be preserved for a considerable time.

A letter from Florence is published in the *Siecle* in which it is stated that a project is on foot to establish direct railway communication between Italy, Switzerland, and Germany, by a passage over the Helvetic Alps, and a few days ago a committee, named by the Italian Minister of Public Works, began its sittings. The statistics distributed among the members of the committee turn in favour of the St. Gothard as being the best passage in the Alps for establishing more direct communications with Frankfurt, Bremen, Lubek, Prussia, &c. But when this passage is adopted, it will be necessary to find the funds to complete so great a work, as more than 200,000,000f. would be required. It remains to be seen if Switzerland and Italy are disposed to provide the funds for this great undertaking, as no private company would be able to contribute more than 40,000,000f. to the work.

An immensely rich quartz ledge, discovered some time since near the Henness Pass in California, is in course of active development. The district is called the Excelsior, and the principal ledge is called the Eclipse. It is about sixteen miles south of Webber's Station. The main lead is easily traced for a distance of five miles. The discovery was kept from the public until all was located. The croppings are from one to twenty feet in width. A toll road has been surveyed leading from the Henness Pass road, and a town is already laid out, and foundations are being laid for two large mills.

A premium of from £150 to £200 has been offered by Dr. Petermann, the well-known geographer, to any German mariner who will explore the current; of the sea between Spitzbergen and Nova Zembla in the course of the year. From these observations it is to be devised a plan for a Polar expedition, which it is hoped will leave some German port before long, and which is destined to attack the great problem from a new side. Dr. Petermann asserts that the above-mentioned part of the sea being under the influence of the Gulf Stream it will be much easier to penetrate in those quarters towards the Pole than by any of the usual routes. He seems also to hope that the quantity of fossil ivory to be collected on the way will defray part of the costs of the expedition.

We have already recorded the successful boiling of a clock and a sewing machine. We now notice the unsuccessful boiling of a watch which was recently found in some peat in Scotland. Being no doubt very dirty, a neighbour of the finder suggested that the watch should be boiled, which was accordingly done, but which process it appears had been too long continued, for, on opening the pot, the watch was found reduced to a mass of loose wheels and pinions.

Hendy's blow pipe combines simplicity and efficiency in a great degree; it consists of an ordinary blow pipe nozzle, supplied from an india-rubber reservoir. The main portion of the blow pipe is made with a joint, at which a valve is placed, which is opened when the operator blows, and closed immediately when he ceases. The bag is filled at a single breath, with very little exertion, and when so filled a continuous current of air is forced from the nozzle of the pipe by the mere contractive force of the india-rubber. A rubber hose is attached between the mouth piece and the pipe which enables the blower to change his position without disturbing the direction of the current on the object upon which it is turned.

We have received a letter from Mr. William Marcroft, of Oldham, in which he refers to the process patented by Messrs. Wheeler and Gloyne for making a polishing powder from the slag of iron furnaces, and described in our last number. Mr. Marcroft states for the information of the patentees and the public that eighteen years since, when foreman in the machine grinding department at Messrs. Platts' works, Oldham, emery being dear, he tried various substances as substitutes. Amongst others he tried the slag from the furnaces, but its action was not equal to that of emery. Laid on paper it served the purpose of dressing wood as a makeshift, but was inferior to glass paper.

A report by M. Dumas to the Imperial Commission on the size and plan of the building necessary for the Paris Exhibition of 1867 states that at least 30,000 exhibitors may be expected to contribute, and space must be found for that number.

There is in America a patent for using superheated steam in seasoning timber, by which it is claimed that the steaming and drying are effected by one operation.

A return to an order of the House of Commons has just been published, showing that the sum paid for producing the various papers printed by command of Her Majesty, as respects the cost of the paper, printing, and binding, during the year 1861, was £22,025, during 1862 £29,611, during 1863 £19,116, during 1864 £22,384 and during 1865 £17,686. These sums do not include the amount paid for printing for the Public Departments by Her Majesty's Stationery Office, which, exclusive of the cost of paper, was in 1864 £86,693, in 1865 £79,333, in 1866 £81,267, in 1867 £81,854, and in 1868 £79,685. The cost of papers presented in return to the order of the Houses of Parliament is not given in this return.

M. Gernez has communicated to the Academy of Sciences an experiment which, to his mind, decides that sulphate of soda is present everywhere in the air. He distilled water in a platinum still to avoid suspicion from glass, and passed through this water air taken in the park at Talmay, at a long distance from any houses. A few drops of the water evaporated on a plate of glass showed, under the microscope, crystals of sulphate of soda.

Continental journals are occupied in discussing a vast project which is in course of realisation at Rome. It is a question of nothing less than the reconstruction of Ostia, the ancient port of Rome, and which the power of Claudius and the genius of Trajan had made a depot for the commerce of the whole world. A Roman engineer, M. Costa, has submitted to the Holy Father plans which would re-establish, at the mouth of the Tiber, in a situation which the late progress in navigation and international relations designate as the most favourable in the Mediterranean, a magnificent free port, with docks, magazines, and a commercial flotilla destined to render the greatest services to the industry of the whole of Europe. Pius IX. entertains the idea most cordially: "In a more exalted sphere," says our authority for the above, "it is the development and the propagation by navigation of the true seeds of civilisation, of which Christianity alone possesses the secret." We hope the "true seeds of civilisation" will in time bring forth fruit of better kind than the following, which we cull from the same source as the above, and give by way of contrast. The spectacle of a bull fight has just been exhibited in the vast Roman amphitheatre of Nîmes (Gard). More than 10,000 spectators, a large proportion of whom were women, enjoyed (sic) the carnage for upwards of four hours. Five horses were embowelled by the bulls, and six of these latter were tortured with explosible darts, and then, when excited to a paroxysm of fury, despatched with swords.

Oil wells are not always sources of unmixed satisfaction, for we learn that the Well No. 19, United States Farm, on Pit Hole Creek, was destroyed by fire on the 3rd August. The well was finished that day, and was flowing about two hundred barrels, and no tanks being up the oil was allowed to flow on the ground. Some twenty persons were standing in and around the derrick, some of whom it is feared were unable to escape, for the ground for forty feet around was one sheet of flame in a moment. Three men are known to be seriously burned, and only saved their lives by jumping into the creek.

The capital expended in this country on railways to the present time has been upwards of three hundred and eighty-five millions sterling, or nearly half the national debt. This amount has been devoted to the construction of eleven thousand five hundred miles of railway in the British Islands, which are now open for traffic.

Captain P. E. Lawson, of the barque "Viking," of Sunderland, reports that on July 16 last, at two p.m., while in lat. 36.18 North, and long. 2.32 West, he experienced a severe shock, as though the ship had taken a shoal of rocks. This lasted about five minutes, when the shock subsided, and the vessel resumed her course, nothing the worse for the severe shaking she had undergone. The weather at the time was fine and the water clear. Captain Joseph Horan, of the barque "William Shillito," of Sunderland, who exchanged signals with Captain Lawson shortly afterwards, reports having experienced a similar shock at the same time. This may perhaps be the effect of the earthquake which occurred on the morning of the third day, and which totally destroyed the village of Fondi di Macchia, near Catania.

We last week called attention to the value of land in and around London. New York city property fetches pretty "tall" prices, too, as the following will show:—The lot on the corner of Broadway and Ann-street, in that city, made vacant by the burning of Barnum's Museum, was recently sold. The lot is 56ft. by 100ft., and 450,000 dol. were paid for it, and 200,000 dol. besides to Mr. Barnum for his unexpired lease of it.

On her passage from Birkenhead to Plymouth the armour-plated screw frigate "Aguincourt," with the tide in her favour, ran a distance of 55 nautical miles in 4 hours 20 min., or at the rate of 12½ knots an hour. Making the usual allowance for the tide, the actual speed would be at the rate of 11½ knots. This corresponded with the register of the patent log. The engines are of 1,350 nominal horse power, and are on the double piston rod principle, having return connecting rods. The cylinders are 10in. in diameter, and have a stroke of 4ft. 6in. The steam is supplied by 10 boilers, heated by 40 furnaces, which will consume on the average 100 tons of coal a day. The engines made from 48 to 50 revolutions a minute, with a vacuum of 26in., and a pressure of 19lb. of steam. There was no inconvenience or stoppage of any kind, and no indications of heated bearings. The vibration, too, promises to be very slight in proportion to her power. She answered her helm admirably. This passage is said to be the first in which a ship has been navigated from her place of construction to a naval port without the aid of canvas or the escort of a steam tender.

The recent trials of the machinery of the frigates "Octavia," "Constance," and "Liverpool," have been completed. The following figures show the approximate results, and give also the main features of the trials:—

Trial.	Ship.	Indication of horse power.	Coal consumed in 10 hours.	Consumption per horse power in 10 hours.	Consumption per square foot of fire-grate per hour.
			Tons.	lb.	lb.
1	Octavia.....	500.29	4.43	1.90	4.09
	Liverpool.....	526.6	12.10	5.15	9.19
	Constance.....	398.70	4.29	2.31	6.39
2	Octavia.....	1247.2	14.17	2.16	11.03
	Liverpool.....	1450.33	23.63	3.65	13.54
	Constance.....	1048.0	9.11	1.95	11.31
3	Octavia.....	1633.0	18.86	2.88	17.34
	Liverpool.....	1824.21	32.63	4.01	17.74
	Constance.....	1432.23	14.0	2.11	10.9

We recently noticed an expeditious method of "skeletonising" leaves; a still better one is now proposed. The leaves should be boiled for two minutes, then transferred to a strong solution of permanganate of potash and gently heated. In an hour or two the laxer tissues may be easily removed by means of a brush. Sulphurous acid or a solution of chloride of lime may be used for bleaching them.

A model miniature locomotive, made of gold and silver, with a ruby for a head-light, and costing 4,000 dollars, is on exhibition at Taunton, Mass. Its wheels are driven by clockwork.

The directors of the National Steam Navigation Company pay 20s. a week to a ratcatcher for professional services on board the company's steamers. The rats being fond of good living are in the habit of migrating from ship to ship when they come into port, and as good living is plentiful on board the company's steamers the rats patronise them extensively.

In consequence of the recent decision of the War Department to substitute iron for timber gun carriages, and the same alteration having taken place with respect to gun carriages for the naval service, it has been found necessary to rearrange the several factories of the Royal carriage department in order to meet the change. The large carpenters' shop has been cleared of its benches, and the flooring is being covered with metal plates previous to the erection of the machinery required.

The work on the east end of the Hoosac tunnel is said to be progressing at the rate of 16ft. a day into the solid rock of the mountain.

An improvement in the carriage way of London Bridge is being effected by the formation of a granite tramway on the side of the footways for the heavy traffic. The granite blocks to receive the wheels of the vehicles are about 8ft. long, 3ft. wide, and 1ft. thick, and the roadway between them is paved with the usual road paving-stones placed edgewise. The tramway is raised to the level of the old footways, and has a slight decline to the centre of the carriage road in a parallel line, to afford a sufficient means for drainage. The footways are being taken up and recut, and placed to give a rise from the tramway of about 8in.

We understand that the Howth Lighthouse is to be illuminated on a new principle. Mr. J. R. Wigham, of Dublin, has been making experiments with oxygenated gas, which is found to be vastly superior to the oil burner at present used in the Howth Lighthouse, and for which it will be applied as a substitute.

The arbitrator has made his award in the action brought against the Lambeth Bridge Company by Messrs. Porter, the contractors for building the bridge. The sum claimed was £3,466. The amount awarded as due was £3,914, with £300 for costs and £219 for half the expenses of the award, making in all £4,433.

The Rev. Wm. Allen Whitworth, M.A., late scholar of St. John's College, Cambridge (16th Wrangler, 1862), and joint editor of the "Oxford, Cambridge, and Dublin Messenger of Mathematics," has been appointed Professor of Mathematics and Natural Philosophy in Queen's College, Liverpool.

An Italian engineer, Signor Guglielmo Giustiniani, has presented to the French Government the model of a submarine boat of which the Italian Government has already expressed its approval, though, for some reason or other, it has declined to adopt it. The French Government has directed a special committee to examine and report upon Signor Giustiniani's system.

The Earl of Aberdeen and Mr. John M'Gregor are at present making a tour in two little canoes on the rivers and canals of Holland, Belgium, and Germany. The canoes have a light bamboo mast and calico sails, and double-bladed paddles, and being only about fifteen feet long are transported, when needful, in the baggage vans of the railways. For shorter distances both boats can be carried easily by the travellers themselves, one of whom has started for the source of the Danube, taking his canoe through the Black Forest to the Tissee, with the intention of returning by the Swiss lakes to the rivers of France.

At a meeting of the Literary and Philosophical Society, Mr. R. D. Darbishire mentioned as a rarity the occurrence of the old English or black rat in Messrs. Whitbread and Co.'s brewery, in Chiswell-street, London, and exhibited stuffed specimens of male, female, and young.

The directors of the London and North-Western Railway Company have been in communication with the directors of the South-Eastern Company, and, subject to the confirmation of the proprietors of the respective companies, the Boards have agreed jointly to work and maintain the North-Western and Charing Cross Railway, which will connect the London and North-Western Railway, near Euston Station, with the system of the South-Eastern Railway Company at Charing Cross.

In Cook County, Illinois, of which Chicago is the capital—there were in 1860 nineteen houses engaged in printing and publishing, employing 356 persons, and producing annually 525,000 dollars worth of books.

Great curiosity has been excited at Cherbourg by a small vessel propelled by electricity with great speed. The inventor, a French engineer, has shown his discovery to M. de Chasseloup-Laubat, the Minister of Marine. Another of the favourite scientific questions there has for some time been submarine locomotion.

Messrs. Bacon and Co. have just published a chart of the Atlantic telegraph. It contains a history of telegraphy, origin and progress of the Atlantic telegraph, and describes the old and new cables. It is well illustrated with maps of the route, engravings of the cables and of the "Great Eastern," showing the arrangements for laying, in fact a large amount of useful information is compressed into a small compass.

A meeting of the justices of Calcutta has been held, to take into consideration the initiatory measures to be adopted for carrying out the scheme, sanctioned by the Lieutenant Governor, and described by us a few weeks since, of supplying Calcutta with pure water on the high-pressure principle. A chief engineer has been appointed, and is to be despatched to England, for the purpose of consulting with eminent engineers and preparing the specifications.

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,—345, 374, 397, 401, 411
BUILDINGS AND BUILDING MATERIALS,—364, 369, 380, 407
CHEMISTRY AND PHOTOGRAPHY,—354, 371, 403, 418
CULTIVATION OF THE SOIL, including agricultural implements and machines, —366, 384
ELECTRICAL APPARATUS,—362
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c.,—347, 376, 377, 389
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals, —348
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.,—349, 351, 352, 355, 361, 370, 373, 381, 382, 385, 392, 394, 396, 399, 406, 414, 416
GENERAL MACHINERY,—400, 417
LIGHTING, HEATING, AND VENTILATING,—344, 350, 353, 390, 408
METALS, including apparatus for their manufacture, —356, 360, 375, 391, 393, 409, 419
MISCELLANEOUS,—379, 383, 388, 398, 413
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.,—357, 378, 386, 404
SHIPS AND BOATS, including their fittings, —359, 363, 365, 387, 405, 420
STEAM ENGINES, &c.,—395, 410, 415
WARRFARE,—346, 358, 367, 368, 372, 402

344 W. SIM. *A method of extracting gases from mineral oils, and in employing the same for illuminating purposes.* Dated February 7, 1865.

This invention relates to the employment of the gases produced by the vaporisation of mineral oils for illuminating purposes as substitutes for coal gas, and it is intended, chiefly, to employ these in lieu of the latter in places where it is difficult and expensive to carry the coal from which the gas is extracted. One kind of apparatus for producing the gas consists of a vessel to hold the oil, from the bottom or sides of which a tube or tubes project, through which the oil is led by its gravitating power, or otherwise, and, in falling, drops or is projected upon a heated plate, retort, or vaporiser made of metal, earthenware, or other suitable material, upon coming into contact with which it is vaporised, and the gas thus formed carried through a hydraulic main, washers, and purifiers into a gasholder, from which it is conveyed by pipes or ducts to places where it may require to be burnt as coal gas ordinarily is. *Patent completed.*

345 J. LAKE. *Improvements in steam generators.* Dated February 7, 1865.

According to this invention it is proposed to employ two, three, or more internal flues, according to the size of the boiler required, the said flues extending from the front to the back end thereof. These internal flues are fitted at their front ends into a flue-plate, which forms the back of the furnace, such furnace or fireplace being made to communicate direct with, and to be common to, the whole of the flues, in lieu of having separate fireplaces in the flues themselves; the furnace or fireplace is surrounded at the sides and back by a water space which communicates freely with the main body of the boiler. In order to facilitate the cleaning of the flues, a hinged or other door or covering is fitted to the front of the furnace, opposite to the entrance to such flues, and beneath this door is hinged or otherwise attached the fire-door of the furnace. The internal flues are each provided at their rear or back ends with a regulating throttle or other valve or damper, which may be worked either together or separately as required from the front of the boiler, the object of such valves or damper being to confine more or less the hot air and gases inside the internal flues, in the place of permitting them to pass off with the draught freely into the chimney; a damper is also fitted at the entrance to the chimney in order to regulate the general draught from the internal flues of the boiler. *Patent completed.*

346 R. BRANDON. *Improvements in cannon shot and shells.* Dated February 7, 1865.

This invention consists in the particular construction of and application to an oblong cannon shot or shell (having an axis one or more times longer than its breadth or thickness) of certain ingredients and parts whereby such shot and shells may be projected from the chamber of a mouth-piece cannon with greater range, force, and accuracy than heretofore. For this purpose the inventor forms a small chamber or socket in the base or back end of the missile, with three or more grooves cut or cast in straight or curved lines from the centre of this socket or chamber, which grooves extend to the edge or periphery of the shorter axis of the missile. A plain cap or cover of metal fits over this chamber or socket and grooves, which cap or cover is secured to the missile by means of bolts, screws, or otherwise. To prepare these missiles for use the inventor takes off the cover or cap from the base of the missile and inserts a prepared charge of "mealed" powder or other inflammable compositions into the chamber or socket of the missile, and then firmly secures the cover or cap on to the missile. The ignition of this charge is effected either by the flame from the chamber of the cannon, or by the remission of a sensitive fuse, which may be inserted through the centre of the cover or cap. When the missile is fired from the gun, the longer axis of the shot will retain its parallel with its line of flight, in consequence of the constant issuing of the flame operating as a fan at the back end of the missile, and which may be made to rotate while in motion by curving the aforementioned grooves on the back face of the missile. *Patent abandoned.*

347 A. A. LAMMUTH. *Improvements in halds for looms, and in machinery or apparatus for manufacturing and winding the same upon "shafts."* Dated February 7, 1865.

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

348 W. E. NEWTON. *An improved apparatus for separating grain.* (A communication.) Dated February 7, 1865.

This invention consists in separating the kernels of one kind of grain from a mass composed of two or more kinds, and in removing and delivering them in a suitable place by themselves, while the remainder of the mass is delivered separately in another suitable place or receptacle. The main feature of the invention consists in providing the exterior surface of a moving body, whether the same be cylindrical or plane, with cells or cups of such a size that, when brought in contact with the mass of the mixed grain, such cells shall receive the grains or kernels of one kind of grain (wheat, for instance), and remove them from the mass, while the kernels of the other kind of grain (oats, for instance), being too long to lie down in and be taken up by the cells the separation of the two different kinds of grain is effected. *Patent completed.*

349 G. TWING. *Improvements in fastenings for stay bucks, leggings, gaiters, and other similar articles.* Dated February 7, 1865.

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

350 S. E. ROSSEN. *Improvements in the ventilation of pressing irons heated by gas, and for preventing the condensation of the vapour in the tubes or flues leading therefrom.* Dated February 7, 1865.

This invention consists, firstly, in an arrangement for drawing off the products of combustion (from the place or chamber in which the gas is burnt) by or through a pipe or passage, or series of pipes or passages, into which pipes or passages the products of combustion are discharged, and from which the air is partially exhausted by an air pump, pneumatic screw, bellows, rotary fan, or by other convenient or suitable means. Secondly, in the method of preventing the condensation of the aqueous vapour contained in the products of combustion passing off by the before-mentioned pipes or passages by admitting thereto a suitable proportion of atmospheric air, whereby such aqueous vapour is retained in suspension and caused to pass away with the other products. Thirdly, in an arrangement whereby the air admitted as described may be heated (and its capacity for moisture thereby increased) which arrangement consists in causing the air to pass through a series of passages surrounding the pipe or passage leading from the combustion chamber, the quantity of air admitted being capable of regulation by means of a cylinder surrounding the passages and adjustable so as to close a greater or less number of holes, whereby the air is admitted as required. *Patent abandoned.*

351 C. FIELD. *A new method (or mechanical contrivance) for lacing and fastening ladies' stays (sometimes called corsets and bodices).* Dated February 8, 1865.

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

352 W. B. WILBY. *Improvements in pencilholders and penholders, and in holders for crayons and other marking, writing, or drawing materials.* Dated February 8, 1865.

The body of the holder in which the sliding propeller carrying the pen, lead, or marking material works has a longitudinal slot in it, as is usual, in which slot a slide works, which slide is fixed to the propeller. By moving the slide up or down the slot, the pen, lead, or marking material is propelled from or withdrawn into the holder. The slide is carried by a spring on the upper side of the propeller. On one side of the longitudinal slot, and parallel thereto, the inventor makes a row or series of holes or perforations, the said holes or perforations being separated from one another and from the slide or edge of the slot. He does not limit himself to the number or shape of the said holes or perforations. On the top of the spring which carries the before-mentioned slide is a pin or projection which is made by the elasticity of the spring to enter one or other of the holes or perforations on the side of the longitudinal slot, and thus fix the slide and propeller in the position to which they have been advanced, and prevent the pen, lead, or marking material being pressed back into the holder in writing. By pressing the slide towards the axis of the holder, the spring is compressed, and the pin or projection withdrawn from the hole or perforation in which it was engaged. *Patent abandoned.*

353 E. C. THORP. *Improvements in the miners' safety lamp.* Dated February 8, 1865.

This invention consists, firstly, in the application of an extinguisher to the miners' lamp, so constructed and arranged that the top or gauze cover cannot be removed without extinguishing the flame. A plate in form of a ratchet wheel is mounted on a pin fixed on one side of and near to the wick tube, so as to cover the top of the said tube. A hole is formed in this plate coinciding with the tube, so that the wick can pass through. One or more spring catches are or are attached to the interior of the gauze cover, which take into the ratchet teeth, which are formed in suitable direction, so that when screwing on the covers, the catches slip over without acting thereon, but when unscrewing the cover they turn the plate, and thereby remove the hole from over the tube, and thus extinguish the flame before the cover can be removed. Secondly, in the application of a glass shield or cover to the bottom part of the gauze, so as to prevent currents of air from blowing or acting on the flame through the gauze, also in having the gauze above the glass cover double, or having a gauze cap or cover to extend down to the top of the glass cover as additional security or prevention of the flame within the lamp igniting any surrounding explosive gases. *Patent abandoned.*

354 J. DISMONTIS. *Improvements in the manufacture of grease for lubricating purposes.* Dated February 8, 1865.

The following are the ingredients of this improved grease, together with the proportions for 1,000 parts, which may, however, be varied if desired:—Wax to nutmeg tallow, 225 parts; hydrated basic oxide of potash, 400 parts; refuse butter without salt, 225 parts; glycerine, 20 parts; solution of carbonate of soda, 30 parts. *Patent abandoned.*

355 J. SINGEK. *Improvements in garments for ladies', gentlemen's, and children's wear.* Dated February 8, 1865.

According to these improvements in trousers, the buttons and braces may be entirely dispensed with, and instead of being fastened with a fly in front, they are opened at the sides, and fastened behind and in front by either long

tabs or straps and buckles, or with belts or elastic bands, or other suitable fastenings, the tabs from the under part being fastened in front, while those from the front part fasten behind; one or more extra fastenings or tabs can be added when desired, so as to constitute a belt (necessary for a corpulent man), either the front lapping over the back, or the back over the front. Buttons and button-holes can be used if desired instead of buckles. The inventor forms an imitation fly in front. He makes the pockets double, that is to say, with a lining somewhat shorter than the pocket, and with an opening at the bottom contracted by elastic webbing. Anything inserted in the pocket is pushed through the contracted opening, and can only be got out by expanding the opening by the hand. *Patent abandoned.*

356 W. ANDERSON. *An improved mode of making metal pipes.* Dated February 8, 1865.

In order to simplify the operation of applying flanges to wrought-iron pipes, the inventor proposes to prepare a sand or other mould in which to cast a flange, and to set the wrought-iron pipe upon its end in the mould; he then pours molten metal into the mould, which metal, as it cools, will shrink upon the pipe and hold firmly thereto. In order the better to ensure this union he proposes to tin or otherwise to coat the end of the pipe at the part which is to come in contact with the molten metal, so as to avoid presenting an oxidised metal surface to the molten metal. *Patent abandoned.*

357 A. W. BANKS. *A new or improved signal applicable to railways, ships, telegraphs, and other such like purposes.* Dated February 8, 1865.

In carrying out this invention the inventor proposes to construct an openwork sphere or globe of thin bands of iron, steel, or wire riveted or soldered, or otherwise fastened together, encircled by an outer band at right angles thereto; the interior of the sphere contains a ring fixed to two axes, which work in bearings in the outer ring, so as to allow of oscillation; the inner ring is then provided with an oscillating bar running at right angles to the line of the axes on which the ring oscillates; the centre of this bar is enlarged and perforated for the purpose of containing a metal tube or case filled with the well-known powder used in theatres for producing coloured fire, either red, green, blue, white, or otherwise, as desired. The tube also contains a friction fuse, which may be drawn out of the tube when it is required to use the signal. The tube is secured in position by descending guide rods or wires, to which is fixed a rest plate for the bottom of the tube, and a small screw is inserted under the plate into the tube for fixing the same. In some cases a tray or receiver for the dross falling from the tube should be fixed on and around the tube. The oscillating bar is made heavier on one side of the tube than on the other, in order to cause the tube always to assume an oblique or slanting position, and it will thus be evident that, when the fuse is withdrawn, and the signal lighted, the apparatus may be thrown from a train and will roll to a state of rest, no matter in what position, since the oscillating ring will act like that in which a ship's compass is secured, and the oscillating bar will allow of the proper position or balance of the tube always being maintained in order that the dross or ash of the fire powder may fall out of or away from the tube. *Patent abandoned.*

358 E. LINDBER. *Improvements in breech-loading fire-arms.* Dated February 8, 1865.

This invention applies more particularly to breech-loading arms, in which the breech is closed by a bolt. It consists in fitting a pin or needle at right angles to the axis of the bore of the gun or at any other angle thereto, for the purpose of exploding the charge, the detonating or fulminating composition being placed in such a position in the cartridge case as that the pin or needle shall come in contact with it when the charge is to be fired. The pin or needle works in a chamber fixed to the gun and through a greased and incombustible stuffing of asbestos or other suitable substance. The needle may be driven by a rod or lever acted upon by the lock or by the hammer according to its position; the needle is withdrawn into a position ready for being again driven to fire the charge, either by cocking the hammer, or by opening the breech, or otherwise. *Patent completed.*

359 G. MILLER and H. COXON. *Improvements in apparatus for discharging coals and other cargo from ships' holds, applicable also to the raising and transferring of weights from one point to another.* Dated February 8, 1865.

This invention consists in the construction and employment of a derrick and appliances as hereafter described. The derrick is composed of a spar or beam fitted with two pulleys or chain wheels near the ends thereof, round which pulleys an endless chain, rope, or band is made to travel. The lower pulley is driven by steam or other power, and the spar is placed in a more or less inclined position. Chains or ropes are connected to the endless chain, rope, or band referred to at intervals, and these chains or ropes carry at bottom a hook or other fastening according to the weight to be acted on. By way of explaining the working of this apparatus, the inventors suppose it applied to the raising of coal from the hold of a ship and discharging it into a shoot. The derrick is fixed at such height and inclination that, when the chains as aforesaid depending from the endless chain reach the lowest point of their travel, they shall enter the hold of the ship. For every chain there is a bucket, with extra buckets to spare. Upon the driving pulley being made to rotate the endless chain will be also set in motion round the pulleys, taking with it the chains attached to it. A bucket being filled and attached to the lowest chain is raised from the hold, and by the travel of the endless chain is carried into a different vertical plane, and over the shoot into which its contents are tilted; the bucket returns by means of the endless chain to the point from whence it started, and is refilled or is replaced by another bucket already filled. The other buckets connected by the chains to the endless chains follow in the same course as the first, and so on. The height and inclination of the derrick should be altered to suit the level of the coals in the hold, and in order to prevent contact between the ascending and descending buckets they apply a partition or screen. *Patent abandoned.*

360 R. A. BROMMAN. *New or improved machinery for the manufacture of wire and other netting.* (A communication.) Dated February 8, 1865.

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

361 W. STAATS. *Improvements in the manufacture of skirt borderings and linings to be applied to wearing apparel.* (A communication.) Dated February 8, 1865.

This invention consists in forming and weaving a binding tape or strong narrow fabric, in combination with a fabric to be used for lining a dress, so that the part of the lining which comes near the lower or bottom edge of a female dress will have woven with it a strong narrow fabric suitable to form the binder to the bottom edge of the dress in which such lining fabric is used. *Patent completed.*

362 W. A. MARSHALL. *A new or improved insulating material for telegraphic and other purposes, together with an improvement in protecting telegraph wires, especially applicable to submarine and subterranean telegraphs.* (A communication.) Dated February 9, 1865.

This invention consists in the employment of asbestos or amiantus (amianto) for insulating purposes. The invention also consists in protecting telegraphic wire, especially for submarine and subterranean purposes, in the following manner:—The inventor protects and completes the insulation of the wire previously covered with the asbestos or amiantus as before described by surrounding or enclosing it in a metal tube, by preference of tin. *Patent abandoned.*

363 J. C. G. HALKETT. *Improvements in protecting wooden surfaces from the fouling and injury to which they are ordinarily liable in sea water.* Dated February 9, 1865.

This invention consists in applying to the wooden surfaces to be protected a covering or sheathing of sheet iron or steel, such sheet iron or steel being itself coated on both sides. The coating on the inner side of the sheathing may be of a kind calculated to preserve it from corrosion merely, such, for example, as white oxide of lead made into a paint with boiled oil and litharge, or an oleaginous, fatty, or bituminous anti-corrosive mixture. The outer side of the sheathing must be coated with a mixture which, whilst it is anti-corrosive, is also anti-fouling, and for this purpose it is preferred to use the mixture described in the specification of letters patent granted to F. Cruickshank, dated 4th August, 1864 (No. 1,941). Care must be taken to apply the outer anti-fouling coating to the edges of the sheets forming the metallic sheathing, and to the nails or other fastenings by which they are fixed on the wooden surfaces to be protected. If preferred the anti-fouling and anti-corrosive coating may also be applied to the inner side of the sheathing instead of the simple anti-corrosive coating. *Patent completed.*

364 J. CHURCH. *Improvements in iron safes and strong rooms.* Dated February 9, 1865.

For the purposes of this invention in order to render the door of an iron safe less liable to be forced open by the introduction of thin hard steel wedges between the frame of the door and the beveled edge of the door, so as to take advantage of the incline on the interior edge of the door, the frame, in place of being made flush, as heretofore, is made to project beyond the door, so that the door will be recessed; and further to protect the door and the keyhole or holes through the door of a strong room or iron safe a hardened steel bar is applied external of the door, and from side to side thereof, and such bar is fitted within a groove across the door. It is preferred that this bar should be of a curved convex form externally, and flat on the side where it comes next the door. At each side of the framing of the door is fixed or formed a projecting socket, into which the bar is slid after the door has been shut and fastened or locked. It is preferred that the sides of the groove across the door in which the bar is fitted should be undercut, in order better to insure that no thin steel wedges shall be introduced between the door and the bar. The bar is fixed in position by the bolt or catch of a lock. *Patent completed.*

365 M. BIER. *Propelling boats, ships, vessels, or other floating crafts and objects.* Dated February 9, 1865.

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

366 R. WINDER. *Improvements in the mode of ploughing and performing other operations upon the land by steam power.* Dated February 9, 1865.

These improvements in steam ploughing consist, first, in the application of a square-linked chain similar to those used in dredging machines, traction engines, &c., or of an ordinary linked chain or rope being used and placed along the space between the two anchors on the headlands. The engine and boiler are fixed upon the frame of the machine that moves backwards and forwards between the anchors. Upon this frame is a pulley which is made to revolve by the steam engine above mentioned. When the square-linked chain is used, this pulley is made with projections which fit into and between the links of this chain; when the ordinary chain or rope is used, the face of the pulley is made plain instead of having projections, so that the ordinary chain or rope is made to take one or two turns around the pulley. This shows the means by which the frame of the machine, as well as the cultivator, plough, or other implement attached, is made to move backwards or forwards in the space between the two anchors upon the headlands. The invention cannot be fully described without reference to the drawings. *Patent abandoned.*

367 M. PRICK. *Improvements in the manufacture of patched balls for fire-arms.* Dated February 9, 1865.

This invention consists in first forming one end of the ball so as to leave a rim or flange of the metal, while the metal which is to form the balance or other end of the ball is of a smaller diameter than the end first formed, and stands in the centre and axially of the ball like a spindle; the patentee then places the first rimmed end upon a round patch of the requisite diameter, then gathers the outer edge up and over the said rim or flange, and then by proper dies or other contrivances compresses the balance of the metal down upon the edge of the patch, so as to securely hold the patch and form the other end of the ball. *Patent completed.*

368 J. P. LINDSAY. *Improvements in locks for fire-arms.* Dated February 9, 1865.

The object of this invention is to combine two hammers so as to be operated by one trigger, and so that but one hammer can be discharged by a single pull upon the trigger. The invention consists in the use of a detent which is operated by one of the hammers so as to arrest the trigger after it has discharged the first hammer, and prevent its action on the sear of the second hammer to discharge it (the second hammer), until the trigger has been released after discharging the first hammer, which discharge and release the trigger from the action of the detent, when by again pulling the trigger the second sear will be operated upon so as to discharge the second hammer. *Patent completed.*

369 G. E. MEEK and W. H. HOWES. *Improvements in fastenings for doors, windows, drawers, and other like purposes.* Dated February 9, 1865.

According to one part of this invention it is proposed to make the socket for receiving the end of a bolt, when applied to the bottom of a door, and made to shoot downwards into such socket which is to be let into the floor, so that no accumulation of dirt may take place in the socket. For this purpose a sliding metal plug is fitted inside the socket, which should be of a tubular form, such plug being forced upwards by a helical spring inside the socket and maintained flush with the top of such socket, so as to close the hole when the bolt is withdrawn, and thereby prevent the entrance of dirt therein. Any ordinary bolt may be used with this socket, or a spring bolt may be employed of a peculiar construction. This spring bolt is contained within a tubular socket, and is forced upwards by means of a helical spring within the tubular socket. The bolt is drawn back by means of a small handle, the shank of which passes through a slot in the side of the tubular socket. In order to hold the bolt back when withdrawn, a bayonet slot is employed, and a slight return slot or notch is made in such bayonet slot to retain the shank of the knob or handle when brought therein by a slight turn of the bolt. This improved socket and spring bolt may be applied if desired to the side of a door or to a sash frame. *Patent abandoned.*

370 A. V. NEWTON. *Improved mechanism for operating the working parts of sewing machines.* (A communication.) Dated February 9, 1865.

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

371 J. DALL. *Improvements in the production of substances to be used in place of the pigment usually termed satin white.* Dated February 9, 1865.

This invention consists, firstly, in decomposing the material called satin white containing sulphate of lime and alumina by chloride of barium or strontium, so as to replace, or partially so, the sulphate of lime by the sulphate of barium or strontium. Secondly, in the production of a material to be used in place of satin white by using caustic baryta or strontia, instead of lime, as in the ordinary method of making satin white. *Patent completed.*

372 A. KRUPP. *Certain improvements in breech-loading ordnance.* Dated February 10, 1865.

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

373 C. LINGARD. *Improvements in the manufacture of scissors, shears, and edge tools.* (Partly a communication.) Dated February 10, 1865.

The object of this invention is to make cast iron available in the manufacture of such articles, and to weld or attach thereto cast steel to form the cutting parts. *Patent abandoned.*

374 E. LEIGH. *Improvements in furnaces for smelting iron ores, commonly called blast furnaces, also in cupolas used in foundries for rendering down or melting iron or other metals.* Dated February 10, 1865.

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

375 J. RAMSBOTTOM. *Improvements in machinery for rolling and hammering iron and other metals.* Dated February 10, 1865.

The nature of this invention of improvements in machinery for rolling iron and other metals, consists in substituting a friction or shearing apparatus in lieu of the breaking spindle usually employed for connecting the driving power to rolling mills; and the nature of the improvements in machinery for hammering iron and other metals consists in supporting the hammer blocks of duplex steam hammers on sectors instead of wheels, as described in the specification of a patent granted to the present patentee the 13th April, 1863 (No. 924). *Patent completed.*

376 E. LORD. *Improvements in machinery for preparing and spinning cotton and other fibrous materials.* Dated February 10, 1865.

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

377 R. G. HAZARD. *Improvements in looms for weaving.* Dated February 10, 1865.

The nature of this invention consists, firstly, in giving the required movements to the shuttle by the force of air set in motion by the action of the working parts of the loom. Secondly, in determining the precise time at which the movements of the shuttle shall commence. Thirdly, in the peculiar construction and arrangement of mechanical parts for effecting these objects. *Patent abandoned.*

378 A. C. EDWARDS. *Improvements in apparatus for communicating between the passengers, guard, and engine driver of a railway train.* Dated February 10, 1865.

Provisional protection has not been granted for this invention.

379 H. W. HART. *Improvements in apparatus for affixing postage and other gummed stamps and labels.* Dated February 10, 1865.

This apparatus consists of a box or case, the interior of which is made of a size and shape to receive the particular stamps or labels to be used. The patentee applies a thin lip or edge just inside the open bottom of the case on one or more of its sides, and he fits inside the case a plunger surmounted by a spring capable of being depressed by a knob or handle passing through and working in the upper part of the case. The case is charged with stamps through a slot in the side or otherwise gummed side downwards, and the spring keeps the plunger down upon them. The lip prevents the stamps falling through the bottom of the case, but on the lowest stamp being moistened by being pressed upon a moistened sponge or otherwise, pressure upon the knob or handle presses the moistened stamp out of the case and affixes it where required. *Patent completed.*

380 W. E. NEWTON. *Improvements in the formation of embankments, sea walls, breakwaters, and other similar constructions.* (A communication.) Dated February 10, 1865.

The patentee claims the formation of embankments and other similar works, such as those above stated, by means of shallow open frameworks placed and secured one upon the other from time to time as the sand accumulates therein, so that the sand and other earthy matters may be caught and retained within the frameworks as they are built up, and thus in time form a solid embankment up to high-water mark, as set forth. *Patent completed.*

381 G. COLKS, J. A. JAKES, and J. A. FANSHAW. *Improvements in the manufacture of boots, shoes, and other coverings for the feet.* Dated February 10, 1865.

This invention relates to an improved mode of making the soles and heels of these articles, and consists in forming them of a combination of hard and soft rubber compound combined with any suitable textile fabric, in place of leather, as is now usually employed. *Patent completed.*

382 H. EMANUEL. *Improvements in boxing, fencing, and cricket gloves, and in cricket pads or guards.* Dated February 10, 1865.

According to this invention the patentee constructs a glove of vulcanised or iron vulcanised caoutchouc, or of other like substance, capable of being inflated and contracted, and he furnishes it with one or more apertures, mouthpieces, or tubes through which it may be inflated with air or filled with other fluid, and which are fitted with plugs, valves, or similar appliances for retaining and discharging the air or fluid. The glove may be covered with leather, or other soft substance, or not. Such a glove may be readily inflated, and will present a light and resilient cushion. When the air or fluid has been discharged, the glove may be folded and packed. *Patent completed.*

383 J. SCHNEIDER. *Improvements in apparatus for counting coins of money, tickets, and other similar articles, and indicating the number thereof.* Dated February 11, 1865.

This invention consists in the combination of an outer box or case and inner boxes or drawers to receive and contain the coins or other similar articles with the apparatus hereinafter described for counting and indicating the number of the same admitted into the box or boxes. In one form of the invention, the outer box is a case composed of wood or metal, and contains a suitable number of drawers or inner boxes, into which the coins or other similar articles are to be dropped through apertures formed in the outer case over an opening in the top of each drawer or inner box. Underneath each of these apertures is fixed a tube leading to the opening at the top of the drawer or inner box, such tube being furnished with a hinged valve at the bottom, which valve is caused to open by the weight of a coin or other similar article falling on the end of a lever, and is closed by means of a rod with a counterbalancing weight at one end. Within the said tube is a stem with a forked opening at the top, such stem being part of or connected to one end of a lever suspended from a pit or centre of motion fixed into the top of the box. The other end of this lever is jointed to a vertical rod, which is connected with the ordinary wheels and dials for the purpose of indicating the number of coins or other similar articles dropped into the box. *Patent abandoned.*

384 D. H. BARBER. *Improvements in reaping machines, parts of which improvements are also applicable to mowing machines.* Dated February 11, 1865.

The patentee claims, first, the application and use of the serrated slotted standard in combination with the teeth on the hollow axle of the supporting wheel, for the purpose of carrying the platform of a reaping machine at any desired height, as described. Second, the application and use to and in reaping machines of an axle so constructed that a bolt passing through the same secures the wheel on the axle, and the axle itself to the supporting standard at any desired height, substantially as described. Third, the peculiar arrangement for carrying the reel of the platform of a reaping machine, and for raising or lowering the same and securing it in any desired elevation, substantially as described. Fourth, the peculiar arrangement for carrying the reel of the reaping or mowing machine, and the means for adjusting the height of its bearings, and for securing the same at any desired elevation, as described. Fifth, the mounting the reel of a reaping or mowing machine upon the end of a vertical standard capable of moving or turning on a pivot or centre at its lower end, and thereby enabling the reel to be moved forwards or backwards, as desired. Sixth, the means for tightening the reel driving hands of reaping or mowing machines, substantially as described and illustrated in the drawings. Seventh, the peculiar mode of splicing the pole of a reaping or mowing machine, as described. Eighth, the application of a guard or shield plate to the inner driving wheel of a reaping or mowing machine for the purpose described. *Patent completed.*

385 G. C. and J. B. HASELKER. *Certain improvements in the manufacture of brooches, part of which said improvements are applicable to the manufacture of lockets.* Dated February 11, 1865.

This invention consists of two parts, first, in making the bodies for brooches without seam from one piece of metal (instead of from two or more pieces of metal as is now customary) by raising the same from flat metal blanks and curving over the edges until the part which was the outside of the blank is turned in so as to form the inner frame or recess for the reception of an ordinary box and glass. The first part of the invention the patentees consider to be particularly applicable to the manufacture of bodies of lockets. Secondly, the invention consists in the application of a rod or shaft on which the body or centre part of a brooch may turn or revolve in manner following. The patentees take a body or centre part made as is described in the first part of this invention, and make two holes opposite each other, one on each side of the said body or centre part; through these two holes they insert a rod or shaft, and to each outer end of the rod or shaft they attach a metal ornament at right angles to the said rod or shaft. On one side of such metal ornaments they fix an ordinary brooch joint and tongue, and on the metal ornament at the other end of the rod or shaft they fix an ordinary catch ring. By such an arrangement either side of the body or centre part can be turned to the front. *Patent completed.*

386 J. and J. PORTER. *The better support and stay of the horizontal iron rail, to be called "Porter's permanent stay."* Dated February 11, 1865.

This invention relates to a peculiar construction of railway chair by the employment of which the ordinary fishplates may be entirely dispensed with, and the lumping of the carriages now experienced obviated, in addition to which greater facility is afforded to workmen in laying the rails, as no previous preparation of the same is required, and they can be readily repaired or replaced. For this purpose the patentees connect three chairs together by means of longitudinal pieces cast in one therewith, and acting as beds for the rail to lie upon; they form one jaw or stay of each chair of a separate piece which fits at bottom against a shoulder, or into a recess formed passing through the chair and screwed into the sleeper, or the bolt may pass through the sleeper and be secured by a nut. The loose

jaws are so formed that, when screwed down, they are made both to press firmly against the side of the rail (a wood packing piece being by preference made to intervene), and to force it down upon its bed. Thus, when the arrangement of three combined chairs above described is employed for holding the abutting ends of two lengths of rail, these being placed so that the extreme ends are held by the middle jaws of the combined chair and the lock jaws firmly screwed down, the joint is held in a firmer and more perfect manner than when the fish-plates are employed. *Patent completed.*

387 C. ATHERTON and A. H. RENTON. *Improvements in buoys, beacons, floats, or pontoons, which improvements are also applicable to floating bodies generally.* Dated February 11, 1865.

This invention consists in the construction of buoys, beacons, floats, or pontoons, and floating bodies generally, in such manner that they shall be rendered permanently buoyant or unsinkable, however damaged by any casualty. And this the patentees effect by using in their construction a quantity of suitable composite material or substance, the mean specific gravity of which shall be less than that of water. The composite material which they prefer to use is a mixture of cork, or other light bark, light woods, or other natural or artificial substances of small specific gravity, suitably prepared for intimate incorporation with bituminous, resinous, oleaginous, or such other adhesive matter, which, when combined therewith, will form a mass impermeable to water, and of a mean specific gravity less than water, and such as, when placed in the interior of the floating body, shall cause it (howsoever perforated or damaged by collision or otherwise) to preserve its buoyancy under the casualties to which floating bodies are subject at sea. *Patent completed.*

388 J. HALL. *The manufacture or production of oil for the use of machinery, or for other similar purposes.* Dated February 11, 1865.

This invention consists in the manufacture or production of oil from the fat of oxen, bull, or cow, in the following manner:—The patentees place any required quantity of the fat of oxen, bull, or cow, in a cauldron or vessel, which he places over a heated stove or other heated surface until the fat which the vessel contains has become thoroughly dissolved. The fat thus dissolved he then runs through a series of sieves, to extract the refuse from it, and he then pours into the vessel which has received the fat thus dissolved, and whilst the fat is still in a liquid state, a quantity of colza oil. He then places the vessel containing these two ingredients on a heated surface, and he then clarifies the liquid by stirring or otherwise, and he then clarifies the liquid by placing dry coffee or equivalent substance within a bag of muslin, or other equivalent material which he inserts in the liquid, and he then stirs or otherwise mixes the liquid. He then proceeds to filter the liquid through flannel, next through thick paper, and subsequently through fine paper; when this has been done the oil is fit for use. *Patent completed.*

389 T. A. and M. A. VERKRUZEN. *An improved winder, and arrangement for winding and putting up velvet and other ribands.* Dated February 11, 1865.

This invention refers to a new form of winder and block, consisting of a rotating cylinder and disc. The new winder itself forms the block, and when used in the first instance by the manufacturer in putting up the ribbons, renders the second winding or re-blocking by the vendor wholly unnecessary. *Patent abandoned.*

390 A. M'LAUREN. *Improvements in apparatus for heating water, and in connecting hot water and other metal pipes.* Dated February 11, 1865.

This apparatus for heating water is particularly applicable to heating water for warming churches, conservatories, and other buildings. This part of the invention refers to what are known as "Saddle boilers," and consists in forming an additional water space across the middle, and between the two sides of the boiler; this water space extends from back to front of the boiler or nearly so, and encloses between its upper surface and the upper water space a longitudinal passage or flue. The flames and products of combustion first pass beneath the additional water space to the back of the boiler, then return through the passage or flue above such water space, and finally back again over the top of the boiler to the chimney. The method of connecting hot water and other metal pipes is chiefly intended for the pipes used in warming churches and other buildings, and consists in forming a socket about half an inch in depth, more or less, in the end of one pipe to receive the end of the next adjoining pipe, and in fitting an india-rubber washer or other packing between the ends of the pipes to make the closing hermetic. The inventor forms a flange near the end of each pipe for the passage of bolts for fixing the pipes to each other; the flanges also act as stops to the packing. *Patent abandoned.*

391 W. CROOKES. *Improvements in extracting and separating gold and silver from their ores or matrices.* Dated February 11, 1865.

This invention consists mainly in the employment of an amalgam of sodium, or such other alkali metal in treating ores or substances containing gold or silver, for the extraction and separation therefrom of the precious metals. *Patent completed.*

392 C. WEST. *Improvements in apparatus for giving alarms.* Dated February 11, 1864.

For the prevention of robbery and burglary this apparatus is composed of vulcanised india-rubber, in which the inventor places two steel or other metal springs, one of them slightly arched, with a separate wire from each one leading to an alarm, and the other to a galvanic battery. He fixes this apparatus in the door posts, window sills, drawers, desks, or otherwise; upon closing the doors, windows, drawers, or articles, the pressure upon the india-rubber and the arched spring breaks the connection between the two wires, but upon opening again contact is immediately made and the alarm given. He also applies this apparatus to the locks of iron safes or chests where money or other valuable articles are kept. *Patent abandoned.*

393 E. H. NEWBY. *Improvements in case-hardening or connecting partially into steel articles of wrought or malleable iron.* (Partly a communication.) Dated February 11, 1865.

Provisional protection has not been granted for this invention.

394 E. J. HILL. *Improvements in pen and pencilholders.* Dated February 11, 1865.

In constructing penholders, in place of the stick ordinarily employed, the patentee applies a loop of wire, or

other suitable material, and this loop, when using the pen, is placed over the forefinger, or other finger, as may be preferred. In place of a loop, a hook, ring, or crutch passing over the finger may be employed. He also prefers to make the holder of a triangular form, in place of cylindrical, as is usual, but the loop, hook, ring, or crutch may be applied to an ordinary penholder. Pencilholders also he forms in a similar manner. *Patent completed.*

395 J. CASS. *Improvements in furnaces and boilers and parts connected with them for generating steam and heating fluids, and also for improved apparatus for reducing and shutting off steam and regulating the speed of steam engines.* Dated February 11, 1865.

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

396 A. V. NEWTON. *Improvements in the construction of single-thread sewing machines.* (A communication.) Dated February 11, 1865.

This invention, under one head, relates to an arrangement of mechanism which will greatly simplify the construction of sewing machines intended to form the ordinary chain or tambour stitch. In this improved machine the chain or tambour stitch sewing is produced by the aid of a looper, which rotates in a horizontal plane, and takes up the loop formed by the vertical needle, and holds it open until it is entered and secured by the next descent of the needle. *Patent completed.*

397 H. H. GRIERSON and J. M. RIGBY. *Improvements in cupolas and blast furnaces.* Dated February 11, 1865.

This invention consists in a method of working cupolas and blast furnaces without the aid of a fan or other such apparatus. For this purpose the inventors close the upper end of the cupola or blast furnace either by a movable or permanent cover, and apply a flue thereto, leading to a steam engine or other chimney. Where several cupolas or blast furnaces are employed separate flues from each may pass to one chimney. *Patent abandoned.*

398 P. A. LE C. DE FONTAINEMOREAU. *Certain improvements in the manufacture of caoutchouc.* (A communication.) Dated February 11, 1865.

This invention consists in manufacturing an artificial caoutchouc capable of resisting acids and a high temperature, and of replacing oilcloth and varnished or plain leather, and other similar products. In carrying out the invention the inventor takes 56lb. of caoutchouc cut in small pieces; 12lb. gutta-percha cut in small pieces, or about 67lb. of caoutchouc if gutta-percha is not used; 67lb. of powdered cork or sawdust; 11lb. of flour of sulphur; to which he adds about 67lb. of any dissolving agent, such as sulphur of carbon or turpentine. He leaves the whole to macerate from ten to twenty-four hours; when in a state of paste he causes it to pass through heated rollers, by which means he obtains sheets of any length. *Patent abandoned.*

399 D. BARR, W. H. PAGE, and C. J. NEWBY. *A machine and tools for making collars, cuffs, wristbands, and other articles of dress.* Dated February 13, 1865.

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

400 H. M. KENNARD. *Improvements in machinery for riveting, and for making rivets.* Dated February 13, 1865.

This invention consists in an improved arrangement of that description of machinery for riveting together metal plates in which both heads of the rivets are formed during the process of riveting, which improved arrangement is also rendered applicable to the making of ordinary rivets when the machine is not employed for riveting. For this purpose a strong framing is provided with two uprights situated such a distance apart that the object to be riveted can pass between them. In these uprights there are arranged two sliding rams or pistons, the one situated opposite the other, and each carrying a die or cup for forming the rivet heads, so that when the object to be riveted is passed between the two uprights (being held and guided in its motion by guide rollers) and a length of heated rivet iron has been inserted into the hole formed in the object to receive it, both pistons or rams with the dies are caused to advance, and by acting simultaneously upon each end of the rivet iron are made to form both heads of the rivets at once. *Patent abandoned.*

401 R. W. THOMSON. *Improvements in steam boilers.* Dated February 13, 1865.

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

402 L. H. G. EHRLHARDT. *An improved gunpowder.* Dated February 13, 1865.

The patentee claims the use of tannin, or such substances as contain this material in large proportions, such as catechu and gum-kino, artificial tannin, coal, or any description of mineral, carbon, wood, charcoal, or other vegetable carbon. He claims the use of any one or more of the above ingredients in combination with either chlorate of potash, or other fusible chlorates, or nitrate of potash singly or in combination and for the manufacture of gunpowder. *Patent completed.*

403 J. A. PASTORALLY. *Improvements in extracting turpentine and tar from resinous wood.* Dated February 13, 1865.

This invention consists in a new process for the direct extraction from resinous woods of the essence or spirit of turpentine, the acetic acid, the gas, and afterwards the tar in one or two operations, at will, by introducing steam into the cylinder in order to preserve the essence of turpentine from burning, or by putting a certain quantity of water into the cylinder to replace the steam and obtain charcoal for residuum. *Patent completed.*

404 W. ADAMS. *Improvements in bogie trucks used for supporting railway locomotive engines, carriages, and waggon.* Dated February 13, 1865.

The patentee, in carrying out this invention, provides means whereby the fixed or driving axles of the engine and the axles of the bogie truck shall assume directions radial or nearly so to the curve round which the engine may be passing, and thus relieve the engine and bogie frame from lateral strain. *Patent completed.*

405 J. G. TONOUR. *Improvements in the construction, arrangement, and mode of applying paddle wheels for propelling boats or other vessels.* (A communication.) Dated February 13, 1865.

This invention is more particularly applicable to boats or packets for navigating canals or rivers at high speeds without injury to their banks. Paddle wheels constructed according to this invention have a number of compartments formed around their peripheries, the divisions in some cases forming fixed paddles, and in others movable

paddles are employed which are projected outwards and withdrawn, by suitable cam surfaces arranged so as to act upon the paddles to project and withdraw them as required to propel the vessel. One or more of these paddle wheels may be arranged and mounted so as to revolve on axes in suitable wells or compartments formed in the interior of the boat or other vessel to be propelled. The under sides of the wheel or wheels project below the bottom in such manner that the paddles only are in operation on the water below and entering the compartment in which the wheel revolves. By this arrangement the paddles only act where the water has the greatest depth. *Patent completed.*

406 F. O. VANNET. *Certain improvements in the manufacture of penholders.* Dated February 13, 1865.

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

407 E. B. WILSON. *Improvements in fireplaces.* Dated February 13, 1865.

This invention has reference to a former patent dated 16th January, 1864 (No. 128). The essential features of the present invention consist, under one modification, of forming the fireplace proper in direct communication with the chamber at the back of the fire-grate, instead of partially dividing them by a diaphragm, as described in the specification of the patent heretofore referred to, the heated products of combustion passing directly into the chamber formed by the grate and the recess at the lower part of the chimney, the upper part of the chamber thus formed being partially closed in, the opening left being fitted with a suitable valve to regulate the draught. According to a second modification a chamber similar to the one before referred to is formed at the back and sides of the fireplace, and a set or sets of pipes are placed in the chamber in connection with openings or perforations at the top and bottom parts of the front plate; thus, as the cool air rushes in at the bottom openings through the pipes, it is expelled at the top perforations, having been warmed and expanded by its contact with the heated sides of the pipes or ducts. A third modification of this invention consists in converting the upper part of ordinary or other fire-grates into a coal hopper or holder, so that, as the lower part of the fuel becomes burnt away, the fresh coal falls downward by gravitation, the supply thus being continuous. *Patent abandoned.*

408 E. J. O. WELCH. *Improved apparatus for supplying with a regular and constant pressure air to burners for consuming or burning hydrocarbons for illuminating purposes.* Dated February 13, 1865.

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

409 W. E. NEWTON. *Improvements in the manufacture of sheet iron.* (A communication.) Dated February 13, 1865.

The patentee claims subjecting the sheet of iron after it has been cleansed of its scale to a bath or coating of oil, which is rolled in at a temperature that will dissipate the oil. He also claims subjecting the sheet, after it has been removed from the bath of alkaline solution, to the action of revolving brushes, upon each of which a jet or stream of water is thrown. He further claims the combination of an organic and mineral acid in the acidulous bath for the purpose set forth. *Patent completed.*

410 J. GRESHAM. *Improvements in and applicable to that and similar apparatus for raising and forcing fluids and feeding steam boilers, known as "Giffard's injector."* Dated February 14, 1865.

One part of this invention consists in arranging charging apparatus so as to overcome certain difficulties. This is effected by causing the charging supply to descend and enter at the lowest point of the suction pipe above the foot valve; by this means upward motion is given to the entire column of water in the suction pipe, consequently, there is no tendency to break the continuity of the jet in the sudden effort to impart motion to the column of water in the suction pipe when the charging supply is cut off, as is the case in the charging arrangement hitherto used. The second part of the invention relates to a method of charging the injector by drawing the feed water or liquid up the suction pipe of the injector sufficiently high to enable the injector to start into operation, at which time the action of this apparatus is dispensed with, and this part of the invention consists in creating a partial vacuum by means of a steam or other fluid jet, or current, the chamber in which the partial vacuum is formed being brought into communication with the feed or suction pipe of the injector. *Patent completed.*

411 H. J. WALDUCK and E. BARTON. *Improvements in furnaces for smelting or reducing ores and for melting metals.* Dated February 14, 1865.

This invention consists in providing for the free admission of air at the top of the furnace along with the materials to be smelted or melted and the fuel, and for working the furnace with a downcast draught, thus dispensing with the necessity for tuyeres. *Patent abandoned.*

413 G. HARTON. *Improvements in waterproofing skins, hides, and leather.* Dated February 14, 1865.

This invention consists in placing skins, hides, and leather that have been previously tanned or preserved in a vessel or chamber made perfectly close, and in exhausting the air therefrom, and forcing into the vessel a solution of india-rubber, or a solution of gutta-percha, with the addition to either solution of a small quantity of copal gum cowrie, or other known and suitable resinous gum insoluble in water, or of a small quantity of wax or spermaceti. *Patent completed.*

414 W. C. HINE. *Stoppers for bottles or other similar vessels, and measuring quantities therefrom.* Dated February 14, 1865.

This invention consists in part in forming the upper part of the stopper, i.e., the part usually taken hold of, in the shape of a cap to cover the lip or rim of the bottle neck, such cap, when removed from the bottle or other similar vessel, and turned upside down, also forming a cup or receptacle for a portion of the contents of the bottle. Such cup or receptacle is flattened sufficiently at the bottom to enable it to stand firmly by itself, the part forming the stopper standing up from the bottom of the cup or receptacle in the centre thereof. This stopper may be made to fit into the neck or upper part of the bottle or other vessel by grinding or otherwise; or the neck of the bottle or other vessel may have a ring composed of cork or other convenient substance inserted in it to fit the stopper, the cup or receptacle of which is marked on the outside or inside by engraving, cutting, casting, or otherwise, with any suitable indication or device, besides being marked to

indicate quantities, parts, or doses of the contents of such bottle or other vessel. *Patent abandoned.*

415 W. F. BATHO. *Improvements in expansion gear for steam engines.* Dated February 14, 1865.

The object of this invention is the ready adjustment of the slide or valve for cutting off the steam from the cylinder according to the requirements of two load whilst the engine is working. For this purpose the patentee employs a loose eccentric carrying a short shaft, having cut on it a worm working in a worm wheel keyed on the crank shaft of the engine. To the said short shaft is fixed a spur wheel or pinion, gearing into another spur wheel or pinion fixed on an intermediate shaft which carries a bevel pinion gearing into two bevel wheels, one loose on the crank shaft and the other loose on the boss of the eccentric. *Patent completed.*

416 R. J. JONES. *An improved system of manufacturing clog soles, pattern boards, and similar articles by machinery.* Dated February 14, 1865.

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

417 G. WHITTON. *Improvements in hydraulic presses.* Dated February 14, 1865.

This invention consists in fitting to hydraulic presses a safety valve and an auxiliary or small ram, which is weighted by weights which can be changed according to the pressure to be exerted and to the test or strain to be applied to any article acted on by the press. The weight carries a projection which comes under the free end of the weighted lever of the safety valve, and when the pressure of the weight is overcome by the pressure on the main ram, the auxiliary ram raises the weight which also raises the safety valve lever. The patentee also applies an alarm bell, which is made to ring upon the escape of any fluid from the waste pipe, to call the attention of the pressman when the calculated pressure on any of the press pumps or valves is exceeded. The fluid, on escaping, enters a machine similar to a Barker's mill or turbine, and gives motion to a shaft connected thereto. This shaft carries a tappet which comes in contact with a hammer shaft, and causes it to strike on or ring a bell. He applies a check valve to every press, so that when two or more are connected they may be independent of one another. *Patent completed.*

418 A. FRYER. *Improvements in the mode of treating for evaporating and concentrating purposes cane juice and saccharine and other solutions and liquids, and also in machinery or apparatus for the concentration of cane juice and saccharine and other solutions, and for the evaporation of liquids.* Dated February 14, 1865.

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

419 E. H. NEWBY. *Improvements in the manufacture of cast and wrought iron.* (A communication.) Dated February 14, 1865.

This invention consists in adding to pig or cast iron the alloy and flux hereafter described for the purpose of increasing its strength and rendering it less liable to corrosion. The alloy is composed of copper, tin, zinc, and aluminium. The flux is composed of carbonate of baryta and fluor spar, or cryolite. *Patent completed.*

420 J. TROTMAN. *Improvements in mooring anchors.* Dated February 14, 1865.

For the purposes of this invention a mooring anchor is formed in two parts, to which usually a stock is applied, which is passed through the end of the shank. The palm or holding part of the anchor the patentee prefers to be of cast iron, or cast steel, with a hole through it to receive the end of the shank. The shape of the holding part is somewhat similar to a ploughshare on each side of the shank. The shank is composed of wrought iron, or of steel, forged straight or nearly so, for the greater part of its length, the transverse sections, however, varying in area according to the strain each part is intended to bear. At the back end the shank is bent downwards, and passes into and through the holding part of the anchor. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated April 12, 1865.

1044 G. A. MONTENAT, Rue de la Fidélité, Paris, chemist. A new apparatus for ejecting and spreading liquids and powder.

Dated July 24, 1865.

1920 H. W. HART, Strand. An improvement in metal pins.

1922 J. LEITCH, Oxford-street, gunmaker. Improvements in crinolines.

Dated July 26, 1865.

1946 T. PEPPER, Newington-green. Improvements in the manufacture of anti-flammable starch.

Dated July 27, 1865.

1952 H. SHERWOOD, Hatcham, Surrey. Improvements in the means of, and apparatus for, treating animal and vegetable fibrous materials, which apparatus is also applicable to various useful purposes.

Dated August 1, 1865.

1984 F. R. WELLS, Hastings. A new or improved method of producing a photographic image on the surface of copper or other metal plates.

1988 W. SINGLETON, Sheffield, cutlery manager. Improvements in apparatus for cutting scales for knives and forming metal webs for knives.

Dated August 10, 1865.

2073 J. and H. LAGHAM, manufacturers, and J. BROADLEY, manager, Halifax. Improvements in looms for weaving.

2075 C. J. R. JENNS, Krausenstrasse, Berlin, engineer. Improvements in mounting telescopes and microscopes.

2079 W. E. NEWTON, Chancery-lane, civil engineer. Improvements in machines for making eyelets. (A communication.)

Dated August 11, 1865.

2081 P. C. KJELLBERG, Minorities. Certain improvements in the mode of fixing safes, boxes, or other depositories for the protection of papers or other materials from fire.

2085 J. H. JOHNSON, Lincoln's-inn-fields. Improvements in the manufacture of candles. (A communication.)

2087 H. JEE, Liverpool, merchant. Improvements in the manufacture of table salt.

Dated August 12, 1865.

2089 J. TATHAM and J. SMITH, Rochdale, Lancashire, machine makers. Improvements in machinery for preparing cotton, wool, and other fibrous materials.

2091 W. BULLOUGH, Blackburn, Lancashire, engineer. Certain improvements in looms for weaving.

2095 H. WOODWARD, Cannon-street, gas engineer. Improvements in carburetted coal gas, and manufacturing artificial gas, and in the machinery or apparatus employed therein.

Dated August 14, 1865.

2097 F. BRAMPTON, Birmingham, manufacturer. Improvements in flier holders for holding letters and music, and for other like purposes.

2099 W. F. HENSON, New Cavendish-street, Portland-place, civil engineer. Improvements in railway chairs.

Dated August 15, 1865.

2103 R. C. LILLY, jeweller, and J. SUNDERLAND, general dealer, Birmingham. Improvements in fastenings for sleeve links, solitaires, brooches, and other articles of jewellery.

2105 J. F. BOETIUS, Smethwick, Staffordshire, civil engineer. Improvements in furnaces to be used in the manufacture of glass and iron and steel, and for other like purposes. (A communication.)

Dated August 16, 1865.

2111 J. BILLINGS, Kanish Town, accountant. Improvements in ventilators.

2113 J. SMITH, turkey red dyer, Baxenden, and W. Schofield, engineer, Heywood, Lancashire. Improvements in machinery used in washing, bleaching, and dyeing yarns and textile fabrics in the bank.

2115 W. GADD, Stratford-square, Nottingham, and J. Moore, Manchester. Improvements in looms for weaving.

2119 J. B. BROWN, Cannon-street. Improvements in lawn mowing machines.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated August 18, 1865.

2130 J. STERENSON, Salisbury-street, Strand. Improvements in steam engines. (A communication.)

Dated August 21, 1865.

2153 G. G. DENNIS, Boston, Suffolk, Mass. Improvements in friction matches, lucifer matches, and matches for re-lighting, called "taper matches."

LIST OF SEALED PATENTS.

Sealed August 25, 1865.

547 C. Ching	579 A. T. Godfrey
553 J. Blackie, jun.	585 S. Chatwood
558 G. Lauder	592 R. Johnson
560 A. Davy	602 L. Thomas
562 W. B. Dalston	638 W. Clark
566 J. Hartshorn and W. Redgate	639 W. Clark
567 S. Whiting	659 W. Clark
562 G. H. Barth	1019 R. Fergusson and W. Ralston
573 W. Holiday	1494 H. Monier

Sealed August 29, 1865.

577 J. Dodd	636 L. Perkins
578 W. E. Kochs	642 F. Tolhausen
580 T. Horton and D. S. Price	665 W. D. Allen
589 P. Rothwell	668 G. F. Ansell
591 C. Rahn	670 J. E. G. and C. H. Freeman
597 D. and J. Maxwell	687 J. Garely
599 R. A. Brooman	718 L. Ganters
610 L. de Cottam	943 C. D. Young
611 R. A. Brooman	1104 D. Greig
612 W. Clainow	1305 G. and G. W. Simmons
622 S. and W. Smith	1392 W. E. Newton
637 A. E. A. Aubert and G. E. M. Gerard	1923 G. E. Way

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the London Gazette, August 29, 1865.

734 D. Gaurley. Boots.	1044 G. A. Montecat. Spreading liquids.
1072 T. Newdigging and A. Hindle. Wet gas meters.	1091 J. J. Jenkins. Tin plates.
1098 R. [A. Jones and J. Hedges. Communicating by electricity.	1093 M. Vogl. Dressing stones. (A communication.)
1100 P. Hampton and J. Abbot. Steel ingots.	1105 W. Beaven. Screening corn.
1106 W. Robinson. Roasting jacks.	1110 T. Greaves and J. S. Wright. Buttons.
1111 D. S. Buchanan. Protecting letters.	1120 H. E. Newton. Invalid carriages. (A communication.)
1123 C. Hall. Engines for ploughing.	1124 O. C. Evans. Digging.
1127 J. H. Wilson. Spools.	1129 C. J. and J. A. Keenan. Lace articles.
1130 A. Grainger and C. M. Girdler. Devices to tombstones.	1143 J. J. Parkes. Communication in buildings.
1150 T. Walker. Measuring liquids.	1152 R. A. Brooman. Smoke-consuming furnaces. (A communication.)
1154 J. N. Brown and T. D. Clare. Paints.	1155 J. Wilkin-on, jun. Printing felts.
1158 J. T. Bucknill. Railway rails.	1169 R. A. Brooman. Preparing fibres. (A communication.)
1184 A. Grainger and C. M. Girdler. Portraits.	1187 T. C. March. Arrangement of flowers.
1197 L. W. Broadwell. Breach-loading guns.	1204 F. Gregory. Machinery for breweries.
1215 M. W. Rathbone. Propelling vessels.	1234 F. T. Read and J. E. Fyfe. Thrust of screw propeller shafts.
1238 T. W. Roe. Carding lace.	1255 W. Henderson. Extracting copper.
1264 W. E. Newton. Steam engines. (A communication.)	1300 J. J. Révy. Gun cotton.
1301 W. J. Rice. Motive power.	1313 A. Parkes. Parkosine. (A communication.)
1335 W. Clark. Hinges. (A communication.)	1360 J. Worrall and T. Hughes. Drying textile fabrics.
1370 W. E. Williams. Dry gas meters.	1372 T. Molden, J. Newsome, and J. Akeroyd. Furnaces.
1426 J. Firth. Railway tyres.	1474 U. H. Murray. Cutting woollen piles.
1552 G. Haseltine. Fuses. (A communication.)	

1802 J. Hopkinson and J. Whitelock. Organs.
1881 H. F. Gilles. Fibres.
1923 M. B. Schumann. Portable chamber.
1959 R. B. Mitchell. Brake.
1971 T. D. Sletson. Hats. (A communication.)
2061 T. R. Shaw. Looms.
2130 J. Stevenson. Steam engines. (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 250 HAS BEEN PAID.

2347 R. Harrington	2410 J. H. Johnson
2370 A. Orlington	2411 J. Meyer
2374 R. Sims	2465 J. H. Johnson
2379 R. A. Brooman	2467 W. A. Richards
3391 W. Husband	2551 A. E. H. B. Butler

PATENT ON WHICH THE STAMP DUTY OF 2500 HAS BEEN PAID.

1950 J. Ireland

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending August 26, 1865.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
2415	0	42425	0	42438	0	42447	0	42458	0	42469	0
2416	1	0	42426	1	0	42437	0	42448	0	42459	0
2417	1	0	42427	1	0	42438	0	42449	0	42460	0
2418	1	0	42428	1	0	42439	0	42450	0	42461	0
2419	1	0	42429	1	0	42440	0	42451	0	42462	0
2420	1	0	42430	1	0	42441	0	42452	0	42463	0
2421	1	0	42431	1	0	42442	0	42453	0	42464	0
2422	1	0	42432	1	0	42443	0	42454	0	42465	0
2423	1	0	42433	1	0	42444	0	42455	0	42466	0
2424	1	0	42434	1	0	42445	0	42456	0	42467	0
2425	1	0	42435	1	0	42446	0	42457	0	42468	0
2426	1	0	42436	1	0	42447	0	42458	0	42469	0
2427	1	0	42437	1	0	42448	0	42459	0	42470	0
2428	1	0	42438	1	0	42449	0	42460	0	42471	0
2429	1	0	42439	1	0	42450	0	42461	0	42472	0
2430	1	0	42440	1	0	42451	0	42462	0	42473	0
2431	1	0	42441	1	0	42452	0	42463	0	42474	0
2432	1	0	42442	1	0	42453	0	42464	0	42475	0
2433	1	0	42443	1	0	42454	0	42465	0	42476	0
2434	1	0	42444	1	0	42455	0	42466	0	42477	0
2435	1	0	42445	1	0	42456	0	42467	0	42478	0
2436	1	0	42446	1	0	42457	0	42468	0	42479	0

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

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

CONSTRUCTION.											
— Timber, duty 1s. per load, drawback 1s.											
Teak -	load	£ 12	0	£ 13	10	Archangel, yellow -	£ 13	10	11	11	
Quobee, red pine -	3	10	4	15	10	St. Petersburg, do. -	10	10	11	11	
Quobee, yellow pine -	2	10	3	15	10	St. Petersburg, do. -	10	10	11	11	
St. John, N.H., yellow	0	0	0	0	0	Moscow -	10	10	11	11	
Quobee oak, white -	5	5	6	6	6	Gothenburg, yellow	10	10	11	11	
" birch -	3	10	4	10	10	" white	9	9	10	10	
" elm -	3	10	5	6	6	Göteborg yellow -	10	10	11	11	
Dantzic oak -	5	5	6	6	6	St. Petersburg -	9	9	10	11	
" -	3	15	3	10	10	Copenhagen, per C.					
Moscow fir -	3	10	4	0	12	by 3 by 6 in.					
Itzehoe -	5	5	3	10	10	yellow					
Swedish -	2	10	3	10	10	Dantzic plank, Dantzic,					
Moscow, Quobee red pine	10	10	10	10	10	St. Petersburg -	0	11	11		
Moscow yellow pine	0	0	0	0	0	St. Petersburg -	0	0	0		
Lathwood, Dantzic, fir	7	10	8	0	0	St. Petersburg -					
" St. Petersburg -	8	10	9	10	10	Scal, pale -	pr	tan	3	9	40
Doxla, per C., 12 ft., by 3						Sperma body -	1	10	0	0	
by 6 in., duty 2s. 6d.						St. Petersburg -	45	0	0		
by 12 ft. by 2 in. by 6 in.						White, St. Sea, pale	53	0	0		
Quobee, white spruce 14	0	13	0	15	0	Ola, G. all pale	53	0	0		
St. John, -	13	0	15	0	15	Copenhagen, Coch. ton	50	0	0		
Yellow pine, per re-						Palau, fine -	36	0	0		
duced C.						Finland -	25	15	35		
Canada, lat quality -	13	0	20	0	20	Revised Eng. pale	45	0	45		
" 2nd -	13	0	14	0	14	Copenhagen -	26	10	34		

THE
MECHANICS' MAGAZINE.

LONDON: FRIDAY, SEPTEMBER 8, 1865.

THE ATLANTIC TELEGRAPH.

THE circumstances which have led to the postponement of the Atlantic telegraph expedition to another year will, we trust, receive the careful consideration not only of those more immediately concerned in that enterprise, but also of all who may be engaged in the manufacture or establishment of submarine telegraph cables. It has been conclusively shown that it is not sufficient merely to produce a perfectly manufactured cable, or to coil it perfectly on board the most suitable of ships, or to be provided with the most perfect appliances for its emission into the sea; but that, having all this, the most careful organization and attention to details, the most perfect order and the strictest and most watchful vigilance even in matters that would seem at first sight to be beneath the notice of those in command, must still be added, or success may be wrested from the grasp at the moment when failure is least expected and by agencies the most contemptible. There can be no doubt that this has been the case with the Atlantic cable. Prophets had arisen and *savans* (more or less) had in various prints prognosticated how and when, and for want of what, the enterprise was to come to grief. The cable was to break by its own weight, but it held staunch and true, and paid out like a silken cord—the “Great Eastern” was to break it, but she has proved a most admirable ship for the work—the gutta-percha was to be drawn to pieces by the elongation of the external spiral, but specimens which we have seen, which have been hauled into the “Great Eastern” by machinery from a depth of 2,000 fathoms, are as well laid up as any portion of the cable, and present no sign of elongation—it was to be crushed by the superincumbent weight of water, but this has proved a piece of bad philosophy—from a like cause the water was to be pressed through the gutta-percha and so destroy the insulating power of the latter, but so far from this being the case, it was found that the deeper the water the better the insulation, owing to the coolness of the temperature and the compression of the particles of the gutta-percha. But, in spite of all these favouring circumstances, the cable is broken, and the primary cause of all this loss and disappointment was the neglect of the mere housemaid’s work of sweeping up a few clippings of steel wire which ought never to have been cut off in the vicinity of the coil, and which, when cut, should have been immediately removed. Each of the three incidents of injured insulation arose from the same cause—a piece of wire adhering probably in the first instance to the manilla covering and subsequently forced into the gutta-percha either by the heels of the men working on the coil, by the jockey pulleys, or by the compression round the drum on its way to the stern. We speak not of the failure of the subsequent attempts to recover the cable; no doubt all that able and persevering men could do in that regard was done, although even here greater attention to the details before the voyage would have led to an examination of the small boiler of the hauling-in machine, which was miserably defective, and, added to the weak and badly-made swivels, contributed doubtless to the final catastrophe.

If, however, the warnings of experience, gained at so much cost, be carefully regarded in future operations, the gain to science from the recent expedition will, perhaps, be not dearly bought, even to the Atlantic Telegraph Company. In fact, the various operations performed by the “Great Eastern” during the voyage, and the satisfactory experience brought home, have placed on an entirely different footing the enterprise of deep sea

telegraphy. It has hitherto been looked upon at best as rather a neck-or-nothing affair to attempt the establishment of a telegraph to America. Noble, certainly, and patriotic, but uncertain of accomplishment, and liable at any time to instant and irrevocable destruction—the very knight-errantry of telegraphy. But the recent expedition has effected a great change in this respect, and sober underwriters are now willing to insure the success of the next attempt for a premium of 10 per cent. who would not previously have touched it at 25 per cent., so important are the facts that have been proved during the present season. It has been shown that the insulation of well-constructed cables greatly improves by submersion in deep water—that, thanks to the size and steadiness of the “Great Eastern,” the laying of these cables is no longer contingent upon fine weather—that if damage occur to the insulation, even in a depth of 2,000 fathoms, a cable constructed on principles like that of the Atlantic Company can be hauled back into the ship and detained with safety while the fault is cut out and mended, and that the paying-out can be resumed as before—that a cable, even when lying with its broken end at the bottom of the sea, 2,000 fathoms deep, can be grappled for successfully, as was done three times out of four by the “Great Eastern,” and but for imperfections in the swivels it is fully believed by all on board that the broken end would have been successfully brought up; as the Atlantic cable is calculated to bear at least eleven miles of its own weight perpendicularly suspended.

These are most important truths, and we may add that so perfect is the electrical system of testing cables at the present day, that in a few minutes electricians are now enabled to ascertain with unerring accuracy the exact spot, whether near or distant, where a fault of insulation exists. The paying-out machinery appears to have answered the most sanguine expectations, and the four miles length of cable recovered from water two miles in depth, and now on board the “Great Eastern,” is as perfect as when it went out, and exhibits not the least appearance of strain or injury. The consideration of all these circumstances seems to have impelled the directors of the Atlantic Company to renewed exertions. Already a new cable is commenced, and preparations are made for issuing further capital for laying this cable next summer in connection with attempts to repair the broken one. The only alteration that will be made in the new cable will be the substitution of strands in place of solid iron wires for the external covering. These strands will each consist of three wires and each strand will be covered with manilla. It is thought that by this means all chance of the gutta-percha being pierced by the external wire will be prevented, as each wire singly would be too weak to be thrust into the interior of the cable.

CONVERTED ENFIELD RIFLES.

TOWARDS the end of February last a report on the conversion of the Enfield rifle to a breech-loader, appeared in our own columns as well as in those of several contemporaries. This report proved to be more or less a fabrication—in short, nothing better than a garbled statement, many facts being distorted and others altogether suppressed. At last, however, we have the genuine reports of the Ordnance Committee on the trials, at Woolwich, of the converted Enfields. These reports bear date respectively February 6th and March 14th, 1865, although they have only just been printed. It may be remembered that the Committee appointed to inquire into the comparative merits of breech and muzzle loading rifles, unanimously reported in favour of the use of breech-loaders as a more efficient weapon than the service Enfield. At that time the stock of rifles on hand was about 800,000, and the replacement of these by breech-loaders was a matter for consideration

on the score of economy. The War Department, acting for once with promptitude, then resolved to ascertain whether this stock of rifles could not be converted into breech-loaders, rather than that they should be wholly sacrificed to an entirely new system. With this view, in the August of last year the War Office invited plans for converting the Enfield into a breech-loader upon the simple conditions that the shooting power of the converted arm should equal that of the Enfield, and that the conversion should not cost more than £1 per rifle. No less than fifty different systems were proposed, from among which the Committee ultimately chose eight for trial, as being the most promising for the object in view. The plans selected were those of Messrs. Mont-Storm, Westley Richards, Wilson, Green, Snider, Joslyn, and two plans, marked respectively A and B, by Mr. E. C. Shepherd. In the last, and the first four systems, the charge is ignited by cap and nipple in the ordinary way, but the other three are adapted for cartridges carrying their own means of ignition. The trials were commenced on the 9th of last January, when the first thing done was to abandon Mr. Shepherd’s plan B without firing a shot. This arose from the fact that it was impossible to load the piece; the cartridges supplied by Mr. Shepherd broke up and the powder clogged the breech. So with plan A of the same gentleman; the imperfection of the arm, and the dangerous nature of the cartridges, rendered it inexpedient to attempt any trials. Mr. Joslyn’s rifles managed to get detained in America, so Mr. Snider had it all his own way, as his was the only remaining system in which cartridges containing their own means of ignition were employed. This, and the four systems in which ignition by the cap is adopted, were the only ones to compete with the service Enfield.

With respect to the mechanical arrangement of these five plans it may be observed that the first, Mr. Mont-Storm’s, is a chamber loading piece. About 2½ in. of the Enfield barrel are cut off, and a chamber capable of containing the powder and bullet substituted, the joint between this chamber and the barrel being closed by an expanding thimble or ring, which effectually prevents escape of gas. This chamber works on a hinge at its front, and is secured in the firing position by a bolt worked by the lock. The system of Mr. Westley Richards is identical with that of his breech-loading cavalry carbine, with the exception that there is a hook at the end of the plunger, which is intended to withdraw the paper case of the cartridge and the wad at its base after each discharge. To facilitate this withdrawal the wad has a small hole in its centre. In Mr. Wilson’s plan the breech of the Enfield rifle is removed, and the barrel prolonged backwards for several inches, the upper part of the added piece being open at the top to allow of the cartridge being placed in it. It also carries a plug or plunger, which slides in it, and by its means the breech is closed. This plunger is secured in the firing position by a traverse bolt, which passes right through it and the stock, a short distance in rear of and above the pivot of the hammer. The plunger has an india-rubber washer a short distance from its face, to assist in preventing escape of gas at the breech. Mr. Green’s system resembles that last described, as regards the method of closing the breech, but the plunger is locked in a different manner. A small lever at the rear end of the plunger enables it to be turned through a quarter circle. There is a recess cut in the left side of the cylinder which carries the plunger, and a lump corresponding in size forms part of the plunger, and when forced into the recess by the lever before-mentioned prevents it from moving. Mr. Snider’s, as already observed, is a new system, dispensing with nipple and cap. His method of conversion is very simple; he cuts away about two inches of the upper part of the Enfield barrel at the breech, and places a solid breech-stopper working sideways on a hinge in the opening thus made. A piston passes through

this stopper, and when the breech is closed, one end of it receives the blow from the hammer, and the other communicates it to the centre of the cartridge, and fires it. There is in addition an arrangement for withdrawing the old cartridge cases after each discharge.

The foregoing five systems were tested for rapidity of fire in the first instance against the service Enfield, and the following results were attained. In firing 20 rounds with the Mont-Storm the mean time occupied was 3 min. 1 sec.; with Westley Richards', 3 min. 29 sec.; Wilson's, 2 min. 44 sec.; Green's, 2 min. 26 sec.; and Snider's, 2 min. 46 sec.; whilst with the unaltered Enfield the time occupied was 6 min. 52 sec. The cartridges and caps being placed ready to hand for the man firing, it is probable that on actual service the relative rapidity of fire would be still more in favour of those systems where no cap is used, owing to the ammunition having to be taken from pouches. However, from the above results we may fairly assume that the repeating power of breech-loading arms over muzzle-loaders is as two to one in systems in which the percussion cap is used, and as three to one in systems where the cartridge carries its own ignition. Mr. Westley Richards' ammunition differs from the other systems inasmuch as the bullet has no cavity, but is formed solid with a projecting rim at its base. In order thereupon to place all the systems on a par with regard to ammunition, 500 additional rounds of cartridge were supplied for each system. After three nights' exposure to the weather and daily firing, three targets of 20 shots each were made from each rifle, foul as it was, at 500 yards' range and using fixed rests. The result of this experiment was a mean deviation in the Mont-Storm of 2.58; Westley Richards, 1.81; Wilson, 2.19; Green, 3.59; Snider, 5.00; and in the Enfield, 1.64. Each rifle had now fired about 270 rounds without cleaning, the number of misfires being—W. Richards', 1; Snider's, 8 (some of these were due to imperfect manufacture of the rifle, and some to bad caps) service Enfield, 1. Thus ended the first series of experiments, after which the rifles were taken to pieces, and carefully examined. The result showed the breech arrangements of all to be in a sound state, but the stocks of Nos. 1 and 2 (Mr. Westley Richards'), of No. 7 (Mr. Wilson's), and of No. 9 (Mr. Storm's), were broken. A further examination of the whole of the arms of each system developed the fact that in Snider's the wood of the original stock is the least cut away and weakened. Mont-Storm's follows next, and the other three are about equally weakened. As far as the trials with Snider's system had proceeded up to the conclusion of the first report, the results met with the approval of the Committee.

The second series of experiments had reference principally to the value of the several systems tried for range, accuracy, and penetration, and the results appear in the second report. The mean radial deviation of the different arms at 500 yards' range was:—Westley Richards, 1.73ft.; Mont Storm, 2.07ft.; Wilson, 2.09ft.; Snider, 4.63ft.; Green, 4.67ft.; the mean deviation of the pieces before conversion was only 1.19ft. At 800 yards Westley Richards showed a mean deviation of 2.55ft.; Storm, 4.16ft.; Wilson, 4.35ft.; Snider, 4.87ft.; and Green, 7.56ft.; that of the Enfield being 3.93ft., under corresponding conditions. So that at 800 yards Westley Richards' system alone gives a better result than the service Enfield, whilst none of the systems equal the average shooting of that arm at 500 yards. The superior shooting of the Westley Richards rifle is attributed by the Committee to the hardness of the bullet and the heavier charge of powder used; and it was found by another series of experiments that the service charge and bullet cannot be used with this rifle. The shooting of Wilson's and Green's rifles was decidedly worse with the service ammunition than with their own; while

Storm's was nearly the same with both, and Snider's better with the service ammunition at 500 yards, but not so good at 800 yards. Experiments were then made for penetration, five rounds being fired from two rifles of each class, at half-inch elm boards, which had been well soaked in water, and were placed in a frame half an inch apart, at a range of 30 yards. Westley Richards' bullet penetrated 16½ planks; Storm's, 11½; Wilson's, 11½; Snider's, 11; and Green's, 10½. The superior penetration of the Westley Richards rifle is of course due to the fact before noticed, that he used a heavier charge of powder and a harder bullet than the others. In another trial for rapidity of firing, the arms being loaded from the pouch as in actual service, Snider's rifle fired 20 rounds in 2 min. 35 sec.; Green's, 3 min. 18 sec.; Storm's, 4 min. 23 sec.; Wilson's, 4 min. 34 sec.; Westley Richards', 4 min. 44 sec.; and the service Enfield, 2 min. 20 sec. On this point, therefore, Mr. Snider stands first, as might naturally be expected where the time of capping was saved. The conclusions at which the Committee arrive after a review of all the experiments are in effect that the Westley Richards' arm is the only one in which the shooting is not inferior to that of the unaltered Enfield, that the Mont-Storm is the best system where capping is used, and most nearly unites all the qualifications desired in an arm to be obtained by conversion. But Storm's system is not recommended, because a breech-loader adapted for a cartridge carrying its own ignition possesses obvious advantages. The ultimate armament of the infantry, however, with breech-loading weapons is determined upon, but as a new breech-loader of smaller gauge and quicker twist looms in the future, only 1,000 are at present to be converted. So it is recommended that Mr. Snider be encouraged to pursue his experiments by the promise that on the production of a pattern arm which shall give satisfaction to the Committee, a thousand muskets shall be placed in his hands for conversion.

Looking at the whole question we confess to some disappointment in the matter; the Committee commenced well enough—in fact, the alacrity with which the question of breech loading was taken up was worthy the use of the traditional piece of red chalk. The necessity of arming our troops with breech-loaders was felt and admitted a year ago; its urgency still exists, if it has not increased, and yet only one thousand rifles are to be converted, only one battalion is to be armed. True, this limited conversion is only an experiment, but one which, we apprehend, will not be extended beyond the thousand, inasmuch as the Committee are looking forward to the introduction of a new small-bore breech-loader. We admit that no converted arm can possess the precision attainable in a new small bore having a quicker twist, but we submit that such an argument is very much beside the question. The starting point of the Committee was the speedy conversion of Enfields into breech-loaders upon a large scale, and unless this is carried out we shall, in course of time, have one battalion of our army exercising on a new and distinctive drill necessitated by the new arm. In course of time, too, we may further expect to see the drill extended throughout our troops, and at some still more remote period our volunteers may hope to come into possession of the desired weapon. The duty of the War Department, however, appears very clear. The Committee only find fault with Mr. Snider's cartridge, which they say can be improved. Let this be done, and as all other conditions have been as nearly complied with as is practicable, let conversion proceed without any hindrance, until every soldier is armed with a breech-loader. Instead of dawdling and wishing for and whining after an arm which in a land of red tape takes a long time to develop, let us have all our Enfields converted, and our service will then be prepared for the new weapon—when it comes.

BARMOUTH VIADUCT.

AMONG the numerous engineering enterprises of considerable magnitude now being carried out may be classed the Barmouth Viaduct of the Aberystwith and Welsh Coast Railway. The mouth of the river Maw at Barmouth, North Wales, is about a mile wide, and at this point the works of the above railway cross the river. These works here consist firstly of an embankment 770 yards long; next comes a timber viaduct of 741 yards, which is divided into one hundred and seventeen spans of 19ft. each. The deepest part of the river is on the Barmouth side, where there is an iron viaduct of 109 yards, consisting of seven spans of 40ft. each and one of 47ft. In order that the free navigation of the river may not be intercepted, but that masted vessels may pass unhindered, one span of the iron viaduct will be made to open. The piers for this viaduct consist each of six cast-iron screw piles, giving a total bearing surface of 42 square feet, which at 5 tons per square foot, gives a sustaining power of 210 tons; five tons per square foot being the sustaining power of screw piles in sand. Each pile is carried down until the large flange rests on the gravel. Considerable difficulty was encountered in forming the foundations of these piers, owing partly to the strong currents, and partly to the circumstance of two piers coming on the rock, but the difficulties have all been overcome. The main girders are on the lattice principle, and are 4ft. deep; the cross girders rest on the main girders and are placed with 3ft. centres. The piers of the timber viaduct each consist of four piles 13in. square, driven to the average depth of 28ft.; they are spliced just above the sand level and are well braced together. The viaduct throughout is constructed for a single line of rails.

The quantity of materials consumed is considerable: the timber viaduct will absorb no less than 80,150 cubic feet of timber, and 82 tons of wrought iron in shoes, bolts, and straps. In the iron viaduct there will be 370 tons of wrought, and 120 tons of cast iron. The tide has a rise and fall of 17ft. and the level of rails is 15ft. above ordinary high water. Mr. Conybeare is the engineer for the line, and the contractors for the works are Messrs. Savin, who are well known for the extensive railway works they have carried out in Wales. The iron work is supplied by Messrs. Rankin, and Mr. John Sutcliffe contracted for the erection of the timber portion of the viaduct. In this work Mr. Sutcliffe used Sisson's patent steam pile-driving engine, which proved a most valuable adjunct. Along the east or land side of the viaduct there is a roadway running the whole length of the structure, and at the side of the roadway recesses for seats are left at intervals of 38ft. Not only are the thanks of the inhabitants due to the railway company for their endeavours to rid Barmouth of the present ferry nuisance, but for presenting the town with a promenade which will not be surpassed by any in the United Kingdom. The company will by no means be losers by the transaction, for by adopting a small toll, which will be cheerfully paid, a short time will suffice to return considerable profits on the necessary additional outlay. It is a question, however, where the promenade will be if, in course of time, the company should find it expedient to lay an additional line of rails. The inhabitants will have contributed towards the construction of the viaduct, but of course they will have had a *quid pro quo*.

RAIN GAUGES.

ONE of the most interesting and important problems presented to the study of the hydraulic engineer is that involving the determination of the proportion of rainfall which will naturally flow off the surface into collecting and impounding reservoirs. This question has usually to be solved where the water

supply is obtained from gathering grounds or drainage areas. The proportions vary much according to circumstances, being influenced by climate and by the geological formation of the district; they also vary according to the season of the year. In order to ascertain the rainfall of a district, the rain gauge comes into use and plays a very important part. The only data obtainable as to the amount of water to be collected from any given area are dependent upon the amount of rainfall, and to ascertain this the gauge must be correctly constructed and accurately placed. Upon the construction and position of the gauge, in fact, depend the value and accuracy of the results recorded. It is a notable fact that the amount of rain collected diminishes as the gauge is placed at higher levels above the ground. This may be accounted for by the circumstance that the rain in its descent passes through a moist stratum of air, and the temperature of the rain being less than that of the clouds through which it passes, the moisture may be condensed, and the rainfall thus increased. But the correctness of this theory is questionable, inasmuch as in a fall of 213ft., to increase the raindrop in the proportion found, sufficient heat must have been liberated to raise the drop to 434 deg. Fahr. The fact, however, that an increase does occur in the rainfall near the earth is beyond dispute, although the cause at present remains a moot point. To obtain an average, therefore, it would be advisable to place rain gauges in different positions, on the tops of mountains and at the bottoms of valleys.

With regard to the proper form to be given to the gauge, opinions vary considerably. As in all other departments of science, the instruments here differ in form, shape, and character, and, consequently, in their degree of utility. The gauge adopted by the Literary and Philosophical Society consists of a hollow cylinder of copper about 8in. diameter and 40in. in length. A receiving funnel of the same diameter as the cylinder fits closely to the top. As the cylinder becomes filled with water a float rises, being free so to do from its slightly decreased diameter. In the centre of the float a half-inch vertical graduated rod is fixed, which rises through a hole in the funnel and indicates the depth of rain falling in any given time. Evaporation cannot take place to any appreciable extent in this instrument, as the surface of the water in the cylinder is covered by the float, with the exception of the very slight annular space between it and the inner surface of the cylinder. A number of these gauges are fixed in the neighbourhood of Manchester; they are encased in strong boxes and sunk in the ground to within 12in. of the top of the apparatus. It can be easily taken out for the purpose of emptying, which should be done occasionally. Another gauge of different form is used by the Manchester, Sheffield, and Lincolnshire Railway Company on the Peak Forest and Macclesfield canals. It is made of copper, the upper part being cylindrical and 9in. in diameter; the lower part is funnel-shaped. A tube 3-8in. diameter from the lower portion passes into a bottle below, which for safety is encased in a wooden box. The rain falling on the gauge is collected in the bottle, whence it is ultimately poured out into a graduated measure and the rainfall thus ascertained. A slight modification of this gauge has been introduced; it consists in making the upper part of the funnel or receiver conical instead of cylindrical, or, in other words, with a rim inverted at an angle of about 45 deg., so that in a drifting rain, splashing, and thereby error in result, are supposed to be prevented. In Mr. Glaisher's arrangement of gauge the cylindrical portion is 8in. diameter and 13in. high. A funnel 6in. deep and terminating in a bent tube 1-8in. diameter, is fitted into the mouth of the vessel. The tube is bent so as to form a trap and prevent evaporation, whilst, at the same time, it allows the water to be discharged freely into the lower part of the cylindrical vessel.

Another description of instrument is known as the staff gauge; one of these was made by way of experiment by Mr. Wood, formerly engineer to the Peak Forest and Macclesfield Canals. The staff is $\frac{1}{4}$ in. diameter, and stands some 12in. above the cover of a cylinder 7in. diameter. The hole in the cylinder cover through which the staff passes is 1in. in diameter. Another gauge of this class consists of a staff of wood 18 $\frac{1}{4}$ in. long by 2in. diameter, which is fixed in a small metal cylinder 2 $\frac{1}{2}$ in. in diameter at the bottom. The exposed surface of the staff, equal to half the circumference by 18-75in. + area of circle 2 $\frac{1}{2}$ in. diameter, being 63-61 square inches, is equivalent to the area of a circle 9in. in diameter, which is the collecting area of the Manchester Railway Company's gauge. The rain as it falls against the staff passes down through the metal cylinder and is received in a bottle beneath, which, as in the other cases, is encased in wood. Osler's Anemometer does more than any of the foregoing, for, in addition to recording the rainfall, it registers the direction and force of the wind. This of course involves complicity of construction, and, therefore, the apparatus will not be further noticed, the object being to give the simplest, but at the same time the most correct, methods of attaining the end in view. By comparing the gauges it will be observed that the four first were somewhat similar in the general principle of their construction; the water is collected on the interior surface of a cone, and is carried thence into a receiver beneath. But the merits of the four examples vary considerably. The Literary and Philosophical Society's gauge possesses an advantage over the other three, but at the same time it possesses a defect to which they are not liable. The advantage is that the amount of rainfall can be at once seen and correctly noted on consulting the instrument itself, whereas in the others the water must be poured into a separate vessel before its quantity can be determined, thus considerably diminishing the accuracy of their results. The defect present in the instrument, however, is a serious one; it is found to give the rainfall in excess, particularly when placed in high and exposed situations.

The staff gauges were designed with a view to prove the inaccuracies of the gauge last referred to, and a number of experiments were made, which showed some remarkable failures. From these experiments, the results of which were communicated to the Society of Engineers by Mr. John Glynn some months ago, it appears that one of Mr. Wood's staff gauges collected in the last six months of one year 9-5in. of water in the 7in. cylinder. During the whole of 1845 the same gauge collected 21-95in. in depth of water; in 1846, 15-4in.; and in 1847, 22-48in. This conclusively showed that if the rod connected with the float in the Manchester Philosophical Society's gauge rises above the top of the instrument considerable error must result. Upon this the larger staff gauge was made, in order to compare notes with the working of the Manchester Railway Company's gauge, the collecting area of each being the same, viz., 63-61 square inches. These two gauges were placed together in four different positions, and a comparison of their collecting power was made during the year 1847. The mean results were as follow:—On a hilltop at a point 1,500ft. above the level of the sea the funnel gauge collected 29-50in., and the staff gauge 46-87in.; at the bottom of the hill, 620ft. above sea level, the funnel gauge showed 38-39in., and the staff gauge 20-67in. On another hill-top 1,670ft. above sea level, the funnel gave 35-05in. and the staff 58-99in.; at the bottom of the same hill 720ft. above level of sea the funnel collected 51-30in., whilst the staff gauge only gave 27-89in. From this it will be seen that, with staff gauges placed in exposed positions, the error becomes very serious, increasing with the increased exposure. It is clearly evident then, that, although from a variety of circumstances perfection is

not to be attained in these instruments, it is most nearly arrived at in those without the staff, and of these the form adopted by Mr. Glaisher is the simplest and best.

Next in importance to the form of the gauge is the method of its location, the accuracy of the results depends very materially on this point. Errors may be occasioned by the drifting of rain over the gauges when they are placed in the vicinity of roofs of houses, or other similar impediments to the free passage of the atmosphere. Some failures from these causes occurred in the instance of the Railway Company's gauges, several of which were placed on the ridging of the roofs of the lock-keepers' houses on the Ashton and Peak Forest Canals. The idea was, that from the exposed position the whole of the rainfall would be intercepted and correctly ascertained. But this view proved erroneous, as, on placing other gauges on the ground, a difference of from 41-92 to 58-76 per cent. more rain was recorded. The sloping roofs of the houses doubtless created currents of wind, which acted prejudicially in carrying the rain over the gauges. It is therefore obvious that in locating gauges care should be taken that they are not shaded by buildings, trees, or other obstructions, and that they should be fixed perfectly horizontal. Whatever the construction of the gauge may be it must always prove more or less defective, owing to the fact that a portion of the water adheres to the surface, upon which it first falls, and is consequently evaporated without entering the receiver. These errors, however, are generally upon the right side for the engineer, when considered in relation to the abundance of a supply of water; but, when affecting the question of the strength of works to be constructed, allowance should be made for greater floods than are recorded by the rain gauge. As to the precise form of the gauge opinions vary somewhat; it unquestionably influences the results, whether the rim be inclined inwards or outwards, or whether it be carried up vertically from the funnel. With a rim inclined inwards at an angle of 45 degrees, as in the third gauge noticed, if the rain is driving at less than a right angle a certain amount will be thrown into the gauge, and the results consequently exaggerated. On the other hand, a gauge having the rim inclined outwards is liable to contrary errors. Mr. Baldwin Latham, an authority on questions of hydraulic engineering, gives it as his opinion that a gauge with a pretty deep rim, nearly perpendicular, is by far the best form. Such a gauge will retain in the funnel three or four inches of snow, a circumstance of importance, and one which should not be lost sight of, as many gauges in use are unable to retain anything like the quantity of snow which falls during a heavy snow storm. It is obvious that the amount of rainfall recorded by the gauge cannot all be made available by the engineer in his works, as there are causes in active operation which render it impossible to utilise the entire rainfall. The questions of evaporation and absorption present themselves for consideration, and correct conclusions can only be arrived at by taking into account the resultants arising during the constant circulation of water.

Before quitting the subject we would call attention to the labours of Mr. G. J. Symons, who for the last five years has been collecting statistics on the important subject of the distribution of rain over the British Isles. These statistics have been published annually by Mr. Stamford, of Charing Cross. The report for 1864 comprises notes on the rainfall from observations taken at about nine hundred stations in Great Britain and Ireland. There are, however, many districts still unrepresented; to some of such the British Association last year granted a supply of thirty-one gauges, sixty more were purchased by private individuals, and nearly the whole of these are reported to be at work. Mr. Symons has endeavoured to render the returns of rainfall as correct as possible, by visiting the various stations, examining the instruments, and

causing many defective gauges to be replaced by correct indicators. This, together with the somewhat onerous duty of testing gauges at the various stations, and the collection of the statistics, is a matter of expense to Mr. Symonds, which we think a man working for the public we should not be called upon to bear. We commend this matter to the consideration of the British Association, which is now opportunely holding its sittings. It would prove highly beneficial, too, if another grant of gauges was made to districts still unrepresented, and, to perfect as far as possible the systems of observations, steps should be taken to have the gauges at all stations of one uniform and approved type. Another point we would suggest is that a brief code of rules be drawn up for the guidance of observers in general. This would lead to more harmonious results, and we should hear much less of the great discordance which at present pervades the returns.

NOTES ON NEW DISCOVERIES AND NEW APPLICATIONS OF SCIENCE.

Alleged Abundance of Gold in the Interior of the Earth—Influence of Tungsten on Cast Iron—Purification of Iron from Phosphorus and Sulphur—Advantages of Nitro-glycerine for Use in Blasting—Application of Artificial Cold to the Extraction of Sugar.

SOMEWHERE in Dante's "Divine Comedy," if we mistake not, occurs the expression, "the golden core of the world." Of course, the poet uses the phrase in some metaphorical sense; but the words do but express the simple fact, if the latest theory respecting the constitution of the interior of our globe be a true one. The theory in question has just been enunciated by Mr. John Calvin Moss, who laughs at the current notion that the earth is a mass of liquid fire, covered with a cool crust some thirty or so miles thick,—a crust whose thickness, as Sir William Armstrong remarked in his famous speech before the British Association at Newcastle, "may be fairly represented by the skin of a peach, taken in relation to the body of the fruit which it covers." The idea that the interior of our globe is a vast fiery ocean "doubtless arose," says Mr. Moss, "from the idea that heat was a material substance, and would have to pass off into space before the earth could cool; whereas the more modern researches of science show that heat is no more a material substance than motion, gravitation, or magnetism, but that it is merely a condition of matter, and that, in the case in question, instead of passing off from the earth, it would only become, by a gradual chemical action, fixed or latent. But even supposing that the cooling would, or did, take place first at the surface, it is a well-known fact that all substances (water in the state of ice alone excepted) increase in density and weight as their heat is diminished, so that the cooler portions would be the first to sink from the surface towards the centre. Is it not quite evident that those substances most difficult of fusion, and possessing the greatest specific gravity, would therefore be the first to find their way to the centre? Now, gold, platinum, and a few other of the precious metals, possess these properties in a high degree, above all other known substances; and though we know them to be scarce on the surface of the earth, we have no assurance but that they are abundant in nature. I believe that the interior of the earth is abundantly supplied with, if not mainly composed of them." Mr. Moss may be right in this belief, but as the specific gravity of the earth, according to the highest estimate, that of Professor Airy, is only 6.56,—other estimates have made it 4.95, 5.44, and 5.48, respectively,—while that of gold is 19.3, and that of platinum 21.5, it is at least certain that the greater part of the bulk of the world must be made up of substances lighter than those metals. The average density, however, of those rocks which are most abundant in as much of the "crust" of

the earth as we are acquainted with does not exceed 2.5, and so, if the average density of all the constituents of the earth, other than those heavy metals, is no higher than that, about one-fifth of the bulk of the earth may be composed of gold and platinum. A globe whose bulk should be one-fifth of that of the earth must have a diameter equal to more than half that of the earth, so that if four fifths of the bulk of the earth consist of materials of an average density of 2.5, and the other fifth, forming a globular "core," of materials of an average density of 20 or so, the diameter of this globular core must be somewhere between four and five thousand miles. Only to think of a globe of that size, all of gold, and to calculate how many sovereigns it would coin into! The man to do that would be the author of that strange book, "Miranda," in which we are told of periods of time of such enormous length that to write, in figures of which ten should go to the inch, the number of years included in one of them, would require a line of figures two hundred thousand miles long. In five-pound notes, allspread out flat, placed one on the top of another, and pressed together as closely as possible, a million sterling would make a column nearly as high as the Monument at London Bridge. In gold, it would go into a box measuring two feet and a half every way, and leave room for a modest fortune besides. A globe of gold four thousand miles in diameter, if divided into as many equal portions as there are men, women, and children on the face of the whole earth, would yield for each individual a greater number of such boxes full than could be counted in a long lifetime.

From gold to iron. There has been considerable controversy from time to time as to the effect which is produced upon iron and steel by alloying them with small portions of tungsten. "Tungsten steel," especially, excited much attention some seven or eight years ago. It was first produced in some Austrian steel works, and at first, says Dr. Hoffmann, "appeared so successful as to threaten a complete revolution in the working of cast steel." Never before, according to the partisans of the new alloy, had steel been produced of such tenacity and hardness. They declared that ordinary cast steel, of best quality, hardened by the usual means, could be turned and bored by tools of tungsten steel. They cited analyses to show that the swords of Damascus, so celebrated for their hardness and elasticity, contained traces of tungsten, and to these they attributed the fine qualities of those weapons. They alleged that the new steel cost less than the best English cast steel, and lasted four times as long. Everywhere patents were taken out for alloys of steel and tungsten,—in this country, Mr. Mushet alone obtaining nine in one year. Tungsten steel seems, nevertheless, to have been a delusion. Many eminent metallurgists,—among them Dr. Percy, Mr. E. F. Sanderson of Sheffield, and Professor Tunner of Leoben,—declined to believe in it from the first, and nobody believes in it now. There seems ground, however, for the idea that the addition of tungsten to cast iron improves its quality. A recent number of the "Annales de Chemie" contains an account of numerous experiments which have lately been made by M. le Gruen at the Marine Foundry at Nevers, which appear to prove pretty conclusively that cast iron has its tenacity increased by about one-sixth by the addition to it of about two per cent. of tungsten. The tungsten was added, of course, as wolfram, metallic tungsten not having hitherto been available.

According to Dr. Adolphe Gurt, of Bonn, Prussia, iron may be purified from phosphorus by means of silica. He asserts that if, in smelting phosphiferous iron ores, enough silica be included in the furnace charge to form a highly silicious slag, the phosphorus contained in the ore will have its condition changed from the crystalline state, in which, he says, it exists originally in the ore, to an amorphous state, in which it is readily eliminated from pig iron during conversion either

into malleable iron or into steel. The same gentleman alleges that iron may be entirely freed from sulphur by means of lead. The lead "may be applied," he says, "either to pig iron which is to be puddled, either before or during the puddling process; or to iron which is to be refined, or in process of being refined, in common refinery furnaces, or in reverberatory furnaces; or to pig iron for casting; or to iron to be treated by the pneumatic process, for the production of either homogeneous iron or steel; or to the materials used in making cast steel by the pot or other process of melting." In any case the lead is to be added to the iron while the latter is in a molten state, and is to be "brought by any suitable means as much as possible into contact with the whole of the melted iron."

In the MECHANICS' MAGAZINE for August 11th, an account was given of some Swedish experiments with that highly explosive compound, nitro-glycerine, which Mr. Nobel, a Swedish engineer, is endeavouring to bring into use, instead of gunpowder, for blasting purposes. The same "blasting oil," as Mr. Nobel calls it, has since been experimented with in Cornwall, with very satisfactory results. It is an oily fluid, of a light yellow colour, and of 1.6 specific gravity. It consists of three atoms of nitric acid, or 3 NO⁵, combined with one atom of glycerine, or C³ H⁵ O³, so that its ultimate composition may be represented by C³ H⁵ O¹² N³. It bears the temperature of boiling water without explosion or injury, but explodes at about 360 deg. Fahrenheit. The changes which occur during explosion convert each volume of it into 46 $\frac{1}{2}$ volumes of carbonic acid, 55 $\frac{1}{2}$ volumes of steam, 39 volumes of oxygen, and 236 volumes of nitrogen, being a total of 1,298 volumes of gas for each volume of the liquid oil. The gases produced by the explosion of gunpowder measure, when cold, only 250 times the bulk of the gunpowder exploded, so that, supposing the gases evolved to be in each case at the same temperature, nitro-glycerine would thus be five times more effective than its bulk of gunpowder. A great deal more heat, however, is generated by the explosion of nitro-glycerine than by the explosion of gunpowder, and the gases produced by the explosion of the former are therefore in so much higher a state of tension than those produced during the explosion of the latter that the new agent is really thirteen times more effective, bulk for bulk, and eight times more effective, weight for weight, than the old. The use of nitro-glycerine in blasting therefore enables thirteen times more disruptive force to be applied, by means of a hole of a given size, than can be brought to bear by means of a bore of the same dimensions when gunpowder is used, and one result of its substitution for gunpowder, for blasting purposes, is thus a very great economy of labour. When there are rents in the rock in which the bore is made, the advantage of nitro-glycerine over gunpowder is greater than thirteen to one, amounting, indeed, to between twenty and thirty to one, by reason of the explosion of nitro-glycerine being so much more rapid than that of gunpowder that the force of its explosion is not appreciably diminished by fissures in the bore which would diminish the effective force of an explosion of gunpowder by fifty per cent. For the same reason, "tamping is never required, a shaft of loose sand being sufficient in all cases. Hence accidents in charging are impossible, besides the saving in time." Other advantages of nitro-glycerine are that, "being insoluble, discharges under water, or in water-carrying rocks, may be effected by it without cartridges; and, as the blasting oil can only be exploded under certain conditions, and by means of igniters manufactured specially for the purpose, its storing and transport involve no danger." Curiously enough, contact with fire is not sufficient to ignite it at ordinary temperatures, neither is contact with phosphorus, or even with potassium. The chief danger in its use is from its intensely poisonous qualities, but these can be effectually guarded against with-

out much trouble. At present, nitro-glycerine is more costly than gunpowder, in about the proportion in which it is more effective, so that, for charges of equal force, nitro-glycerine and gunpowder cost about the same. The saving of labour and time which results from the use of the former, however, renders it by far the more economical agent of the two.

Artificial refrigeration is evidently destined to receive most important industrial applications. Already, in the paraffin-oil manufacture, and in the ingenious process by which M. Balard and M. Merle obtain chloride of potassium from sea-water, it renders most valuable service, and now M. Alvaro Reynoso, of Havana, is applying it to the concentration of syrups. In face of the well-known fact that water, in freezing, becomes completely separated from whatever it may have previously held in solution, and of the successful working of the process by which Carré and others produce any desired degree of cold, by mechanical means, at a scarcely appreciable cost, one wonders that no one should have thought before of applying artificial cold to the extraction of sugar from syrups, especially when it is remembered how injurious the action of heat is apt to be. However, M. Reynoso has conceived the idea at last, and is devoting himself energetically to its realization. He is in England just now, testing the respective merits of the various cold-producing appliances in use here. He has found that a syrup marking only 6 deg. of Beaumé's saccharometer becomes converted by congelation into ice and a syrup of 30 deg. Should it be found that the cold does not injure the syrup, we may look to see great changes in the processes of the sugar manufacture.

THE BRITISH ASSOCIATION.

THIS learned body is again holding its meetings in Birmingham. This is the third time during the thirty-five years over which the history of the Association extends, that the above town honours the members, and is honoured by their presence. The first meeting of the general committee was held in the Lecture Theatre of the Midland Institute at one o'clock, on Wednesday, Sir Charles Lyell in the chair. The object of the meeting was the election of sessional officers, and the usual business. The first general meeting was held in the Town-hall in the evening. Sir Charles Lyell, Bart., M.A., D.C.L., F.R.S., &c., formally resigned the chair, and Professor Phillips, M.A., LL.D., F.R.S., assumed the presidency, and proceeded to address the meeting.

THE PRESIDENT'S ADDRESS.—Assembled for the third time in this busy centre of industrious England, amid the roar of engines and the clang of hammers, where the strongest powers of nature are trained to work in the fairy chains of art, how softly falls upon the ear the accent of science, the friend of that art, and the guide of that industry. Here, where Priestly analysed the air, and Watt obtained the mastery over steam, it well becomes the students of nature to gather round the standard which they carried so far into the fields of knowledge. And when, on other occasions, we meet in quiet colleges and academic halls, how gladly welcome is the union of fresh discoveries and new inventions with the solid and venerable truths which are there treasured and taught. Long may such union last—the fair alliance of cultivated thought and practical skill; for by it labour is dignified and science fertilised, and the condition of human society exalted. Through this happy union of science and art the young life of the British Association—one-third of a century—has been illustrated by discoveries and enriched by useful inventions in a degree never surpassed. How else could we have gained that knowledge of the laws of nature which has added to the working strength of a thousand millions of men the mightier power of steam, extracted from the buried ruins of primeval forests their treasured elements of heat and light and colour, and brought under the control of the human finger, and converted into a messenger of man's gentlest thoughts, the dangerous mystery of the lightning?

ASTRONOMY.

Few of the great branches of the study of nature on which modern philosophy is intent were left unconsidered in the schools of Athens; hardly one of them was, or indeed could be, made the subject of accurate experiment. The precious instruments of exact research—the measures of time and space, and force and motion—are of very modern date. If, instead of the few lenses and mirrors of which traces appear in Greek and Roman writers, there had been even the first Galilean or the smallest Newtonian telescope in the hands of Hipparchus, Eratosthenes, or Ptolemy, would it have been left to their remote successors to be still struggling with the elements of physical astronomy, and waiting with impatience till another quarter of a century shall have rolled away and given us one more good chance of measuring the distance of the sun by the transit of Venus? Had such instruments as Wheatstone's chronoscope been invented, would it have been left to Foucault to condense into his own apartment an experimental proof of the velocity of light, and within a tract of thirty feet to determine the rate of its movement through all the vast planetary space of millions and thousands of millions of miles, more exactly than had been inferred by astronomers from observations of the satellites of Jupiter? By this experiment the velocity of light appears to be less, sensibly less, than was previously admitted; and this conclusion is of the highest interest. For, as by assuming too long a radius for the orbit of Jupiter the calculated rate of light movement was too great; so now by employing the more exact rate and the same measures of time we can correct the estimated distance of Jupiter and all the other planets from the sun. We have, in fact, a really independent measure of planetary space; and it concurs with observations of the parallax of Mars, in requiring a considerable reduction of the assumed diameters of the planetary paths. The distance of the earth from the sun must be reduced from above ninety-five to less than ninety-three millions of miles, and by this scale the other space-measures of the solar system, excepting the diameter of earth and the distance and diameter of the moon, may be corrected.

The light and heat which are emitted from the sun reach the earth without great diminution by absorptive action of the atmosphere; but the waste of heat from the surface of our planet through radiation into space is prevented, or rather lessened, by this same atmosphere. Many transparent bodies admit freely heat-rays derived from a source of high temperature, but stop the rays which emanate from bodies only slightly warmed. The atmosphere possesses this quality in a remarkable degree, and owes it to the presence of diffused water in vapour, a fact which Dr. Tyndall has placed in the clear light of complete and varied experiment. The application of this truth to the history of the earth and of the other planets is obvious. The vapourous atmosphere acts like warm clothing to the earth. By an augmented quantity of vapour dissolved, and water suspended in the air, the waste of surface-heat of the earth would be more impeded; the soil, the water, and the lower parts of the atmosphere would grow warmer; the climates would be more equalised; the general conditions more like what have been supposed to be the state of land, sea, and air during the geological period of the coal measures.

Such an augmentation of watery constituents in the atmosphere would be a natural consequence of that greater flow of heat from the interior, which, by many geologists, mathematicians, and chemists, is supposed to have happened in the earlier periods of the history of the earth.

By the same considerations we may understand how the planet Mars which receives not half so much heat from the sun as the earth does, may yet enjoy—as, in fact, it seems to enjoy—nearly a similar climate, with snows alternately gathering on one or the other of its poles, and spreading over large spaces around, but not apparently beyond the latitude of 50 deg. or 40 deg.; the equatorial band of 30 deg. or 40 deg. north or south being always free from snow-masses bright enough and large enough to catch the eye of the observer. Mars may, therefore, be inhabited, and we may see in the present state of this inquiry reason to pause before refusing the probability of any life to Jupiter, and even more distant planets.

The history of suns and planets is in truth the history of the effects of light and heat manifested

in them, or emanating from them. Nothing in the universe escapes their influence; no part of space is too distant to be penetrated by their energy; no kind of matter is able to resist their transforming agency. Many if not all the special forces which act in the particles of matter are found to be reducible into the general form of heat; as this is convertible and practically is converted into proportionate measures of special energy. Under this comprehensive idea of convertibility of force, familiar to us now by the researches of Joule, the reasonings of Grove and Helmholtz, and the theorems of Rankine, it has been attempted by Mayer, Waterston, and Thomson to assign a cause for the maintenance of the heat-giving power of the sun in the appulse of showers of aërolites and small masses of matter, and the extinction of their motion on the surface of the luminary. By calculations of the same order, depending on the rate of radiation of heat into space, the past antiquity of the earth and the future duration of sunshine have been expressed in thousands or millions of centuries. In like manner the physical changes on the sun's disc, by which portions of his darkly heated body become visible through the luminous photosphere, have been connected—if not distinctly as a cause, certainly as a coincident phenomenon—with particular magnetic disturbances on the surface of the earth; the solar spots and the magnetic deflections concurring in periods of maxima and minima of ten or eleven years' duration. Thus even these aberrant phenomena become part of that amazing system of periodical variation which Sabine and his fellow-labourers, British, French, German, Russian, and American, have established by contemporaneous observation over a large part of the globe.

What message comes to us with the light which springs from the distant stars, and shoots through the depths of space to fall upon the earth after tens, or hundreds, or thousands of years? It is a message from the very birthplace of light, and tells us what are the elementary substances which have influenced the refraction of the ray. Spectral analysis, that new and powerful instrument of chemical research, for which we are indebted to Kirchhoff, has been taught by our countrymen to scrutinise, not only planets and stars, but even to reveal the constitution of the nebulae, those mysterious masses out of which it has been thought new suns and planets might be evolved—nursing-mothers of the stars. For a time, indeed, the resolution of some nebulae, by the giant mirror of Lord Rosse, afforded ground for opposing the speculation of Herschel and the reasoning of Laplace, which required for their very starting point the admission of the existence of thin gaseous expansions, with or without points or centres of incipient condensation, with or without marks of internal movement. The latest results, however, of spectral analysis of stars and nebulae by Mr. Huggins and Professor W. A. Miller, have fairly restored the balance. The nebulae are indeed found to have in some instances stellar points, but they are not stars; the whole resembles an enormous mass of luminous gas, with an interrupted spectrum of three lines, probably agreeing with nitrogen, hydrogen, and a substance at present unknown. Stars tested by the same accurate hands are found to have a constitution like that of our own sun, and, like it, to show the presence of several terrestrial elements—as sodium, magnesium, iron, and very often hydrogen. While in the moon and Venus no lines whatever are found due to an atmosphere, in Jupiter and Saturn, besides the lines which are identical with some produced in our own atmosphere, there is one in the red, which may be caused by the presence of some unknown gas or vapour. Mars is still more peculiar, and enough is ascertained to discountenance the notion of his redness being due to a peculiarity of the soil.

To aid researches into the condition of celestial bodies, the new powers of light discovered by Niepce, Daguerre, and Talbot, have been employed by Bond, Draper, De la Rue, and other astronomers. To our countryman, in particular, belongs the honour of successful experiments on the rose-coloured flames which extend from certain points of the sun's border during an eclipse; as well as of valuable contributions through the same agency to that enlarged survey of the physical aspect of the moon, which, since 1852, the association has striven to promote. By another application of the same beautiful art, in connection with clockwork, the momentary changes of magnetic force and direction, the variations of temperature, the fluctuations of atmospheric

pressure, the force of the wind, the fall of rain, the proportion of ozone in the air, are registered in our observatories; and thus the inventions of Ronalds and his successors have engaged the solar rays in measuring and comparing contemporaneous phenomena of the same order over large parts of the globe—phenomena some of which are occasioned by those very rays.

METEOROLOGY.

As we ascend above the earth heat, moisture, and magnetic force decrease, the velocity of wind augments, and the proportion of oxygen and nitrogen remains the same. The decrease of heat as we rise into the air is no new subject of inquiry; nor have the views respecting it been very limited or very accordant. Leslie considered it mathematically in relation to pressure; Humboldt gave the result of a large inquiry at points on the earth's surface unequally elevated above the sea; and, finally, Mr. Glaisher and Mr. Coxwell, during many balloon ascents to the zones of life-destroying cold, far above our mountain tops, have obtained innumerable data, in all seasons of the year, through a vast range of vertical height. The result is to show much more rapid decrease near the earth, much slower decrease at great elevations; thus agreeing in general with the view of Leslie, and yet throwing no discredit on the determinations of Humboldt, which do not refer to the free atmospheric ocean, but to the mere borders of it where it touches the earth and is influenced thereby.

The proportion of carbonic acid gas in the atmosphere at great heights is not yet ascertained; it is not likely to be the same as that generally found near the earth; but its proportion may be more constant, since in those regions it is exempt from the influence of the actions and reactions which are always in progress on the land and in the water, and do not necessarily compensate one another at every place and at every moment.

Other information bearing on the constitution of the atmosphere comes to us from the auroral beams and other meteoric lights known as shooting stars. For some of these objects not only appear at heights of ten miles, fifty miles, and a hundred or more miles above the earth, but at the height of fifty miles it is on record that shooting stars or fire balls have left waving trains of light, whose changes of form were in seeming accordance to varying pressure in the elevated and attenuated atmosphere.

Researches of every kind have so enriched meteorology since our early friend, Professor J. Forbes, printed his suggestive reports on that subject, and so great have been the benefits conferred on it by the electric telegraph, that at this moment in M. Leverrier's observatory in Paris, and the office so lately presided over by Admiral Fitzroy in London, the messages are arriving from all parts of Europe to declare the present weather, and furnish grounds for reasonable expectation of the next probable change. Hardly now within the seas of Europe can a cyclone begin its career of devastation before the warning signal is raised in our seaports, to restrain the too confident sailor. The gentle spirit which employed this knowledge in the cause of humanity has passed away, leaving an example of unselfish devotion in a work which must not fail through any lack of energy on the part of this Association, the Royal Society, or the Government. We must extend these researches and enlarge these benefits by the aid of the telegraph, bringing the ends of the world together. Soon may that thread of communication unite the two great sections of the Anglo-Saxon race, and bring and return through the broad Atlantic the happy and mutual congratulations for peace restored and friendships renewed.

CHEMISTRY.

By the labours of Lavoisier and his contemporaries chemistry acquired a fixed logic and an accurate nomenclature. Dalton and the great physicists of the early part of this century gave that law of definite combination by proportionate weight of the elements, which is for chemistry what the law of gravitation is for celestial mechanics. A great expansion of the meaning of the atomic theory took place when Mitscherlich announced his views of isomorphous, isomeric and dimorphous bodies. For thus it came gradually to appear that particular forces resided in crystals in virtue of their structure, lay in certain directions, and exhibited definite physical effects, if the chemical elements, without being the same, were combined in similar proportions,

and aggregated into similar crystals. Some years later ozone was discovered by Schönbein, and it occurred with a few other allotropic substances in reviving among philosophic chemists the inquiry as to the relative situation of the particles in a compound body, and the effects of such arrangements—an idea which had been expressed by Dalton in diagrams of atoms, and afterwards exercised the ingenuity of Exley, Macvicar, and others.

Everything connected with this view of the modification of physical properties by the arrangement of the particles, whether elementary or compound, is of the highest importance to mineralogy—a branch of study by no means so much in favour, even with chemists, as its own merits and its collateral bearings might justly deserve. Yet it is in a great measure by help of this branch of study that the opinions now current regarding metamorphism of rocks *in situ*, and the formation of mineral veins, must acquire that solid support and general consent which at present they do not possess. Crystals, indeed, whether regarded as to their origin in nature, their fabrication by art, or their action on the rays of light, the waves of heat and sound, and the distribution of electricity, have not been neglected by the association or its members. In one of the earliest reports Dr. Whewell calls attention to the state of crystallographical theory, and to the artificial production of crystals; and in another report Professor Johnston notices epigene and pseudomorphous crystallisation; and for many years at almost every meeting, new and brilliant discoveries in the action of crystals on light were made known by Brewster, and compared with the undulatory theory by Herschel, [M'Cullagh, Airy, Hamilton, Whewell, Powell, Challis, Lloyd, and Stokes.

Within our association-period both the nomenclature of chemistry and the conception of the atomic theory have received, not indeed a change, but such an addition to its ordinary expression as the more general language and larger meaning of algebra have conferred on common arithmetical values. The theory of compound radicals, as these views of Liebig, Dumas, and Hofmann may be justly termed, embraces the consideration of groups of elements united in pairs by the ordinary law, these groups being for the purpose in hand treated as single elements of combination. The nomenclature which attempts in ordinary words to express these relations grows very unmanageable even in languages more easily capable of polysyllabic combinations than ours; but symbols of composition—the true language of chemistry—are no more embarrassed in the expression of these new ideas than are the mathematical symbols which deal with operations of much greater complexity on quantities more various and more variable. The study of these compound radicals comes in aid of experimental research into those numerous and complex substances which appear as the result of chemical transformations in organic bodies. Thus in some instances the very substances have been recomposed by art which the vital processes are every moment producing in nature; in others the steps of the process are clearly traced; in all the changes become better understood through which so great a variety of substances and structures are yielded by one circulating fluid; and the result is almost a new branch of animal and vegetable physiology, not less important for the health of mankind than essential to the progress of scientific agriculture.

GEOLOGY.

In our own days, within our own memories, the very foundations of the series of strata, deposited in the beginning of time, have been explored by our living friends, our Murchison and Sedgwick, while the higher and more complicated parts of the structure have been minutely examined by our Lyell, Forbes, and Prestwich. How instructive the history of that long series of inhabitants which received in primeval times the gift of life, and filled the land, sea, and air with rejoicing myriads, through innumerable revolutions of the planet, before in the fullness of time it pleased the Giver of all Good to place man upon the earth, and bid him look up to heaven.

Wave succeeding wave, the forms of ancient life sweep across the ever-changing surface of the earth; revealing to us the height of the land, the depth of the sea, the quality of the air, the course of the rivers, the extent of the forest, the system of life and death—yes, the growth, decay, and death of individuals, the beginning and ending of races, of many successive races of plants

and animals, in seas now dried, on sandbanks now raised into mountains, on continents now sunk beneath the waters.

Had that series a beginning? Was the earth ever uninhabited, after it became a globe turning on its axis and revolving round the sun? Was there ever a period since land and sea were separated—a period which we can trace—when the land was not shaded by plants, the ocean not alive with animals? The answer, as it comes to us from the latest observation, declares that in the lowest deposits of the most ancient seas, in the stratified crust of the globe, the monuments of life remain. They extend to the earliest sediments of water, now in part so changed as to appear like the products of fire. What life? Only the simpler and less specially organised fabrics have as yet rewarded research among those old Laurentian rocks—only the aggregated structures of Foraminifera have been found in what, for the present at least, must be accepted as the first deposits of the oldest sea. The most ancient of all known fossils, the Eozoon Canadense of Sir W. Logan, is of this low, we may even say lowest, type of animal organisation.

Then step by step we are guided through the old Cambrian and Silurian systems, rich in Trilobites and Brachiopoda, the delights of Salter and Davidson; with Agassiz and Miller and Egerton we read the history of the strange old fishes of the Devonian rocks; Brongniart, and Goppert, and Dawson, and Binney, and Hooker unveil the mystery of the mighty forests now converted to coal; Mantell, and Owen, and Huxley restore for us the giant reptiles of the Lias, the Oolite, and the Wealden; Edwards and Wright almost revive the beautiful corals and echinoderms; which with all the preceding tribes have come and gone before the dawn of the later periods, when fragments of mammoths and hippopotami were buried in caves and river sediments to reward the researches of Cuvier and Buckland, Prestwich and Christy, Lartet and Falcoeur.

And what is the latest term in this long series of successive existence? Surely the monuments of ever advancing art—the temples whose origin is in the caverns of the rocks; the cities which have taken the place of holes in the ground, or heaps of stones and timber in a lake; the ships which have outgrown the canoe, as that was modelled from the floating trunk of a tree, are sufficient proof of the late arrival of man upon the earth, after it had undergone many changes, and had become adapted to his physical, intellectual, and moral nature.

Compared with the periods which elapsed in the accomplishment of these changes, how short is the date of those yet standing monoliths, cromlechs, and circles of unhewn stone which are the oldest of human structures raised in Western Europe, or of those more regular fabrics which attest the early importance of the monarchs and people of Egypt, Assyria, and some parts of America! Yet, tried by monuments of natural events which happened within the age of man, the human family is old enough in Western Europe to have been sheltered by caverns in the rocks, while herds of reindeer roamed in Southern France, and bears and hyænas were denizens of the south of England. More than this, remains of the rudest human art ever seen are certainly found buried with and are thought to belong to races who lived contemporaneously with the mammoth and rhinoceros, and experienced the cold of a Gallic or British winter, from which the worldly covering of the wild animals was a fitting protection.

ETHNOLOGY.

Our own annals begin with the Kelts, if indeed we are entitled to call by that historic name the really separate nations, Belgian, Iberian, and Teutonic, whom the Roman writers recognise as settlers in Britain; settlers among a really earlier family, our rudest and oldest forefathers, who may have been, as they thought themselves to be, the primitive people of the land. But beyond the Kelts who occupied the sources of the Danube and the slopes of the Pyrenees, and were known to Rome in later days, there was present to the mind of the father of Grecian history a still more Western race, the Cynetes, who may perhaps be supposed the very earliest people of the extreme west of the continent of Europe. Were those the people, the first poor pilgrims from the East, whose footsteps we are slowly tracing in the valleys of Picardy and the south of England, if not on the borders of the lakes of

Switzerland? Are their kindred still to be found among the Rhætic Alps and the Asturian cliffs, if not amid the wilds of Connemara, pressed into those mountainous recesses by the legions of Rome, the spear of the Visigoth, and the sword of the Saxon? Or must we regard them as races of an earlier type, who had ceased to chip flints before the arrival of Saxon, or Goth, or Kelt, or Cynetian? These questions of romantic interest in the study of the distribution and languages of the families of man are part of a large circle of inquiry which finds sympathy in several of our sections, especially those devoted to zoology, physiology, and ethnology. Let us not expect or desire for them a very quick, or, at present, a very definite settlement. Deep shadows have gathered over all the earlier ages of mankind, which perhaps still longer periods of time may not avail to remove. Yet let us not undervalue the progress of ethnological inquiry, nor fail to mark how, within the period to which our recollections cling, the revelations of early Egypt have been followed by a chronology of the ancient kingdoms on the Tigris and Euphrates, through the same rigorous study of language. Thus has our Rawlinson added another page to the brilliant discoveries of Young and Champollion, Lepsius and Rosellini.

Nor, though obtained in a different way, must we forget the new knowledge of a people nearer home, which the philosophic mind of Keller has opened to us among his native mountains. There, on the borders of the Alpine lakes, before the great Roman general crossed the Rhone, lived a people older than the Helvetians; whose rude lives, passed in hunting and fishing, were nevertheless marked by some of the many inventions which everywhere, even in the most unfavourable situations, accompany the least civilised of mankind. Implements of stone and pottery of the rudest sort belong to the earliest of these people; while ornamented iron weapons of war, and innumerable other fabrics in that metal, appear about the later habitations, and correspond probably to the period of the true Helvetii, who quitted their home and contended with Cæsar for richer settlements in Gaul. The people of whom these are the traces on almost every lake in Switzerland are recognised as well in the ancient lake basins of Lombardy and among the Tyrolean Alps, and farther on the north side of the mountains, and probably fresh discoveries may connect them with the country of the Sarmatians and the Scythians.

Thus, at length, is fairly opened for archaeology and palæontology to read a new chapter of the world's history, which begins in the pleistocene periods of geology, and reaches to the prehistoric ages of man. Did our ancestors really contend, as the poets fancied, with stones and clubs against the lion and the rhinoceros, and thus expel them from their native haunts, or have they been removed by change of climate or local physical conditions? Was the existence of the hyæna and the elephant only possible in Western Europe while a climate prevailed there such as now belongs to Africa or India? And was this period of high temperature reduced in a later time for the elk, reindeer, and musk ox, which undoubtedly roamed over the hills of England and France? If we think so, what a vista of long duration stretches before us, for no such changes of climate can be supposed to have occurred except as the effect of great physical changes, requiring a lapse of many thousands of years. And although we may think such changes of climate not proved, and probably careful weighing of evidence may justify our disbelief, still, if the valleys in Picardy have been excavated since the deposit of the gravel of St. Acheul, and the whole face of the country has been altered about the caverns of Torquay since they received remains of animals and traces of man—how can we admit these facts and yet refuse the time required for their accomplishment? First, let us be sure of the facts, and especially of that main fact upon which all the argument involving immensity of time really turns, viz., the contemporaneous existence of man with the mammoth of the plains, and the bear of the caravans. The remains of men are certainly buried with those of extinct quadrupeds; but did they live in the same days, or do we see relics of different periods gathered into one locality by natural processes of a later date, or confused by the operations of men?

GEOGRAPHY AND HYDROGRAPHY.

How important, in the view of many important questions, is that never-tiring spirit of geogra-

phical and maritime discovery, to which through four hundred years Europe has sent her noblest sons and her most famous expeditions; sent them, alas! too often to an early grave. If it be asked, what share in the discoveries and inventions of the last thirty-three years is claimed for the British Association? let us answer fearlessly—We had a part in all. In some of them we took the foremost place by the frequency of our discussions, the urgency of our recommendations, the employment of our influence, and the grant of our funds. For others we gave all our strength, to support the Royal Society and other institutions in their efforts to accomplish purposes which we approve. In all instances our elastic system responds quickly to pressure, and returns the friendly impulse. If we look back on the work of previous years it is easy to mark the special action of the Association in fields which hardly could be entered by any other adventurers.

Many of the most valuable labours of which we are now reaping the fruits were undertaken in consequence of the reports on special branches of science which appear in the early volumes of our Transactions—reports in which particular data were requested for confirming or correcting known generalisations, or for establishing new ones. Thus, a passage in Professor Airy's "Report on Physical Astronomy" first turned the attention of Adam to the mathematical vision of Neptune; Lubbock's "Report on Tides" came before the experimental researches and reductions, which since 1834 have so often engaged the attention of Whewell and Airy and Haughton, with results so valuable and so suggestive of further undertakings. Among these results may be placed additional knowledge of the probable depth of the channels of the sea. For before the desire of telegraphic communication with America had caused the bed of the North Atlantic to be explored by soundings to a depth seldom exceeding three miles, there was reason to conclude from the investigations of "Whewell on Cotidal Lines" that a depth of nine miles was attained in the South Atlantic, and from the separate computations of Airy and Haughton, that somewhat greater depth occurred in a part of Ireland. The greater portion of the sea-bed is within reach of soundings directed by the superior skill and greater perseverance of modern scientific navigators; a depth of six miles is said to have been reached in one small tract of the North Atlantic; depths of nine or ten miles in the deepest channels of the sea are probable from considering the general proportion which is likely to obtain between sea depths and mountain tops. Thus the data are gradually being collected for a complete survey of the bed of the sea, including among other things information, at least, concerning the distribution of animal and vegetable life beneath the waters.

Waves—their origin, the mechanism of their motion, their velocity, their elevation, the resistance they offer to vessels of given form—these subjects have been firmly kept in view by the Association, since first Professor Challis reported on the mathematical problems they suggest, and Sir J. Robison and Mr. Scott Russell undertook to study them experimentally. Out of this inquiry has come a better knowledge of the forms which ought to be given to the "lines" of ships, followed by swifter passages across the sea, both by sailing vessels and steamers, of larger size and greater lengths than were ever tried before.

One of the earliest subjects to acquire importance in our thoughts was the unexplored region of meteorology laid open in Professor J. Forbes's reports. Several of the points to which he called attention have been successfully attained. The admirable instruments of Whewell, Osler, and Robison have replaced the older and ruder anemometers, and are everywhere in full operation, to record the momentary variations of pressure or sum the varying velocities of the wind. No small thanks were due to Mr. Marshall and Mr. Miller for their enterprise and perseverance in placing rain gauges and thermometers amidst the peaks of Cumberland and Westmoreland. These experiments are now renewed in both counties and in North Wales; and I hope to hear of similar efforts among the mountains of the west of Ireland and the west of Scotland. Our meteorological instruments of every kind have been improved, our system of photographic registration has spread from Kew into other observatories, and our corresponding member, Professor Dove, has collected into systematic maps and tables the lines and figures

which represent annual and monthly climate over every land and sea.

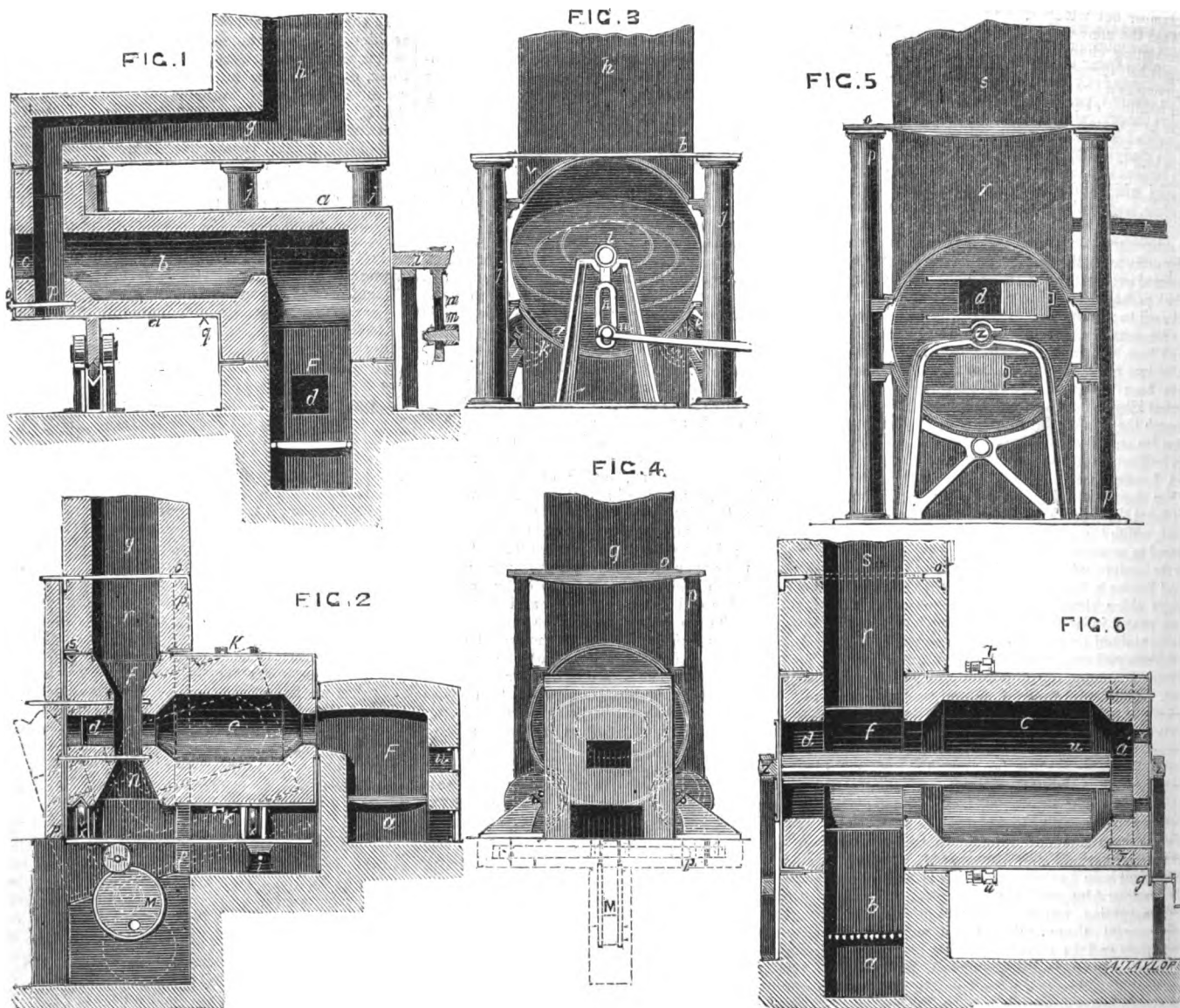
In the same manner by no sudden impulse or accidental circumstance, rose to its high importance that great system of magnetic observations, on which, for more than a quarter of a century, the British Association and the Royal Society, acting in concert, have been intent. First, we had reports on the mathematical theory and experimental researches of magnetism by Christie, 1833; Whewell, 1835; and Sabine, 1835; afterwards, a magnetic survey of the British Islands; then, the establishment of a complete observatory at Dublin, with newly arranged instruments, by Dr. Lloyd in 1838. On all this gathered experience we founded a memorial to Her Majesty's Government, made a grant of £400 from our funds for preliminary expenses, and presented to the meeting of this Association in Birmingham, in 1839, a report of progress, signed by Herschel and Lloyd. From that time how great the labour, how inestimable the fruits! Ross sails to the magnetic pole of the south, America and Russia co-operate with our observers at Kew, Toronto, and St. Helena, and General Sabine, by combining all this united labour, has the happiness of seeing results established of which no man dreamed—laws of harmonious variation affecting the magnetic elements of the globe, in definite relation to the earth's movement, the position of the sun and moon, the distribution of temperature, and the situation in latitude and longitude.

Our efforts have not been fruitless, whether, with Mr. Mallet, we make experiments on artificial earth shocks at Dalkey, or survey the devastations round Vesuvius, or tabulate the records of earthquakes since the beginning of history, or establish the Kew Observatory as a scientific workshop where new instruments of research are made and proved and set to work; or dredge the sea with Forbes and Brady, and Jeffreys, or catalogue the stars with Bailey, or investigate electricity with Harris, Ronalds, Thomson, and Jenkin, or try the action of long-continued heat with Harcourt—in these and a hundred other directions our attempts to gain knowledge have brought back new facts and new laws of phenomena, or better instruments for attaining and better methods for interpreting them. Even when we enter the domain of practical art, and apply scientific methods to test a great process of manufacture, we do not fail of success, because we are able to join in united exertion the laborious cultivators of science and the scientific employers of labour.

The same work is ever before us; the same prudence is always necessary, the same aid is always ready. Great, indeed, should be our happiness in reflecting on the many occasions when the Royal Society in particular, and other institutions older than our own, have readily placed themselves by our side to share our responsibility and diminish our difficulties. But for this our wishes might not always have prevailed, and the horizon of science would not have been so clear as now it is. Of late years, indeed, societies formed on our model have taken up special parts of our work; and thus to some extent have relieved us of the pressure of communications relating to the practice of particular professions and the progress of some public questions. Not that scientific agriculture, social statistics, or physiology are neglected in our meetings, but that these and other practical subjects are found to have more than one aspect, and to require more than one mode of treatment. With us, facts well ascertained, conclusions rightly drawn, will ever be welcome, from whatever quarter of the horizon of science they may make their appearance. Whatever societies cultivate these objects they are our allies, and we will help them, if we may. With pleasure we receive proofs of the good work done in limited districts by the many field clubs formed by our countrymen; whether, like those of Tyneside, and the Cotswolds, and in this immediate vicinity those of Warwickshire, Worcester-shire, and Dudley, they explore the minutest recesses of our hills and glens, or, like the rangers of the Alps, bring us new facts regarding glaciers, ancient climate, and altered levels of land and sea.

Wherever and by whatever means sound learning and useful knowledge are advanced, there to us are friends. Whoever is privileged to step beyond his fellows on the road of scientific discovery will receive our applause, and, if need be, our help. Welcoming and joining in the labour of all, we shall keep our place among

IRON CONVERTING MACHINERY.



those who clear the roads and remove the obstacles from the paths of science; and whatever be our own success in the rich fields which lie before us, however little we may now know, we shall prove that in this our day we knew at least the value of knowledge, and joined hearts and hands in the endeavour to promote it.

At the conclusion of the President's interesting address, of which the above are the most important features, Sir Roderick Murchison, as representing the *savans* present, moved a vote of thanks to Professor Phillips; while the mayor, on behalf of the public, seconded the motion, which was carried by acclamation in the presence of two thousand persons.

IRON CONVERTING MACHINERY.

WITHIN the last few years many circumstances have arisen to stimulate manufacturers and others interested in the production of iron and steel, in their endeavours to perfect their furnaces and other apparatus. But notwithstanding all that inventive talent has suggested or practical knowledge utilised in this direction, there still remain points whereon further improvement may be made. Mr. Morgan Morgans, of Brendon Hills, Somerset, engineer, has discerned this, and not long ago he improved the blast furnace by the introduction of a central core of conical form. That gentleman has now patented improvements in converting cast iron or pig iron into wrought iron or steel, and in machinery employed therein. This invention consists, first, in mixing spiegeleisen, or any carboniferous or manganeseiferous iron or ore in a solid or fluid state (and in proportion varying according to the percentage of carbon and manganese it contains, and according to whether the iron is to be converted into wrought iron or steel), with the iron to be converted or refined in puddling furnaces. The mixture is

sometimes effected before the iron to be refined is melted; but it is preferred generally to add the carboniferous or other iron when the iron operated upon is in a fluid or plastic state. An intense heat is secured by placing one or more steam or compressed air jets in the stack of the furnace to increase the draught, and cause the metal or ores added to be thoroughly incorporated with the iron to be converted or refined. The invention consists, secondly, in an improved apparatus for puddling, whereby the gases from the fire are caused to act effectually upon the iron to be converted, at a great economy of time, labour, and fuel; for this purpose, a cast or wrought-iron casing or cylinder, termed a containing vessel, is constructed in one or more parts of any convenient shape, but by preference circular or elliptical in cross section; and in this containing vessel one or more chambers are formed. It is mounted on rollers, suspended on bearings or otherwise, so that it may receive an oscillatory motion or be made to partly rotate; at one end of the vessel, a stationary fire-grate and stack are constructed, or sometimes the grate is allowed to oscillate with the vessel. When only one chamber is formed in the vessel, the iron to be refined is placed therein, and the hot gases from the fire pass over the iron until it is melted; it is then agitated, and fresh surfaces are exposed to the action of the gases by giving the vessel an oscillatory motion, which is effected by preference by means of one or more rods connected at one end with the vessel and at the other end with a crank, eccentric, or other arrangement for giving to-and-fro motion; if required, the spiegeleisen or other metal or ore is added, and when the process of converting is completed, the charge is taken out and hammered, shingled, rolled, or otherwise treated as required. The gases from the fire, after passing through the converting chamber, are caused sometimes to return to the stack through a return flue or cham-

ber, situated over, under, or on either side of the vessel. The pig iron is placed in this flue or chamber, so that it may become heated before being raked into the puddling chamber for conversion. Puddling apparatus thus constructed possess the advantage of having one end entirely free for operating, and for removing the charge, which may be performed without shifting either the fireplace or containing vessel. Sometimes the containing vessel and framework is suspended upon hinges or pivots, so that it may be tipped without being removed, and the charge rolled out. If the heater is not required, the fireplace may be at one end of the containing vessel, and the stack at the other; the return flue may then be dispensed with.

This invention further consists in constructing the containing vessel with two or more chambers in the same casing, or separate casings fastened together. The gases from the fire are caused to pass through one of the chambers which contains the iron to be refined, which, when melted, is agitated, as before described; and, after the spiegeleisen or other metal or ore has been added (if required), and the process of converting is completed, the charge is drawn out (if preferred, by tipping the containing vessel) through suitable holes and treated as usual. The hot gases, however, are not allowed to pass directly from the first or converting chamber into the stack, but they are made to return through the other chamber and heat a charge therein previous to such charge being puddled; the gases then pass off into the stack, or are otherwise further utilised. When the converting is completed in the one chamber and the charge removed, the vessel is turned half round so that the chambers change positions; that which was before the heating chamber now becomes the converting chamber, the charge therein being already considerably heated, if not in a melting state. Another charge is then introduced into

the chamber which was before the converting chamber but which is now a heating chamber. When the conversion in that which is now the converting chamber is completed, the vessel is again half turned round and so on, each chamber serving as a heater and as a converting chamber or puddling chamber alternately. The charges can be removed from the top or bottom chamber without taking away either the vessel or furnace; the heat is, therefore, regularly kept up and all sudden contraction of the bricks or cement by allowing cold air to be drawn through the chambers avoided.

In the engravings fig. 1 is a longitudinal section and fig. 2 is an end view of an improved puddling apparatus. A A is the containing vessel having only a single chamber b, which is formed of fire clay, brick, or other suitable refractory material inside a metal casing. F is the furnace, d the furnace door. The hot gases from the furnace pass through the converting chamber b, then through the return flue g into the stack h, which is supported by the pillars j j under the girders t t to admit of renewing the parts v v when required. The containing vessel A A is supported upon the rollers k k and the axle l, so that it may be oscillated when required. The iron to be operated on may be heated in the return flue g, and then raked into the converting chamber b, where it is brought fit for puddling; and oscillating motion is then given to the containing vessel by means of the connecting rod m and the lever n, so that the metal becomes agitated and converted. When the process is completed the charge is taken out through the hole c, or, by drawing the slide o, it can drop through the passage p on a carriage, and be removed to the hammer or rolls as required. This containing vessel can be made to tip in its place on the fulcrum q, by arranging the rollers k k so that they may be lowered. Fig. 3 is a longitudinal section of another single chamber containing vessel without a return flue; and fig. 4 is an end view of the same; a is the ashpit, F the furnace, C the converting chamber, d the charging whole, f the flue leading to the stack g. When renewing the charges the position of the containing vessel may be altered, so that the roof of the converting chamber may become the bottom by turning it half way round, for by adjusting the slides h h the containing vessel will work on either half of a revolution. This containing vessel is made to oscillate by a connecting rod working on the pin k. After the charge has been placed in the chamber C, and the process of puddling is completed, the containing vessel may be tipped on the fulcrum l by means of the eccentric M until it assumes the position shown in dotted lines, when the charge is removed through the passages n or f. The stack g is supported on the girders o by the pillars p p, so that the portion r may be rebuilt when required on the saddleback s. If it be required to have both ends of this containing vessel free for operating, the furnace F is built under the containing vessel, as shown at figs. 1 and 2; w w are openings to the ashpit and furnace; x x are rollers on which the containing vessel moves. Fig. 5 is an end view, and fig. 6 a longitudinal section of a double chamber containing vessel, a is the ashpit, b the furnace, c c the two chambers, d d charging holes, f f flues, s the stack resting on the girders o supported by the pillars p p. The containing vessel is suspended on the pivots z z. After the charge has been placed in the lower chamber c, and has become sufficiently heated, the containing vessel is made to oscillate by the connecting rod t working on the pin u; in the meantime a second charge is placed in the upper chamber c to become heated by the waste gases from the lower chamber. When the iron in the lower chamber has become converted, it may be withdrawn through the passage T, or the containing vessel may be turned half round by the rack and pinion y y; the charge will then be collected on the centre piece w w and can be removed through the charging hole d; the chamber which was before the upper chamber containing the second charge now becomes the lower and its contents are ready for puddling; a third charge is placed in the upper chamber to become heated for puddling previous to its being again turned half round. When some particular kind of "fetting" is used for forming the converting chamber, to avoid its displacement it is preferred not to turn the containing vessel half round. In this case it is advisable to use the lower chamber entirely for converting and the upper for heating the charge, which may be

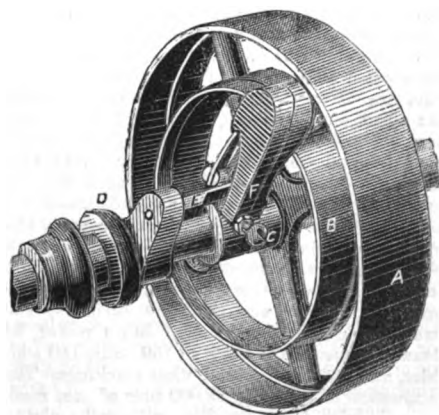
raked down the flue a' a' for puddling; x x are operating holes. This containing vessel does not conveniently admit of being tipped, but the inclination and the centre piece w w render the removal of the charge comparatively easy.

REAPING OR MOWING MACHINES.

AN invention having for its object the constructing of reaping or mowing machines in an improved manner, with a simplified combination of the parts, and so as to be more efficient and convenient in use than such machines as hitherto made, has been patented by Mr. Peter Winton, of Thorn, near Falkirk, N.B. The accompanying engraving shows a plan of the machine, in which the driving gear is arranged upon a horizontal cast-iron frame 1, 2, 3, 4, of a rectangular form, and which is formed with plain eyes in the inner and outer sides 4, 2 of it, and the main shaft 5 is entered through these eyes and through the eyes of the driving wheel 6 placed in position within the frame. The intermediate shaft 7 for working the cutter bar 8 is set on the frame 2, so as to project within the rim of the driving wheel 6, and it has a pinion on its inner end which is driven by a toothed ring or wheel 9, formed or fixed upon the spokes or centre frame of the driving wheel 6. The inclined crank shaft 10 is carried upon the outer side of the frame 2, and is driven by bevel gearing in the usual way; and the intermediate shaft 7 is shifted into gear with or out of gear from the spur wheel or rim 9 by means of a lever 11 and clutch 12. The machine being for two horses, a long centre pole 13, which is of tubular iron, is fixed to the front 3 of the rectangular frame, and is fitted with swivelling or swing trees 14 at back and front, whilst a fore wheel is by preference dispensed with. The delivery is self-acting, and is effected by two rakes 15 on arms 16, fixed on a shaft 17, which shaft is inclined inwards and backwards from the vertical, being principally held near its upper end by a bracket 18 fixed to the rectangular frame 4, and steadied by a stay 19. The inclined shaft 17 is driven by bevel gearing 20 directly from the main shaft 5, the driving bevel pinion being fixed on the inner end of that shaft, whilst to get the inclined shaft 17 as close to the side as possible, the inner side 4 of the rectangular frame is indented, as shown, to allow the bevel pinion to be put the more closely in near the wheel. The inclined shaft 17 is put out of

gear by means of a clutch lever 21, which lifts the bevel wheel 20, being acted on by a bell-crank lever 22, connected by a link 23 to the lever 11 for acting on the cutting gearing; thus both the cutting and delivery mechanism are put into or out of working gear by one movement. The delivery board or platform 24 is quadrant-shaped in plan, and is curved horizontally to the conical form, swept through by the rakes 15 descending a little just behind the cutter bar 8, and rising considerably at the back end 25. The side of the delivery platform 24 further from the driving gear is supported by the usual running wheel 26, which is held in a bracket 27 hinged to the platform frame, so as to be adjustable as to height by a lever 28 and catch rack 29. The bracket 27, besides being forked vertically to receive the wheel 26, is slotted horizontally to receive the wheel spindle, and when on turning the machine this side of the platform moves back a little the wheel gets to the front of the bracket, the spindle running up the slots; the bracket is curved a little in such a way that when the wheel shifts, as described, it assumes a better position for the turning of the machine, immediately receding to its former position on the machine resuming a straight course.

FRICTION PULLEY.



FAST and loose pulleys, the first to transmit power, and the second to carry the belt when

not at work, have been used for years, but there are many objections to them which render some other device desirable. Friction pulleys, as a substitute, have been employed with advantage, and many are now in use in different parts of the country. The one illustrated in the accompanying engraving is novel in design, and very efficient; by a simple movement of the shipper bar the pulley is made to drive the machine, or run free without imparting power when the bar is thrown back. This ingenious arrangement has been patented in America by Mr. L. H. Olmstead, of Newark, N.J. Its details are as follow:—The pulley A has a secondary wheel B cast on its arms, which is accurately turned; so also is the inner side of the rim of the first pulley. Between these two faces is a cam block C, which is of a peculiar shape, constructed in such a way that it will bite or jamb between the rims aforementioned, when the coupling D is slipped up on the shaft by the shipper. When this is done, the wedge E strikes the arm F, and turns the cam block on its axis, so as to jamb between the two turned faces, and thus drive the work. Thus, it will be seen that an exceedingly efficient, simple, and elegant device for throwing power on and off is given in this pulley. There are no parts to rattle when in or out of use, or stick so that they cannot be readily worked; the wear of the operating wedge can be compensated at any time by the set screw G, and one belt only is necessary instead of two as heretofore.

DEATH OF MR. APPOLD.

WE have to record the lamented death of one more labourer in the field of engineering. Yesterday week Mr. Appold passed from the world in which he had long been an active worker in mechanical science—not in its foremost ranks it is true, yet well known among engineers and men of science for his great ingenuity as an amateur mechanic. His centrifugal pumps formed striking features of our Great Exhibitions both in 1851 and 1862. The paying-out apparatus used in laying submarine telegraphs was mainly his contrivance, and he, at least, shared with Mr. Hawkshaw the credit of first suggesting the use of syphons for draining off the flood waters in the Fen country, when the embankment there gave way some time ago. The most remarkable proofs of his cleverness as an inventor, however, were collected in his own house and the works adjoining it. There everything that could be made so was automatic. The doors opened as you approached them, and closed after you had entered; water came unbidden into the basins; when the gas was lighted the shutters closed; a self-acting thermometer prevented the temperature rising or falling above or below certain fixed points; and the air supplied for ventilation was both washed to cool and screened to cleanse it from blacks. Even the gates of his stableyard opened of themselves as he drove through, and closed again without slamming. Mr. Appold was a dresser of furs by a secret process, which he practised successfully for many years, and which secured him a practical monopoly of the trade, and he always maintained that this was a far more effectual way of working an invention than any patent.

THE ESSEN STEEL WORKS.

THE establishment of F. Krupp, of Essen, is well known in England as the largest steel manufactory on the continent, and it may be said in the world, notwithstanding the magnitude of some of our Sheffield establishments. The extent of the works is 301 acres, and the length of the railways for interior communication about twelve and a half English miles, on which four locomotives and one hundred and fifty waggons are in constant use. The buildings cover an area of 46 acres. There is a gas work, and a bakery, and cooking establishments for the unmarried men. In 1864 in the steel works, exclusive of the collieries and blast furnaces, which are situated in Nassau and Tayn, there were 6,600 workmen. In the same year there were in operation 850 smelting, heating, and puddling furnaces, 186 steam engines from 4 to 1,000-horse power, 34 steam hammers from 1 ton to 150 tons, 110 smithies, and 508 turning and other machines. The production of 1864 was 27,000 tons of cast steel, in guns, axles, tyres, springs, rails, boiler-plates, rollers, &c. The productions are sent to every quarter, but chiefly to England, Germany, France, Russia, United States, and India. In

May, 1865, the establishment employed 8,000 workmen, and the production has increased so enormously that it will be over 50,000 tons for the year. According to the *Star*, arrangements which have been for some time in progress for the organisation in England of a great steel work in Styria to supply the Austrian empire are now in course of completion; and from the success of M. Krupp's establishment in Prussia, there can be little doubt that in Austria, where the very best iron in the world for steel-making can be obtained, a similar undertaking would be successful and very profitable.

CIGAR SHIP.

IT is now so long since we last heard anything about Mr. Wynans' cigar ship that it had almost faded from memory. More than twelve months since she was to have been ready for her first cruise, but she has not yet even been launched. The delay has been caused partly by the novel nature of all the work, both in hull and engines, and partly from unforeseen causes beyond control. Now, however, Mr. Wynans, for whom the ship is being built as a yacht, and by whom every part of her hull, engines, and boilers, &c., has been designed, has taken the completion of it in hand himself. The hull is finished, the greater part of the engines are fitted, the cabin and saloons are going rapidly on in their fixtures, and everything promises an early launch. No date for this ceremony has been fixed, but it is almost certain that by the end of October she will be ready for sea. The vessel is of wrought iron, and the execution was at first intrusted to Mr. Hepworth, who expended upon it the most perfect workmanship of which wrought iron is capable. The hull is immensely long, perfectly round, resembling the shape of a cigar, being, however, finely pointed at both ends instead of, as in a cigar, only one. The rivets that fasten her are counter-sunk, so that she presents outwardly a perfectly smooth surface, while the workmanship of her joints is so perfect that even the touch fails to detect the slightest irregularity in her evenness.

Her engines are three-cylinder, to be driven at high pressure, turning one steel shaft (made by Mr. Krupp), which revolves through the whole length of the vessel, projecting from the fine points at each end, where it carries a screw. These screws are to be four feet greater in diameter than the greatest diameter of the vessel—namely, 22ft., and each is to have eight blades, because the two points being only, say, a foot or so below the water, four of the blades of each screw will be out as it revolves, while there will be always four of each immersed to do the work of propulsion. Under each screw is a rudder, and by steering with both the vessel can be turned as on a pivot. As the extreme points would be too fine to admit the passage of the screw shaft and its bearings also, this difficulty is obviated by making about 16ft. of each end revolve with the shaft, and thereby form part of it, so that with the increased diameter of the point at the end of the 16ft. towards the midships there is ample room gained for both shafts and bearings. Her boilers are on a new plan; four of them are on the locomotive principle, with vertical tubes. A blast fan is to give them draught, and they are to work at 150lb. pressure. There are 136ft. of fire-bar surface, and it is expected that, with the aid of the blast fan, each of these 136ft. can be made to burn 50lb. of coal per hour. If the furnaces can accomplish this, then, according to the rule which gives one nominal horse power for every 2½lb. of coals consumed per hour, Mr. Wynans' yacht will be working at nearly 2,500-horse power. In our best mail steamships on their fastest trips it is found difficult to burn 30lb. of coal per foot of fire-bar surface per hour. If Mr. Wynans, then, burn 50lb., he will be working up to nearly 2,500-horse power, or at the rate of eight indicated horse power to every ton burden of his vessel. In very fast ocean-going steamers the ratio of horse power to tonnage is only about 2½ tons to one nominal horse power. The advantage which the cigar ship possesses in this respect, together with those which her slender form, smooth surface, and very small midship section (only 100ft.) will give, should enable her to go at an extraordinary speed.

The extreme length of the vessel over all is 256ft., and her greatest width and depth is, of course, amidships, where the circle is 16ft. dia-

meter; her length is, therefore, sixteen times that of her greatest width, ordinary vessels being thought very narrow if their width is only one-seventh of their length. The cigar ship is built throughout of the finest boat plates, in some parts of steel, in some of Low Moor iron. To the waterline these plates are five-eighths of an inch thick; above the waterline they are only five-sixteenths. Her displacement will be about 500 tons, which gives her a little over 300 tons burden, according to builders' measurement. She is built without any longitudinal stringers, but throughout her entire length she is divided by sixteen water-tight compartments, and in the engine and boiler rooms is further strengthened by inner rings of angle-iron 7in. deep, which are riveted to the side and placed at intervals of only 3ft. apart. Underneath the vessel's bottom, in place of a keel, is a broad band of the best Low Moor iron 1in. thick by 3ft. wide, and meant to protect her in case of her taking the ground. Inside is an iron floor, which also runs from end to end, covered with wood, and forming, in fact, the lower passenger deck of the yacht. This floor amidships is only about six feet from the bottom of the cylinder, so that overhead there is a roomy cabin enough, much resembling in shape a small railway tunnel. The upper and only external deck is 130ft. long by 10½ft. broad, and is formed by building for that length a square flat-topped wooden cover on the top of the cylinder. This cover, or deck, is 4ft. 10in. high altogether, of which the lower 2ft. is of iron, the other 2ft. 10in. of common light wooden bulwarks. She has two short funnels, two light telescopic iron masts, and these, and her little deck, and a small part of the upper curve of the cylinder are all that will be seen out of the water. In our correspondence columns will be found some remarks upon this extraordinary vessel which we hope may fulfil all the expectations of her spirited designer.

CLYDE SHIPBUILDING.

THE progress of steam shipbuilding on the Clyde will be seen from the following summary:—The "Buffalo," a sister vessel to the "Wolf and the Llama," has just been put on the Irish mail service; she was built by Messrs. Caird, of Greenock. Messrs. Denny and Brothers, of Dumbarton, have launched a composite screw of about 1,000 tons, builders' measurement, and to be supplied with engines of 800-horse power nominal. This fine ship is named the "Wisconsin." The blockade-runners "Fanny" and "Alice," which were recently thoroughly overhauled and repaired at Dumbarton have been put on the station between Stranraer and Ireland. The "Mongolia," screw, built by Messrs. Scott and Co., and engined by the Greenock Foundry Company for the Peninsular and Oriental Steam Navigation Company, has left the Tail of the Bank for Southampton. The dimensions of the "Mongolia" are:—Length, 390ft. over all; breadth, 40ft. 4in.; depth of hold, 34ft. She is fitted with oscillating engines of 500-horse power, steam winches at each hatch on the spar deck, Downton's patent pumps, &c. She has a ventilating fan, worked by machinery, for sending a current of air along the main or troop deck. The "Count van den Bosch," screw, has made a trial run of 150 miles. She accomplished the stipulated speed with 350 tons dead weight, at a consumption of 2½lb. of Scotch coal per indicated horse power per hour. As the "Count van den Bosch" is intended for Indian service, this economy in respect to coal is a very important consideration. The burden of the "Count van den Bosch" is 850 tons, and she is fitted with a steam windlass, three surface condensers, &c. She is the property of the Netherlands Steam Navigation Company, and was built and engined by Messrs. W. Simons and Co., of the London Works, Renfrew. Messrs. Hedderwick and Co., of Govan, have on hand an iron screw of 600 tons for the East India trade, and two paddle saloon steamers for the Saloon Steam-packet Company, London, to be engined by Messrs. J. Howden and Co.

THE "ALLEMANIA."

SOUTHAMPTON has from time to time turned out some fine vessels, but the largest ever built there is the "Allemania," which left the Southampton Docks on Saturday morning last for the purpose of making a trip to Stokes Bay and Spithead, and to test her sea-going capabilities and average rate of speed. The "Allemania" was built and engined by Messrs. Day and Co., from whose premises several splendid steamers

have lately been launched for the Peninsular and Oriental and the Union Steam Shipping Companies. The "Allemania" belongs to the Edinburgh-American Steam-packet Company, and will be a powerful addition to their already fine fleet of steamers running regularly between Southampton and New York. Her length between perpendiculars is 313 ft.; breadth, 40 ft.; depth from base line to spar deck, 36 ft.; tonnage, builders' measurement, 2,484. Her engines are 100-horse power nominal, with four boilers, including superheating apparatus and the most modern improvements. She has accommodation for 60 first, 160 second, and 600 steerage—in all, for 820 passengers. She has also space for 1,000 tons of cargo and 900 tons coals. The fittings of the saloon are walnut and gold, relieved by some fine executions in paintings. The result of her trip was highly satisfactory to all parties. On sitting outside of the Isle of Wight there was a good sea and stiff breeze, but the motion of the ship was hardly perceptible. With revolution of engines 62 per minute, steam 25 lb., vacuum 27, her speed attained to fourteen knots, or about seventeen statute miles per hour.

CLEANING IRON SHIPS AFLOAT.

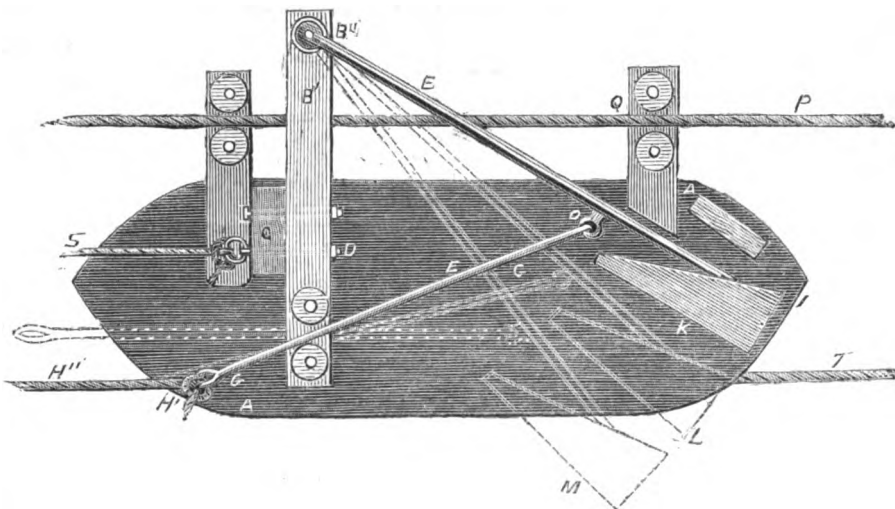
By MR. JOHN HARRISON.

(Continued from page 136.)

It is not the poisonous nature of copper which prevents these creatures from fixing upon it, indeed they do fix upon it, as fast as upon any other substance, but it is its rapid oxidation, scaling off which prevents their remaining where they do fix. It is therefore my opinion that, if ever a covering is found to protect a ship from fouling, it will be a pigment of some sort that will possess the same property as slow metal or copper—namely, of scaling off continually cleaning itself. It was in this edition that I first extended my inquiries, and my proposal was to cover the iron plates with copper to a considerable depth before building the ship, and to give the two metals a metallic reaction, so that there should be no galvanic action evolved between them. These two metals, however, have no affinity. They will not act together as iron will, and therefore it was a considerable difficulty that I succeeded in finding them. By a certain chemical process, however, it was done, as you will see from some of the samples on the table. Whether vessels may or may not be built in this way I do not know, there being still some mechanical difficulties in the way which I have not as yet been able to remove. But on this question I will not dwell, although prevention is said to be better than cure, the question of prevention is as yet a *tabula rasa* on which not two are found to rest, but which, in the absence of facts, may continue to be a fair field for experiment and speculation.

Let us, therefore, now look at another phase of the subject—namely, since we cannot prevent the colonising fishermen from squatting on our property, what is the best way of ejecting them? I answer at once, by mechanical means. This, in my opinion, is the most effective and the cheapest. Many attempts have been made in this direction. Some shipmasters have tried the friction of a chain on the bottom, others a series of wooden bars, and pieces of iron upon them. One machine present in use in the navy, is called a "Hog," and consists of a circular brush, shaped like a barrel, and which they cause to revolve beneath a vessel longitudinally from stem to stern. Another machine has been tried in Liverpool, consisting of a rope ladder, the steps of which are broad pieces of wood, one side being covered with bristles, forming a series of teeth, while on the other there is a piece of iron, forming a series of scrapers. This is acted round the vessel, and is wrought by a sort of see-saw motion, rubbing up and down. I have reason to know, however, that neither of these plans has given satisfaction, and whoever has examined the degree of tenacity with which these creatures cling to the iron must know that it is not the soft persuasion of a brush, nor even a gentle rub, that will induce them to leave their hold. Nothing, indeed, but a sharp steel edge, equal to that employed by the hand, can ever make any impression upon them. The extent to which a coating of these animals retards a vessel's progress is something very considerable, ranging from two to as many as ten knots an hour.

CLEANING IRON SHIPS AFLOAT.



The mechanical appliance for cleaning vessels afloat consists of what may be shortly described as a travelling lever fixed in a movable frame. The frame is a wooden sledge held close to the side of the ship by two guide lines,—upon which it travels as upon a railway, down to the keel and back. It is wrought vertically over all the ship, except upon the quarter, where it should be angled towards the stern to allow it to go into the "run" of the ship.

In the engraving the line A A A is an outline of the right side of the sledge, the left side being removed to show the interior. B is an upright fixed to the crossbar C, by the ring bolt D. To this fixed base the other two sides of a triangle E E are attached, but jointed and movable, while the lower side of the triangle G passes through double sheaves, beyond the base, ending in an eye for the attachment of the scraper-rope at H. Upon the apex of this triangle, at I, the scraper-blade is fixed, being set at right angles with the shaft, and the long ears at K being at right angles with the edge of the blade. As is shown by the dotted lines L M, when the rope H is hauled upon, the scraper leaves its position at K and descends to L, where being beneath the level of the frame, it comes hard in contact with the plates of the ship. The lever being still farther hauled upon at the fulcrum at O, its longest end pushes forward the bar B, making the machine travel forward on the lines P, which pass through the double sheaves at Q Q, while the scraper-blade at L continues its course over the ship's plates, sweeping everything before it. By constructing the long ears of the blade at right angles with the edge, they perform the threefold office of keeping the blade within the frame while passing over a hollow at the bow, or the quarter where the blade requires to descend, as it is seen at M. They also form an inclined plane for leading the edges over the landings of the plates, so that it is not impeded in its vertical course from the keel upwards to the bulwarks. They also prevent the edge of the scraper from going too deep and injuring the paint on the plates, as the edge can never go deeper than the parallel of these inclined planes. The ropes S and T are used, the former for lowering down the machine and adjusting it; the latter, as will be seen on the model, is for hauling the machine down to the keel against the natural flotation of the frame. As to the power of scrape which the machine possesses, it can be regulated to almost any amount consistent with the strength of the materials of which it is made. By keeping a gentle strain upon the back rope at T, the machine will be harder to push along at B, and the power of scrape at L or M will be proportionately increased; or by slackening the rope at T, and also throwing the guide-ropes slack P P, the machine will be relieved from the pressure against the sides of the ship, and will be consequently easier pushed along at Q, and the scrape on the ship at L or M will be lightened in proportion as these ropes are slackened. The other wooden frames or fenders which stand at the keel, the bilge, and against the topgallant rails of the ship, are merely for the purpose of holding the ropes that guide the machine, and for carrying the running tackle

through double sheaves, and so preventing the friction and abrasion of the ropes against the plates.

Such is a brief outline of the mechanism of this instrument. It is exceedingly simple in its construction, and easily managed in its working. It is moved fore and aft the ship by fleet lines attached to the fender at the keel. It is thus perfectly under command, and can be sent down to any part of the ship's bottom, and if it is at any time desirable merely to try the condition of the plates, it is only necessary to attach a bag of thin cloth or small mesh-net to the instrument at the part from I to Q, and it will bring to the surface whatever it takes from the bottom; so that you may always know whether you are taking anything off, or whether there is anything to take off. From the glance that we took at the natural history of the barnacle, we saw that they only inhabit the shallow waters. If, therefore, a vessel be gone over with this scraper immediately before leaving a foreign port, and perhaps get another going over, while waiting for wind in the tropics, she will come home here comparatively clean, nearly as clean as when she went out. If so then the object so much desired will be gained. Iron ships will acquire that ascendancy in point of speed which the material of their construction ought to confer upon them, while the expense of keeping them clean will be less than the putting of copper on a vessel of wood; and thus it is hoped another step will be gained in the great march of industrial progress.

Correspondence.

THE CIGAR VESSEL.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—There is nothing in the form of the cigar vessel to resist a roll, and if she goes to sea she cannot always be kept end on to the waves. Alternately on both slopes of the wave, with sufficient time to take an inclination, the weights she carries below the axis of buoyancy (which must of necessity be very great to keep her in an upright position and steady, if possible) will be set in transverse motion, and when once oscillations take place the weights will be acted upon in their vibrations by gravity and inertia, the same as the weight of a pendulum. The consequences are palpable enough. Friction will offer but small resistance to rolling when the bottom is smooth.

Another point to which I should wish to call attention is this. The longitudinal form of the cigar vessel, though imperfect, is calculated for running at a very great velocity through the water, and when she attains her maximum speed, *vis inertia*, will have become a force great enough to maintain her impetus with very small propelling power. The question suggests itself, can eight-bladed screws of very large diameter, although only half submerged, be driven with sufficient rapidity to keep pace with the vessel while her bottom is smooth? This I think is very doubtful. To enable this vessel to arrive at the highest velocity which she ought to be capable of attaining some other propeller should be applied to her than those eight-bladed screws of large diameter.

Yours, &c.,

JOHN KENNEDY.

August 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. 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.

No issue 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.—U. C.—G. D. B.—T. H. E.—W. W.—R. P. E.—G. P.—P. W.—W. W.—H. E.—G. S.—N. H. H.—W. H. H.—C. B.—J. N.—T. T. and Sons.—B. J. N.—A. F. and Co.

ANSWERED BY POST.—T. H. E.—J. F. M.—C. J. R.—U. C.—B. F. N.—H. L.

G. H. (Wakefield).—We are not aware that there is a special manufacturer of the Wilson furnace. One, however, is in full operation at the rivet works of Messrs. Miller, Stobcross-street, Glasgow.

Miscellaneous.

A statue to Francois Arago, the great French astronomer, was uncovered on Friday last, with much ceremony at Etage, in the department of the Eastern Pyrenees, his native place. To honour the ceremony there arrived savants from Germany, England, Italy, and Spain. Arago started early on the road to scientific distinction. A pupil of the Ecole Polytechnique, he at once entered the Bureau des Longitudes, and at twenty-three was named member of the institute. An enthusiastic student of pure science, he early devoted himself to its practical application. Thus it was he who first demonstrated the utility of "paratonnerres," and first discovered magnetism by electric currents, which is nothing less than the first principle of the telegraph. Arago and his friend Fresnel took a leading part in establishing the system of concave reflectors and convex lenses, which have proved so invaluable for lighthouses and so great a blessing to sailors. Arago perfected the compass and many other equally useful inventions. The special object of his life, however, was to popularise science, which, in his estimation, rose in importance far above literature.

It is said that the impression produced on the officers of the British fleet during their late visit to Cherbourg, is that the iron shops at Portsmouth might be contained within the smallest basin in the Cherbourg Docks, while the building, refitting, and repairing works of the French iron marine occupy a space of many acres. It is evident that large establishments for iron shipbuilding must for the future assume the most prominent position in British naval dockyards.

The quarterly report recently issued by the committee of management of the Oldham Industrial Co-operative Society, shows the profits for the last quarter were £1,710 19s. 9d., which, after paying interest on capital and incidental expenses, allowed a dividend of 1s. 11d. in the pound on members' purchases at the stores during the quarter. This satisfactory state of things is explained by the cash account, which shows the current expenses to be exceeding small, reflecting great credit on the management of the society.

From Berlin we learn the death of Astronomer Enke, whose name will ever attach to the comet he described and traced through its recurrent orbit; while other important additions to our knowledge of the firmament secure him immortality.

The long course of experiments at Woolwich, which have been conducted by Mr. Richardson, show the perfect practicability of the use of petroleum as fuel for steam vessels. Some slight alterations are now about to be made in the boiler, and when these are completed it will be able to burn the Rangoon, Barbadoes, or Trinidad petroleum, together with the English coal and shale oils alternately, as well as every other kind of hydrocarbon, and to obtain any degree of speed that may be required without waste.

The proposed memorial to the late Captain Speke is to be a granite obelisk, similar to the one erected to the memory of Lientenant Bellot, at Greenwich. Sir R. I. Murchison, Colonel Rigby, and the Right Hon. N. Addington, Messrs. F. Galton, and C. R. Markham, have been appointed an executive committee in order to carry out the necessary arrangements.

The report of a submarine telegraph between Sweden and Finland is now confirmed. The wire will be laid between Grislehamn and Neystadt, and will cross the Aland Islands.

At the mineral works of MM. Perret, of Lyons, on emptying an old cistern which had for some time been filled with water charged with sulphates of copper and iron, moderately thick coverings of metallic copper were found attached to the wood which had served to support the roof of the cistern, and amongst the stones forming its floor. The debris of the wood had doubtless acted by reduction on the cuprous solution. The reducing gases developed in the cistern had also acted.

We understand that the Town Council of Preston have decided upon enlisting the services of some eminent engineer in reporting upon the state of the navigation of the river Ribble, and as to the best mode of improving the same; also as to the necessary dock and quay accommodation. It is in contemplation to construct new docks at Preston, and in order to do this the present course of the river opposite the quays at Preston will have to be diverted to the west for about three-quarters of a mile. The cost of the new docks will, it is estimated, be not less than £40,000.

Down to a few months ago steam engines in Wurtemberg used to be fed with Saarbrück coals. The Prussian Government, to which the principal mines on the Saar belong, has, however, of late, been unable to carry out southern orders, having engaged to furnish such enormous quantities of the "black diamond" to the French as to make it impossible for them to serve any other customers. Thus it is that Bohemian coal has now become a saleable article in the immediate neighbourhood of the Swiss frontier.

Dr. Ponowski, of St. Petersburg, proposes powdered hellebore (*veratrum album*), as a remedy for the cholera; it is to be taken by the nose, like snuff. This is an infallible remedy when the patient sneezes eight or ten times after a pinch; but if the patient does not sneeze his case is altogether hopeless.

A number of Capt. Rodgers's patent indented small palmed anchors intended for the ships of the squadron, have been received at Woolwich within the past few days from the manufacturers at the North Field Ironworks at Rotherham in Yorkshire. The average weight of the anchors is 70 cwt. each. Thirteen of the number have been proved under hydraulic pressure, according to Capt. Rodgers's desire, at 50 per cent. above the Admiralty test, namely—up to a tensile strength of 80 tons. After undergoing the severe trial, to which no other manufacturer and inventor has consented, it was announced upon a close examination and measurement of the parts, that the greatest variation was merely five-eighths of an inch, and no permanent deflection. This is a great success, of which Capt. Rodgers has cause to be proud. The manufacturers have likewise their share of credit, as in each of the various tests not the slightest flaw has been discovered. Four of these anchors are to be supplied to the "Pallas," two as bower anchors and two as sheet anchors, and the remainder to the "Bellerophon," the "Lord Warden," and the "Lord Clyde."

In addition to the duties noticed by us as performed by the lithographer engaged on board the "Great Eastern" during the recent cable expedition, it appears that he was still further useful in transferring to stone an interesting map, drawn by Staff-Commander Moriarty, of the course and position of the "Great Eastern" when trying to recover the lost end of the cable. From this is seen with great clearness the precise whereabouts of the ship every hour or so during her drifting search; where the first buoy was placed on August 4; where the second buoy after the rope broke on August 8; where the cable was first lifted on August 3; where the second lift was on August 8; and where the third lift when the rope broke on August 11. Many other interesting particulars are given, and from the cheapness, convenience, and rapidity with which these things were done, it is to be inferred that a lithographic artist will henceforth be considered an indispensable ally on all similar expeditions.

In Europe, Asia, Africa, and Australia there are 52 submarine cables, which are of the aggregate length of 5,625 miles, and the insulated wires of which measure 9,783 miles. The longest of these is 1,550 fathoms, and the shortest 1½ fathoms. There are 95 submarine cables in the United States and British North America, which measure 68 miles, and their insulated wires 133 miles. The overland telegraph line between New York and the west coast of Ireland, through British Columbia, Northern Asia, and Russia, will be 20,479 miles long, 12,740 miles of which are completed. It has at length been resolved that this line shall cross from America to Asia at the southern point of Norton Sound, on the American side to St. Lawrence Island and from thence to Cape Thadens on the Asiatic continent. Two submarine cables will be required for this, one 135 miles long and the other 250 miles long. Cape Thadens is 1,700 miles from the mouth of the Amoor river.

Another fine paddle steamer has been added to the Channel fleet of the London, Brighton, and South Coast Railway Company. The new steamer which is called the "Bordeaux," was built by Mr.

Charles Langley, of Deptford-green Dockyard, and Managing Director of the Millwall Ironworks, took her trial trip last Tuesday, starting from Tilbury at twelve o'clock for the Nore, and returning before dusk. She made a run which fully met the expectations of all concerned in the result of the test; her speed may be stated as averaging fourteen knots. The dimensions of the "Bordeaux" are—length on water-line, 210ft.; breadth, 23½ft.; depth, 11ft.; her builder's measurement is 57½ tons; and her saloons are spacious, comfortable and elegant. Her engines, of 200 nominal horse-power, and on the oscillating principle, have also been built by Mr. Langley. The boilers are tubular, and the work is of the highest character throughout, the tubes being brass. The diameter of the cylinders is 52in., the length of stroke 57in., and the diameter of the wheel 19ft. over all.

A sailing frigate of the French Imperial Navy, the "Isis," Captain Binet, arrived at Brest on the 23rd August, after accomplishing a complete voyage of circumnavigation in nine months and twelve days. There is no example, we believe, of such a voyage having been made in so short a time. The "Isis" sailed on an average about 153 miles a day.

A Russian steam frigate has put into Harwich harbour this week short of coal. The frigate, which carries six guns, fell short of fuel when within a few miles of Harwich, and in order to get up sufficient steam to reach that port was compelled to burn up nearly every available article of furniture on board.

By the last annual report of the Union of Lancashire and Cheshire Mechanics' Institutes, it appears that there are 116 institutes in the Union, of which 35 have entered during the past year; 73 of these number 19,790 members—17,818 males, 1,972 females—and have an income of £21,703 16s. 5d. They have libraries containing 118,200 books, and the number of issues during the year was 247,594. The number of members attending evening classes was 6,670; 23 institutes have science classes in connection with the department of Science and Art, and prize examinations have been held during the year in 33 districts of the Union. During the same period, five of the institutes hitherto in the Union have ceased to exist. Prizes for next year have been offered by the Right Hon. W. E. Gladstone and other gentlemen. The Prince of Wales has accepted the office of patron.

A self-heating iron for smoothing clothes has been recently patented in America. It is hollow, and has within it a gas-pipe, which is supplied with gas by a flexible tube connected with the handle. In the gas-pipe are a few small apertures that constitute jets, which furnish minute flames. The upper portions of the iron are most heated; but when the lower has become too cold for use, the position of the upper and lower surfaces, both of which are perfectly smooth, can be easily reversed.

In consequence of the complaints of the principal mercantile houses in Liverpool as to the many and great inconveniences experienced through the want of an efficient telegraphic system between the office and docks, the Mersey Docks and Harbour Board is about to grant the Universal Private Telegraph Company certain concessions by which the company will be enabled to carry wires over the whole of the dock estate.

From the commencement of the American war to its close a few months ago, the tin plate trade of this country suffered severely owing to the great falling off in the demand from the States, which were previously such important customers. Many of the works were only employed three or four days a week, and makers as a rule preferred to stock their plates rather than sell at the exceptionally low prices that prevailed. The result of this was that at the end of last year the stocks in all the makers' hands had reached the enormous quantity of something like 300,000 boxes, and this was quite independent of the heavy stocks in the warehouses of buyers. About the commencement of 1865 the trade moved a little; from that time up to the present there has been a gradual improvement in both demand and prices, and there is every prospect that, if the political horizon keep clear, the tin plate trade will be in a prosperous position ere long.

It is stated that instructions have been received in the garrison at Woolwich from the War Department, announcing the intention of the Government to limit the term of office of the various officers superintending the manufacturing branches of the arsenal to a period of five years, and not to have it indefinite, as formerly. These regulations will be put into effect, commencing on the 1st of July next. Col. Clerk, R.A., superintendent of the carriage department, will then be superseded by Col. Shaw, the present assistant and acting superintendent, by whose energy and zeal the system of wooden carriages has been abolished in favour of wrought iron for battery guns. Col. Shaw likewise introduced the method, now under consideration, of removing the trunnions so as to enable the gunners to carry out the defences of a garrison from the battlements without the necessity of having exposed portholes.

A ship canal is about to be opened from Marquette Bay across the Portage, a little over two miles long, that will save 140 miles of the most dangerous navigation of Lake Superior.

The effluvia which escape from sewers, in the very attempt to ventilate them, are of a very pernicious character, and have often been productive of mischievous effects. M. Robinet, a French chemist, has devised a very effective means of freeing the sewers from them. His plan has already been carried out on a small scale. He proposes that the furnaces of factories shall derive their supply of air from the sewers; the latter will thus be emptied of their mephitic gases, which will be destroyed by combustion, fresh air from the atmosphere supplying their place. He calculates that if the combustion of only 70,000 tons of coal can be thus economized annually in Paris, or only a tenth part of what is burned there, the sewers will be supplied with about 140,000,000 cubic feet of fresh air—that is, more than seven times their contents—daily.

The recent exhibition at Dunedin, New Zealand, appears to have been a success. The certificates of merit reached England by the last mail. It is believed that the results of the exhibition will favourably influence the future commercial relations of England and that thriving colony.

The history of Pothooks is given in *Once a Week*, by which it appears that in the last century, the original Crawshaw, then a farmer's son, rode to London on his pony (his sole property) to seek his fortune. He began by sweeping out the warehouse of an ironmonger, who was of a discriminating mind, and saw that young Crawshaw had good stuff in him. The ironmonger had been speculating successfully in sending out iron pots to America, and his astute apprentice observed that if the Americans used so many pots they must want hooks to hang them on. Whereupon his master not only took the hint, but kindly determined that Crawshaw should send them out, and that he would lend him the money for the purpose. Upon this venture £100 was realised, and from that time the farmer's son moved rapidly upwards, being first taken into partnership by his master, and ultimately becoming an iron king in South Wales. It is curious that from this stock have arisen (in so short a time) two baronetages and one peerage, that of Lilanover.

The operation of fixing the 8-inch and 6-inch armour-plates which will protect the reconnoitering tower on the upper deck of the "Bellerophon" has been commenced. The port and starboard portion of the tower will be protected by armour-plates 8-in. in thickness, but as this portion will be of conical form, the chances of any hostile shot effecting any injury to it, although obviously more exposed than the other portions of the tower, are reduced to a minimum. All the 8-in. plates have stood the bending, slotting, and planing processes to which they have been subjected without exhibiting any flaw. The 8-in. plates are the largest yet operated upon at Chatham dockyard; but arrangements are now being completed for bending and working armour-plates of 9-in. in thickness, or double those of the thickness of the "Warrior," with which the sides of the iron frigate "Hercules," to be built at Chatham, are to be encased. Even this thickness of plating has been exceeded at the works of Messrs. John Brown and Co., Sheffield, where several thousand tons of armour-plates of no less than 13½-in. in thickness have lately been manufactured for the Russian Government for encasing the sea face of the forts at Cronstadt.

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.—443, 473, 478
BUILDINGS AND BUILDING MATERIALS.—441, 451, 452, 453, 480
CHEMISTRY AND PHOTOGRAPHY.—449, 456, 460, 477
CULTIVATION OF THE SOIL. including agricultural implements and machines.—458
ELECTRICAL APPARATUS.—None
FIBROUS FABRICS. including machinery for treating fibres, pulp, paper, &c.—429, 440, 466
FOOD AND BEVERAGES. including apparatus for preparing food for men and animals.—467
FURNITURE AND APPARATUS. including household utensils, time-keepers, jewellery, musical instruments, &c.—423, 430, 437, 439, 442, 460, 469, 469, 463, 471, 475, 477
GENERAL MACHINERY.—427, 436, 457, 461, 479
LIGHTING, HEATING, AND VENTILATING.—None
METALS. including apparatus for their manufacture.—469, 470
MISCELLANEOUS.—428, 435, 446, 447, 448, 464, 465

ROADS AND VEHICLES. including railway plant and carriages, saddlery, and harness, &c.—432, 434, 444, 454, 472, 474
SHIPS AND BOATS. including their fittings.—422, 431, 433, 439, 445
STEAM ENGINES. &c.—468
WARFARE.—421, 424, 425, 426, 455

421 J. VON DER POPPENBERG. *Improvements in breech-loading fire-arms, and in cartridges for breech-loading fire-arms.* Dated February 14, 1865.

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

422 G. HOFMAY. *Improvements in the mode of making or forming the links of iron or steel chains, chain cables, shackles, couplings, parts of the same, and for machinery to be used therein.* Dated February 14, 1865.

In performing this invention the patentee receives the coil from the coiling machine upon a bar terminating in a mandrel fitting the inside of the coil; the mandrel fits upon the steeling or cutting part of a pair of shears. This steeling is made in such a form as to insure the links being cut off with uniformity in size and scarf, and when cut to fall off or be removed, and the coil to be pushed forward for the next cut. Or he receives the coil upon a trough or rest fitting the outside of the coil, on which the coil is pushed forward to the steeling of the shears. He pushes the coil forward either by hand or by self-acting machinery; he cuts the scarf either at the side or end of the link, and he passes the links when cut through an oven or furnace where they are kept at a sufficient heat for closing; or he links them together and closes up the joint at the shears, or he allows them to cool, and re-heats them as the size of the chain may require. He then takes the link, either hot or cold, links it to the last link, and places it in a press containing metal dies of the necessary shape for closing, welding, and furnishing each link, and shedding the link when required. The machinery consists of a pair of shears having a steeling fitted into their bed of the shape required to cut the scarf or joint at the proper angle, and allow it when cut to fall off or be removed and the coil pushed forward for the next cut. The shears are connected with a mandrel. The welding and finishing machinery consists of a press worked either by hand, steam, or hydraulic power. In the press he places metal dies of the required shape for closing, welding, finishing, and putting in the stud of each link of a chain or chain cable. *Patent completed.*

423 R. P. BARRETT. *A new or improved combined garment.* Dated February 14, 1865.

This invention relates to the manufacture of a new or improved garment, which combines in one article as complete a covering for the body as is afforded by a jacket or coat and trousers, and if desired including a covering for the head. The patentee proposes to form a jacket or coat body with sleeves, and to connect thereto by a seam at the waist a pair of trousers, the front of the jacket or coat and trousers being open and provided with buttons and button holes or other fastenings, so that the garment may be readily applied to the wearer, and fastened. A neck band and collar piece is attached at the proper place, and is fastened in front; and to this may be attached a hood extending upwards to the back of the head and terminating in a cap. *Patent completed.*

424 J. PURDEY. *Improvements in breech-loading fire-arms.* Dated February 14, 1865.

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

425 B. THOMPSON. *Improvements in fire-arms.* (A communication.) Dated February 14, 1865.

The object of this invention is to make a breech-loading shot gun, or to convert an ordinary muzzle-loading shot gun or musket into a breech-loading arm, and to this end it consists in a novel construction and arrangement of parts whereby the movement of a lever in one direction is made to force the stock away from the barrel at the butt end, so as to admit of the charge being introduced into the gun at the breech, and the movement of the lever in the opposite direction is made to draw the stock and barrel together, and firmly lock and secure them against casual movement independent of each other, while the piece is being discharged. *Patent completed.*

426 B. THOMPSON. *Improvements in cartridges.* (A communication.) Dated February 14, 1865.

This improved cartridge consists of a case of any suitable material, with a pin firmly secured in one wall of such case, and extending nearly to the opposite wall, which opposite wall is perforated to permit the application of a percussion cap to the end of the pin or rod within the case, an outer cap closing the aperture in the case to confine the percussion cap and prevent the escape of gas. *Patent completed.*

427 S. R. FREEMAN AND A. GRUNDY. *An improved blowing apparatus.* Dated February 15, 1865.

The patentees claim mounting a fan in a framework, and having the gearing or mechanism for producing the motion and required speed of the fan in the said framework, thus forming a complete blowing apparatus in a portable form, suitable for blowing smiths' fires, and for other purposes where a continuous blast is required; and combining a smith's hearth with such blowing apparatus to form a complete portable forge, as described. *Patent completed.*

428 W. A. HACKETT. *An improvement in fish hooks.* Dated February 15, 1865.

This invention consists in constructing a fish-hook of a pair of fins, wings, or vanes of metal, horn, bone, or other material, soldered, brazed, screwed, socketed, or otherwise fixed or secured to the fishing-hook at either end, or on any other portion of the said hook, in such a manner that, when the said hook is drawn through the water, or held in a running stream, the said hook shall be compelled to spin or twirl, the said hook being of course attached to the line by means of a swivel, and having no artificial bait or substance in connection with it. *Patent abandoned.*

429 W. C. RIDINGS. *An improved protector for the needles and cards used in jacquard machines.* Dated February 15, 1865.

In performing this invention, the patentee attaches springs to each end of the frame and needle-board of the jacquard machine, and he places the needle board so as to cover the points of the needles, and thereby prevent them from touching the cylinder or cards until the cylinder clasps the needle board and moves the springs, and presses the hooks from the guff. As the cylinder moves outwards the needle board returns and covers the points of the needles, so that the cards are prevented from touching them whilst the cylinder is moving backwards or forwards, and,

as the points of the needles are inside the needle board, they are prevented from being bent by the action of the cylinder, and the cards are at the same time protected from being torn or perforated. *Patent completed.*

430 A. V. NEWTON. *Improvements in sewing machines.* (A communication.) Dated February 15, 1865.

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

431 W. H. BROWN. *Improvements in cast steel or other metal chains for cables and for other purposes, and in machinery or apparatus for manufacturing the same.* Dated February 15, 1865.

This invention consists, firstly, in a method of making chains whereby the patentee is enabled to produce the links and to adapt them to each other without a welded joint. For this purpose he takes a tube of cast steel or other metal and cuts it into rings, which tube may be manufactured by the process for which letters patent were granted to the present patentee the 30th December, 1864. (No. 3,251.) A ring so made he compresses towards the centre thereof, leaving a loop at each end, which loops being folded towards each other, the solid ring constitutes a link through which another flattened ring may be threaded, and then folded. The rings mentioned, however, may be cut from tubes other than those above referred to, or they may be made by casting, stamping, or other ordinary process. Another part of the invention relates to machinery or apparatus for winding the section of the said metal rings when they have been cut from the tubes, or are otherwise, as aforesaid, produced. With this view he places rollers at right angles to each other on the outside of a framework, and between which therefore the rings may be placed. *Patent completed.*

432 M. LANE. *Improvements in apparatus for working and controlling railway switches, points, and signals.* Dated February 15, 1865.

This invention consists in the employment of a shaft carrying a toothed wheel or ratchet and a screw thread, which thread works through a fixed nut for the purpose of communicating to and fro motion to the said shaft; also in connecting to the switch or other lever a rod with teeth, to engage into the teeth of the ratchet or toothed wheel upon the shaft. The shaft carries locking bars, which are carried to or fro according to the direction in which the shaft is made to travel, by driving the toothed rod in one direction or the other upon motion given to the switch lever, and these locking bars either hold secure or allow motion to switch or signal levers, according to the direction in which the shaft is made to travel. Instead of a toothed rod or rack being connected to the switch lever to work the shaft, the patentee places a worm-wheel on the shaft, and a worm upon the rod. *Patent completed.*

433 O. LUNGEY. *Improvements in ventilating blinds or screens, and in means of ventilating ships and vessels.* Dated February 15, 1865.

This invention consists in constructing blinds or screens with alternate fixed and movable laths or battens, or with part of the battens fixed and part movable, as represented in the drawings. The patentee constructs the battens of such shapes that when entirely open the air shall not have direct access through the screen, while the air admitted may be regulated by causing the movable battens to move or slide, and more or less close the apertures between the battens. For ventilating ships he fits ventilators at the bottoms of cabins, in the form of a trunk or pipe, with openings therein, and fed by air, made in some cases to pass in tubes through refrigerators or tanks, made to communicate by pipes with the sea or external water so as to allow of circulation therein of water from the sea, or in cases of paddle-wheel boats through a refrigerator placed in the paddle-box or a place near thereto. In some cases he employs a pump or fan to drive the air through the refrigerating tubes. *Patent completed.*

434 D. C. PIERCE. *Improvements in railway rails.* Dated February 15, 1865.

In order to deaden the jars produced by the blows of the wheels of railway carriages and trucks on the rails, the patentee forms a groove along the table of the rail from end to end, and into this groove he fits a strip of wood, by preference of oak, and over it a bar or ribbon of steel. The groove and the steel bar or ribbon inserted into it are both dovetailed, so that the said bar or ribbon cannot escape from the groove; it is driven into the groove longitudinally, before the rail is laid. In this arrangement the blows of the wheels from the passing trains are received by the bar or ribbon of steel, and this does not oppose a rigid resistance to them, but yields to the extent which the compression of the wood beneath will admit; thus the wear both of the rails and rolling stock is much reduced, whilst at the same time travelling on the line is rendered more pleasant. *Patent completed.*

435 F. J. EMERY. *Improvements in ornamenting china and earthenware, and in preparing materials to be employed therefor.* Dated February 15, 1865.

In ornamenting china and earthenware according to this invention the inventor applies the colour to the surface of the china or earthenware to be ornamented by means of crayons compounded of a colour suitable for being employed for ornamenting china and earthenware, and also a flux suitable for vitrifying the colour when subjected to heat. These materials he, by preference, makes up into the form of crayons by combining them together with wax, but they may be otherwise compounded together into crayons. The design to be produced is shown on the surface of the china or earthenware with the crayon; the china or earthenware is then submitted to heat, by which the colours are fixed. The surface of the china or earthenware to be ornamented may be either glazed or unglazed. When glazed, the surface of the glaze should be rendered rough by applying a further glaze to the surface, which is only partially vitrified. When the colour is applied by the crayon to an unglazed surface, the surface may be glazed after the colours have been applied to it. *Patent abandoned.*

436 G. T. HUMPHREYS. *Improvements in pumps, and in apparatus for working the same.* Dated February 15, 1865.

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

437 R. H. ENKINSON. *An invalid or syphon drinking cup.* Dated February 15, 1865.

In accordance with this invention the patentee adapts to or forms as part of cups or other drinking vessels a bent tube, forming a syphon in communication with the interior of the cup or other vessel; a small opening or air course penetrates the syphon tube, this opening being easily

stopped or closed by the finger of the attendant in administering the drink or medicine; the end of the syphon tube is placed in the mouth of the patient, and the air opening being closed, a very slight inspiration creates the necessary vacuum therein, and the contents of the vessel will flow through the syphon until the vessel is empty, or until the finger of the attendant is removed from the air hole or opening. *Patent completed.*

438 G. T. BOWFIELD. *Improvements in the construction of armour-plated ships.* (A communication.) Dated February 15, 1865.

This invention consists in the use of metallic beams or bars of arched form in cross section, firmly bolted or otherwise secured to the face of the structure, and securely connected with one another to guard against their lateral displacement, and placed so near to each other as to oppose the entrance of a projectile in the space between them. The invention also consists in constructing the backing of an arched form, whereby its strength, stiffness, and consequent resistance to the crushing effects of a blow are immensely increased, and which serves moreover to diffuse the weight of the blow, and convey or direct it against the mass of the decks, floors, or partitions of the structure against which the backing takes its bearing. And the invention further consists in facing the metallic plating with wood arched in cross laminations—that is, with the fibres of each layer placed at an angle with those of the adjoining layers, which is again faced and built up level with wood laid flat-wise and cross laminated, which facing serves to resist and cushion the projectile and diminish the force of the blow upon the metallic plating. *Patent completed.*

439 A. CLARK. *Improvements in burglar-proof and fire-proof safes.* Dated February 15, 1865.

According to these improvements in safes the inventor makes them of one piece of cast iron, and chills them on the exterior. He also makes them of a spherical form, so that they present a surface exceedingly difficult to operate upon. He further makes the door or opening of such safe of a circular form, or it may be octagonal, or other many-sided figure, so as to obviate the long straight side of the square door usually adopted. Safes of chilled cast iron may be cylindrical, with hemispherical ends, or even rectangular, and of the ordinary form, but he prefers the rounded forms, as no angles are presented which might be operated upon by the burglar. In either case he makes the door circular or many-sided, as before described, and to occupy considerably less area than the side of the safe (if square), thereby leaving great strength at all points round the door. Instead of chilled cast iron these safes may be of cast steel hardened on the exterior, and so resist equally well the penetration of tools. When safes are required to be fireproof he places the fireproof material on the outside instead of inside, as usual. For this purpose he builds the safe in fire-bricks, or other fireproof material, suitably bound with hoop or other iron, and applies a door of like material in a frame hinged or otherwise mounted. For fireproof safes it may not, in all cases, be necessary to make them thickproof; in such case the form of the same and of the door may be modified, so as to be more suitable for books and other large articles. Another improvement consists in making the door or access to wrought-iron safes of a circular or many-sided form in the middle of one side, instead of occupying the whole area of such side, as usual, and so leaving great strength in the door frame. *Patent abandoned.*

440 W. E. GEDDGE. *An improved manufacture of barge stuff.* (A communication.) Dated February 16, 1865.

The barge stuffs which form the subject of this invention are woven with a back or ground in a loom, the harness of which is composed of five reeds or slays and two treadles, and by means of two warps, each distributed on a warp beam. One of these warps stretches and the other lets go one half, more or less, according to the greater or lesser thickness of the rib it is desired to obtain; that is to say, that the length of one of the warps must be left more or less according to the thickness of rib required. *Patent abandoned.*

441 W. KIRKAGE. *An improvement in the manufacture of artificial stone for building and other purposes.* Dated February 16, 1865.

The patentee claims the manufacture of an artificial stone or hard material by mixing and using the sulphate of iron or other similar metallic sulphates, or other similar mixtures of acids, with metallic bases in combination with cements and silica and limes and silica, for the purpose and in the manner described. *Patent completed.*

442 E. A. BROOMAN. *Improvements in the manufacture of boots, shoes, and other like coverings for the feet.* (A communication.) Dated February 16, 1865.

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

443 E. B. WILSON. *Improvements in furnaces.* Dated February 16, 1865.

This invention relates to certain improved practical arrangements for the effecting of more perfect combustion in furnaces. The patentee states that he finds from a series of experiments that the efficiency of furnaces is considerably increased by exposing a long inclined bank or layer of fuel in an ignited state from which the heated products of combustion are carried into those parts of furnaces where the greatest intensity of the temperature is required. In altering an existing puddling, heating, or other similar furnace, he removes the fire bar, and substitutes in lieu of these a brick arch or other bottom forming the hearth below the bridge, on or over which the heated products of combustion pass into the puddling or other chamber. In addition to these alterations he closes up the ordinary feeding door and erects a hopper or fuel receiver in preference sloping into the furnace to facilitate the automatic ingress of the fuel. At the top of the hopper or receiver he places a door fitted with mechanism for keeping it open or shut. At the bottom of the furnace he arranges an air-tight door or doors, which when required may be opened for taking out the ashes and other refuse portions of the burnt fuel. In the side or sides of the furnace he also arranges air-tight door or doors. There is also arranged an opening through which the bridge may be viewed. In altering the boiler of a locomotive he takes away the fire bars, and prefers to arrange a water space, upon which the fuel rests, having an air-tight cleaning-out door at the lower side, and he also converts the ordinary fire-door hole into a hopper for supplying the fuel with a door for regulating the admission of air at the top, and he further prefers that this fuel hopper should be situated at the highest possible point of the firebox. *Patent completed.*

444 H. J. PICARD. *An improved machine for clearing, sweeping, and removing the refuse from highways, streets, and roads or ways, applicable also for removing the leaves of cut grass and other refuse from lawns and other grass lands and walks.* Dated February 16, 1865.

This machine consists of a cart, vehicle, or receptacle, hereafter called cart only, which is provided with two shafts, so that it may be drawn by horse or animal power; the shafts may, however, be removed, and a handle substituted therefor, so that the machine may be drawn by hand. When the machine is of such size as to require horse or animal power, the end of the cart between the shafts is hollowed out or recessed to receive the hinder parts of a horse or other animal. The cart is provided with two wheels working on an axle, on which is also placed one or more toothed wheels; or the toothed wheels may be secured to the spokes or other parts of the wheels of the cart. On the upper side of the toothed wheels or wheel is a smaller toothed wheel provided with a pulley, each wheel and pulley being fast on an axle working in bearings attached to the framing of the cart. At the back of the cart are bearings for an axle from which radiate lifters or shovels, and further back on the cart are bearings for the axle of a brush, which may extend the width of the cart. The axes of the brush and lifters, or shovels, are capable of adjustment vertically, and of sliding in their bearings vertically. The brush and lifters, or shovels, have rotary motion communicated to them by the employment of a crossed strap passing round pulleys on the end of their axes, and round the pulley or pulleys on the axle of the small toothed wheel before stated. The cart is covered in at top, and has an adjustable covering for the brush and lifters, or shovels, and at each side of the cart near the front end thereof is a sliding shuttle, and when this is raised the refuse or rubbish which has been gathered into the cart will run out of the holes closed by the shuttles. Or the rubbish or refuse may be drawn out thereat. The bottom of the cart is inclined from the centre to the sides thereof, in order to facilitate the emptying of the same. *Patent abandoned.*

445 H. O. and J. OLKAYER. *A fog or other signal for the prevention of collisions at sea, or on rivers, or canals, or on land.* Dated February 16, 1865.

This invention consists of a signal constructed as follows:—A frame supports a circular or otherwise shaped bellows, or one or more air pumps, which force air into a reservoir supported by the frame; the bellows or pumps are worked by hand or otherwise. On the frame are a whistle (similar in character to a steam-whistle) and a horn or trumpet; these are either fixtures, or capable of turning on a swivel joint, so as to be out of the way when not in use. The swivel joints are hollow, and connected to the air vessel above named. Between the whistles and air vessel is a stopcock having a handle by which the air may be directed to the horn or trumpet, or whistle, either of which will produce a loud and continuous sound, alternately or otherwise, in any pre-arranged order, so as to produce any signal or series of signals whether as fog signals or telegraphic signals. *Patent abandoned.*

446 C. O. STAUNTON. *Improvements in apparatus for lifting and tilting casks containing liquids.* Dated February 16, 1865.

This invention relates in the first place to the tilting of casks containing wine, beer, and other liquids, by raising one of their ends while their other end rests on the trestles or frame on which they are supported. For this purpose a cross shaft is mounted in the ordinary supporting frame or trestles, in which shaft are fitted two eccentric discs capable of being adjusted to any required distance apart by means of screws or otherwise, and on applying power to the shaft the eccentrics are turned so as gradually to bring their greatest diameter in a vertical line with the centre of the shaft. By this means the end of the cask which rests on the eccentrics when at their lowest position is gradually raised until the eccentrics arrive at their highest position, the further turning of the shaft being prevented, if necessary, by a stop fixed in the supporting frame. A stop is or may be fixed in the supporting frame for the purpose of preventing the end of the cask which rests on the said frame from moving forwards as the cask is raised. The power is or may be applied to the shaft by means of a lever worked by hand. *Patent completed.*

447 W. E. NEWTON. *Improvements in apparatus for distilling petroleum and other volatile liquids and for making gas.* (A communication.) Dated February 16, 1865.

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

448 J. F. HARSEY. *Improved apparatus for measuring the specific gravity of liquids.* (A communication.) Dated February 16, 1865.

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

449 F. A. LAURENT, J. CATHÉLAX, and N. BASSET. *Improvements in the manufacture of oxalic acid.* Dated February 16, 1865.

This invention consists, firstly, in manufacturing this acid from waste animal matter. The waste animal matters employed are, by preference, the cuttings of leather or hides, woollen rags, wool or hair, the parings or refuse of horn, residuum of glue, the waste pieces from tanneries, and other waste animal matter of this description. In manufacturing oxalic acid from these materials, the inventors prefer, in the first place, to obtain the dissolution or disintegration of the matters by sulphuric acid diluted to about 20 per cent., and afterwards to treat the product with nitric acid of a density of, say, 36 deg. Beaumé, diluted with three or four times its weight of water at a temperature of 176 deg. Fahrenheit. The quantity of nitric acid employed is thus generally not greater than the weight of the material that is to be treated. *Patent abandoned.*

450 J. THOMPSON. *Improvements in safes.* Dated February 16, 1865.

Safes have recently been forced open by driving steel wedges between the door and frame of the safe, and then, when the frame is sprung back, introducing a lever by means of which such force has been applied as to tear the front plate of the door away from the lock. In order to prevent the separation of the lock from the door the patentee causes the bolts to shoot through an inner flange, or through lugs formed solid or in one piece, with the door-plate; and in order that the bolts may not tear out from the holes into which they shoot, he causes the bolts to shoot behind an internal flange formed solid or in one piece with the casing of the safe. This flange also serves to render it difficult to use wedges in the manner described, as it

forms a stop preventing them entering to a distance greater than the thickness of the doorplate. Further, to prevent the effective application of leverage in the manner described, the patentee applies a strong band or ring all round the safe at the front, so as to overhang or project in front of the door when closed, so that the door shuts, as it were, into a recess; thus the fulcrum of the lever is thrown back to a distance from the door, and so the obtaining sufficient leverage is rendered impracticable. The band or ring should be shrunk on the safe, and further fixed by screws and dowels, or otherwise; or it may be made solid with the casting. *Patent completed.*

451 R. SMITH. *Improvements in treating sewage, and in arranging apparatus in sewers and culverts to facilitate the ventilation of such structures.* Dated February 16, 1865.

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

452 R. HILL and R. TUSHINGHAM. *An improved preparation or treatment of clay for the manufacture of bricks.* Dated February 17, 1865.

The patentees claim preparing or treating common clay to be made into bricks by mixing it with black-ash waste, or soap waste, or the liquor of these substances. *Patent completed.*

453 W. E. GEDDGE. *The manufacture of various articles in pottery, earthenware, or porcelain by mechanical process.* (A communication.) Dated February 17, 1865.

This machinery is composed of four principal parts, which are, firstly, a mould suited to the shape of the article to be made; secondly, a movable piece which supports the said mould; thirdly, a revolving shaft, at the lower part of which is fixed a small board which hangs from it; fourthly, a driving wheel. When it is desired to manufacture plates, the mould will present on its upper side a cavity shaped like a plate. This mould will be placed on the movable piece which serves as support for it, or upon any other arrangement provided it can rise and descend; it must set freely on and in this piece like a tenon in a mortice without the aid of a mallet. The revolving shaft is formed of a piece of iron, round at the top, and having at the bottom a board about two inches thick, and the breadth of which will somewhat exceed the diameter of the mould, which is that of a plate. The under side of this small board will be cut to a level, or rather out to an obtuse edge; this edge, which will exist on the projecting breadth of the lower part of the small board, will be cut or modelled so as to enter the mould, which it will resemble, being in projection what the mould is in hollow. This edge will turn in level so as to press and polish the clay, instead of simply scraping it. This board is intended as a substitute for the hand of the workman. It will be fixed, that is to say, will not rise and lower, and the framing which holds it will be arranged accordingly. It will be held upright by being passed into two holes made in two cross pieces forming part of the framing. A toothed wheel attached to it will gear with the driving wheel, both placed horizontally. The movement of this small board may, however, be effected by any suitable mechanical contrivance. Hand, or any other motive power, may be used. *Patent abandoned.*

454 C. DEPRIERS. *An improved means of securing the safety of railway passengers.* Dated February 17, 1865.

In carrying out this invention the inventor proposes to give to the guard the power of securing from his van the whole of the carriage doors of a train as the train starts from a station, and to release them as the carriages come to a state of repose on the train's arrival at another station. For this purpose he passes a rod (square or round) under the framing of each carriage, and at each side thereof, the ends meeting as do the buffers between the carriages. On to this rod he places certain catches or bolts, which, as the rod moves (actuated by the apparatus in the guard's van) to and fro, are passed into or released from staples placed at the opening side of each carriage door. He operates on the rod by means of a lever which he proposes to put near the breaking apparatus in the guard's van. Or he tooth a part of the rod in the guard's van, and works it by means of a quadrant-shaped toothed segment of a wheel, or by a whole toothed wheel, if preferred. He proposes to provide for the traction jerks and curves by allowing the ends of the rods free play, and bringing them together again by a double helical spring, or by any contrivance suitable for that purpose. *Patent abandoned.*

455 J. BROWN. *Improvements in armour plates for vessels of war and for other similar purposes.* Dated February 17, 1865.

This invention consists in deeply grooving the outer face of iron plates or armour slabs which generally constitute the exterior side of the ordinary iron casing of vessels of war and armoured fortifications, so as to form longitudinal ridges taking care, however, that they shall run in a horizontal direction when the plate is fixed in its place. The salient angle formed by the lateral planes of the ridges, should measure 90 deg. or thereabouts, that is to say, the angle which will enable the most power to be absorbed from the shot with the least damage to the plate from the diverging resultants of the force represented by the impinging projectile. The bottom of the groove may be either angular or plane; in either case it should receive one or more shallow ridges, the lateral sides of which may form acute angles. The opening and depth of the grooves should be such that projectiles of large calibre when fired for the purpose of penetrating these plates will be compelled to lodge in the grooves; and therein take a plurality of surfaces of contact, as well as crush in the shallow ridges, the object being on the part of the plates to increase the amount of work that the shot has to do at the first moment of penetration, and thereby facilitate the absorption on the part of the armour and the consumption on that of the projectile of the force of the impact. *Patent completed.*

456 J. O. CHRISTIAN, and J. and H. CHARLTON. *Certain improvements in the manufacture of magnesium and its compounds.* Dated February 17, 1865.

This invention consists, first, in the application and use of carbonate of magnesia or "dolomite," or a carbonate of magnesia or magnesite combined with any other carbonate, instead of carbonate of lime or other carbonates, in the generation of carbonic acid gas, such as, for instance, in the airating of waters or bread, in the manufacture of carbonates, or for similar purposes, whereby the patentees are enabled to manufacture sulphate of magnesia, a useful product arising from the aforesaid chemical action, or to obtain other salts of magnesia, and also to employ the gas arising in the conversion of the

carbonates into the sulphate or other salts, such residue being of use for the manufacture of magnesia and all its compounds. The second part consists in the application and use of magnesia or magnesian compounds instead of lime in the process of distilling tar water, and in the manufacture of ammonia or its salts from any of the salts of ammonia, having valuable magnesian compounds as residue. Thirdly, in manufacturing sulphate of magnesia, or other valuable magnesian residue, by passing sulphuretted hydrogen through "dolomite" or calcined dolomite, or other magnesian compounds either in a wet or dry state, which will leave a residue valuable for the manufacture of sulphate or other compounds of magnesia; for example, in the purification of coal gas, "dolomite" or other magnesian compounds may be employed instead of lime, and a more valuable residue will remain. *Patent completed.*

457 W. CLARK. *Improvements in shifting wrenches.* (A communication.) Dated February 17, 1865.
This invention cannot be described without reference to the drawings. *Patent completed.*

458 J. B. BROWN. *Improvements in lawn mowing machines.* Dated February 17, 1865.
We cannot here give space to the details of this invention. *Patent abandoned.*

459 J. FERNUSSE. *Improvements in iron safes and strong rooms.* Dated February 17, 1865.

For the purposes of this invention the iron doors of iron safes and strong rooms, in place of turning on hinges, as heretofore, are made to slide up and down in grooves at the sides and at the bottoms, and they are counterbalanced on chains passing over pulleys. In order to prevent such chains being used as means of raising the doors, the links or connecting instruments are made of such strength only as to allow of their being used when the drawers are free, and to break in the event of power being applied to force the doors with a view to open them in opposition to the bolts or fastenings of the locks. On each side of the door a sufficiently deep groove is formed to receive and retain the door, and such groove is formed to receive and retain the door, and this is the case in respect to the bottom of the frame to receive the bottom of the door. The upper part of the door is, by preference, made flush with the upper surface of the top frame of the door, and a slide or cover of hardened steel is applied, which, being locked or fastened securely, offers an additional security to the door of a safe or strong room. In other cases a safe may be moved back into a recess, and be fastened or secured therein so as to prevent the door being opened till the safe is again moved forward. *Patent abandoned.*

460 C. F. CLAUS. *Improvements in obtaining sulphates and carbonates of potash and soda.* Dated February 17, 1865.

In performing this invention, the inventor takes the rock salt of Strasfurt, in Prussia, or similar rock salt, containing a large percentage of chloride of potassium, or it may be the refined salt in which the percentage of chloride of potassium has been increased by crystallization. He converts these mixed chlorides into sulphates, and then separates the sulphates one from another by washing, as hereinafter described. In case the native rock salt is used, he grinds the same into coarse powder, and decomposes it with its equivalent of sulphuric acid, in the way in which it is done with common salt in the manufacture of alkali. In case the refined salt is used he decomposes the same without grinding. The mixed sulphates (which he prefers to grind) he treats repeatedly with water, by preference, of about 80 deg. or 100 deg. Fahr., at which temperature the water will dissolve out the maximum of sulphate of soda, whilst but little of the sulphate of potash will be dissolved, or, if any be dissolved, he allows the same to crystallise out of the solution of sulphate of soda. The solution of sulphate of soda being very concentrated requires very little boiling down to convert the same into dry sulphate. When dry (if required) he converts the sulphate into carbonate by the process generally known, and which is no part of this invention. The sulphate of potash, when freed from all salts of soda (as it can be almost perfectly), he, if required, converts into carbonate of potash by a process analogous to the well-known alkali process. (Leblanc's). The crude carbonate of potash thus obtained he lixivates and carbonates, and b. l. down the solution; afterwards he calcines the residue. The product of this operation may then be further refined in the manner now practised in the manufacture of refined pearl ash, or the production of pearl ash from the sulphate of potash may be otherwise effected. *Patent abandoned.*

461 T. P. TROASKIS. *The improved use of magnets in overbalancing weights.* Dated February 18, 1865.

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

462 P. E. BIDAUX. *Improvements in the application to clocks and alarms of a circular escapement in place of the ordinary balance wheel.* (A communication.) Dated February 18, 1865.

This invention consists in substituting a circulating escapement for the ordinary balance wheel, the advantage of which is that it obviates the necessity of maintaining the timepiece always in a vertical position. *Patent completed.*

463 E. CARBON. *Improvements in dyeing the herbs and straw used in the manufacture of straw hats and artificial flowers or other fancy articles.* Dated February 18, 1865.

This invention consists in the preparation of an improved green dye, which may be used for dyeing herbs, straws, various parts of artificial flowers, and other articles employed in millinery. The first operation is to cleanse the herbs or straw of any extraneous matter; the inventor causes them to be placed in boiling water, where, after remaining a short time, they are withdrawn and well rinsed in cold water; they are then subjected to a bleaching process by placing them in a bath containing a mixture of 300 grains of chloride of calcium and from 110 to 140 grains of sulphuric acid, which is diluted with 45 pints of water; this being effected they are again rinsed in cold water, and afterwards placed in a bath containing one of the following mordants—namely, sumac, litmus, alum, tartaric acid, tartrate of potassa, or any chemical possessing the same properties. Finally, they are placed in a bath containing the dye, which is made in the following manner:—He takes a quantity of the liquid from the last-named bath, varying in proportion to that of the substance to be dyed; to this he adds a small quantity of either picric acid, curcuma, or any other matter having a deep yellow colour, and green aniline, in which liquid the articles to be dyed are placed

and allowed to remain a sufficient length of time to produce the shade of green required. *Patent abandoned.*

464 J. J. CHIDLEY. *An improved method of stopping bottles.* Dated February 18, 1865.

This invention consists in stopping bottles by the use of a valve sustained by a spring to stop a bottle from the inside. We cannot here quote the details. *Patent abandoned.*

465 C. BRACKELL, W. HOEHL, and W. GUNTHER. *An improved composition as a substitute for leather or similar materials.* Dated February 18, 1865.

One part of this invention consists in combining or incorporating with paper pulp or other substance in a semi-fluid state the material known as cocoanut fibre. The patentees, however, apply the fibre in what may be termed its raw state, and the result is a material of great tenacity and strength, which can be made more or less coarse to suit different purposes to which it may be applied, according as more or less of the fibre is made use of. *Patent completed.*

466 T. OGDEN. *Certain improvements in mechanism or apparatus for lubricating the cylinders of "clashing" and "laying" machines, such machinery being employed in the sizing of cotton and other yarns.* Dated February 18, 1865.

This invention relates to a novel and improved arrangement of mechanism whereby the size employed is, or any extraneous matters are, prevented from accumulating upon the peripheries or outer surfaces of the heated cylinders of clashing and taping machines employed in sizing yarns. The improvements consist in the novel application and use of a small extra cylinder to each heated cylinder, which is covered with flannel or other absorbent material, and which presses against, and is caused to revolve by contact with, the surface of the heated cylinder. This small cylinder is supported in suitable bearings attached to the framing of the machine, and is perforated with one set of holes along its surface parallel with its axis; the interior of this cylinder is supplied through ordinary lubricating cups with oil, tallow, or other lubricant, and as the small cylinder revolves, a small quantity of lubricant escapes through the perforation which is thus supplied, and saturates the absorbent material covering its surface. This absorbent material being in contact with the large or heated cylinder of the machine, keeps the surfaces of such cylinders constantly greased or lubricated, whereby the adhesion of the yarn and accumulation of size upon their surfaces is prevented. When the machine is out of operation, the lubricating cylinder is turned with the perforation upwards, or in such manner as will prevent the escape of oil therefrom. *Patent completed.*

467 R. A. BROOMAN. *Improvements in filters.* (A communication.) Dated February 18, 1865.

This invention refers to filters for filtering large bodies of water, and consists in constructing them in manner hereafter stated. The inventor constructs a reservoir for receiving the water to be filtered between the supply and the main filtering basin, from which the reservoir is separated by a wall or partition fitted at its upper part with sluices, and formed at bottom with a channel closed by valve, and communicating with the water in the filtering basin. In the opposite wall of the filtering basin there are similar sluices, and a similar channel also closed by a valve. The filtering basin is formed with sides sloping towards the bottom of the filter beds, and these consist of a top layer of stones or pebbles, immediately under which is a layer of sand, below that, of small gravel, to prevent the sand descending, then a layer of coarser gravel, a layer of stones or pebbles, and under that rough stone slabs not joined, or perforated plates, to allow the water to pass through into the space provided for it at the bottom of the filtering basin; a conduit leads the filtered water into a reservoir or the filtered water, from whence it is taken by pump or otherwise. At the outlet from this conduit there is a slide to stop the flow of water when required. The working of the filter is as follows:—Water flowing from the source of supply enters the receiving reservoir, in which the heaviest impurities are deposited, and the sluices near the top of the reservoir being opened, and the opposite sluices and channel closed, water flows into the upper part of the filtering vessel, passes down through the filter beds into the space at the bottom of the basin, and into the reservoir for the filtered water. When the filter beds become so charged with impurities as to prevent the filtered water flowing in sufficient quantity into the filtered water reservoir, it is necessary to cleanse the filter, and that is as follows:—Close the outlet from the conduit into the filtered water reservoir, open the valves on the inlet and outlet channels to allow of the current driving out all mud and dirt deposited, then, as soon as the water flows clear, close the valve on the outlet channel and the inlet sluices to the filtering basin, and open the outlet sluices. The water entering the inlet channel will flow up through the filter beds, and will detach and carry away most of the matter deposited on the sand; to complete the cleansing, close the valve in the inlet channel and open the inlet sluices; a current is thus provided over the surface of the filter beds; he then uses a rake or stirrer to act on the sand, and the current carries off the remaining impurities. The outlet sluices are now closed, and the slide on the outlet of the conduit into the reservoir for filtered water opened, and the filtering goes on as before. *Patent abandoned.*

468 J. G. JONES. *Improvements in beam engines.* Dated February 18, 1865.

In constructing a beam steam engine according to this invention in place of applying the piston rod to, and connecting with, one end of the beam in the usual manner, the steam cylinder, whether of a single or double acting engine, is mounted on and moves with the beam, and the piston rod—when it is a single-acting engine—is connected with a weight which is caused by the working of the engine to be moved in a direction to and from the axis of the beam; but, when a double-acting engine is used, then the piston rod is caused to pass through and work in a stuffing box at each end of the cylinder, and to give motion to two weights, one on each side of the axis of the beam. It is preferred that the steam engine should be mounted parallel with the beam, and above its axis, and that the beam beyond the axis should be formed with a track suitable for receiving a weight, and it is desirable that the weight or weights used should be of a cylindrical form, and caused to roll or revolve when moved to and fro on the track. By thus combining a steam engine with the beam, the pump or other rods applied at one or both ends of the beam will be actuated by the weight or weights, in place of through the piston rod, by the direct action of the steam, by which means the first cost of such machinery will be reduced, and great convenience of appli-

cation will in many cases result. Although steam only has been mentioned, the invention is equally applicable when working with compressed air, water, or other fluid. *Patent completed.*

469 J. GRAHAM. *Improvements in treating products obtained when coating iron with zinc.* Dated February 18, 1865.

The patentee claims, first, treating a solution obtained from flux skimmings with an alkali, or an alkaline earth and afterwards distilling off the ammonia, as described. Secondly, the recovery of spelter from spelter dross by distilling the spelter therefrom, as described. *Patent completed.*

470 W. ROBINSON. *Improvements in the manufacture of iron, and in articles made thereof.* Dated February 18, 1865.

For the purposes of this invention cast or crude iron, at a suitable temperature, is interposed between the poles of permanent or electro magnets, and is connected thereto so as to be in metallic contact therewith. Such cast or crude iron, if in a fluid state, may be in a furnace ladle or vessel, or in a mould. In certain cases it is preferred to use two or more bar magnets, and to apply the north pole of one magnet or series of magnets to one side or end of the iron to be acted on, and the south pole of another magnet or series of magnets to the opposite side or end of such iron. The other or opposite poles of the magnets or series of magnets are to be so connected as to complete the magnetic circuit. When acting on masses of wrought iron the magnetic poles are to be put in metallic connection with the opposite sides or ends of the masses to be acted on, in a similar manner as when treating cast or crude iron. *Patent completed.*

471 C. D. BARON and A. HERMANT. *Improvements in waterproof and other coats and capes.* Dated February 18, 1865.

This invention relates in one respect, principally, to coats or capes for riding on horseback, and consists in attaching an inner piece or skirt to the front parts of the skirt from the bottom up to about the waist; these pieces extend backwards, and are narrowed and otherwise shaped and adapted to the position, and terminate in a button or other fixing which holds the back end up. In riding, these inner parts or skirts are inside or between the legs of the wearer, which are thus kept covered and protected from the weather. In adapting this coat for riding when on, it is simply necessary to unbutton the back end of the flaps or skirts, pass them between the legs, and button them again in position. In putting it on, the legs may be put through instead of unbuttoning as before. This coat, which may be made of any material, is equally well adapted for walking, in which case it is unnecessary to enclose the legs between the inner and outer skirts. The second part of the invention consists in adapting the collars of coats to receive a hood which may be worn over the head at pleasure, or tucked within the collar. *Patent abandoned.*

472 L. W. G. ROWE and A. BAAR. *New or improved indicating apparatus for the protection of railway passengers, buildings, rooms, safes, and other objects.* Dated February 18, 1865.

The patentee claims, first, the construction and employment of indicating apparatus for the protection of railway passengers, buildings, rooms, safes, and other objects, consisting of one or more communicators actuated by clockwork, whereby a series of electric currents are transmitted from a galvanic battery to one or more electro-magnets of an indicating apparatus, the motion of the armature to which electro-magnet is caused to record by the agency of clockwork, and of a pointer on a dial, the number of currents passed at one time by any one of the communicators, substantially as described. Second, the peculiar arrangement of the communicating apparatus described, whereby, when several such situated at different localities are employed, the number of currents passed at one time by each communicating apparatus is made to differ from the number passed by the others, so as to show upon the indicating apparatus by the number of currents passed the exact locality from which the signal was sent. *Patent completed.*

473 J. G. N. ALLEYNE. *Improvements in puddling furnaces, and in apparatus connected therewith.* Dated February 18, 1865.

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

474 G. H. H. WARE. *An improved apparatus for shifting points on railways from an engine or train in motion.* Dated February 20, 1865.

This invention consists in the employment of a bent lever free to play horizontally on a fixed stud and connected to a point or switch bar. The lever carries at each end an arm rising vertically. The point or switch bar carries outside the rails a weighted lever, or a lever connected by a rod to a spring, to cause the switch or point to remain in the position into which it had been forced until purposely shifted. The horizontal lever is bent in such a shape as to be capable of being acted on by an engine or train on the main line or on the crossing. The inventor fits to the engine or train wedge-shaped or other suitable blocks, which according to the intended passage of the engine or train are placed in such position as to come in contact with one of the arms on the horizontal lever, and ensure the points being in a proper state whether for continuing on the main line or for passing on to the crossing, or from the crossing to the main line. *Patent abandoned.*

475 H. PERCY. *Improvements in sewing machines.* Dated February 20, 1865.

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

476 A. SHARP. *Improvements in the construction of bedsteads.* Dated February 20, 1865.

This invention relates to certain improvements in the construction of cabinet, sofa, and chair bedsteads, and consists chiefly in joining together the framework of the bedstead proper by cast-iron binders, in lieu of drilling holes in some of the bars and uniting the bars contiguous thereto by riveting. According to one method of carrying out this invention, when any two pieces of the framework are placed in the position which they are intended to permanently occupy relatively to one another, the portions of the two parts to be joined are placed within a chisel, and the metal is run into it, which as soon as it sets embraces those portions on which it is cast. *Patent completed.*

477 W. E. GEDEN. *A chemical combustible substance and apparatus to which it is applicable.* (A communication.) Dated February 20, 1865.

This combustible substance or fuel is composed, principally, of carbon obtained from the distillation of light woods in a close receptacle, say, two thirds "fusain" (the charcoal used by artists), reduced to powder, and one-third vinegar charcoal, this latter being part of the residuum of acetic and pyroligneous acid or spirit of wood or verditer manufactories. To this mixture which serves for basis various metallic salts are added, such as nitrates of soda, of potash, or of baryta, which play the part of combustible and oxygenating bodies, their proportions varying with the amount of calorific required from the fuel. Agglomerating bodies, such as gum adraganth, fecular, starch, or dextrine, are added in proportions varying from two to five per cent. The whole having been well triturated can be pressed and moulded into very compact cakes, varying in size and form according to their destined uses. *Patent completed.*

478 J. OLIVER. *An improvement in the utilisation of the waste gases of blast furnaces.* Dated February 20, 1865.

It has heretofore been common to use the gases generated in the blast furnace for heating the hot-air stoves and for generating steam in boilers, and for some other purposes. This improvement consists in the use of those gases, or a portion of them, by blowing them back into the blast furnace itself, or by carrying them into another blast furnace in the same works, either along with or separately from the air which is blown into the furnace. *Patent abandoned.*

479 J. D. NICOL. *Improvements in apparatus for folding envelopes.* Dated February 20, 1865.

This invention relates to the folding process in the manufacture of envelopes, and consists in the adaptation and application to the apparatus for that purpose of movable bars or fingers, in order to hold the flat envelope securely in its required position during the operation of folding, combined with wings of the kind hereinafter described for pressing the said envelope into the box and folding the flaps. The flat envelope is placed between ordinary guide pins over a shallow box, into which it is afterwards folded, the four flaps of paper extending over the box, and resting on four metal wings mounted on pivots at the four sides of the box; three movable bars or fingers are then caused to descend upon the junctions of the two end flaps, and the top flap with the body of the envelope, and thereby hold the latter in its position ready for folding; the next movement of the apparatus causes one of the four wings to be turned on its pivot, and thereby to fold over the bottom flap, which rests upon it down to the bottom of the box; the said wing when turned over being of sufficient depth to produce this effect, and the holding bars or fingers allowing the envelope to slide under them for the purpose. The two movable bars or fingers for the two end flaps are now caused to spring up, when the two end wings are turned over so as to press the two end flaps in like manner to the bottom of the box. The third movable bar or finger is then caused to spring up, and the top flap is pressed down into the bottom of the box by the action of the fourth wing, when the folding of the envelope is completed. *Patent completed.*

480 C. W. HOMER. *Improvements in machinery for making and pressing bricks.* Dated February 21, 1865.

This invention consists of certain improved combinations of machinery for making and pressing bricks in moulds formed in revolving mould plates. The clay or brick earth in a pulverised or plastic state is put into a hopper or pugmill placed over and between the two mould plates, which receive an intermittent rotary motion by catches on a reciprocating bar or other suitable mechanism. At the lower end of the hopper or pugmill is a plate with diagonal blades, which revolve in the same or in the contrary direction to the blades of the pugmill. These diagonal blades press the clay into the moulds, which are provided with plungers; these plungers are forced upwards by a toggle joint or wedge acted upon by an eccentric or crank to compress the clay against a top plate, which is weighted to the desired extent by a lever and sliding weight. When the brick has been formed and pressed in the mould, the plunger is raised by an incline to lift the brick out of the mould ready to be removed from the machine. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

1180 A. Francis, St. John's Wood. An improved apparatus for condensing steam and feeding boilers with the product therefrom. Dated May 31, 1865.

1497 F. N. Giabourne, West Strand, engineer and electrician. Improvements in apparatus for indicating the pressure of steam or liquids in gauges, and for signalling. Dated June 16, 1865.

1624 P. Lawrence and G. Jeffreys, New York. Improvements in copying presses. Dated June 30, 1865.

1740 H. W. Rosser, Leadenhall-street, marine engineer. Improvements in the mechanical arrangement of water-closets for ships. Dated July 26, 1865.

1935 T. Spencer, Euston-square, chemical engineer. Improvements in the preparation of soils to promote general vegetation. Dated July 28, 1865.

1956 W. E. Newton, Chancery-lane, civil engineer. Improvements in conical plug steam valves. (A communication.) Dated July 29, 1865.

1964 E. Sabel, Moorgate-street. Improvements in the manufacture of iron. (A communication.) Dated July 31, 1865.

1970 W. W. Biggs, Rue d'Hautville, Paris. Improvements in the manufacture of iron. (A communication.) Dated July 31, 1865.

1972 B. Robinson, Stainland, near Halifax, engineer, and J. Varley, Mold Green, near Huddersfield, general agent. Improvements in means or apparatus for promoting the combustion of fuel in furnaces of steam boilers, dyers' or brewers' pans, and other furnaces whereby smoke is prevented and fuel economised. Dated August 1, 1865.

1983 T. W. Tobin, Watson's-road, Wood Green, architect, and Col. Stodare, Egyptian Hall, Piccadilly. A new or improved apparatus for illusory exhibitions. Dated August 1, 1865.

1989 A. Noble, Newcastle-upon-Tyne, engineer. Improvements in fuses for shells.

1991 F. Ransome, Queen-street-place, City. Improvements in roofing tiles and slabs. Dated August 2, 1865.

1996 J. M'Ewan, engineer, and W. Nielson, builder, Glasgow. Improvements in the raising, lifting, or drawing and forcing of water and other liquids, and in the apparatus and means employed therefor. Dated August 9, 1865.

2059 J. H. Radcliffe, King-street, Oldham, Lancashire, iron and tin plate worker. Improvements in the lubricating of spindles, the necks or bolsters in which the said spindles revolve having a traversing motion in the said neck or bolster. Dated August 9, 1865.

2065 A. Budenberg, George-street, Manchester, engineer. An improved apparatus for adjusting levels and other instruments. (A communication.) Dated August 29, 1865.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated August 28, 1865.

2203 H. A. Bonneville, Porchester-terrace, Bayswater. Improvements in the construction of apparatus for distilling and rectifying alcohols. (A communication.)

2204 H. A. Bonneville, Porchester-terrace, Bayswater. Improvements in the manufacture of velvet, and in the apparatus employed therein. (A communication.)

2205 H. A. Bonneville, Porchester-terrace, Bayswater. Improvements in the construction of presses for the compression of elastic substances. (A communication.) Dated August 29, 1865.

2221 W. P. Gregg, Boston, U.S. An improved roller skates.

LIST OF SEALED PATENTS.

Sealed September 1, 1865.

608 H. Taylor	669 V. Delperdange
624 F. Crutckshank	671 E. A. Phillips
628 W. Biddle	796 W. M. Williams
633 E. W. Young	813 T. H. Saunders
635 J. H. Wilson	962 W. Olark
652 F. W. Turner	1048 G. Jackson
662 R. G. Fisher	

Sealed September 5, 1865.

634 R. A. Brooman	737 J. Farrar and E. Booth
648 J. Shanks	757 J. M'Connell
649 M. Morgans	890 A. Chaplin
660 J. T. Harris	901 A. Turner
661 W. H. James	980 G. Davies
668 J. Cliff	1134 J. Howard and E. T. Bousfield
675 G. Wright	1562 J. R. Cooper
680 J. Samuel and S. Millbourne	1885 G. Nimmo
693 J. M. Napier	

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the London Gazette, September 5, 1865.

1115 A. O. Herrmann. Index balance.
 1121 G. G. W. and J. Betjemann. Matchboxes.
 1137 H. A. Bonneville. Charts. (A communication.)
 1141 W. E. Gedge. Pessary. (A communication.)
 1145 A. Atkins. Shoes.
 1153 J. N. Brown and T. D. Clare. Iron.
 1160 W. Oxley. Rollers.
 1168 E. D. P. J. Cabasson. Disintegrating animal substances.
 1172 J. Dodge. File cutting machines.
 1174 W. H. Smith. Photographing upon wood.
 1177 J. Carr. Breach-loading fire-arms.
 1178 H. W. Wood. Reducing friable substances.
 1179 S. Harvey. Shaping maats.
 1181 J. F. Feltham. Mallets for croquet.
 1182 R. A. Brooman. Closing cartridge cases. (A communication.)
 1188 E. Moore. Dress shirts.
 1193 E. Ferrie, J. Murray, and A. Wilson. Dyeing yarns.
 1195 A. Wyllie and J. M'F. Gray. Steam engines.
 1198 T. White. Reburning animal charcoal.
 1202 P. A. le C. de Fontaineau. Spinning silk. (A communication.)
 1206 D. Y. Stewart. Making moulds.
 1208 H. Bessemer. Pig iron.
 1212 D. Rankine. Marine steam engines.
 1216 W. K. Wiley. Ever-pointed pencils.
 1223 J. H. Johnson. Self-acting alarms. (A communication.)
 1225 T. H. Campbell. Shields for ships.
 1237 P. A. le C. de Fontaineau. Burning petroleum. (A communication.)
 1241 E. G. Smith. Shelling peas.
 1251 J. Lilley. Ship compasses.
 1262 J. M'Glashan. Jute.
 1272 J. H. Johnson. Measuring spirits. (A communication.)
 1286 J. H. Johnson. Paraffin candles. (A communication.)
 1305 J. H. Johnson. Safety valve regulator. (A communication.)
 1312 D. Ellis and M. Hillas. Weaving broadened fabrics.
 1357 R. Leddicot. Rivets.
 1378 W. Easie. Driving piles.
 1386 W. Davy. Purifying coal gas.
 1425 J. Ramsbottom. Tyres.
 1473 F. A. Paget. Looking screws.
 1541 W. E. Newton. Photo-electrotyping process. (A communication.)
 1626 H. A. Bonneville. Traction of vehicles. (A communication.)
 1650 G. Clark. Envelopes.
 1735 W. E. Newton. Locks. (A communication.)
 1762 J. Calvert. Propelling ships.
 1782 G. Carter. Locks.
 1793 J. M. Macrum. Iron. (A communication.)
 1846 H. A. Bonneville. Copying letters. (A communication.)
 1890 O. H. Simpson. Propelling vessels.
 1944 W. Barton. Cooking stoves.
 2023 J. A. Leon, G. Tessimond, and J. Kiasack. Filtering sugar.
 2049 A. V. Newton. Transportation of letters. (A communication.)
 2095 H. Woodward. Carburetting coal gas.
 2203 H. A. Bonneville. Rectifying alcohols. (A communication.)

2204 H. A. Bonneville. Velvet. (A communication.)
 2205 H. A. Bonneville. Presses. (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 £40 HAS BEEN PAID.

2396 F. H. Lefranco	2441 R. A. Brooman
2401 W. Owen	2448 H. L. Emery
2402 P. W. Mackenzie and S. W. Smith	2450 J. Platt and W. Richardson
2414 J. Walker	2490 G. T. Bousfield
2418 E. G. Fitton	2519 H. Higgins
2428 R. Glanville	2540 G. L. Lee
2440 E. Dyson	2910 A. Krupp

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

1965 J. L. Clark, F. Braithwaite, and G. E. Preese	1985 J. Sloper
1971 M. A. F. Menonns	1987 W. Wams
1980 A. V. Newton	1988 A. V. Newton
	2001 G. T. Bousfield

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending September 2, 1865.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
2480.0	4	2497.1	0	2514.0	6	2531.0	4	2548.0	6
2481.0	10	2498.0	10	2515.0	10	2532.2	2	2549.0	10
2482.0	4	2499.0	4	2516.0	4	2533.0	10	2550.0	4
2483.0	8	2500.0	6	2517.0	4	2534.0	8	2551.0	4
2484.2	6	2501.1	4	2518.0	4	2535.0	4	2552.0	4
2485.1	0	2502.2	4	2519.0	4	2536.1	0	2553.0	4
2486.0	4	2503.0	4	2520.0	8	2537.0	4	2554.0	10
2487.0	4	2504.0	4	2521.0	4	2538.0	4	2555.0	10
2488.0	4	2505.0	4	2522.1	0	2539.0	6	2556.0	4
2489.0	4	2506.0	4	2523.0	4	2540.0	8	2557.1	10
2490.0	4	2507.1	4	2524.0	4	2541.0	8	2558.0	10
2491.0	4	2508.1	10	2525.0	4	2542.0	8	2559.0	10
2492.0	8	2509.0	4	2526.0	4	2543.0	4	2560.0	10
2493.0	4	2510.0	10	2527.0	8	2544.0	4	2561.0	4
2494.1	0	2511.0	4	2528.0	4	2545.0	4	2562.0	4
2495.0	8	2512.0	4	2529.0	10	2546.0	4	2563.0	4
2496.0	4	2513.0	6	2530.0	8	2547.1	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 Woodcroft, Great Seal Patent Office, 25, Southampton-building, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

TRENCH, duty 1s. per load, drawback 1s.		ARBURG, duty 1s. per load, drawback 1s.	
Teak -	load 212 0	10 Arburg, yellow -	213 10 11 9
Quebec, red pine -	3 10	415 St. Petersburg, do. -	11 0 11 9
Yellow pine -	2 15	315 Finland -	8 0 11 9
St. John, N.B., yellow -	0 0	0 Memo -	8 0 11 9
Quebec oak, white -	5 5	0 Goshburg, yellow -	16 0 11 9
Swedish -	3 10	0 Yellow, white -	45 0 11 9
" elm -	3 10	0 Gedo, yellow -	10 10 11 9
Danish oak -	3 5	0 Soderhamn -	9 10 11 9
" fir -	2 15	0 Christiania, per C. -	
Memo fir -	3 10	0 187, by 3 by 9 in.	
Riga -	3 5	0 187, yellow -	18 0 22 0
Swedish -	2 10	215 Dock Plank, Danisic, 4 in. x 12 in. x 3 in. -	0 14 1 8
Maats, Quebec red pine 6 in. x 10 in. x 3 in. -	0 10	0 187, yellow pine 6 in. x 10 in. x 3 in. -	0 14 1 8
Lathwood, Danisic, 7 in. x 10 in. x 3 in. -	0 10	0 187, yellow pine 6 in. x 10 in. x 3 in. -	0 14 1 8
Doals, per C. 12 ft. by 3 in. -	0 10	0 187, yellow pine 6 in. x 10 in. x 3 in. -	0 14 1 8
by 9 in., duty 2s. per load, drawback 1s. -	0 10	0 187, yellow pine 6 in. x 10 in. x 3 in. -	0 14 1 8
Quebec, white spruce 14 in. x 18 in. x 3 in. -	0 18	0 187, yellow pine 6 in. x 10 in. x 3 in. -	0 14 1 8
St. John -	13 0	0 187, yellow pine 6 in. x 10 in. x 3 in. -	0 14 1 8
Yellow pine, per re-dwood C. -	0 10	0 187, yellow pine 6 in. x 10 in. x 3 in. -	0 14 1 8
Canada, 1st quality -	18 0	0 187, yellow pine 6 in. x 10 in. x 3 in. -	0 14 1 8
" 2nd -	13 0	0 187, yellow pine 6 in. x 10 in. x 3 in. -	0 14 1 8

METALS.

IRON:—		STEEL:—	
Welsh Bars, in London -	per ton 7 15 0	do 15 0 0	0 0 0
Nail Rods -	do 8 10 0	do 15 0 0	0 0 0
Hoops -	do 9 15 0	do 15 0 0	0 0 0
Sheets, single -	do 10 10 0	do 15 0 0	0 0 0
Staffordshire Bars -	do 8 10 0	do 15 0 0	0 0 0
Bars, in Wales -	do 7 0 0	do 15 0 0	0 0 0
Italis -	do 7 0 0	do 15 0 0	0 0 0
Foundry Pigs, at Glasg. No 1 -	do 12 15 0	do 15 0 0	0 0 0
Swedish Bars -	do 11 15 0	do 15 0 0	0 0 0

COPPER:—		ZINC:—	
Sheet & Sheathing, & Bolts -	per ton 91 0 0	do 27 10 0	23 0 0 2 1/2
Hammered Bottoms -	do 101 0 0	do 27 10 0	23 0 0 2 1/2
Flat Bottoms, not Hamrd -	do 95 0 0	do 27 10 0	23 0 0 2 1/2
Cake and Tough Ingot -	do 55 0 0	do 27 10 0	23 0 0 2 1/2
Best Selected -	do 87 0 0	do 27 10 0	23 0 0 2 1/2
Fine Foreign Copper -	do 92 0 0	do 27 10 0	23 0 0 2 1/2
Vel. Metal Sheathing & Rods -	per lb. 0 0 7 1/2	do 27 10 0	23 0 0 2 1/2

TIM:—		SILVER:—	
English Block -	per cwt. 93s 0d	do 27 10 0	23 0 0 2 1/2
do Bar -	do 93s 0d	do 27 10 0	23 0 0 2 1/2
do Refined -	do 93s 0d	do 27 10 0	23 0 0 2 1/2
Banco -	do 93s 0d	do 27 10 0	23 0 0 2 1/2
Straits -	do 8 10 0d	do 27 10 0	23 0 0 2 1/2

LEAD:—		SILVER:—	
Pig, English -	per ton 20 10 0	do 27 10 0	23 0 0 2 1/2
" Spanish Soft -	do 18 12 6	do 27 10 0	23 0 0 2 1/2
Shot, Patent -	do 23 10 0	do 27 10 0	23 0 0 2 1/2
Sheet -	do 20 0 0	do 27 10 0	23 0 0 2 1/2
White -	do 26 0 0	do 27 10 0	23 0 0 2 1/2

ON THE SPOT:—		SILVER:—	
English Sheet -	per cwt. 27 10 0	do 27 10 0	23 0 0 2 1/2
Quicksilver -	per boll. 7 15 6	do 27 10 0	23 0 0 2 1/2

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BLACKFRIARS BRIDGE.

THE above heading may appear somewhat anomalous when it is considered that at the present moment there is virtually no such thing as a Blackfriars Bridge. The old bridge has been taken down and the new one has not yet been erected. True, there is the adjacent temporary timber structure that does duty for a road bridge, and close alongside it is the useful and unornamental range of lattice girders and piers forming a railway bridge, but a Blackfriars Bridge proper there is not now. It is in one sense a thing of the past, and in another a thing of the future; it has no real or tangible present. As of the past, we remember it as the third of our metropolitan bridges—London and Westminster Bridges being respectively the first and second—and a noble piece of masonry it was. The principal new feature in the structure was the elliptical arch, which Robert Mylne, its engineer and architect, was the first to introduce in England. This innovation gave rise to a lively controversy at the time, in which Dr. Johnson took part in opposition to Mr. Mylne, and in support of his friend Gwyn, who had a competing design. Succeeding engineers, however, have endorsed Mylne's principle to a very considerable extent, and with the utmost success in the construction of bridges with very flat gradients upon arches of very elegant contour. But Mylne's bridge had also a radical defect, and this lay in the foundations; had they been as perfect as the superstructure the durability of the bridge would have been unquestionable. Turning to the future we have, in anticipation, Mr. Joseph Cubitt's new wrought-iron rib bridge. In this bridge each arch will be composed of nine ribs, the arches varying in span from 185ft., the centre, to 155ft., the abutment spans, there being altogether five arches; the contour of the ribs presents a flat segmental curve. The piers will be of masonry—Cornish granite being the material—surmounted by red polished granite columns, with handsome carved caps and bases. The total width of the bridge between the parapets is 75ft.; this comprises a roadway 45ft. wide, and two footways, each 15ft. wide. Messrs. Cubitt and Carr are the engineers for the new bridge, and Messrs. P. and A. Thorn are the contractors, whose contract also included the removal of the old structure.

But our more immediate object is to notice the works as they at present stand, and the appliances which the erection of the new bridge involves. These possess in many instances features of an unusually interesting character, owing to the peculiar conditions under which the constructive work has to proceed. These peculiarities are referable to the circumstance that the bridge has to be built and the workshops necessary for carrying on the construction have to be erected almost over one and the same spot. The contractors have no space at either of the shore ends of the works for putting up shops or smithies. They have, therefore, been obliged to extemporise structures of this class out in the stream, where on large stagings supported by piles may be seen forges, carpenters' shops, and sawpits, all in full work. Another inconvenience experienced in taking down the former bridge was the lack of space for stowage of the old materials, which therefore had to be lowered piecemeal into barges, and thus removed. Again, in the foundation work, for want of room to construct cofferdams in which to erect the new piers, the contractors have had to sink caissons. As already observed, the works as they at present stand embody several noteworthy features, and evidence the exercise of no small amount of skill and care in their

arrangement and construction. The taking down of an old bridge and the construction of a new one under ordinary circumstances are matters worthy of attention; but when the conditions of working are fettered, clogged, and restricted, then the arrangements of necessity become more complicated and tax in a far greater degree the skill and ingenuity of the engineer. The first remarkable feature is the arrangement of the gantries for carrying the travellers. These, and in fact all other matters connected with the removal of the old, and construction of the new bridges, have been carried out by Mr. F. W. Bryant, who is engineer for the contractors. There are four of these gantries, which rise 70ft. above the bed of the river; along the longitudinal timbers on their summits rails are laid, and they form in effect two lines of railway from one bank of the river to the other, of the rather broad gauge of 55ft., with a 5ft. way between them. The area covered by the gantries includes the entire space to be occupied by the new bridge, so that the travellers which have been employed during the work of demolition will also have their full share in the work of re-construction. In the gantries three openings, each 70ft. in width, and spanned by wrought-iron girders, have been left, in order that the traffic of the river might not be impeded by the works. These openings of course correspond to similar openings in the temporary wooden bridge, and in the railway bridge beyond.

Hitherto the traveller engines used in works of this class have been movable upon the girders, and incapable of imparting a lateral motion to the whole machine; but the steam travellers at Blackfriars are new in design, and are far superior to the old in respect of working arrangements. These travellers, of which there are five at work, consist each of two box girders placed about 3ft. apart, and having cast-iron framed connections at the ends, and carried on wheels running on the gantry rails. On the girders is a trolley, which by a chain arrangement can be drawn in either direction in the length of the girders and across the gantry way. The trolley carries the lifting tackle, which is worked by an engine fixed at one end of the traveller. The engine also controls the motions of the trolley along the traveller girders, and of the traveller itself along the gantries. Although in building the piers cofferdams have been dispensed with, yet in both the abutments this method of construction has been resorted to. These dams are each 110ft. in length by 50ft. in width, and are composed of single rows only of sheet piling. The piles are driven as close together as practicable, and the interstices well caulked. The leakage is of a very trifling character; the dam as we found it being kept practically dry by one of Woodford's centrifugal pumps of small dimensions, but which performs its duty in a very effective manner, and is in general use on the works. The dam on the Surrey side, which encloses the space where the first stone of the new bridge was recently laid, is completed, and three-fourths of the abutment masonry up; the dam on the Middlesex side has been recently commenced. The foundations of the abutments have of course been built on the London clay, which is very soon reached in the bed of the Thames and forms an excellent basis for operations. The cause of failure in Mylne's piers was that he did not carry his foundations deep enough, but contented himself with building them on the gravel. The caissons for the piers, which will also form part of their foundations, are made of wrought-iron plates bolted together by means of internal flanges. They are put together on a temporary staging erected over the spot where they are to be sunk, guide piles being driven to direct their descent. The caissons are sunk to a depth of about 18ft. below the bed of the river, and are filled in first with a bed of concrete in some 10ft. and in others 15ft. deep, upon which the solid masonry is carried up. Six caissons are sunk for each pier to

rest on, the four middle ones being rectangular and the two end ones pointed, in plan like a Gothic arch, to receive the cutwaters. A considerable amount of sub-aqueous work has arisen and will yet occur at Blackfriars. This has been performed by divers in dresses and helmets, and the amount of work executed far exceeds that which resulted from the use of the diving bell at Westminster Bridge, which method proved very effectual in enabling the workmen to indulge in an occasional rest, enlivened by a game at cards and a draught of beer.

AMERICAN IRONCLAD TRIALS.

THE experimental trials of the engines of certain vessels in the British navy, for which the public has waited more than four years, have at last been made. The purport of these experiments was to determine the relative economy of the machinery of the "Octavia," the "Arethusa," and the "Constance." So long was the trial postponed that the "Arethusa" got out of repair, and did not enter the lists. The "Octavia" and "Constance" were, however, pitted against the "Liverpool," and the long-looked-for trial—the results of which were expected to be of the utmost importance—recently came off. The benefits which engineering science will derive therefrom may be estimated by the fact that the results of three trials, which were only stated to be approximate, were reported in so brief a manner as to be easily included in a short paragraph in our issue of the 1st inst. Thus the great expectation which may have been raised must be satisfied with meagre and uncertain results; that is, if expectation has outlived the time which has elapsed since it was raised, and has not ceased long since to expect. They manage these things better across the Atlantic; when they resolve to do a thing they do it offhand, and no waiting for this, that, or the other little piece of circumlocution. And when it is done they tell the nation so, and not only so, but how it is done, deeming it to be to the interest of the country to furnish all particulars, and not the mere dry bones of an approximate result. As an illustration we may refer to the recent trials of the "Dictator," the most formidable American iron-clad, and the "Agamemnon," another similar vessel, for speed. True, the results depending on this trial were of a different character to, and of less general importance than, those anticipated in the English trials. But the principles involved were the same; the Government resolved upon certain experiments, and they did not postpone them year by year, nor obtain only approximate results in the end; they worked out the sum they had set themselves, and definitely ascertained what they wanted to know.

The "Dictator" is a single-turreted monitor; she was built at New York, and was engined by Mr. Ericsson. The "Agamemnon" is a two-turreted vessel, of Portsmouth construction, her engines having been built under the direction of Mr. Isherwood. The motive power, however, is similar in both vessels, each being propelled by Ericsson's vibrating lever engine. The first race was a run from Boston to Portsmouth, in which the "Dictator" won by ten minutes. The two vessels started together from Boston Light and arrived at Portsmouth, N.H., a distance of fifty-two miles—the "Dictator" in six hours and five minutes, and the "Agamemnon" in six hours and fifteen minutes, from the time of starting. During the six hours and five minutes the main engines of the "Dictator" were in operation, the total number of revolutions of the screw was 11,763, giving an average of 32.21 revolutions per minute. The total amount of coal consumed during the same time was 13 tons 2,080lb., or an average of 2 tons 650lb. per hour. The lower tier of furnaces in the boilers were the only ones used. Three of the boilers foamed

badly at first, but they afterwards furnished dry steam for the maximum number of revolutions made. The engines were prevented from working at a higher speed by the water which passed over into the cylinders from the boilers which foamed. The engines worked well without heating in any of the journals. Such is the report of the "Dictator's" working, as given by Mr. Robie, the chief engineer. Of the "Agamentious" the acting chief engineer, Mr. Hartwell, reports that the engines of the vessel were in operation between Boston Light and Portsmouth for six hours and fifteen minutes—five hours and thirty-five minutes without stopping—at the expiration of which time the engines were stopped and backed to take in a pilot. The total number of revolutions for the five hours and thirty-five minutes was 23,600, giving an average of 70.61 per minute; the highest average for one hour was 75 per minute; average steam, 25lb.; total number of pounds of coal, 12,765. The throttles were wide open, and sixteen furnaces only were used. No foaming of the water in the boilers, or heating of the journals, occurred during the passage. The total distance run, as already observed, was fifty-two miles; and to the point where the engines were stopped for the pilot, between forty-seven and forty-eight miles. The maximum was eight knots and four fathoms, and the minimum eight knots and one fathom. There was no attempt at speed after taking the pilot, and some time was consumed in making fast to the mooring buoy; but the following are the revolutions, &c., for the whole distance:—Total number of revolutions for six hours and fifteen minutes, 26,499; average pressure of steam, 25lb.; total coal, 15,015lb.

The second trial of speed took place between Portsmouth and Portland, and gave better results than the first, inasmuch as the distance—fifty miles—was run in five hours and ten minutes by the "Agamentious," which this time came off the winner. The "Dictator" hung behind a mile and a half when the "Agamentious" had concluded her trip off Portland. The "Dictator," however, claims an allowance of seventeen minutes for the stoppage of her machinery on account of the heating of the crank pin; it is reported, too, that her bottom was foul, while that of her competitor was clean. In these trials it is important to notice that the "Dictator" employed but half her furnace power, the upper tier of twenty-eight furnaces having been kept closed. The heating of the crank pin in the second experiment appears to have been caused by some cotton waste having clogged the pipe by which lubrication was supplied to the pin. In consequence of this, only half steam pressure could be employed for some time, and ultimately the engines had to be stopped to cool the pin. After cooling it seems that a steam pressure of 25lb. was employed, but a constant application of cold water was found necessary in order to prevent overheating. Notwithstanding these disadvantages, however, the engines averaged for three hours 36 revolutions per minute, and from three p.m. to four p.m. the propeller made 2,202 revolutions. The pitch of the screw is 34ft., so that its progressive movement was 12.3 knots. In the "Warrior's" performances, we find the slip of the screw to be 10.9 per cent.; taking this as a standard it will be clear that in the "Dictator" the force exerted, with half furnace power and 25lb. pressure, was fully equal to 11 knots. We have also to bear in mind and allow for the foul state of the latter vessel's bottom when judging of the ultimate results. So there is no doubt, had all things been equal, and had the working conditions been the same, the "Dictator" would have distanced her competitor in the second trial as well as in the first one. They are, however, both fine vessels, and the results of their trials for speed, in which they are well matched, are highly satisfactory, for speed is becoming one of the most important qualifications of ships of this class.

The point from which we started was the experimental trials of the engines of English vessels for the purpose of ascertaining the relative economy of the machinery. To return again thereto, we may observe that the results of those trials were eagerly looked for, not only in our own country but in America also. The subject of marine competitive trials is, in fact, at the present time in active controversy with the American public. We noticed three weeks since the novel and somewhat absurd proposition to make fast two vessels to a wharf for the purpose of trying the relative power of their engines. It is to be hoped that the American Government will accede to Mr. Dickenson's proposition to try the speed and economy of the "Algonquin" fairly by a sea race. Going beyond this the *New York Army and Navy Journal*, referring to the interest evinced in our experiments, advocates the institution of a series of trials between the double-turreted monitors "Agamentious" and "Monadnock," which are propelled by Ericsson's vibrating lever engines, and the double-turreted monitors "Miantonomah" and "Tonawanda," propelled by back-acting engines planned by Isherwood. This would determine the relative merits of the two classes of engines, and practically solve a moot point. An additional reason is that Mr. Isherwood condemns the vibrating-lever engine of Captain Ericsson as unfit for naval service. The value of his opinion would be determined by such a trial, and the Navy Department would be furnished with data for deciding the question of the most suitable engine for practical sea service. A comparison of the results with those obtained in our own Channel trials is talked about; the report of these will by this time have come into the possession of our expectant cousins, and we hope they will not be over disappointed.

FRICTION OF ENGINES.

THE ordinary formula for ascertaining the actual power of an engine, and the data generally used to determine the nominal power, do not take into consideration the friction. It is universally considered that the result gained will be sufficient, irrespective of arrangement or design. The frictional surfaces of engines are not alike. The many kinds of guides for the piston rods have their advantage in arrangement, and excess or reduction of friction. For land purposes the engines generally adopted are of the beam and horizontal types. In the former class we have the beam gudgeon, connecting pins, parallel motion, and shafts or pins, to consider, whilst in the latter, the surfaces mostly to be noticed are those of the guides, the remaining portion in each type being much the same. Before comparing the strains of the two classes, it will be well to consider the direction of the strains imposed. Engines of the beam type are alike in principle of action, irrespective of the locality of the beam, or main lever as it is sometimes called. When the piston is ascending, the outer end of the beam moves in an opposite direction, the connecting rod is forcing the crank, and hence there is a thrust action at each end. On the motion of the beam being reversed the action of the steam is to cause a tensile strain on the piston rod. The connecting rod pulls the crank, and therefore the strain is reversed or changed from crushing to tensile. The weight of the beam causes more friction on the gudgeon bearing during the down stroke of the piston, from the causes alluded to. In some instances the caps of the plunger blocks have been dispensed with, when the beam is loaded heavily; such a practice is not, however, to be recommended. The friction of the main bearing of the beam is the greatest below the angles assumed, which is due to the length of the stroke and radius of the arc described. In the case of small beam engines moving quickly, the friction on the upper portion of the bearing will be greatly increased. The friction on the pin for the

crank connecting rod is due to the length of stroke, or rather angle, assumed by the rod, the thrust and pull strains being in a line with the centre of action; therefore the lower portion of the pin virtually has more friction than that of the upper. The brasses of the rod generally clasp the pin for the whole of the circumference; hence the friction may be said to extend throughout the surface of the bearing. The connection of the piston rod to the beam is generally by a single rod, but in some cases the double link connection is still adopted. The pin in the piston cap is exposed to the vibratory motion of the link or rod, and the action or power of the steam on the piston. In this case the friction may be termed alike above and below the centre line, at right angles with that of the beam during its motion. The friction of the beam pin is much alike in principle as that for the piston cap, with the exception that the vibratory motion of the link is greater at the top end. The strains imposed on the parallel motion are, as the portions already alluded to, subservient to the angle assumed by the beam. When the piston is ascending, the friction on the pins is greatest on the under side of the bearings. The parallel bars may be said to have less strain on them than any portion of the motion; this is due to the fact that the radius rods are the vital portion of the motion in question. Should these rods be too long or short, the parallel bars and the piston rod will receive an undue strain on them. The friction of the pin or shaft bearings of the radius rods will be greatest at the stationary point if any deviation does exist; but should perfection of length be attained, the friction may be said to be alike for each pin or bearing.

Having considered the frictional surfaces of the guiding portion of the beam engine, we will turn to that of the horizontal type, and the strains imposed. Engines of this class generally move at high velocities; hence it is not impracticable to reduce the size of the cylinder in relation to that of other kinds. Now, it is obvious that when the area of the cylinder is reduced, and the pressure of the steam remains as before, the strain on the piston rod will be lessened in proportion, but, should the pressure be increased, it will be equivalent to enlarging the area.

The action of the steam on the piston at the back end causes a crushing strain on the rod, while, when acting at the front, a tensile strain is imposed. This simple fact may appear unworthy of notice, but in practice it is a matter of the greatest consequence. The guides adopted for horizontal engines are generally double-surfaces, which are alike in area. Correct as this may appear, yet in theory and practice one of the surfaces may be reduced for engines moving in one direction. To demonstrate this will be to assume an engine in section longitudinally: suppose the piston be at the back end, the connecting rod will be on a line with the piston rod. Now, if the crank rises, on motion being given to the piston, the thrust will be transmitted to the crank pin at an angle due to the proportion of the length of the connecting rod to the stroke of the engine. The crank, it must be borne in mind, has a stationary tendency till the centrifugal action of the fly-wheel is in operation. Presume the piston to have assumed the half stroke, the greatest strain will then be on the crosshead pin, and hence, also, on the lower face of the guide. Now, when the crank is at the plane line or the piston at the front end, the strain and friction are momentarily neutral. On the piston reversing its motion or returning to the back end, the strain on the piston rod becomes changed from crushing to tensile. The crank is descending, and is pulled, so to speak, not forced, by the action of the steam. Now, it may be said that the friction will be greatest on the upper face of the guide owing to the angle of the connecting rod. It is assumed that the crank has descended to the half stroke; the crank pin has a tendency to pull or rather remain stationary during its descent from the

plane line. Therefore the strain will be on an angle with the connecting rod; hence the lower surface of the guide will be most operated on. Assuming the crank pin to be ascending from the half stroke to the plane line, the connecting rod will be at an angle till the piston is at the back end: the tensile strain, or pull on the crank pin, will also then cease. It is thus obvious that the thrust or strain above the plane line, and the pull below it, impart more friction to the lower surface of the guide than the upper, owing to the direction in which the engine is working.

Assume the motion of the crank to be reversed, the piston being at the back end. The thrust on the piston rod forces the crank downwards, and the upper surface of the guide receives the strain in a line with the connecting rod. To further demonstrate this, assume that the crank is at the full stroke: the crushing strain on the piston and connecting rods will cease, and on the ascent of the crank the tensile strain will be in operation. It may be thought that, the angle of the connecting rod being above the plane line, the friction on the guide will be greatest at the lower face. The fact, however, that the crank pin is being drawn towards the guide already shows that the upper face must receive the greatest friction. The accompanying diagram will assist in rendering the matter clear. Fig. 1 repre-

stuffing-boxes, slide valves, and mode of working the same.

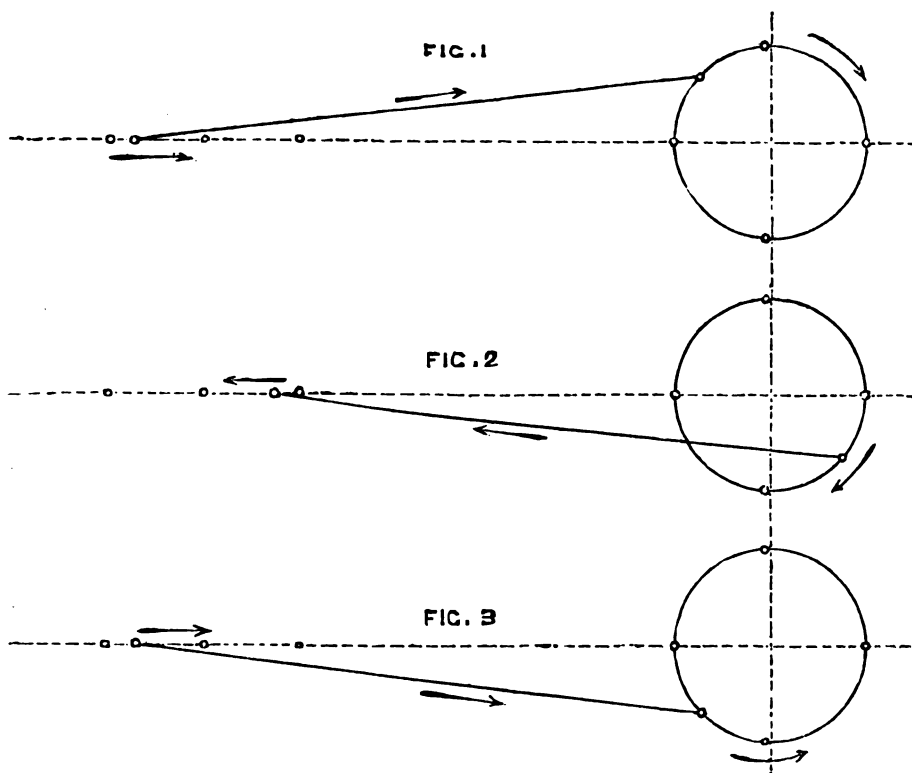
The pistons of engines in the present day are simply rings of metal in the shape of a spring, or, rather, they are springs in action. The modes of rendering the spring ring steamtight are various. Some makers prefer a gasket and compression ring, while others will insist on a series of springs behind the ring. We prefer that the action of the steam should act as a spring for engines of moderate power. For large cylinders, say 80in. to 120in. in diameter, we should use the ordinary ring and gasket, or springs behind; with superheated steam, undoubtedly the latter. The amount of friction in the piston is due to its depth and diameter. There is no practical reason for affirming that the horizontal arrangement will impart or produce more friction than the vertical. The increased speed of the piston will not necessarily increase the friction of the same in proportion, if a proper amount of lubrication be retained. When the speed amounts to 500ft. or even 800ft. per minute, we have seen that both cylinder and piston wear well with the horizontal arrangements. The friction imposed by the action of the piston rod passing through the stuffing-boxes, is due to the nature and compression of the packing. The pressure of the steam may be said to regulate the friction also. We have

the stroke required for the valve. The necessary motion is either imparted by mitre gearing or motion rods. The friction imposed in each case may be said to be equal; hence, with reference to the power required, or rather expended, the arrangements are on a par. In order to attain a correct result as to the friction of the slide valve, its position must first be determined. When the valve is at the top of the cylinder, the weight of the valve may be said to be added to the pressure of the steam; hence an increase of friction. In the case of the valve being located at the side of the cylinder, the weight of the former may be termed neutral, whilst, if the valve were underneath the cylinder, its weight at the back would tend to reduce the action of the steam. To ascertain the exact area in contact when the valve is at half-stroke, we must consider the outside and inside laps, and those at the side. The amount of friction imposed during the travel of the valve will be the outside lap and width of bars, *minus* inside lap for one end of the valve. The friction of the other part in contact will be due to the raised portion beyond the supply port. The side laps are the same throughout the stroke. The valve at present under notice is the ordinary slide valve, with a spring at the back; hence the steam in the casing may be said to act on the back of the valve by its pressure. In order to counteract the pressure of the steam at or on the back of the valve, a ring has been introduced to fit against the inner portion of the casing cover. It is obvious that, by a communication with the condenser, a vacuum must be caused at the back of the valve, and thus the friction on the face greatly reduced. Slide valves with double ports may be said to have an increase of face friction due to the large and small bars and double laps, but the principle of contact is the same as for the ordinary kind.

The different arrangements introduced for imparting motion to the valve are much the same with relation to the friction incurred. Direct action will greatly reduce the friction in proportion to levers and weigh-shafts, to say nothing of the wear and tear due to the reverse action required with some arrangements. When the valve-link motion is introduced, the vibration of the link causes friction by its contact with the sliding block. Now, to counteract, or rather eradicate, this evil, the link in some cases is allowed to rest dead on the block, which greatly reduces the friction. The frictional surfaces of the eccentrics can be greatly reduced by introducing hollow surfaces in the groove and the band. This may be said to increase the wear and tear, but in practice such is not the case. The strains imposed on the bearings of the crank shaft and the friction incurred can be readily understood from the description alluding to the piston-rod guides and the diagrams introduced. When the crank is on the plane or perpendicular line, or rather in a line with the centre of the cylinder, the strains are reversed at each stroke of the piston. The brasses of the bearings wear, theoretically, most in a line with the cylinder, owing, of course, to the thrust and pull on the piston rod, but in practice the wear under the bearing is as great as at the sides.

THE PERMANENCY OF PHOTOGRAPHS.

ALMOST every household now has its photographic album, yet a minority of the public only seem to be aware of the perishable nature of its contents. Some of the pictures turn yellow and fade very rapidly, whilst the remainder show little change, and are as a rule considered permanent. The glaze of an ordinary carte de visite picture is given by the albumen surface on which the photograph is taken; an albuminate of silver is formed in the sensitising process, and this salt is not of sufficient stability to guarantee permanency in any photograph, however carefully it is tended in the different manipulations. In the early days of photography on albumenised paper,



sents the connecting rod above the plane line; fig. 2 shows the crank moving in the same direction, but the rod below the plane line; fig. 3 illustrates the piston moving in the same direction as shown in fig. 1, but the cranks reverse in rotary action.

These demonstrations of natural laws apply more particularly to heavy working engines, where the strains are continuous, and alike above and below the plane line. With fast moving engines the strains may be said to be slightly decreased, and the friction on the surfaces of the guides more alike, but never equal under any arrangement or speed of piston. It may be observed that when the crank has a tendency to be overcome by the centrifugal force of the fly-wheel, or any other cause, the frictional surfaces will be more equalised, owing to the fact that the crank pin may be said to assist rather than retard its motion. Having alluded to the strains imposed, and the surfaces operated on, relating to the guidance of the piston rods of the beam and horizontal engines, allusion will now be made to the friction of the piston,

known packing actually burnt so that it required a hammer and chisel to remove it. In other cases, with sufficient lubrication, we have known a gasket to remain partially perfect after three months' use. The screwing of the nuts of the gland greatly affects the friction. A nip on the rod in some cases is sufficient to reduce the power of the engine to one-half. This is clear when we remember that the friction on the rod is due to the compression on its surface, and that the greater the angle of the gland the greater the tendency to increase the friction. The same will apply to the packing.

The valves generally adopted for beam engines are of two kinds—double-beat, and those of the sliding kind. The former greatly reduce the friction, owing to the action of the steam being neutral. With valves of this class the friction of the stuffing-boxes may be termed the vital portion in relation to the surfaces in contact. The modes adopted for lifting these valves are by cams of the ordinary forms, or tappets and levers. The friction in either case is due to

hyposulphite of soda was used in the toning bath, and the free sulphur, liberated in the solution by time, added somewhat to the rich appearance of the prints. All pictures toned in such solutions, however, are found to be less durable than those which in all the processes are rigidly protected from contact with free sulphur, which, as might be expected, has a deteriorating effect upon the thin film of silver forming the image. By taking precautions not always practised by professional photographers, it is now possible to take pictures on albumenised paper as permanent as can be obtained on that somewhat unstable medium; but there is scarcely a doubt that all the numerous photographs taken on that substance will eventually perish, and the family portraits be no more seen. The new Wothly-type pictures are said to be more permanent in character, but as yet they are under trial in this respect. In his process nitrate of silver is dissolved in collodion, to which has been added a salt of uranium. A sheet of paper is next covered with a film of the sensitised collodion, on which the picture is taken, toned, and fixed in the usual way.

Many efforts have been made to take photographs in which the shadows of the picture should contain nothing but carbon, the most imperishable substance that could be desired for such a purpose. The insolubility of this substance, together with its insensibility to the action of light, render the attainment of the object difficult; but recently Mr. Swan, of Newcastle-upon-Tyne, succeeded to a greater extent than others in obtaining good pictures in Indian ink, the imperishable character of which is well known. At the present time Mr. Swan is making experiments to perfect his process, which, as it stands, gives very perfect pictures, which may be expected to last as long as the paper on which they are taken. A film of gelatine containing a bichromate salt, say bichromate of potash or bichromate of ammonium, is rendered insoluble by exposure to the action of light, consequently if such a film contained Indian ink, and half its surface were exposed to daylight, the uncovered half would be insoluble, whilst the half in the shade would rapidly melt away in warm water. Mr. Swan takes advantage of this fact, and by his process a plate of glass is first covered with collodion and dried. On this surface a bichromated solution of gelatine containing any desired colouring matter, is poured carefully and evenly, and the film allowed to dry. This operation of course must be performed in the dark. When it is dry one corner of the black film should be raised from the glass with a penknife, and the whole can then be peeled gently off, and it looks and feels like a very perfect and highly-polished sheet of patent leather. The prepared film is exposed to light under the negative, the collodion surface being the one in contact with the glass. After it has been sufficiently exposed, which can only be surmised and not accurately known, since no visible image is formed, the film is fixed, by means of a solution of india-rubber in benzole, to the face of a sheet of paper. It is next placed in warm water, where the gelatine, on which the light has not acted, dissolves off, and leaves the lights of the picture, pure white paper, but the shadows, in their true gradations, will be found in the form of Indian ink, thus giving a sharp, well-defined picture, as permanent as a printing ink impression, and containing more detail than an ordinary photograph.

The principal objection to the process is that the time of exposure has to be guessed, so that, in a batch of pictures, there will be a larger proportion of imperfect ones than if they had been taken on the ordinary paper. In fixing the film to the paper much difficulty is sometimes met, because the collodion is apt to blister and to come off the paper in the developing water. Both these impediments can be surmounted by practice. The process also is very simple, so that it is now possible to take photographic pictures as imperishable

as the black letter manuscripts of the monks of old, which in some cases have so effectually resisted the action of time. A modification of Mr. Swan's process has been introduced, whereby the collodion film is abolished, and a sheet of paper used in its place. The picture is then printed direct on to the surface of the gelatine, and a second sheet of paper fastened, by the india-rubber solution, on the exposed surface. On placing the picture in the warm water, the first sheet of paper comes off as the gelatine dissolves, and the picture develops as before, except that in this instance there is no interposing collodion film on the finished print. By another modification the picture can be fixed without difficulty to the paper on which it is to be developed. A piece of albumenised paper is slightly damped till it is rendered sticky; the collodion surface of the film is then laid on the paper, and the two are pressed together. A few drops of strong alcohol are next poured on to a sheet of glass, and the two films laid thereon, paper downwards. The alcohol soaks through the paper and coagulates the albumen, after which no amount of soaking in warm water will detach the picture from the paper.

There is another very good printing process which is under trial as to permanency, discovered by Mr. G. Wharton Simpson. By his method, chloride of silver is held in suspension in collodion; the paper is coated with the mixture, and the picture printed and toned in the usual way. This process gives very beautiful pictures on plain and opal glass, those on the former being very suitable for the magic lantern. The transfer of positive pictures to sheets of patent leather gives very beautiful results, but is little practised now; a few years ago Mr. Joseph Hall, of Swansea, took some excellent pictures by this process. Some methods of printing by means of salts of iron, all modifications of the processes introduced by Sir John Herschel in the first days of photography, are also known, but very rarely used. As long, then, as the public demand the present silver printed pictures, they will always find a ready supply, yet it should be more generally known than it is that the goods will infallibly perish. At the same time there is a method of taking photographs which cannot fade, since each of such pictures itself consists of that very imperishable substance, carbon.

THE BRITISH ASSOCIATION.

In our last number we gave at considerable length the President's inaugural address, which was delivered on Thursday. On the following day the various sections commenced work in earnest by reading and discussing papers. We now give abstracts of some of the most interesting and important of those read in the mathematical, chemical, and mechanical sections; and we propose in succeeding numbers to give abstracts of important papers read in other sections.

SECTION A—MATHEMATICS AND PHYSICS.

TELEGRAPHIC INSULATION.

AFTER the delivery of an opening address by the president of this section, W. Spottiswoode, M.A., Mr. William Hooper read a paper "On India-rubber, considered in reference to its applicability as an insulator for telegraphic conductors." In this communication the author first noticed the difficulties encountered in applying caoutchouc for insulating purposes, describing the decay of native caoutchouc, especially when exposed to air and light, arising from oxidation, and resulting in a condition of fluidity. The components of caoutchouc were stated by the author to be 84.56 carbon, and 12.33 hydrogen, agreeing almost exactly with Dr. Miller's figures in a previous analysis. In applying caoutchouc as an insulator it has been generally washed, dried, and masticated, being manufactured by the process into solid blocks, which are then cut up into sheets, which are again divided into tapes. After serving the tapes around the wires they have usually been consolidated by heat, or by the use of solvents, both of which are injurious in their tendency to favour oxidation. Wires thus insulated give

good results for a short time, but their efficiency is soon destroyed. The results obtained with five specimens of india-rubber-covered wire supplied for experimental purposes to the Government of India, and sent out to Kurrachee in 1863, were adduced by the author, and showed that four out of the five were defective after submersion in the Indian Ocean; one only, supplied by himself, remained perfect. In insulation this specimen was the highest yet attained, and the perfection of the joints was fully proved. The central position of the conductor was unaltered by any elevation of temperature, and its insulation remained good up to 154 deg. Fah. and even higher temperatures. The mechanical properties of the core devised by the author were also shown to surpass all other materials yet produced. The importance of the low inductive capacity of the wires insulated by the author's process was also dwelt upon. Sir Charles Bright, Mr. Latimer Clarke, and Professor Thomson had made independent investigations into the capabilities of the wire thus insulated, and the results deduced by those gentlemen were singularly in accordance with each other, the two former giving the induction of the author's wire compared with gutta-percha as 100 to 136, the latter as 100 to 135. The rate of signalling being proportionate to the retardation arising from induction the value of the process in a line of such length as the Atlantic cable would be at once apparent in a commercial as well as a scientific view.

DEEP SEA CABLES.

MR. C. W. SIEMENS read a paper "On the Sheathing of Deep Sea Cables." The object of this paper was to call attention to the forces which act upon a cable while descending to the bottom, and to certain conditions which have to be fulfilled in order to insure its durability when laid. It was mentioned that the spiral, or rather helical, sheathing usually employed for deep sea cables is eventually defective, because it must necessarily elongate and burst round its own axis during its descent, because the iron or steel wires composing the sheathing frequently break and endanger the success of the operation, and because such cables when laid are rapidly destroyed through oxidation of the iron. It was shown that an outer covering of each wire with hemp, while beneficial in reducing the specific gravity of an iron-covered cable, cannot be depended upon for strength, and rather increases the risk of rapid destruction of the cable when laid. The paper proceeded to show that a sheathing composed of two layers of strong hemp under a certain tension, bound tightly round by a flexible armour of copper or zinc sheathing, is free from the objections previously enumerated; that such a cable actually forms the connecting link between France and Algeria, and has given evidence of permanent success.

THERMODYNAMICS.

In a paper "On the Second Law of Thermodynamics," by W. J. Macquorn Rankine, C.E., LL.D., F.R.S., the author gave an elementary proof of the proposition (which in the Edinburgh Transactions for 1851 he had demonstrated by a lengthy algebraical process), that the "second law" of thermodynamics followed from the supposition, that sensible or thermometric heat consists in any kind of steady or steam-like molecular motion within limited spaces (as distinguished from unsteady motion, such as vibratory or wave-like motion, which is supposed to constitute radiant energy). The law in question is, that the quantity of energy converted between the forms of heat and mechanical power during a given change in the dimensions and condition of a body, is the product of the absolute temperature into a function of that change; and in it and the first law (that of the convertibility of heat and mechanical energy) are summed up all the known phenomena of thermodynamics.

MAGNETIC STORMS.

MR. BALFOUR STEWART read a paper, drawn up by himself and Mr. J. B. Capello, "On the Magnetic Storm of the beginning of August last, as recorded by the instruments at Kew and Lisbon." Mr. Stewart prefaced his paper by explaining that the needle of the compass does not always point to the north, and is not always fixed in any direction. These changes in the direction of the compass are sometimes violent, and are then called magnetic storms. The appearance of the Aurora Borealis and "earth currents" of electricity accompany these storms, which are also sometimes marked by the breaking out of many spots on the sun. The storm which began in August last, during the laying of the Atlantic cable, resembled in several particulars

one which occurred in 1859. The instruments at Kew and Lisbon recorded the effects of these storms, and showed the variations of the needle. Their effects extended a long way. The storm of August 3 broke out at an early hour in the morning, and lasted till the next day, with rapid movements of the needle. After an interruption it broke out again, and lasted nearly all the day. The storm showed the influence of forces horizontal, vertical, and declinational, and the magnetic storms of 1859 and the present year agreed in this, as well as in being characterised by two distinct outbreaks. Both also began in the night, or early in the morning, and there were many spots on the sun, which rapidly altered their shape and character. This showed that during these storms rapid changes were taking place on the surface of the sun.

Mr. Grove said that magneticians were now looking for the establishment of some connection between magnetic storms and the solar spots, and the subject was well worth following up, not much data having yet being obtained.—Mr. Glaisher said photographic observations had been carried on for twenty years at Greenwich, and very minute ones in Canada. He had also corresponded with Mr. Hodgson and Mr. Carrington, and with the Astronomer Royal on the subject, but had not come to the conclusion that there was any connection between the solar spots and magnetic disturbances. A more important subject was the spontaneous electricity, or earth current, which interrupts our telegraphic communications to such an extent that sometimes we can only send messages by going a long way round to avoid the difficulty. Supposing the Atlantic telegraph were laid, it was questionable, with a cable of such a length, and in view of these earth currents, how much or how often we could use it.—Mr. Balfour Stewart said he thought there was proof of the existence of two independent forces, of which sometimes one predominated and sometimes another. This would account for discrepancies in the records of observations at different places, which had been noticed by Mr. Glaisher.

MAPPING THE MOON.

An interesting report of the Lunar Committee with reference to mapping the moon was received from Mr. Glaisher (the chairman) and Mr. Birt (the secretary). The committee had adopted four forms for the registration of objects observed in the moon, to be used in the constructing of a map. The work was one of such great magnitude that it might remain undone for twenty years or more, even if the devotion of Mr. Birt should continue unabated during all that time. It was therefore of importance that all lunar observers should take part in it, and they should make use of the forms adopted by the British Association, as nothing was more conducive to accuracy in reports than the use of printed forms. Form No. 1 was intended to receive the records of observations of the moon. Form No. 2 was to facilitate the cataloguing of lunar objects, and divided the moon's surface in spaces distinguished by symbols. First, there were four quarters—the north-west, the north-east, the south-west, and the south-east, and each of those was divided and subdivided upon a system which admitted of easy reference to the position of any object on the surface. Form 3 contained twenty-one columns for the registration of particulars as to the position, extent, and height of lunar objects. Form 4 was intended for the ready and easy calculation of the relative positions of lesser bright objects, whose points were well determined. There were some details furnished by Mr. Birt of the results he had obtained during the past year. He had made observations on 121 nights and mornings, a number which had caused much astonishment considering the difficulty of obtaining observations in the English climate. It must be inferred that he had spent a great deal of time when he was unable to gain an observation. The labour of reducing the results in the shape of entries on the forms was very great, and the committee said it was manifestly too much to expect of Mr. Birt that he should observe all night and then compute all day. They had resolved to place a clerk at his disposal for the performance of the latter task. Mr. Birt had made many hundreds of measures for position and magnitude, and 705 observations had been entered on the forms.

Professor Phillips congratulated the Association on the progress made in lunar science, to which it had devoted its attention for some thirteen years, and reminded the section that however much attention might be given to the study of lunar phenomena in observatories, independent observers with smaller instruments might usefully contribute to the progress of the study by directing their attention to limited portions of the moon's surface at a time, small objects being quite capable of detection and scrutiny with instruments of 6 in. diameter. There was a large field of minute discovery still open to such observers.—Mr. Grove confirmed this, and said that with a 4 in. object glass a great deal of work might be done. There were probably some important changes going on so insensibly that they were difficult to observe from the earth. By ascer-

taining the most recent changes, an important set of statistics might be obtained.

SECTION B.—CHEMISTRY.

COMPOUNDS OF COPPER AND PHOSPHORUS.

PROFESSOR F. A. ABEL observed that about six years ago his attention had been called to the above subject by Sir R. James, at the Royal Engineers' meeting, who suggested that it would be possible to apply phosphorised copper as a material for casting guns instead of the alloy known as gun metal. Some few experiments had been submitted to an eminent professor, and the results had been so far favourable as to lead to the hope that the material might be worked on a large scale. He had, therefore, been induced to take up the examination of the compounds of copper with phosphorus. He referred to the works of Rose and other eminent authorities on the subject, and he found that the notions that had with them existed were scarcely sufficient to guide one in carrying out large experiments in all their fulness. However, he had been induced to go into the subject some three years ago, and the result of his laboratorial evidence he would lay before them. He then referred to each step of his experiments, the result of which was that if phosphorised copper were cast in iron moulds or chills, it would get greater solidity and strength than if cast in sand or loam. He instanced the amount of pressure—in some instances enormous—which the phosphorised copper would stand before breaking. The experiments had been made by him in the Government arsenals. The employment of an iron rod for stirring the metal when in an incandescent state, if phosphorus were used, should also be avoided.

A Member inquired the percentage of tin in the metal, and Mr. Abel replied that it was the ordinary metal, and the percentage was from 7 to 10 per cent. The object of the experiments was to try if gun metal could not be manufactured with a small addition of phosphorus, and the result was, what he had observed before, that the metal obtained greater tenacity, greater uniformity, and a greater degree of hardness. Mr. Abel said the metal had been tested by means of a double lever of peculiar construction, used at the Arsenal for the purpose of testing. The phosphorised metal would not bear a great jar, but would endure great strain, and if the phosphorus were increased more than one per cent. it would be still less able to endure a sudden jar. He admitted that the metal would not roll well. He also observed that, whether Muntz's metal (used chiefly as sheathing) was improved by the addition of a small quantity of phosphorus infused into it or not, he was not prepared to say.

SILICIUM IN IRON.

This paper was by Dr. Phipson, who, in a paper recently printed in the *Comptes-Rendus* of the Paris Academy of Sciences, had shown that silicium, like carbon, invariably existed in pig irons in two states, viz., α silicium and β silicium, corresponding to a carbon combined, and β carbon (free carbon or graphite). He had also shown that these allotropic states of silicium had an enormous influence in the production of Bessemer steel, and they would probably be found to have quite as great an influence upon the quantity of iron in general. He had been led to the discovery in analysing three specimens of very pure hematite pig iron, forwarded to his laboratory by Messrs. Lloyd, Foster, and Co., of Wednesbury, who desired to know how it was that one of these irons gave tolerably good steel by the Bessemer process, the second very indifferent steel, and the third so bad that it could scarcely be called steel at all. These three specimens had been submitted to a rigorous analysis, and his astonishment was indeed great on discovering that they yielded, as nearly as possible, the same composition. There was evidently something remaining to be done, and he entered into a correspondence with Mr. F. H. Lloyd, in order to ascertain that the treatment the irons had been submitted to was identical for each. This point having been ascertained he made a third and fourth analysis, but the results led to no explanation of the mystery, although great attention had been paid to the relative amounts of free and combined carbon. The thought then struck him that, as these irons were tolerably rich in silicium, this element might exist in two states of the iron, and so influence the manufacture of Bessemer steel, according as one or the other of these states predominated. The results obtained had

been most satisfactory. Through the kindness of Mr. F. H. Lloyd he had been enabled to carry his researches a little further, and he doubted not but that some new experiment he was commencing would throw still greater light upon the subject, should they not prove too laborious, or require more time than he could spare. In the meantime the results here described had furnished him with the means of distinguishing at once pig irons which would make Bessemer steel from pig irons which would not, even when the different specimens presented the same appearance.

Professor Calvert said that in experiments which had been made by himself and Mr. Schneider, the appearance of the iron was all that could guide them. The peculiar appearance of cast iron, instead of being due to carbon, might be due just as much to silicium.—Captain Noble said the results of the experiments he had made were such as to confirm him in his opinion that there was scarcely any iron as an hematite iron but it was found that by mixing it with other irons it would add a very large amount of strength. On testing some other very strong irons, he found nearly as great an amount of silicium as in hematite.—Mr. F. H. Lloyd said the results referred to in Dr. Phipson's experiments were not derived exactly from hematite iron. The speaker had been present when the analyses were made, and two-thirds of the iron used was made from the ordinary Staffordshire ore, and the other third was hematite. The Doctor was pursuing his experiments, and when he had completed them other valuable results would be obtained.

PARKESINE AND ITS PROPERTIES.

This paper was by Mr. Owen Roland, electrician to the late joint committee of the Board of Trade and the Atlantic Telegraph Company inquiry into the manufacture of submarine telegraphs. Parkesine derives its name from its inventor, Mr. Alexander Parkes, of Birmingham, whose popular invention of the vulcanisation of india-rubber was spoken of in very favourable terms by Mr. Thomas Handcock. Parkesine is serviceable for a great variety of purposes, and possesses properties akin to gutta-percha and india-rubber. It can be manufactured with the utmost facility into any shape and of any colour. Gun cotton is used in its manufacture as a basis, but a number and variety of other materials are also introduced; they consist mainly of solvents, oils, cotton waste, &c. Articles manufactured from Parkesine were exhibited, and attracted considerable attention. Cotton not readily explosive is the most desirable thing that can be used for manufacturing iodide; chloride of zinc being also used to prevent rapid combustion. The solvent was invented by Mr. Parkes, and is applicable chiefly for india-rubber solution, gutta-percha, and a number of gums. It is by mixing these substances in their legitimate proportions that the several varieties of Parkesine are manufactured. Dr. Roland had also observed that Parkesine was valuable as an insulating material for the purposes of telegraphy. He considered it more valuable for such a purpose than india-rubber, gutta-percha, or any other combination hitherto brought into operation for a similar purpose. The material is enormously strong, being capable of supporting a mile of its own weight, while it possesses the great qualification of being joined in case of fracture with a strength equal to the original substance. It is not affected even by acids; and sea water, in which it has been immersed for a period of four years, has not in the least deteriorated its qualities. In dry heat as high as 212 degs. it remains electrically unimpaired, and not softened at even a higher temperature. Results of experiments made at Hackney Wick on August 29, 1865, on the loss of insulation, on lengths of variously coated copper wire, &c.; instrument employed, Peltier electrometer; full tension, 40; temperature, 61 degs. Fah. :—Parkesine, 5 in 1' 45"; plain gutta-percha, 5 in 0' 37"; gutta-percha and Chatterton's compound, 5 in 1' 8"; plain gutta-percha covered with Parkesine, 5 in 1' 4"; india-rubber (masticated), 5 in 1' 15"; india-rubber (virgin), 5 in 0' 30"; ebonite disc, 5 in 2' 10"; Parkesine disc, 5 in 2' 35".

THE ACTION OF ACIDS ON METALS AND ALLOYS.

PROFESSOR F. GRACE CALVERT's paper on the above subject attracted a good deal of attention, as being especially useful in various articles of Birmingham manufacture, such as the plating of metals, manufacturing of brasses, bronzes, and alloys. The

point which had first engaged his attention was that of sulphuric acid on zinc. At first he could not obtain anything like accurate results, but this he found was attributable to the fact of the zinc not being unoxidised. With sulphuric acid with 1, 2, 3, 4 equivalents of water, it produced no perceptible appearance, but with 5, 6, and 7 equivalents of water a slight action. At a temperature of 180, sulphuric acid with 7 equivalents of water dissolved zinc with great rapidity. He had experimentalised on tin and copper. Sulphuric acid with one equivalent of water acted powerfully on copper, but with two equivalents it only dissolved 15dr. He had also experimentalised on alloys, bronze, and brasses. With an alloy of brass, of one of copper, one of zinc, one of sulphuric acid, and one of water, at a temperature of 150 deg. C., the quantity of metal dissolved on a metre surface was equal to 1,155dr., but if sulphuric acid with three equivalents of water, there was no action at all on that alloy. If a brass alloy, composed of one of zinc and three of copper, were compared with the next alloy of one of zinc and four of copper, the chemical actions of the acid were entirely different. In the first the sulphuric acid acted upon the copper in preference to the zinc; but in the last alloy the result was otherwise. The results of a number of other experiments made by Professor Calvert were likewise submitted.

FURNACE SLAGS.

Dr. F. G. FINCH read a paper "On the Utilisation of Blast Furnace Slags." He said within the last two or three years, by a process of slow cooling, a durable artificial stone had been produced at several ironworks in France and Belgium, and was used for building purposes and as paving-stones for roadways. The result had been satisfactory in a pecuniary point of view. Having recently visited most of the places where the stone was produced he would describe the plans adopted. The slag was allowed to run from the furnace in a fluid state into pits in the ground, eight or nine feet in diameter at the top, with sides sloping inwards to the bottom, the pits being three feet deep in the centre. The liquid hardened on the top, and the hardened mass rose as the pit filled. The furnaces were tapped every eight hours. The mass in the pits took nine or ten days to cool. It was quarried by means of large hammers and iron bars. The material thus obtained, except the crust on the top and a thin layer at the sides and bottom, was a hard, compact, crystalline stone, often resembling certain basalts. Of course, its quality depended on the nature and proportion of the materials with which the furnace was charged. That produced from cinder iron did not equal that produced in the manufacture of grey pig. The stone was found to have a high degree of resistance to crushing. It was largely used in France for paving, and was worked by masons into pieces of the form and size desired with facility, while the waste thus obtained was employed for macadamised roads. He had seen it where it had been laid down for three years. The French engineers spoke favourably of it, and the ironmasters showed him proofs that, while this process got rid of a cumbersome material, it was itself a profitable branch of industry. The great consideration in England in respect to such a manufacture would be the space it would require. With three tappings a day, each tapping filling one pit, and ten days for cooling, 80 pits would be needed, which would require a space of 2,400 square feet. It was not often that so large a space could be made available at our ironworks; but, on the other hand, it should be remembered that France was very deficient in stone suitable for paving.

CARBONIC ACID.

Dr. ANGUS SMITH observed that estimating carbonic acid in the air had generally been considered a difficult experiment, and, after many, he had obtained a method which possessed the additional qualification of being capable of being used by persons who had not devoted much attention to science. The advantage of his method was that they would observe in the liquid greater density could be obtained, and be able to number it with greater accuracy, as it did not go beyond a certain point. The precipitant might be obtained by dissolving barytes in water, and letting in certain quantities of air by the means of the india-rubber ball communicating by a tube to the water, and according to the number of times the bulb was emptied, the precipitant being thus obtained, and according to its density and other appearances the amount of carbonic acid gas in the air was thus observable. It was very serviceable in getting good ventilation to rooms and public buildings, and very serviceable in ascertaining the amount of ventilation in mines, such knowledge being of great importance in ascertaining when the air is sufficiently pure for the miners to carry on their mining operations.

SECTION G—MECHANICS.

FAILURE OF THE ATLANTIC TELEGRAPH CABLE.

Mr. W. FAIRBAIRN read the following paper "On some of the Causes of the Failure of Deep Sea

Cables, and experimental researches on the permanency of the insulators." The recent disaster and loss of the greater portion of the Atlantic cable is one of those casualties which may be considered national, and may be looked upon as a misfortune much to be regretted, as it delays the completion of one of the most arduous enterprises that have taken place in marine telegraphy. It is, however, suggestive of improvements and the removal of impediments which seem to have beset the last attempt to submerge what was considered the best and most effective construction for a durable and certain communication between this country and America. The lost cable, or that part of it which now rests as a lifeless thread at the bottom of the Atlantic, was unanimously selected by the scientific committee to whom was entrusted a long series of laborious experiments to determine the strength and other mechanical, chemical, and electrical properties of the material of which it was composed; and it may be interesting for the section to know how these experiments were conducted, and to what extent they were calculated to form a safe and durable cable. For these details I must refer to my own report, published in the Transactions of last year, in which will be found the mechanical properties of this and other cables submitted to various experimental tests. In this report the results deduced from these experiments are given, and we have now to inquire how far they were conducive to carry out the objects of the company in establishing a safe and effective communication between Valentia and Newfoundland. It will be noticed that the late failure of the insulation, submergence, &c., is not an uncommon occurrence. On the contrary, it has been estimated that out of about 14,000 miles of cable that have been laid, nearly three-fourths of that length have been failures, and that at the present time not more than from 4,000 miles to 5,000 miles are in successful operation. These repeated failures and loss of property are much to be deplored, but they have been, like the last great failure, fruitful as the means of accumulating a vast amount of experience, and have suggested remedies for the almost inevitable difficulties that have to be surmounted. There are, however, two things in marine telegraphy which require special attention, viz., the manufacture of the cable and its submergence in deep water. In the first, we may venture to assume that the conducting wires, insulation, and strength of the cables are satisfactory, and that we have nothing more to do than to lay it quickly in the bed of the ocean. The recent defects of the Atlantic cable, and the imperfect insulation of others, are, however, important lessons which prove the necessity of vigilant inspection of every yard of cable as it is manufactured in the first instance, and its careful preservation until it is safely departed at the bottom of the ocean in the second. All these conditions were supposed to have been carefully attended to in the manufacture of the Atlantic cable. When it was run from the machines into the water tanks at the manufactory, from these again into the steamer conveying it to Sheerness, and ultimately into those of the "Great Eastern" ship, where it was carefully coiled for final immersion, every possible care was taken, but, notwithstanding the precautions exercised by the manufacturing company, small pieces of wire, on three different occasions, were found sticking in the cable, in contact with the conducting wire and destructive of the insulation. Now these very trifling circumstances were the whole and sole cause of the loss of the cable; and it may be necessary as we proceed to advert to the subsequent trials of underlaying, dredging, fishing, and hauling which ensued, and which finally terminated in the loss of nearly two-thirds of the cable. In my paper of last year I gave a full account of the experiments and results which led to the manufacture of the present cable, and I closed with the remark that "I had not entered upon the process of immersion, either in tanks or the sea, and the question of coiling, shipping, submergence, &c., were left for future inquiry." I was in hopes that this inquiry would not have been necessary excepting only to prove that the machines and every other appliance on board the "Great Eastern" had effectually performed their respective duties, and that we had only to record them as contributions to one of the most successful enterprises that had been achieved in modern times. In these our most sanguine hopes we have been disappointed, and we have now simply to inquire what extra precautions should be taken

to prevent a similar occurrence in laying the next cable, which I hope to see done with perfect success and without interruption, at the bottom of the Atlantic. Having spoken approvingly of the paying-out machinery of the "Great Eastern," the paper spoke of the difficulty attending paying out. On the subject of splicing, the paper went on to say—If those pieces of wire which penetrated the gutta-percha had not been there, the cable would at the present moment have been in full activity and in regular communication with the American States, and it is much to be regretted that this cable—so strong and so powerful in its resistance to strain, so well executed and so full of promise—should have failed. With regard to the "Great Eastern" ship, never was a company more fortunate in having such a vessel for such a purpose. She proved herself everything that could be wished for. Her easy, steady motion was just what was required for paying out the cable, and its relief from any undue strain by the pitching of the vessel renders the big ship exclusively calculated for the submergence of submarine cables in deep water. She is the very thing that is wanted for such a purpose, and I firmly believe if she was properly fitted and prepared for such a service—with some additional stringers to strengthen the upper decks and sides—she would find full employment as a submerger of cables in every sea which divides the four quarters of the globe. As to the recovery of the lost cable, the paper went on to say that such a process was at all times a precarious operation, and especially so in the case of the Atlantic cable. If that cable were raised at all it must be at an exceedingly slow speed, and that with one end loose, otherwise he should despair of raising it from a depth of 2,100 fathoms by hooking it in the bight or middle, where the resistance would be doubled in raising two sides instead of one. This proposition was illustrated by reference to diagrams, after which the paper recommended the cutting of the cable at the American side after making it fast with a second grapnel. The object of this recommendation was to escape the enormous strain by hauling it up in the middle. This, he said, appeared to be a remedy calculated to meet the difficulties of the case; but the only feasible plan which suggested itself was to commence *de novo*, not only to lay a new cable, but to place the "Great Eastern" over the cable at Valentia and pluck it up at a rate proportionate to the depth of water from which it had to be abstracted. The success of submarine cables depended upon such a variety of conditions that the wonder was that they had succeeded so well. In the manufacture of marine cables there was no difficulty in the matter of the copper wire, but great care was necessary with the insulator, and attention to the question of the degree of permeability under great pressure. Generally the various materials that have been tried stand in the following order of permeability—the first absorbing least, and the last most water:—Chatterton's compound, gutta-percha, masticated india-rubber, vulcanised india-rubber, carbonised india-rubber, Wray's compound, unmasticated bottle india-rubber. Experiments on insulation are less complete than those on absorption, and had been prosecuted under greater difficulties, and with less variety of conditions. So far as they went, however, Wray's compound retained the charge larger than any other gutta-percha, is less absorbent, and india-rubber most. The order of merit in the matter of absorption stands as follows:—Vulcanised india-rubber, Chatterton's compound, gutta-percha, masticated india-rubber, Wray's compound, carbonised india-rubber, unmasticated india-rubber. Experiments made as to the effects of temperature on the absorption of water by insulators, at a pressure of 20,000lb. to the square inch, with eight square inches area, and $\frac{1}{16}$ in. in thickness, showed that gutta-percha absorbed 0.044 grains at 45 deg. temperature; india-rubber 0.177 grains at a lower temperature; and 0.45 grains at 75 deg., or two-and-a-half times as much as Wray's compound. The various experiments made, however, while showing the relative permeability of different insulators, were insufficient to solve the main question—that of the most perfect insulation, or the ultimate condition of the material surrounding the insulator or conducting wires of the cable.

CHAIN-TESTING MACHINES.

Sir W. G. ARMSTRONG read a paper on "Chain-testing Machines." He said the engineering firm

of which he was a member, having been entrusted with the construction of the apparatus for testing chain cables and anchors, lately established at Birkenhead, by the Mersey Harbour Trustees, had occasion to enter into very careful consideration of the conditions requisite for effecting the operation in the best manner. The most important consideration in the construction of a chain-testing machine was to obtain an accurate indication of the strain upon the chain. The hydraulic press had been the means employed, but the method for determining the amount of strain had been extremely imperfect. Most commonly the strain had been estimated by the indications on a mitred valve pressed down by a lever and weight. This mode of indication he considered was highly delusive, and he pointed out the advantage of substituting a packed loaded plunger for the loaded valve. The packing, he said, should consist of cup leather, so that the friction should vary directly on the pressure. When a chain broke in the test it was desirable to show not only that it failed to bear the full test strain, but also the amount of strain exerted at the moment of fracture. Various indicators on the principle of those commonly used in the Birkenhead machine for this purpose were unsatisfactory in their results, and the pendulum indicator had since been brought into general use. In this indicator the pressure upon the plunger was exhibited by the travel of a pendulum through a graduated arc. The movement was communicated from the plunger to the pendulum through the medium of a compound lever. When a chain broke, the pendulum fell back until stopped by a ratchet, but left a marker at the exact point on the scale attained by the pendulum. Having spoken of the effect of friction on the results indicated, the writer proceeded to say that in the arrangement of a public chain-testing establishment it was desirable that the apparatus for the various operations should be placed in such succession as would allow the chains to move from process to process without any retrogression. The Birkenhead establishment was then described, in which the machines are adapted to cable lengths of fifteen fathoms, the Board of Trade having recently fixed upon that length as the limit of chain to be tested at one time. He thought the restriction very desirable, and referred to many objections to testing chains in greater lengths.

Admiral Sir E. Belcher said he considered that the Board of Trade had taken a step in the right direction in fixing the length at which cables should be tested. He also called attention to the fact that, though a cable might be properly tested, still if it were allowed to remain in the water forty-eight hours, and during that time came in contact with the copper bottom of a vessel, its strength would be greatly impaired. He referred to an instance which occurred on board a vessel off Rio de Janeiro, in which the cable was nearly destroyed from such cause.

RESISTANCE OF WATER TO FLOATING AND IMMERSED BODIES.

PROFESSOR RANKINE read an interim report of the committee appointed for experimenting on the difference between the resistance of water to floating and immersed bodies. The experiments not being complete, the committee deferred a detailed report. The committee had several meetings during last winter and spring, and agreed to a programme of experiments. Two models of shi p-shape, four feet long and painted, were made and employed in those experiments. The experiments were made according to the method formerly put in practice by Mr. Scott Russell, in which the uniformity of the propelling force was maintained by means of a regulating weight hanging from a pulley, under which the hauling cord passes, the model being guided in a straight course by means of a stretched wire. The experiments were made with the models both totally immersed and only half immersed. The execution of the experiments was superintended by Mr. Scott Russell, as being the only member of the committee resident in or near London. The actual performance of the experiments was entrusted by Mr. Russell to Mr. J. Quant, who had performed the duty with great skill and assiduity. A lake in Blackheath Park was kindly granted for the experiments by Dr. Joseph Kidd. Twenty-eight experiments had been made on the first model, with the following results:—1. The resistance, when immersed so as to be just covered with water and no more, was more than double its resistance when half

immersed, at the same speed. 2. When the after body of the model was turned so as to convert the water-line into buttock-line, its resistance was increased, and that whether the model was half immersed or just covered. The report deferred the detailing the description of the experiments until they should be completed.

THE STRENGTH OF MATERIAL IN RELATION TO THE CONSTRUCTION OF IRON SHIPS.

MR. W. FAIRBAIRN read a paper on this subject the joint production of himself and Mr. Tate. The quality of iron estimated by work expended in the ultimate elongation of a bar one foot long and one square inch in section was first considered. This work with dynamic effect gave a comparative measure of the powers of resistance of different kinds of material to a strain of the nature of impact. The value of this modulus or coefficient of dynamic resistance determined by Dr. Fairbairn's experiments for different plates or bars of iron show that the resistance of thick plates to mixture is about two and a half times that of thin plates; that the resistance of thick steel plates is about one-tenth greater than that of the low iron plates A; and that the resistance of these latter plates is one-half greater than that of the rolled plates D. Similarly the work expended in the deflection of a bar supported at its extremities by a force applied at its centre may be taken as the modulus of dynamic resistance strain, different kinds of material to a force of impact tending to produce transverse. The next section of the paper gave the maximum transverse strain produced on a ship when the load is unequally distributed. The point of maximum strain is not always at the centre of the ship, as many practical men assume. The third section of the paper gave the value of the moment of inertia for different elementary sections of material. Section four gave certain simple general analytical expressions for the moment of inertia of complex sections of girders, such as that of an iron ship. The distribution of the material, so that the beam may have the greatest strength, was then investigated, and the formula applied to the section of one of our most approved iron ships showed that the upper portion of the ship should be about one-half stronger than it was in order to have a proper distribution of the material. Section five treated on the penetration of iron armour-plates by flat-faced tempered steel shot. The following formula, derived from Dr. Fairbairn's experiments on punching, will be interesting. The work requisite to penetrate a plate varies as the square of its thickness multiplied by the radius of the shot, or $U = CVT^2$. The result of this formula deducted from the experiments with ordnance may be taken as 24,400. It was shown from this formula that a 100lb. steel shot, five inches in diameter, with the velocity of 1,200ft. per second, would completely perforate an armour-plate exceeding five inches in thickness. At the conclusion of the paper Mr. Tate explained the formula of the experiments in lucid explanatory remarks, and by reference to illustrations.

BLOWING BLAST FURNACES.

MR. E. A. COWPER read a paper on the effect of blowing blast furnaces with blast of very high temperature. The paper opened with the observation that very satisfactory results were obtained in 1860-61, from a pair of Cowper's hot blast stoves, heating the blast to a particularly high temperature for one tuyere only for a blast furnace (the other four being blown with ordinary hot blast). These stoves were for a length of time in successful operation at Messrs. Cochrane and Co.'s works, at Ormesby, near Middlesbrough-on-Tees. These gentlemen then erected large stoves to supply blasts of very high temperature for a whole furnace, which stoves had now been in full operation for upwards of four years, with the following satisfactory results, viz., an increased "make" of iron from the same plant of fully 20 per cent., the iron being of rather improved quality, owing to less impurity being carried in with the fuel, the avoidance of all leakage caused by the ordinary blast iron pipes; reduced friction or loss of pressure in the blast passing through the stoves; and a saving of upwards of 5 cwt. of coke per ton of iron made, the blast being at 1,150 deg. Fah. These stoves were the invention of Mr. E. A. Cowper, who had adopted the regenerative principle invented by Mr. Siemens, as the means of absorbing the heat from the products of combus-

tion, and giving it out again to the air to be treated, the regenerators being each enclosed in an iron casing lined with fire brick and provided with valves to allow of the passage of ignited gas through the stove to heat it, and valves to allow the entrance of the cold blast and exit of the hot blast. Messrs. Cochrane and Co. were now erecting more stoves on the same plan.

ON PUDDLING IRON BY MACHINERY.

BY MR. HENRY BENNETT, OF WOMBRIDGE IRON WORKS.*

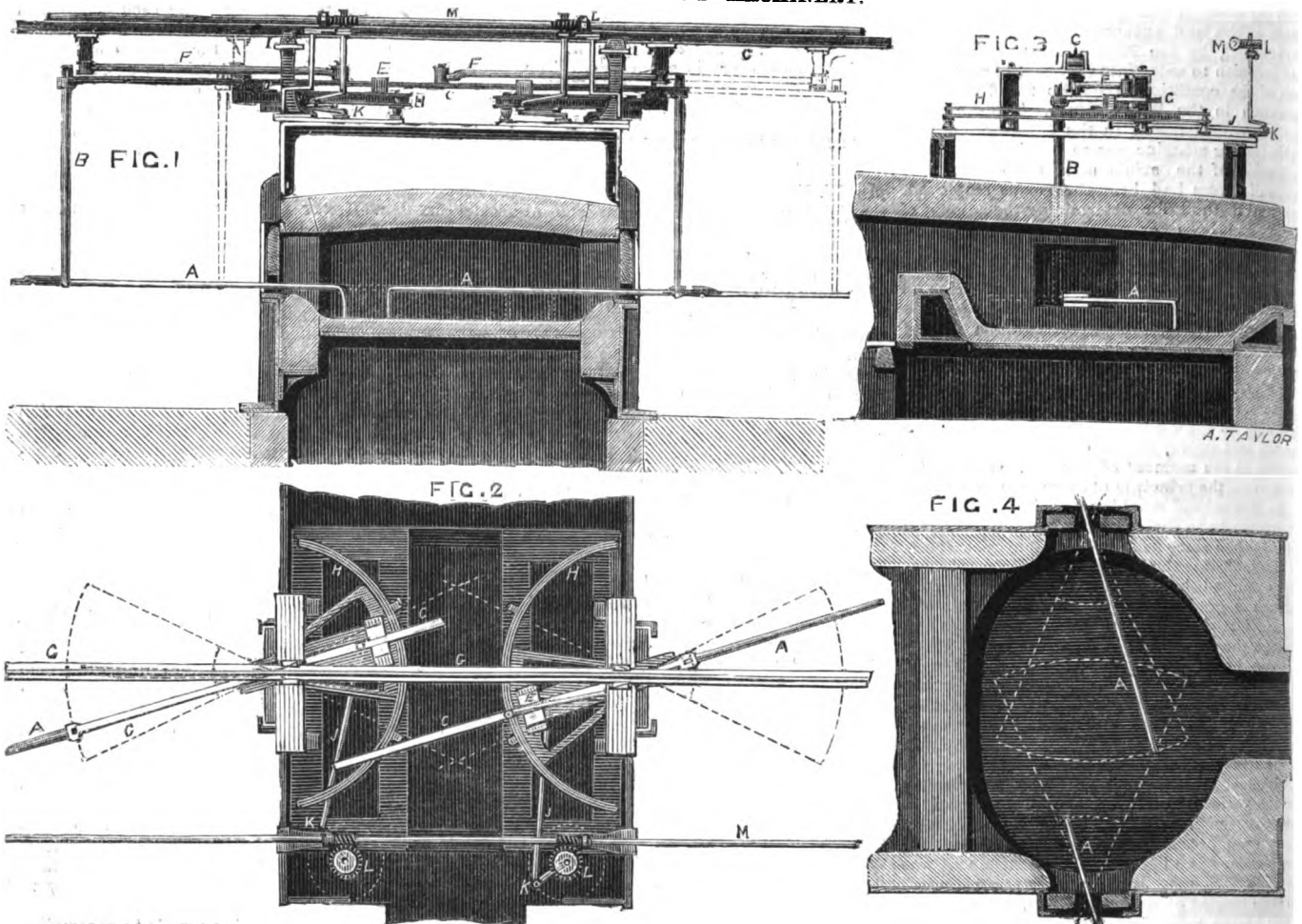
IN the manufacture of wrought iron from the crude pig iron, the purifying of the metal by the process of puddling involves very heavy and long continuous hand labour, since the metal, after being melted in the puddling furnace, has to be continuously stirred for a considerable time whilst boiling, in order to expose it thoroughly to the action of the current of air passing through the furnace, so as to effect the chemical changes required for the separation and removal of the impurities originally combined with the iron. The metal has then to be balled up into separate masses of about three quarters of a hundredweight each for the shingling hammer, and the whole process extends over about an hour from the time of melting the pig iron for each heat, of which six are worked in the day. The application of machinery to puddling has long been felt to be very desirable, on account of the laborious nature of the process, owing to the continuous heavy work required and the great heat to which the men are exposed, and the simple mechanical character of the greater portion of the process, which consists in merely a continuous uniform stirring of the material, renders it very suitable in that respect for the application of machinery. But the high temperature of the furnace and the necessity for not interfering with the current of air passing through it, which has to be regulated and changed as the process advances, cause great practical difficulties in successfully carrying out the application of machinery in place of hand labour.

Many attempts have been made to accomplish puddling by machinery. A rotary furnace has been tried, having the portion containing the melted iron made to revolve by machinery horizontally upon a vertical axis, with a scraper placed across it for stirring the metal as it revolved, the object being to effect the entire operation by machinery; but the practical difficulties in keeping such a machine at work and obtaining the proper result in the process were found too great to be surmounted. Various attempts have also been made to produce an action similar to that of the hand puddling process, by means of machinery more or less complicated, but it is important that any apparatus for the purpose should be simple in construction, and not liable to get out of order under the rough usage of the men by whom it has to be worked. In the plan to be described in the present paper, the object of the writer has been to adhere as closely as possible to the ordinary course of hand puddling, and to employ machinery simply to aid the puddler by relieving him of the most laborious part of the work, viz., the stirring or working of the metal in the puddling furnace. At the same time, the objects aimed at have been, by a more rapid and uninterrupted process of stirring the metal, to shorten the time of the puddling, thereby economising fuel; to improve the quality of the iron, by rendering the process more uniform and perfect than with hand labour; and to increase the yield of the furnace, by working larger charges than could be both puddled and balled up at one heat by hand labour alone.

The apparatus is shown in the accompanying engraving in figs. 1 to 4, which represent it as applied to a double puddling furnace worked from both sides. Fig. 1 is a transverse section of the furnace, fig. 2 a plan of the top of the furnace, showing the machinery, fig. 3 a longitudinal section of the furnace, and fig. 4 a sectional plan showing the area worked over by the machine. The ordinary puddling tool or "rabble" A A, fig. 1, is worked backwards and forwards in the puddling furnace by the vertical arm B B outside the furnace, to which it is connected by a notch in the handle of the rabble, dropped loosely upon a pin at the bottom of the working arm. This arm is cottered at top into

* Read before the Institution of Mechanical Engineers

PUDDLING IRON BY MACHINERY.



a horizontal square slide bar C C overhead, sliding longitudinally through two guide sockets D and E, and worked by the connecting rod F F from the main bar G G, which is a long T-iron bar extending horizontally across a whole row of puddling furnaces, being carried by rollers I I in the frame fixed upon each furnace; and a longitudinal reciprocating motion is given to it by a crank at one end driven by engine power. The guide frame or sector carrying the guide sockets D and E of the sliding bar C is centred on a vertical pin immediately over the door of the puddling furnace, and the outer end is moved transversely from side to side with a slow reciprocating traverse along the guiding quadrant H, fig. 2, by means of the connecting rod J from the crank K, which is driven through a worm wheel and screw L by the horizontal shaft M extending over the furnaces alongside the reciprocating bar G.

The main bar G, fig. 1, works at a speed of about fifty strokes per minute, and has a length of stroke of 2ft. 10in., carrying the rabble with the same length of stroke across the floor of the furnace, as shown by the two extreme positions in the transverse section, fig. 1, and the sectional plan, fig. 4. The transverse motion given by the crank K, which makes one revolution for every seventy strokes of the rabble, causes the direction of each stroke to change gradually between the two extremes of the guiding quadrant H, fig. 2, so that the end of the tool, instead of moving backwards and forwards always in the same line, is worked successively over every portion of the floor of the furnace within the range marked by the dotted lines on the plan, fig. 4, in lines radiating from the working hole in the door of the furnace, corresponding exactly to the action in hand puddling. In the double furnace, with a door on each side, the two traversing cranks K K are set at right angles to each other, so that the two rables are always working in different parts of the furnace. The whole of the machinery is kept clear above the furnace, outside, and completely protected from the heat, and quite out of the way of the men; nothing being exposed to the heat except the rabble or puddling tool, the same as in hand puddling. The double furnace shown in the engravings is exactly the same in construction in all respects as the

ordinary single puddling furnaces, except that it is made with a working door at each side, and is 1ft. wider inside.

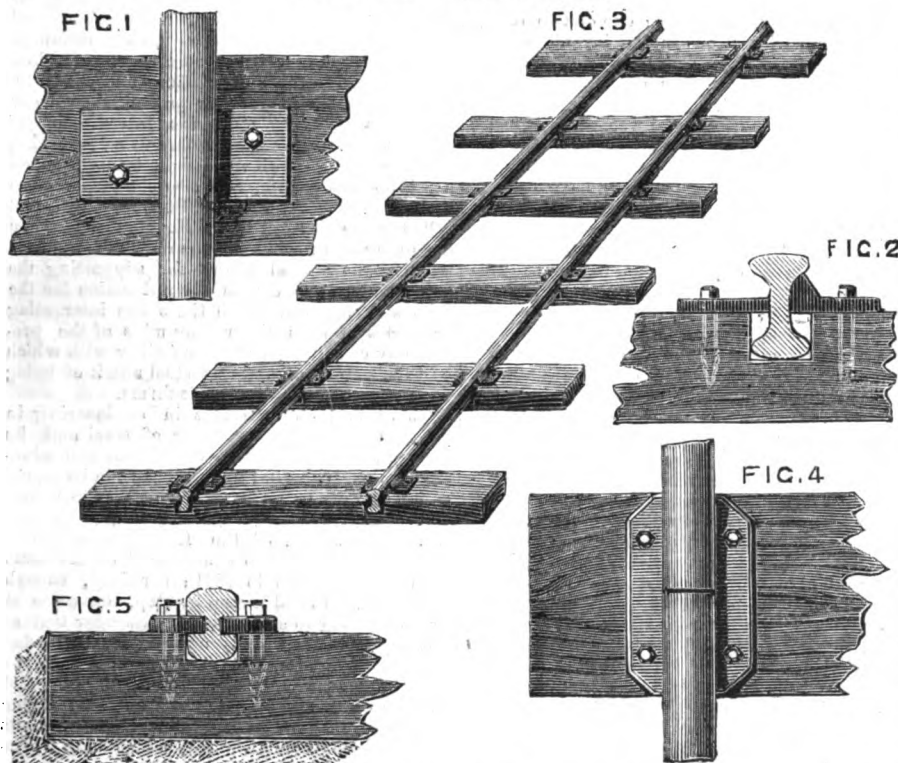
When the charge of pig iron is melted and ready for the commencement of the process of puddling, the apparatus is put into action by simply dropping the notch in the handle of the rabble A, fig. 1, on to the pin in the working arm B, which is kept continuously in motion by the horizontal reciprocating bar G working overhead. The puddler changes his tool from time to time as it becomes heated, by simply lifting the notch in the handle off the pin in the working arm, and replacing the tool with a fresh one, without stopping the machine, and when the iron begins to thicken, he takes the opportunity of each change of tool to make a few strokes by hand, in order to collect the metal from the extreme sides of the furnace into the centre, which is found to ensure the whole charge being uniformly worked. The usual time of working with the machine is about twenty-five minutes with ordinary forge pig iron, the tool being changed five or six times; but with grey iron the time of working is much prolonged. In the latter case the machine is especially serviceable, since the iron keeps in a fluid state much longer, and requires consequently so much more working; which causes the labour to be so much more severe in the case of hand puddling that there is great difficulty in getting the men to work any iron that is very grey. With the machine, however, this causes no increase of labour to the men, and only increases the time of the process. When the iron begins to thicken, or as it is termed is "coming to nature," the machinery is disconnected without stopping it, by simply knocking out the cotter that fixes the upper end of the vertical working arm B, fig. 1; the arm then drops out, leaving the furnace door entirely clear for the puddler to ball up the iron, which is done exactly in the same manner as in ordinary puddling furnaces, without the man being in any way inconvenienced by the machinery continuing at work overhead.

The general objects aimed at in this puddling machine have been simplicity of construction and action, and small cost, both in construction and repair. The machine has nothing in it liable to get out of order, and possesses great dura-

bility in the working parts. Also, the object has been to improve the quality of the iron produced, by its being more thoroughly and uniformly worked than is done by hand labour. When the metal is in the boiling state, it is known that the more work is put into it the better is the quality of the iron produced, and this work is necessarily better done by the machine than it can be by hand, since the speed of working with the machine is one-half greater, and the working is kept up uninterruptedly, without any intervals for rest, such as in hand labour, during which the metal would remain stationary in the furnace. The machine is applied to ordinary single puddling furnaces by employing simply one-half of the apparatus shown in the engravings, without any alteration being required in the furnace, the frame of the apparatus being merely attached to the top of the furnace. The double furnace shown in the engravings is preferable however, as it effects a great economy in the consumption of fuel, as compared with a single furnace; and puddles double the quantity of iron in the same time. With the single furnaces at the writer's works, and charges of 5 cwt., the consumption of coal is 25 cwt. per ton of puddled bar made; but with the double furnace and charges of 10 cwt., the consumption of coal is only 17 cwt. per ton of puddled bar, being a reduction of 39 per cent. The number of heats or charges worked in the single furnace is six heats of 5 cwt. each, and in the double furnace five heats of 10 cwt. each, per turn of from nine to ten hours. In working the double furnace it is found best to have one puddler only and two under hands, to avoid the division of responsibility that would arise in the case of two puddlers working the same charge of iron. The yield of iron in working 5 cwt. charges in the single furnaces is 18 cwt. 2 qrs. 21lb. per ton of pig, or 93 per cent.; and with the double furnace working 10 cwt. charges the yield is 18 cwt. 2 qrs. 9lb. per ton of pig, or 93 per cent.

We learn that the Russian Government has lately given up the working of its gold mines in the Ural Mountains, and has arranged for them to be worked by private enterprise. The results of this change have been very remarkable. The quantity of metal extracted is now increased tenfold.

RAILS AND RAILBEARERS.



THE permanent way of railways has been the subject of a vast number of patents, some tending to complicate and others to simplify its character. Among the latter may be classed that of the late Mr. H. A. Jowett, whose improvements are effected as follow:—While the double-headed rail now in use for railways is hot, after having passed through the rolls, a longitudinal slot of 4in. or 4½in. in length by ½in. in depth is punched by a machine in the central web or thin portion of the rail, one slot at the distance of every wooden sleeper, say 3ft. apart, or as the engineer may direct, and when the slot is made, and while the iron is hot, a flat piece of cold wrought-iron plate of 9in. to 10in. in length by the width of the slot and ½in. in depth is driven in so that by the contraction of the rail on its becoming cold the inserted plate becomes a fixture, and answers the purpose of a foot or bearing surface, which should be spiked or bolted on each side of the plate into the wooden sleeper, and be in place of the cast-iron chair and wooden key or wedge now used for securing the rail. A groove is cut in the sleeper, also by a machine, transversely just the distance from the bottom of the rail to the under side of the iron plate, so that the bottom of the rail will rest in the groove cut in the sleeper as well as upon the bearing surface of the iron plate so spiked or bolted upon the sleeper as before described. The wrought-iron plate is rolled or made with a shoulder to fit up to the under side of the top head of the rail like a fishplate, and the shoulder side of each plate is placed on the right or left side of the rail alternately. The rail can rest on the sleeper, or be suspended at the option or discretion of the engineer. When the joints of two rails meet and rest upon a sleeper, the slot is punched in the end of each rail in a hot state as before mentioned, say 2in. or 2½in. long, and the iron plate is also made with a shoulder thereon to fit up to the under side of the top head of the rails so meeting together; the shoulder and the web of each rail are bolted through, thereby making a fish joint. The rail set in this way can be and is fished in the ordinary manner. A short trial length of this system of permanent way has been down on the London and South-Western Railway, for more than a year, the rail being fished in the ordinary way. It desired the shoulder may also be bolted through in all cases, that is to say, when they come intermediate of the length of the rails, as well as at the joints. In place of producing the holes or slots by punching the rails while hot, they may be punched, cut, or drilled when the rails are cold, and a wedge-shaped or a parallel piece of wrought-iron plate driven tightly in, a groove being cut in the sleeper to receive the rail with the plate and shoulder upon it, the fastenings being the same as before described, and

thus lines already in working operation may be altered, and chairs and keys dispensed with. In the accompanying engraving, fig. 1 represents a plan and fig. 2 a sectional elevation of the improved system of securing the rail on the sleeper by means of a plate in lieu of a chair. Fig. 3 is a perspective view of a length of way laid according to this arrangement.

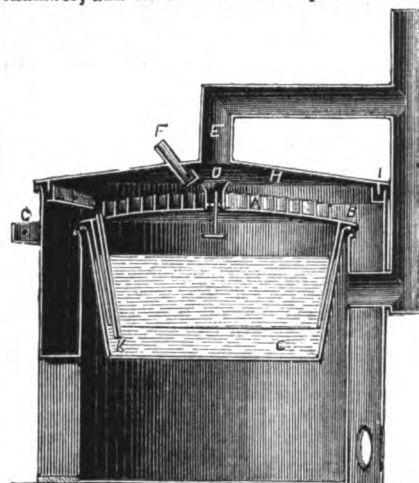
Another improvement in the construction of rails and bearers is shown in figs. 4 and 5, and consists chiefly in forming the rails with a rectangular groove upon the sides running from end to end, and in securing them in position by the use of plates or bearers, one edge of which is inserted into the grooves, the other end being secured to the sleepers, thereby dispensing with the use of the ordinary chairs and keys, and also in the mode of uniting the adjacent ends of the rails. In the engraving fig. 4 is a plan of the rail showing the method of securing it to the sleepers; and fig. 5 a section of the same. The width of the rail head is about the same as that of an ordinary double-headed rail, but in place of a wide web, the rail is rolled with a web about one inch in width. The inner sides of the flanges or heads are made at right angles to the web, forming therewith a rectangular groove or channel running from end to end of the rail on each side. The rails thus shaped are secured to the sleepers by inserting one edge of the plates or bearers into the grooves, and bolting or otherwise fixing the other edge of the plates to the sleepers, as shown in the engraving. A groove is formed in the sleeper to admit the lower flange or head of the rail, which comes nearly in contact with the bottom of the groove, and may, if found desirable, rest thereupon, and be partially or entirely supported thereby. The plates or bearers are inserted in the grooves on both sides of the rail, at suitable distances apart. Similar plates may be employed for coupling or fishing the rails.

Among the advantages of Mr. Jowett's system may be noticed its simplicity and readiness of adaptation to most forms of rails or sleepers. There is also great saving in first cost of plant, labour, and time. Economy and fewness of parts in laying are obtained, this system requiring only sleeper, rail, plate, and bolts; chairs, wedges, keys, &c., being entirely dispensed with. For shipment to the colonies, foreign countries, and for inland transportation, the Jowett system also offers advantages, inasmuch as the weight or measurement of plant is less by many tons per mile than that of most other systems. Mr. Chas. F. Dennet, of 18, Ladbrooke-square, Notting-hill, is the agent for working the above patents.

IMPROVED EVAPORATOR.

It is a well-known fact that sugar, in any form, submitted to a temperature of 400 deg. Fah.,

caramelises, i.e., turns brown; it is, in fact, fused and is no longer crystallisable; hence the absolute necessity of a low temperature to obtain the crystallisation of all the crystallisable matter in saccharine juices, and avoid molasses of a tarry appearance and nature. Another fact is, that where the pressure of the atmosphere is partly or wholly removed, evaporation is more active, and ebullition obtained at a much lower degree than 212 deg. Fah. Hence the application of a hot-air chamber, in this evaporator, gives evaporation in a comparative vacuum, thereby helping crystallisation in the case of saccharine matters, besides saving considerable time and fuel. This apparatus is the invention of Messrs. H. Kohly and J. Curtis, of Potosi, Mo. On reference to the engraving it will be seen that the evaporator proper consists of a scroll-shaped passage A, formed by metallic walls on the top of the case B, and a boiler C, wherein the chamber sets. This boiler is partly filled with water, and it is the steam from the water which supplies the requisite heat to evaporate the fluids contained in the channels A. The heat is prevented from getting too great by the safety valve D, inserted in the case B; it being well known that for certain pressures the steam has a certain degree of heat which this safety valve, therefore, regulates by rising when the pressure is too great. Through the pipe E, this steam escapes into the main flue, and this aids the draught in the furnace of the boiler before mentioned. The liquid to be vaporised is admitted through the pipe F, and discharged at G, and whatever moisture condenses on the roof H of the boiler flows down it to the joint I, which it fills and keeps tight, while any surplus falls into the trough J and returns through it and the pipe K to the boiler again. It is claimed for the action of the steam escaping through the valve D that it creates a partial vacuum in the evaporating chamber, and thus facilitates the process.



The various advantages of this apparatus are as follow:—Perfect regularity of the heat applied; impossibility of scorching the saccharine matters; a considerable saving of time in evaporation by a constant flow in and out uninterrupted; the absorption of moisture by the dry air, and the ebullition in a comparative vacuum. The apparatus can be made self-skimming, if required, avoiding thereby a very filthy and tedious work; a great economy of fuel, as every particle of waste heat from the whole apparatus can be turned to account, after it comes out of the evaporator, to warm the contents of the feeding tank or vat. The whole operation must, of necessity, be cleanly done; the apparatus being covered, no dust, flies, wasps, smoke, or other matters, can get access to it and spoil the contents. In naked fire evaporators it is not usual to start the fire before the cane mill. In this one it is quite different, and no matter how brisk the fire, it is impossible to injure the syrup. The apparatus can be applied to any ordinary small boiler, or to larger ones, by a slight alteration, viz., removing or putting a tight bottom under the rim below the volute channel, and forcing the steam by a hole in the side of the under rim. The apparatus is so simple and compact that it can hardly, if properly constructed, get out of order; it is light, and takes very little room when not in use, and is also very easy to clean. It can be applied equally to the evaporation of all saccharine matters, condensing of wine and cider, also to salt water, and many other uses in chemicco-industrial works.

ON THE MANUFACTURE OF CAST STEEL.

In section G British Association, Mr. Bessemer read a long and highly interesting paper "On the Manufacture of Cast Steel, its Purity, and Employment as a Substitute for Wrought Iron." The writer alluded to the paper read by him at the meeting of this Association at Cheltenham in 1856, and which created so much sensation at the time in the iron and steel trade; he illustrated by diagrams some of his early experiments, and pointed out the most prominent of the difficulties he encountered. Many forms of "converting vessels" were tried on the large scale before this desirable object was attained. In some of them the lining was too easily broken down by the violent motion of so heavy a fluid as iron; in some of the forms tried the angles allowed the metal to solidify in them, and so clog up the vessel; in others the mouth of the vessel being too small caused the metal to be thrown out by the force of the escaping blast; it was also found that if the mouth was too large the heat escaped so as to cause part of the converted metal to solidify in the vessel, the relative height and diameter of the vessel was also found to produce important differences in the working of the process; finally, after many long and expensive trials, a form of vessel was adopted, made in two parts, to admit easily of its being lined up with a pulverised silicious stone known as "garrester," which so resists the action of the heat and slags as to last for fully one hundred consecutive charges of steel before it is worn out. The form of the vessel was described—it is mounted on trunnions, supported on stout pedestals, so that a semi-rotary motion may be communicated to it at pleasure. In the fixed vessel first used any giving way of a few clay tuyeres would stop the process, and cause much inconvenience; but with the movable vessel it is not so, for at any movable time during the process the vessel may be turned on its axis, and the tuyeres raised above the level of the metal; the blast may then be turned off, the tuyere box opened, and the faulty tuyere stopped up or removed, after which the process may be again resumed. The movement of the vessel on its axis, the rise and fall of the casting crane, and the other cranes employed for removing ingots from the casting-pit are all effected by a simple hydraulic apparatus, so that the whole process is under the perfect control of a single operator, placed far away from the heat and showers of splashes that accompany the process. Up to this period the manufacture of cast steel by the old as well as the new process is still so far imperfect that steel of the highest quality cannot be made from inferior iron. In the old Sheffield process the original quality of the Swedish charcoal iron employed governs the quality of the cast steel made, consequently £36 per ton is freely given for the high class Demarrara iron, while other brands of Swedish charcoal iron may be bought for £15—in either case these are expensive raw materials for the cast-steel maker. The paper next referred to the important invention for the town of Sheffield made in 1839 by Josiah Marshall Heath, who patented that which he described as the "carbonet of manganese."

Allusion was made to the circumstances which followed the reading of the author's paper in 1856; to the great expectations formed by scientific and practical men; and to the fact that in less than twenty-five days immediately after the reading of the paper licences to manufacture malleable iron under the patent were purchased by ironmasters to the amount of £25,000. Great excitement took place in the iron trade, and there was a rush to the Patent Office, many persons coveting a share in an invention which seemed to promise so much. Several rough trials of the Bessemer process were made privately by persons in the iron trade, and defects discovered which were supposed by practical men to be perfectly fatal to the invention. Again the press teemed with accounts of the process, but this time it spoke only of its utter impracticability, and of regrets that the high expectations originally formed of it were so fallacious. That there were defects in the process the author had had irrefragable proofs; he set himself to work quietly to remedy them, and at the expiration of three years' incessant labour on the part of himself, and after an expenditure of more than £10,000, the process was again brought before the public. Not the slightest confidence in it was then manifested by the trade; it had been for years agreed on all sides that it was a total failure, and it was looked upon simply as a brilliant meteor that had suddenly flitted across the scientific horizon, leaving

the subject in more palpable darkness than before. This entire want of confidence on the part of the trade was most discouraging; one of two things became imperative—either the invention must be abandoned, or the writer must become a steel manufacturer. The latter alternative was unhesitatingly accepted, and Messrs. Bessemer and Co. determined to erect steel works at Sheffield, in the very heart of that stronghold of steel-making. At these works the process has since been successfully carried on; they have become a school where dozens of practical steel-makers received their first lessons in the new art, and are the germ from which the process has spread into every State in Europe, as well as to India and America. By the time the new works at Sheffield had got into practical operation the invention had sunk so low in public estimation that it was not thought worth paying the £50 stamp due at the expiration of three years on Mr. Mushet's large batch of manganese patents; they were consequently allowed to lapse and become public property. The author has, therefore, used without scruple any of these numerous patents for manganese without feeling an overwhelming sense of obligation to the patentees. At the suggestion of the author, works for the production of manganese alloys were erected by Mr. Henderson at Glasgow, who now makes a very pure alloy of iron and manganese, containing from 25 to 30 per cent. of the latter metal, and possessing many advantages over spiegel-eisen, which it will doubtless replace. Two bright rods of 1½ in. diam. were folded up cold under the hammer. This extremely tough metal is made by using Mr. Henderson's alloy in lieu of spiegel-eisen, which is incapable of making steel of such a quality. The invention of a Prussian named Preiger, in manufacturing a new alloy which had been found useful in making malleable iron by the Bessemer process, was next referred to.

The paper went on to state that the Bessemer cast steel made for ships' plates by the several eminent firms now engaged in that manufacture is of an extremely tough and ductile quality, while it possesses a degree of strength about double that of the inferior kind of iron plates usually employed in shipbuilding. Hence it is found that a much less weight of material may be employed, and at the same time a greater degree of strength may be given to all parts subjected to heavy strains. Most prominent among the builders of steel ships is the firm of Jones, Quiggin, and Co., of Liverpool, who have now constructed no less than 31,510 tons of shipping, wholly or partially built of steel. Of these, thirty-eight vessels are propelled by steam, with an aggregate of 5,910-horse power; besides this, the principal masts and spars of eighteen sailing ships have been made by them wholly of steel. Vessels of a large size constructed to Class A, twelve years, at Lloyd's, weigh when built of iron about 13 cwt. per ton measurement, whereas similar vessels built of steel weigh only about 7 cwt. per ton measurement; thus, an iron ship to take first class at Lloyd's for 1,000 tons measurement would weigh 260 tons more than a steel one of the same class. Such a vessel could, therefore, take 260 tons or 25 per cent. more freight at the same cost, or could avail herself of the difference of immersion to leave or enter port when the tide would not permit an iron vessel to do so. As a steamer she could carry 250 tons more of coal, and thus be enabled to lengthen her voyage or take her coal for the return trip. The two steel paddle-wheel steamers launched at Liverpool by M. Jones and Co. on the 13th ult., for Dublin and Liverpool service, will draw from 8 ft. to 4 ft. less water than iron steamers built on the same lines, and being thus enabled to leave port at all states of the tide will not require a tidal train in connection with them. If the employment of steel for the construction of merchant vessels is found to be so important, how much more so is it for ships of war? Some of the larger class of armour-plated vessels require 6,000 tons of iron for their construction, and an addition of 1,800 tons in the shape of 4½ in. armour-plates. Now if the frames and inner skin of such a vessel were constructed of steel, it would be much stronger, even if reduced to 4,000 tons in weight; this would admit of 9-in. armour-plates being used in lieu of 4½-in., and would still leave the vessel 200 tons lighter than the present ones; and, hence as the resistance of the armour to impact is as the square of the thickness of the plate, we should have a vessel capable of resisting four times the force of those at present constructed, while it would be 200

tons less in weight. These important facts have not escaped the attention of Mr. Reed, our present talented Constructor of the Navy, and doubtless we should soon have substantial proof of what may be effected by the employment of steel in the construction of ships of war. The application of steel for projectiles has now become a necessity since the introduction of armour-plates. We have before us a 110 lb. shot that has passed with very slight injury through a 5-in. armour-plate, and also some specimens of bent angle-iron, made of Bessemer steel, and rolled at the Millwall Ironworks, in London, and from the same works a portion of one of Hughes's patent hollow steel beams for supporting the armour-plating in course of construction for the forts at Cronstadt. Both these are interesting examples of what the rolling-mills of the present day can effect, and of the facility with which cast malleable iron and cast steel admit of being worked into the most difficult forms.

There is no department in engineering in which the peculiar toughness of steel and its strength and power of resisting wear and abrasion are of such vital importance as in its application to railway purposes. This fact had long since impressed itself strongly on the mind of Mr. Ramsbottom, of the London and North-Western Railway, who commenced experiments with this material in 1861; carefully, though trustingly, he tried it step by step, not even at first venturing to employ it for passenger trains; but as proofs of its safety and economy crowded themselves on him, he carefully applied it to the most important parts of passenger engines, and even to the manufacture of the formidable engine cranks (at that time entrusted only to the most eminent iron-making firms in the kingdom). These iron cranks are now being replaced by steel ones forged from a single mass. One of these cranks, manufactured at the new steel works at Crewe, has been obligingly lent by Mr. Ramsbottom as an illustration of the use of steel for this purpose. That gentleman has also taken out of use a plain steel axle that has run a distance of 112,516 miles, and now exhibits very slight signs of wear. The tires of wheels, on which so much of the public safety depends, were then tried, but the exact amount of difference between the endurance of wrought iron and Bessemer steel for this purpose is not yet ascertained, as none of these steel tires are yet worn out: but enough has been shown to prove the advantage of entirely replacing iron by steel for this purpose. In order to show how a steel tire will resist the most violent attempts to produce fracture, an example is given of a steel tire manufactured by Messrs. Bessemer and Co., of Sheffield. It was placed on edge under a six-ton steam hammer and subjected to a series of powerful blows until it assumed its present form, that of a figure of 8, a degree of violence immensely more than it could ever be subjected to in practice. These tires are made without weld or joint, by forging them from a square ingot, partly under the improved plan invented by Mr. Ramsbottom, and partly by an improved mode of flanging and rolling, invented by Mr. Allen, of the Bessemer Steel Works, Sheffield. So important were found to be the advantages of employing cast steel as a substitute for wrought iron at the works of the London and North-Western Railway Company, that the directors, acting under the advice of their able engineer, determined on building large steel works at Crewe, which are now in active and successful operation. In the design and arrangement of their plant for working up the steel several important improvements have been introduced by Mr. Ramsbottom; among others his duplex hammer, which strikes a blow on both sides of the ingot at once in a horizontal direction, and thus renders unnecessary the enormous foundations required for ordinary hammers. Here also he has put up his improved rolling mill for rolling blooms of large size, the enormous machine being reversed with the greatest rapidity and ease by the attendant without any shock or concussion whatever. While matters were thus steadily progressing in the engine department of the company, the engineer of the permanent way, Mr. Woodhouse, took in hand a thorough investigation of a no less important problem—viz., the substitution of cast steel for wrought-iron railway bars. For this purpose some 500 tons of rails were made and put down at various stations where the traffic was considerable, so as to arrive at the earliest period at a true comparison of the respective endurance of wrought-iron and cast steel rails. It will be unnecessary here to enter into the numerous details of the extensive

series of experiments systematically carried out by Mr. Woodhouse, since the trials made at Camden will suffice to show the extraordinary endurance of steel rails. It is supposed that there is not one spot on any railway in Europe where the amount of traffic equals that at the Chalk-farm Bridge at Camden Town; at this spot there is a narrow throat in the line, from which converges the whole system of rails employed at the London termini of this great railway. Here all passenger, goods, and coal traffic has to pass. Here also the making up of trains and shunting of carriages are continually going on. At this particular spot two steel rails were fixed on the 2nd of May, 1862, on one side of the line, and two new iron rails were on the same day placed precisely opposite to them, so that no engine or carriage could pass over the iron rails without passing over the steel ones also. When the iron rails became too much worn to be any longer safe for the passage of trains they were turned the other way upwards, and when the second side of the iron rails was worn as far as the safety of the traffic would allow, the worn-out rail was replaced by a new iron one, the same process being repeated as often as was found necessary. Thus we find at the date of the last report on March 1, 1865, that seven rails have been entirely worn out on both faces; since then another rail has been worn out up to July, making sixteen faces worn out, the seventeenth face being in use on August 22nd, when the steel rail was taken up in the presence of the writer. The first face of the rail only has been used, and this is now become much thinner than it was originally, but in the opinion of the platelayers is still capable of wearing out another half-dozen faces; taking its resisting powers at three more faces only, it will show an endurance of 20 to 1 in favour of steel. Mr. Woodhouse has ascertained by careful and continued testing of twenty-four hours at a time that an average of 8,082 engines, tenders, or carriages, pass over the steel rails every twenty-four hours, equal to 16,164 wheels every day for 1,207 days, making a total of 9,754,974 wheels passed over the rail. Subject to this excessive wear the rail appears to have been reduced 7½ lb. per yard, hence for every grain in weight of steel lost by abrasion no less than 371 wheels had to pass over it. Another steel rail, put down also in May, 1862, at a place much less subject to wear, has had four faces of iron rails worn out opposite to it, and still appears as if very little used. An iron rail wears out by the giving way at various parts of the imperfectly-welded mass, and not by the gradual loss of particles of metal, as in the case of the steel rail, which no amount of wear and tear seems capable of disjoining. It must be borne in mind that this enormous endurance of cast steel is not owing to its hardness or brittleness, as some have supposed, for, in fact, Bessemer steel possesses an extreme degree of toughness. There is before the meeting an example of this fact. One of the same quality of steel rails was attached at one end to the main driving shaft of a steam engine so as to twist it while cold into a long spiral measuring 9ft. in length at top and bottom, and only 6ft. if measured along the centre of the web. A single glance of this spiral rail will, it is presumed, dispel any idea of brittleness that may have been entertained.

Cast steel is now being used as a substitute for iron to a great and rapidly-increasing extent. The jury reports of the International Exhibition of 1851 show that the entire production of steel of all kinds in Sheffield was at that period 35,000 tons annually, of which about 18,000 tons were cast steel, equal to 346 tons per week; the few other small cast-steel works in the country would probably bring up this quantity to 400 tons per week as the entire production of cast steel in Great Britain. The jury report also states that an ingot of steel called the "monster ingot," weighing 24 cwt., was exhibited by Messrs. Turpin, and was supposed to be the largest mass of steel ever manufactured in England. Since that date a great change has been made, for the largest Bessemer apparatus at present erected in Sheffield—at the works of Messrs. John Brown and Co.—is capable of producing with ease every four hours a mass of cast steel weighing 24 tons, being 20 times larger than the "monster ingot" of 1851. There are now seventeen extensive Bessemer steel works in Great Britain. At the works of the Barrow Steel Company 1,200 tons per week of finished steel can easily be turned out, and when their new converting house,

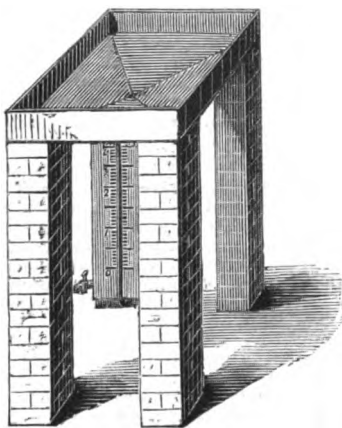
containing 12 more 5-ton converters, is completed, these magnificent works will be capable of producing weekly from 2,000 to 2,400 tons of cast steel. There are at present erected and in course of erection in England no less than 60 converting vessels, each capable of producing from 3 to 10 tons at a single charge. When in regular operation these vessels are capable of producing fully 6,000 tons of steel weekly, or equal to 15 times the entire production of cast steel in Great Britain before the introduction of the Bessemer process. The average selling price of this steel is at least £20 per ton below the average price at which cast steel was sold at the period mentioned. With the present means of production, therefore, a saving of no less than £6,240,000 per annum may be effected in Great Britain alone, even in this infant state of the Bessemer steel manufacture.

Correspondence.

RAIN GAUGES.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—On reading your article on "Rain Gauges" it occurred to me to bring before your notice a form of gauge which I used for several years, and which proved to me more satisfactory than any of the numerous varieties procurable from instrument makers and others; the accompanying is a sketch of my gauge. It consists of a square box of zinc



accurately made 3ft. square, 6in. deep, and sloping towards the centre. It is supported on four brick piers 5ft. from the ground. At the centre and underneath, is a square zinc box bearing a certain proportion, which may be arbitrary, to the area of the receiving box. Outside this long lower box, and bending into it at the bottom, is placed the tube of a mountain barometer. This is inserted on one side, and on another is a small cock to let off the water. A certain point or zero is kept with water up to it. Outside the long box and across it gradations of inches, tenths, and hundredths are drawn with black paint. Thousandths may be drawn, but are more easily estimated. I am satisfied that the small gauges give rise to very erroneous conclusions.

Yours obediently,

September 11.

A.

THE CIGAR VESSEL.

SIR,—Your correspondent, Mr. Kennedy, says, "there is nothing in the form of the cigar vessel to resist a roll." May I ask, if that is of any consequence, when there is nothing in the form of the vessel to induce a roll? It appears to me that the cigar ship, in virtue of its circular section, will lie along the slope of a wave, without the slightest tendency to roll, and that, theoretically, the small quantity of ballast will be sufficient to keep its beam level.

Yours, &c.,

Edinburgh, Sept. 9.

ROBERT AYTOUN.

TO CORRESPONDENTS.

The MECHANICS' MAGAZINE is sent post-free to subscribers of £1 la. 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 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, not necessarily for insertion, but as a proof of good faith.—Ed. M. M.

RECEIVED.—A.—J. H. S.—G. B.—J. K.—J. A.—H. S. E.—R. W.—F. J.—A.—C. E.—O. F. D.
ANSWERED BY POST.—C. J. R.—C. D. A.—R. A.—F. G.—W. W.

Miscellaneous.

In our issue for March the 3rd last, we printed a letter from Mr. Walter Power, of the School of Mines, upon Schönbein's supposed separation of oxygen into two distinct bodies—ozone and autozone. This question has recently been discussed, and it appears that the statement in the letter above referred to is incorrect. In a letter to the *Times* Mr. Richard B. Prosser states that Schönbein has not succeeded in isolating autozone, nor has he ever asserted that he had isolated either or both of the constituent principles, viz., ozone and autozone, of which he believes oxygen to be composed.

We have received another letter upon the subject of Messrs. Wheeler and Gloyne's patent for utilising the slag of smelting furnaces. M. J. Aubé, of the Forges d'Herseurange, par Longwy, Moselle, writes to say that he has used the slag produced by seven iron blast furnaces on the above works, for every purpose named in Wheeler and Gloyne's patent, with the exception of tooth powder and soap, for many years past, and that he has a ready sale for all he can produce at the works, in the shape of sand for cement, building, and road purposes, at four francs per cubic metre.

Referring to the paragraph in our last issue describing a method of ventilating sewers devised by M. Robinet, Mr. Richard Willatt, of Church-road, Homerton, writes us to say that in the autumn of 1848 he submitted a similar plan to the Commissioners of Sewers for the City of London. He states that the principal point of his invention was the compulsory use by all large furnaces, boilers, &c., of air drawn from the sewers.

The consumption of the newly discovered illuminator and lubricator, petroleum, is increasing very rapidly, both at home and abroad. In 1862 Europe consumed 10,000,000 of gallons; in 1864 the importation had increased three hundred per cent., 30,000,000 of gallons being consumed there. And in 1866, it is estimated that 90,000,000 will be required. There is a brisk market for it the world over—Asia, Africa, South America, and the islands of the sea all calling for it.

The *Building News* states that plans have been prepared of a bridge which the Union Railway Company intend to throw across the Clyde from East Clyde-street on the north to Adelphi-street, Glasgow, on the south. The river will be spanned by five iron arches, besides which there will be one arch at either end, each of these being 75ft. in width. There are to be six piers in the river, constructed of cast-iron tubes, the diameter of each of which is to be 8ft. 4in. There will be two of these tubes at each pier. The elevation of the bridge above high water at spring tide is to be 29ft. East Clyde-street is also to be crossed with an arch, the span of which will be 65ft. 3in.; and an arch of similar dimensions will be thrown across Adelphi-street. The girders of the bridge are to be of wrought-iron lattice work. The length of the waterway of the present stone bridge at Stockwell-street is 366ft. at the high-water level; and the waterway of the Union Railway Bridge will be 368ft. in extent.

Mr. Crawshaw Bailey recently stated at a public meeting in South Wales that there were no less than 2,900 millions of tons of unworked coal in the Monmouthshire seams.

It appears that the American ironclads were provided with what are called "deck scrapers." These are machines for passing up through the deck from below nine-inch percussion shells, which are then exploded and sweep everything overboard. They were tried on the "Dictator" with wooden men, and the force of the explosion tumbled everything on deck into the sea, and a fragment of shell cut the chain cable in two. An American contemporary observes that this is a fact for the English papers, which proposed to capture Yankee ironclads by boarding.

At the recent inauguration of Arago's statue at Estagel, M. Pereire in his address, before entering on the life of the great man, passed a splendid encomium on Michel Chevalier, whom he designated as one of the masters of economic science, whose life had been devoted to commercial liberty and to the benefit of the working classes. M. Pereire reminded his audience that as early as 1831 young M. Chevalier traced the network of railroads which now covers the face of Europe, and which he decided should all have a common terminus, the coast of the Mediterranean. This plan, carried into execution by M. Pereire and his brother, is now realised and in active operation.

Experiments have been made to show that the miasmata from putrefying substances may be rendered harmless by means of phenic acid, since it prevents or puts an end to spontaneous fermentation. A piece of perfectly fresh meat was placed within about two yards of one in a state of putrefaction. In eight days it was found merely to have begun to dry; the phenic acid had destroyed the miasmata, so that they were not transmitted by the air. It has been concluded, from these and similar results, that phenic acid is a powerful antipestilential agent, and it is considered extremely useful in places where cholera or other infectious maladies prevail. It appears, however, that this substance is not to be had from druggists or drysalers; perhaps some of our readers can inform us how or where it is to be obtained, otherwise the mere knowledge of its valuable uses is of no avail.

The Paris correspondent of the *Chemical News* observes that Dr. Burg, having noticed that workmen employed on copper are never attacked with cholera, suggests the employment of this metal as a prophylactic against, and as a remedy in case of an attack. With the first object, he applies the metal externally, in the form of a girdle. The metal must be in contact with the skin, and left there until a considerable amount of verdigris is formed, which must not be disturbed. A copper bandage, however, sometimes brings out an eruption, and even causes sickness. Should either happen the bandage may be discontinued and an ointment of verdigris, extract of belladonna, and lard, rubbed under the armpits and inside the thighs every night; or, instead of this, bathing in a solution of sulphate of copper every other day may do. In case of an attack Dr. Burg, recommends the use of all these methods together.

The following is a summary of the results of gun-powder explosions during the last ten years:—Nov. 15, 1855, French Siege Train, 92 lives lost; July 11, 1856, Salonica, 100; Nov. 15, 1857, Mayence, 25; March 30, 1859, Hounslow Powder Mills, 7; Aug. 6, 1859, Ballanclough Powder Mills, 5; Sept. 9, 1862, Powder Works near Bedruth, 5; Oct. 1, 1864, Erith Magazines, 10; Oct. 4, 1864, Powder Mills near St. Petersburg, 9; Nov. 7, 1864, Davington Powder Works, 2; Dec. 14, 1864, Her Majesty's ship "Bombay," 91; Jan. 18, 1865, Peninsular and Oriental steamer "Rangoon," 2; May 24, 1865, Magazine at Mobile, 300—total, 648.

The definite magnetic effect of an electrical current was the discovery of Oersted in 1819; Cooke and Wheatstone's patent for an electric telegraph is dated in 1837; the first message across the Atlantic was delivered in 1858.

It has been determined by Government that the principal lines of railway in India are to have double lines, and that the Great Indian Peninsula Railway, as far as Jubbulpore, will forthwith be constructed in that way.

The discovery of a coal mine at Caterina, a bay about thirty miles from Salonica, has just been announced. The coal is said to be superior to that of Cardiff, and it can be put on board vessels at Caterina for 8s. the ton.

According to the *Moniteur* the European powers which signed the treaty of 1856 have at last come to an understanding for improving the Sulina mouth of the Danube. The English government at first thought that St. George's mouth would be the best if it could be rendered navigable; but the expense it found would be too great, and it joined France in proposing the Sulina. The proposition has been accepted by the other powers, and a convention is to be signed as soon as certain matters of form can be settled. The improvement of the Sulina will be of great advantage to the maritime commerce of all nations.

On Thursday week an iron screw steamer, to be barque rigged, was launched from the building yard of M. Pearse and Co., on the north shore of the Tees. The following are the dimensions:—Length over all, 355ft. 6in.; breadth, 42ft.; depth of hold, 28ft. 6in.; tonnage, 2,845, 80.94. She is built for the British Steam Navigation Company, and is intended for the South American trade. She is called the *Chilian* and is the largest vessel built on the Tees.

An indelible black ink for writing on zinc, may be made by taking 30 parts of verdigris, 30 of sal-ammonia, 8 of lampblack, 8 of gum-arabic, and 300 of water. Dissolve the gum in water, and pour it over the other ingredients, well mixed and reduced to a powder. A quill pen should be used for writing.

The following curious results have just been published by a German who professes to have counted the hairs on the heads of four women of different complexions. On the head of the blonde there were 140,419 hairs; on that of the brown-haired woman, 109,440; on that of the black-haired, 102,963; and on that of the red-haired, 83,740. Although there was this disparity in the number of individual hairs, each crop was about the same weight. The average weight of a woman's hair is stated, on the same authority, to be 14oz.

Professor Thomson assigns to the sun's heat, supposing it to be maintained by the annihilation of masses of matter, a limit of 300,000 years; and to the period of cooling of the earth from universal fusion to its actual state 98,000,000 years. These are the lowest estimates sanctioned by any mathematician.

A series of experiments which were considered to be of a highly successful nature have been carried out at Woolwich dockyard to test the value of a new system of naval signal lights, invented by Messrs. Wilkinson and Haines.

Letters from Victoria, Vancouver's Island, state that telegraphic communication between New Westminster, the capital of British Columbia, and New York, has been open since last March, and has reached beyond Fort Yale on the Fraser River. A cable across the Straits of Fuca connects Vancouver's Island with her sister colony across the Gulf of Georgia, and brings the islanders within "speaking distance" of every State in the United States of America.

From America we learn that the war steamer "Fusiyama," of 1,000 tons burden, carrying a battery of one 100-pounder and three 30-pounder Parrotts, four 9-inch Dahlgrens, and four 20-pounder brass smoothbores—12 guns in all—will sail from New York for Japan at an early day. She is the first vessel built in America for the Japanese navy.

The autumn All-England ploughing matches commenced last week, during which three matches have taken place. At the Berkley and Thornbury Society's match the only competitors were Ransomes' ploughman Barker and Howards' veteran ploughman Brown, where Brown was defeated. At the great Sparkenhoe match, Barker met Brown again, also Howards' second crack ploughman Purser, and three other competitors holding ploughs of well-known makers, and was again the victor; while at the Kingscote match which took place on the same day as the Sparkenhoe, the champion prize was awarded to Colonel Kingscote's man, Baylis, holding a Ransomes plough. Thus the three first matches of the season have been won by men holding Ransomes' ploughs.

The American Magnesium Company of Boston have just commenced the manufacture of magnesium from dolomite or magnesian limestone by the Sonstadt method, and are producing the metal, both crude and refined, in considerable quantities. The principal use of this hitherto very rare metal is to burn for light. It is burned in the form of fine wire. The light is achromatic, intense, has good actinic properties, and is very penetrating. Hence colours can be distinguished as in sunlight; a wire a hundredth of an inch in diameter gives a light equal to seventy-four tallow candles, actinograms (ambrotypes and the like) can be taken as by daylight, and the light can be seen twenty-eight miles at sea. Its actinic power is shown by the fact that while its intensity is but 1-525th that of the sun at noon on November 13, its photographic power is 1-36th that of the sun. The heat it yields in burning is infinitesimal compared with gas, oil, or candles.

The German Arctic Exploring Expedition has suddenly and unexpectedly come to grief. Before the "Queen of the Isles" had proceeded to sea, her engines broke down a few miles below Cuxhaven. The mischief could not be remedied, and the expedition is given up for this year, as the needful repairs cannot be effected for at least a week or ten days; and as the season will then be so far advanced that the six months' night in the Arctic regions will have set in before they could reach Spitzbergen, it would be both useless and dangerous to be groping about in the dark in unknown seas. The promoters, however, nothing daunted by the result, intend to attempt to retrieve their bad luck by a second expedition early in the spring.

An imperial decree institutes a professorship of organic chemistry at the Collège de France, to which M. Berthelot has been appointed. A better choice it would have been impossible to make.

From the Clyde we learn that the "Arno," paddle, built and engined by Messrs. Caird and Co. for the West India Royal Mail Company, has gone into service. Messrs. Caird and Co. have closed a contract with the Norddeutscher Lloyd, of Bremen, for two sister steamers to the "Hermann;" the first is to be completed at the end of next year, and the second in the spring of 1867. The steamers will be each about 2,100 tons burden. The "Cisne," a twin screw of 330 tons, builders' measurement, has been launched by Messrs. Aitken and Mansel. The vessel has been built to the order of Captain A. Santos for trading on the River Plate, and will be fitted with engines of 60-horse power, by Messrs. James Aitken and Co., Cranston-hill. The "Limens," paddle, built and engined by Messrs. Randolph, Elder, and Co., with engines on the double cylinder principle, for the Pacific Steam Navigation Company, has made a run between St. Vincent and Montevideo, a distance of 3,686 nautical miles, in eleven days 20 hours, thus attaining an average speed of 12½ knots per hour, on a consumption of 24cwt. of coal per hour.

A meeting has recently been held in Liverpool at which it was agreed to form a Patent Law Reform Association, the object of which would be to collect evidence, to discuss, and by every legitimate means to promote improvements in, patent law, and in the mode of trying the validity of patents. Colonel Clay occupied the chair, and in opening the proceedings said the patent laws were in an unsatisfactory state, not only as regarded the interests of the patentees, but also as regarded the interests of the public. Certain steps had been from time to time taken with a view to obtain an amendment of the law, but they had failed, principally, he believed, because the matter had not been sufficiently brought under the notice of the public. The late Lord Chancellor acknowledged the necessity of some alteration being made, but intimated he thought action should be taken in the principal centres of industry to push the matter and have the subject discussed. About seventy gentlemen have promised to co-operate in the matter and a president and council have been appointed.

The *Oil News* states that a company, impatient of speculation, which we take to be trying to see things with the eyes shut, proposes to look with the eyes open, and has begun the sinking of a shaft at Petroleum Centre, for the purpose of going bodily down stairs and inspecting, if it can, nature's oil locker. This cellar way is of dimensions liberal enough to admit Falstaff, seven feet by fourteen, and is to be sunk below that precious place where so much money has been buried—"the third sand." The result of this exploration is awaited with curious interest, though when we consider the variety of locations and conditions wherein oil has been discovered, we can hardly see how they are to gain any portable knowledge unless they can carry the hole about with them. But, as the first direct inquiry of nature in broad daylight, it may, at least, possess a scientific value.

Gradually the smaller class of sailing vessels which have been so long lying idle at Chatham are disappearing, but a complete squadron of large vessels still remains, encumbering the entrance to the harbour, at what, from the character of the ships lying there, is termed "Rotten-row." Few, if any, of these will ever again be required for service, although each vessel yearly absorbs a considerable sum in the shape of wages.

The quantity of coal dug in Great Britain in the year 1864 appears by the returns of Mr. R. Hunt to have been 92,787,873 tons. This would yield, if employed in steam engines of good construction, an amount of available force about equal to that of the whole human race. But in the combustion of coal not less than ten times this amount of force is actually set free—nine-tenths being at present unavailable, according to the statement of Sir William Armstrong, in his address to the meeting at Newcastle in 1863.

Another earthquake has taken place at Trecastique, in Sicily. The inhabitants of the village made their escape while it was coming on, so no lives were lost. A fresh eruption has also been observed at Mount Etna, at the same place as that of 1852.

In a note presented to the Academy of Sciences by M. Damour on the minerals which have been employed for stone implements. The author describes a stone of which many implements have been formed, and to which he gives the name *Chloromelanite*. The stone appears to be black, but a thin section held up to the light is seen to be green. M. Damour regards it as a variety of jadeite in which a portion of alumina is replaced by ferrio-oxide. Implements of this stone have been found in various parts of France, in Mexico, and in New Granada, but the author knows of no locality in which the rock occurs.

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,—433
BUILDINGS AND BUILDING MATERIALS,—482, 499
CHEMISTRY AND PHOTOGRAPHY,—512
CULTIVATION OF THE SOIL, including agricultural implements and machines,—522
ELECTRICAL APPARATUS,—488
FIBROUS FABRICS, including machinery for treating flax, pulp, paper, &c.,—469, 490, 494, 503, 511, 517, 531
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals,—483, 502
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.,—484, 491, 498, 507, 508, 514, 528, 527, 529

GENERAL MACHINERY,—481, 492, 500, 523, 526, 532, 533
LIGHTING, HEATING, AND VENTILATING,—528
METALS, including apparatus for their manufacture,—534
MISCELLANEOUS—496, 495, 497, 505
ROADS AND VEHICLES, including railway plant and car-
riages, saddlery, and harness, &c.,—487, 504, 513, 520,
530
SHIPS AND BOATS, including their fittings,—509, 510, 524
STEAM ENGINES, &c.,—485, 496, 501, 516, 521
WARFARE,—506, 515, 518, 519

481 R. WILLISON. *Improvements in mashing machines and in apparatus connected therewith.* Dated February 21, 1865.

The patentee claims, first, the construction of self acting mashing machines by employing the weight or gravity of the malt, grist, or other materials, and the weight, gravity, or pressure of the water, liquor, or liquids for propelling the mixing paddles and various parts of the machines, as set forth and described with reference to the drawings. Second, making the paddles or arms V-shaped, vandyked, or corrugated, as described and set forth with reference to the drawings. Third, the fixing of knives or bars bent, angled, or straight diametrically in the casings between the paddles or arms, as described. Fourth, regulating the quantities of water, liquor, or liquids by means of a long tap, slide valve, stop, or sluice worked by means of hand wheels, rods, screws, or spindles, either single or double, and geared together by means of wheels or pinions, or by ratchets and pins, racks, levers, and rods, and with graduated scale or scales and index pointer or pointers to the same. Fifth, regulating the quantities of malt, grist, or other material by means of a shut slide or stop plate worked by means of a hand wheel or hand wheels, pinion or pinions, levers, pins, rods, and ratchets, and having a scale or scales with index pointer or pointers to the same, as described. Sixth, mounting a second stopcock or valve on the water or liquor pipe, independent of the regulating tap, slide valve, or sluice, and in mounting a second shut slide or stop plate in the malt or grist shoot or spout, independent of the regulating slide or stop plate, and connecting the second stopcock and second stop plate together in such manner that they shall be opened and shut simultaneously, as described. Seventh, the working of indexes, index pointers, or handles by worms or worm wheels, or quadrant, or ratchet and pinions, in combination with mashing machines. Eighth, the combination of the various improvements relating to mashing machines, as described. *Patent completed.*

492 W. HIRSH. *Certain improvements in sash fasteners, and which said fasteners are also applicable to other useful purposes.* Dated February 21, 1865.

This improved sash fastener has for its object additional mechanical force in its construction, so that resistance may be better overcome and additional security afforded. In effecting this object the inventor fixes a quick-wormed screw in vertical ear on the front or principal plate, and on which screw is placed a traversing bar, which, when out of use, assumes a vertical or other position, but when in action is thrown back horizontally, and by turning the screw this bar traverses to and fro, and from the formation of the inner end and a graduated projection on the back sash plate the parts are engaged, and by continuing the revolution of the screw, the sash or other object to which it is applied will be raised or held in close contact. But for large sashes, and for extra security, he prefers using a right and left-handed worm with the thumb piece fixed in the middle, or at either of the ends, or actuated by other equivalent means. In this case two traversing bars would be required, the back plate being formed and arranged for the action or engagement of the additional traversing bar. *Patent abandoned.*

493 J. H. JOHNSON. *Improvements in machinery or apparatus for kneading or working dough.* (A communication.) Dated February 21, 1865.

This invention relates to a peculiar arrangement of machinery or apparatus for kneading or working dough intended to be made into bread, the essential feature of which is that the dough or paste has time to repose during the kneading operation, such operation being carried on progressively from end to end of the kneading trough, in lieu of the entire mass of dough being kneaded at one and the same time. In carrying out this invention it is proposed to employ revolving spiral or inclined blades or arms, which, during their rotation in the dough, are made to travel simultaneously to and fro from end to end of the kneading trough. This transverse motion may be produced by causing the boss of the blades to slide along a square shaft, or along a feather or keyway on a round shaft driven by a driving pulley and belt of its own, or by any convenient arrangement of gearing. An arm is made to grasp this boss, and through this arm works a screw shaft extending from end to end of the machine so that on imparting a rotary motion in one direction or the other to this shaft the arm will move along it, and will carry with it the blades from end to end of the trough. The screw shaft is rotated by any convenient arrangement of reversing gear, or by means of two driving pulleys brought into gear therewith alternately by a sliding clutch box, one of such pulleys being driven by a crossed strap so as to rotate in an opposite direction to the other. The sliding clutch may be operated upon by a stop attached to the traversing arm, thus making the machine itself reverse the motion of the screw spindle. A clutch lever is also employed for throwing the screw spindle out of action when required. *Patent completed.*

494 O. BAUON. *Improvements in machinery for sewing or uniting leather and other hard substances, particularly applicable to the manufacture of boots and shoes.* Dated February 21, 1865.

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

495 J. R. SWANN. *Improvements in steam engines.* Dated February 21, 1865.

In place of the slide valve usually employed the inventor applies at each end of the cylinder of a steam engine a pair of rotating valves, one for the admission and the other for the exit of the steam. These valves are hollow cones fitted in suitable cases; each cone has a passage through it on one side, and there is a corresponding passage in the case; when these passages are brought to correspond with each other the steam passes from the interior of the cone outwardly through the case. The valves are caused to revolve continuously in one direction by spur gear or otherwise. From the exit valves the steam passes into a casing which surrounds the cylinder, and thence away; thus the

cylinder is steam-jacketed. The piston he constructs in the following manner:—He employs two split packing rings with covering plates at the top and bottom, and he makes passages through the covering plates to admit the steam to the back of the packing rings, which are thus expanded and caused to press firmly against the sides of the cylinder. *Patent abandoned.*

496 W. E. NEWTON. *Improvements in apparatus for extracting liquid from solid substances.* (A communication.) Dated February 21, 1865.

This invention relates to an apparatus which is particularly intended for extracting oil from paraffine, but which also can be made for making extracts of any other material. The invention consists in subjecting the crude material from which the extract is to be obtained to the pressure of the atmosphere by placing it in a tank with a perforated false bottom, and forming underneath such bottom a more or less perfect vacuum. The means employed for producing the vacuum are of different kinds, and can be varied as may be convenient. *Patent completed.*

497 E. JESURUM. *Improvements in machinery for stopping railway trains.* (A communication.) Dated February 22, 1865.

In carrying out this invention the patentee applies to each carriage levers or arms which are hinged or jointed to the under side of the frame, and each lever at its lower end carries a small elliptical wheel mounted on an axis. When the train is travelling these levers or arms are carried in an inclined position, but should it become necessary to stop the train suddenly the levers or arms are allowed to fall till the small elliptical wheels come down on the rails; the levers or arms then immediately become vertical, and the carriage is lifted off the ordinary running wheels. The carriage is then supported on the elliptical wheels on which it runs, until in a very short time the forward motion is absorbed in the short up-and-down motions which the running of the elliptical wheels imparts to the carriages of the train. *Patent abandoned.*

498 O. V. and A. O. WALKER. *Improvements in the construction of electro-magnetic apparatus for railway signalling and other purposes.* Dated February 22, 1865.

This invention consists in using one and the same electro-magnet to move an index into either of two positions, in either case locking or securing it in the position into which it is moved, and by the action of the same electro-magnet at the same time to strike a bell or gong, or not, as may be required, the twofold or threefold operations being effected by a single current of electricity of momentary duration, and for railway signalling purposes requiring only one telegraph wire for two (up and down) lines of a railway. *Patent completed.*

499 J. KNIGHTLEY and R. SHEPARD. *Improvements in circular box looms.* Dated February 22, 1865.

This invention relates to means or apparatus for operating the "clicks" or "catches" which are attached by means of pins to one end of what are technically termed the "pulling levers," to the other extremity of which are also attached the "pulling catches" for actuating the circular revolving shuttle box, in order to produce any desired change in the colour of the web employed, the chief object being to obtain greater simplicity in detail and certainty of action. For this purpose, instead of the ordinary levers, card pins, and connecting rods, the patentees employ a bell-cranked lever or levers, having its fulcrum, or their fulcrum, upon a stud made fast to the framing of the loom; the ends of the bell-cranked levers are placed in suitable guides or brackets from the main framing of the loom. In the bracket or guide placed immediately over the card cylinder of the Jacquard apparatus are the pins which operate these levers. These pins are formed with heads, and are capable of rising and falling freely, and are entirely disconnected from the bell-cranked levers. One end of each of these bell-cranked levers rests upon one of the pins (there being one pin for each of the levers employed), and as the cards of the Jacquard apparatus are brought in contact with one or other of these pins, it is thereby caused to rise vertically, giving motion simultaneously to one or other of the bell-cranked levers, and in consequence of the opposite end of the bell-cranked levers being in contact with the clicks or catches of the pulling levers, one or other of these catches is brought into position to be raised by the cam or tappet levers, as may be required by the pattern being woven. *Patent completed.*

490 J. MALLISON. *An improved method of treating yarns or threads previous to the processes of dyeing and dressing.* Dated February 22, 1865.

This invention is designed for the purpose of preparing yarns or threads so as to render them fit for use in that description of machines described in the specification of letters patent granted to H. Cooke (No. 576) in the year 1856, and in similar machines which have not hitherto been quite successful from the want of such method of treating the yarn. The improved method relates to the mordanting of the yarns or threads, and consists in passing the yarn or threads from the "warper's beam" (that is, in a wide or laterally distended state) through a trough or troughs containing any suitable mordant such as sumach, catechu, or other suitable substance containing tannin, and on to another beam, or from a series of beams on to a corresponding number of beams (or from hobbins on to a beam); after passing through squeezing rollers they may be allowed to remain in a partially wet state to absorb as much of the remaining mordant as possible; or they may be passed very slowly through the mordant troughs to ensure thorough saturation. The yarns or threads having been thus mordanted in the "warper's beam" state, are then ready (without warping or winding) to be dyed, sized, and dressed in any machine which effects the processes simultaneously; or, if preferred, in separate machines. *Patent abandoned.*

491 I. PAHIENTE. *Certain improvements in scarfs, and in the manufacture of the same.* (A communication.) Dated February 22, 1865.

This invention relates to the description of scarf principally worn in Africa, Turkey, and other Eastern countries, usually made of fine soft worsted warp and woollen weft, and woven as an open single-twilled cloth. The improvements consist in manufacturing the said scarfs with worsted warp hard twisted and fine wool weft, and, in the weaving, the body or the middle portion of the scarf is to be woven in a close fine hold twill, in the method known as diagonal, and the borders or side extremities of the scarf are to be woven double with twill stripes or herring-bone twill, by which means the scarfs are rendered more durable. The ends of the scarf may either be left plain or faced, as it is

termed, with coloured stripes or borders and be made with fringes at both ends. *Patent completed.*

492 E. A. BROOMAN. *An improved mercurio-hydraulic motor.* (A communication.) Dated February 22, 1865.

This invention is based upon the property of mercury on account of its density, of imparting an ascensional power to water which passes through it. The inventor utilizes this ascensional power, which water in traversing mercury possesses, to cause a paddle or bucket wheel to rotate and thus obtain motive power. This invention consists in the employment in a vessel containing mercury of a bucket or paddle wheel, and in causing water to traverse or rise through this mercury, the pressure of the water being greater than that of the mercury and being derived from a reservoir on a higher level; the water in rising through the mercury forms a continuous jet, which acts upon the buckets of the wheel, part of which enters the mercury and produces rotary motion in the wheel. The motion may be taken from the shaft of the wheel to drive any machinery required. *Patent abandoned.*

493 J. HULLEY. *Improvements in boilers for heating water and delivering it at an equal temperature to any number of flow pipes, and also for the generation of steam.* Dated February 22, 1865.

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

494 J. DODGSON, J. GAUKROGER, and W. SHACKLETON. *Improvements in looms for weaving.* Dated February 22, 1865.

This invention relates to the letting-off motion in looms for weaving, and the improvements consist in arranging and applying parts or apparatus in combination with ordinary friction chains, straps or cords, levers or weights, to the warp beam in such manner that, as the quantity of yarn or warp on the beam is diminished, the pressure thereon becomes less in the same ratio or proportion, and thus the letting-off motion is rendered self-adjusting. *Patent completed.*

495 H. P. RISTON. *An improved fastener for envelopes.* Dated February 22, 1865.

This invention consists of an improved fastening to be applied to the flaps of envelopes. In carrying out this invention it is proposed to attach to the under flap of an envelope a small metal eyelet, a flat metal ring being secured to the outer flap so as to correspond to and close over the eyelet. This ring may either be concealed in the paper, or placed on the outside thereof, in which latter case it may be made of an ornamental character. The closing of the eyelet over the ring may be effected by means of a pair of pinners, a punch, or small hammer or mallet adapted for the purpose. *Patent abandoned.*

496 W. E. NEWTON. *A new and improved balanced slide valve.* (A communication.) Dated February 22, 1865.

The object of this invention is to balance the pressure of the steam on the back of a slide valve in such a manner that the same will work equally free under a pressure of a hundred pounds or more to the square inch as it does in the open atmosphere. This object is obtained by combining with the valve a small cylinder, in which works a piston, and through a series of interlocking levers, rockers, and links, the upward pressure of steam on the piston is made to counterbalance the downward pressure on the back of the valve, and the valve is therefore perfectly balanced. The bottom of the valve-chest forms the seat for the slide valve, and a reciprocating motion is imparted to this valve in the usual manner. *Patent abandoned.*

497 T. G. WEEB. *Improvements in the manufacture of ornamented articles of glass.* Dated February 22, 1865.

This invention consists in the production of ornamented articles of glass by combining the usual processes of blowing and pressing, ornamental designs being produced by the latter operation and attached to the article by the former. *Patent completed.*

498 J. CARTER. *Improvements in apparatus for ventilating hats.* Dated February 22, 1865.

For the purposes of this invention, when constructing a ventilating apparatus for a hat, a tube is used formed with a movable or fixed flange at one end, or it may be otherwise formed to facilitate its being attached to the crown of a hat. This tube is divided into two channels or compartments by a partition fixed longitudinally therein. The lower end of the tube is closed whilst the upper end is open, and there is an opening on each side of the tube near its opposite ends, through one of which hot air passes away out of the hat, and through the other cool air passes into the hat. In place of the tube having a longitudinal partition, two tubes may be used, one within the other, leaving a space between the inner and outer tubes. In this arrangement the outer tube has similar means for fastening it to the interior of a hat as are above mentioned. The air from the interior of the hat descends in one direction, whilst cool air descends in the other direction into the hat, or two tubes may be placed side by side. *Patent completed.*

499 G. N. SHORE. *Improvements in iron safes and strong rooms.* Dated February 22, 1865.

For the purposes of this invention, in constructing the framing and door of an iron safe or strong room, the angle around the door frame, against which the door usually shuts, is filled with hardened bars (by preference of tempered steel), and the surfaces of such bars, against which the door shuts, are made of a hollow curved form, whilst the edges of the door are made of a like convex transverse section, so that the edges of the door may fit correctly to the hardened surfaces against which they come. *Patent completed.*

500 J. NICHOLAS. *Improvements in producing oil and cokes from coal and slack.* Dated February 22, 1865.

This invention consists in a process of, and apparatus for, producing oil and cokes from coal and slack, which process admits of the condensable gaseous and aqueous vapours being condensed and collected in the same form in which they would be procured if the coal or slack were distilled simply in order to procure oil. The oven, chamber, or vessel in which the coal or slack is to be treated, may be of any convenient shape or size, and should be capable of being made steam tight, and on its crown or top have two apertures, one communicating with a condenser so arranged that the communication can be opened or shut at any time, the other aperture leading to the air, and also being capable of having its communication closed or opened at pleasure; the oven, chamber, or vessel should have a door for the purpose of charging and discharging, and should have draught holes at the sides, or in other convenient position. The chamber, oven, or vessel is charged in the usual manner for making

coke with coal or slack, the draught holes and all apertures being carefully closed with the exception of the aperture leading to the condenser, which is left open. The coal or slack is then heated to a temperature sufficiently high to disengage the oil and condensable products, which, as they are evolved, pass to the condenser, when they are condensed in the ordinary manner and there leave a mixture of coal oil and ammoniacal water; these are as usual separated the one from the other, and the oil, if necessary, may be purified. If the mass in the oven were at once drawn out it would be a soft coke; if a harder coke be wanted the aperture to the condenser is shut, and the other aperture opened, with a sufficient number of draught holes to produce proper combustion, after the manner of ordinary cooking ovens, and this combustion is allowed to continue until coke of the required hardness is produced. By these means the patentee produces coke suitable for all purposes for which coke is required, and he collects and condenses the gaseous and aqueous vapours. *Patent completed.*

501 M. P. W. BOULTRON. *Improvements in obtaining motive power from aeriform fluids and from liquids.* Dated February 22, 1865.

When it is desired to heat air or aeriform fluids in a close vessel under pressure, this may be done by forcing into the vessel heated matter in a state of fusion, which may be injected into the vessel in numerous small jets or streams. The matter thus employed may be a metal or metallic alloy in a state of fusion, or it may be some compound of a metal with non-metallic elements, such as metallic oxides, chlorides, fluorides, salts, such as carbonates, silicates, borates, and mixtures of such substances. The heated liquid may be made to flow in contact with plates, surfaces, or bodies surrounded by the aeriform fluid, which it is desired to heat, and may be made to pass through perforations in these. Also the aeriform fluid may be caused to pass through the heated liquid, receiving heat in its passage through it. The piston of the pump employed for forcing the heated liquid may be similar to that which the patentee described in the specification of a previous patent, as applicable to engines which are worked by heated gases. The valves employed may be kept cool in the interior by the passage through them of water or liquid. The exterior of the cylinder may be kept cool by water, the interior being separated from this by some substance which is a slow conductor of heat. This method of heating fluid may be employed for superheating steam. It may also be employed to heat aeriform fluid when used as in Stirling's air engine. In such a case, to prevent oxidation of material, the aeriform fluid employed may be some fluid other than atmospheric air, such as nitrogen or carbonic oxide. The following is a mode of employing heated aeriform fluid for the production of motive power:—Heated aeriform fluid which has been contained in a vessel under pressure is caused to issue in a constant stream or blast into a passage communicating with the air, acting like the blast in the chimney of a locomotive engine; it draws air or causes air to be forced into the passage. The cooler current of fluid thus created passes into a chamber, in which it creates pressure, and from this chamber the fluid passes to a cylinder in which it works a piston. Or it may work several pistons in several cylinders. *Patent completed.*

502 D. BARR. *Certain improvements in machinery for dressing fruit.* Dated February 22, 1865.

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

503 A. BARKER. *Certain improvements in looms for weaving.* Dated February 23, 1865.

This invention relates to a novel and peculiar arrangement of mechanism whereby the cloth or fabric is more regularly and evenly taken up throughout the entire length of the piece as it is woven than hitherto, by the employment of which the ordinary sand and cloth roller is dispensed with, one roller only being used, upon which the cloth accumulates during the weaving. The invention consists in the employment and use of a bowl pressing upon the fabric wound upon the said one roller, which bowl is secured to one end of a lever, the fulcrum of which is fixed to the cross-bar of the loom; to the opposite end of this lever a bell-crank lever is attached, which actuates a sliding pawl as the bowl in the aforesaid lever is depressed by the increasing diameter of the cloth roller; the bar or rod forming the support and fulcrum of such sliding pawl is attached to the slay, thus causing such pawl, as the slay vibrates, to act upon a fluted cone drum placed and secured outside the framing, and in connection with the gearing actuating the cloth roller. *Patent abandoned.*

504 G. SINGLAI. *Improvements in signalling between passengers and guard or driver in railway trains.* Dated February 23, 1865.

This invention consists in fitting to one end or to both ends of railway carriages, and on the outside thereof, two weighted wings or metal plates or discs, each of which is carried by a rod, the lower end of which is fastened by a bolt to the carriage, and on which it is free to turn; a metal loop within which the rod is passed limits the movement of the rod, and consequently of the signal plate, both inwards and outwards. Each rod is furnished with the chain, the inner end of which terminates in a ring. These rings are passed over the hinged tongue of a disengaging hook fixed at about the centre of the carriage and near the upper part thereof, and the tongue is secured to the body of the hook by a ring sliding down the hook and over the tongue; this last-named ring is attached to a chain passed over a pulley and carried inside the carriage along the roof on both sides to the end of the farthest compartment, so as to be within easy reach of every passenger in each compartment. Supposing a passenger desires to make a signal; he pulls the chain in the carriage, thereby raises the ring on the disengaging hook and lets free the hinged tongue; which falling, the signal rod chain-rings slip off, and the signal rods and plates, having nothing to retain them, fall outwards, and the plates show themselves beyond the line of the carriages on both sides. The patentee's wing signal may be fitted to the guard's van worked by a chain running through every carriage. *Patent completed.*

505 W. WESTBURY and T. WATKIN. *Certain improved means for holding, attaching, or suspending fancy articles as exposed in bazaars, show rooms, or shop windows for sale, as well as the providing of means for portably fitting or holding the price ticket to such articles, a modification of which arrangement is also applicable for holding and fitting papers or other purposes.* Dated February 23, 1865.

This invention consists in adapting hard-drawn wire, suitably bent and fashioned, so as to obtain an elastic and spring force of sufficient strength to retain large or small price tickets, or other notifications required to be temporarily held, attached, or applied to articles exposed in

bazaars, shops, and show rooms where fancy articles are generally displayed for exhibition or sale, such ticket or paper holders being likewise so fashioned as to be provided with the means of suspension as well as for holding the article to which the price ticket has reference; but in cases where such ticket holders are required for attachment to woven fabrics, the inventors purpose sharpening one end of the wire like an ordinary pin, by which it may puncture the fabric or hook on to it. *Patent abandoned.*

506 W. H. AUBIN. *Improvements in breech-loading fire-arms.* Dated February 23, 1865.

This invention relates to fire-arms of the kind commonly called drop-down or snap guns, that is, guns in which the barrels turn in a vertical plane on a joint at the fore end of the body, the open breech ends being raised at the false breech or break-off for loading and shut down, and firmly held against the said false breech or break-off during discharge. In order to fasten or lock the barrels the inventor employs a tumbler bolt, situated in a vertical slot in the break-off. The tumbler bolt is capable of motion in a vertical plane on a centre; it is carried by, and fitted into a bridge piece let into the back part of the break-off. The said bridge piece consists of a plate having two projecting parallel blocks upon it, between which blocks the tumbler bolt is situated, and in which it turns. That side of the tumbler bolt which is turned towards the barrels has a slot or recess made in its middle, the said recess dividing the tumbler bolt at that side into two curved tongues. When the barrels are shut down after the insertion of the cartridges, the bottom of the barrels strikes against the lower tongue of the tumbler bolt, causing the said tumbler bolt to turn upon its centre, and its upper tongue to enter a slot situated between the breech ends of the barrels made for its reception, the lower tongue receding as the tumbler bolt turns on its centre. On raising the barrels after discharge the bottom of the slot between the barrels strikes against the upper tongue of the tumbler bolt in the said slot, turning it upon its centre, and causing the said upper tongue to enter the recess in the break-off and permit the barrels to be raised. *Patent abandoned.*

507 S. WHITFIELD. *Improvements in locks or fastenings for safes or strong boxes.* Dated February 23, 1865.

The patent claims looking or fastening safes or strong boxes by means of screw bolts carried by the door of the safe or strong box, which said screw bolts are made to advance into, and retire from the sides of the safe or box by a screwing motion, or, in the case of double doors, from the edge of one door into the edge of the other door, the said screw bolts being used alone or in combination with plain or ordinary bolts, whether the said screw bolts have the requisite rotary motion transmitted to them from an axis carried by the mechanism of the lock, or by an independent axis. *Patent completed.*

508 W. S. MAPPIN. *Improvements in the manufacture of safes or strong boxes.* Dated February 23, 1865.

The patentee claims, firstly, making safes or strong boxes from plates of iron or steel having flanges or ribs on one side, and connecting or engaging the said plates together by means of the said flanges or ribs, essentially as described. Secondly, riveting together the parts of safes or strong boxes by means of rivets having flanges or enlargements at or near the middle of the shanks of the said rivets, the said flanges or enlargements preventing the rivets being driven out of the rivet holes, as described. *Patent completed.*

509 G. HASLETIME. *Improvements in naval ships, partly applicable to ships designed for the merchant service.* (A communication.) Dated February 23, 1865.

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

510 J. G. HUGHES. *An improved screw propeller and an improved application of the motive power to the propelling of boats and steam ships, applicable also to other purposes.* (A communication.) Dated February 23, 1865.

The documents relating to this invention cannot at present be seen, a petition having been lodged for an extension of time.

511 S. SAVILLE. *Improvements in separating wool from refuse, mixed fabrics, and materials.* Dated February 23, 1865.

This invention consists in submitting mixed fabrics or materials containing wool to the joint action of an acid and other substances which the patentee has found to possess a restraining effect, so as to prevent injury to the wool, and to preserve, or partially so, the dyed colours. The substances he has found to possess this property when added to the acid employed are alkalies, alkaline earths, and metals, or salts of these substances. *Patent completed.*

512 W. E. NEWTON. *An improved mode of preparing fertilising compounds or artificial manures.* (A communication.) Dated February 23, 1865.

The object of the present invention is to render the phosphoric acid contained in the phosphate of iron or of alumina, or of both, the phosphates occurring in a more or less pure state, such as blue clay, blue ironstone, vivianite, wavelite, the so-called festigo guano, el roque guano, navassa guano, or any other substance in which phosphate of iron or of alumina, or of both, may be found available for agricultural and other purposes. The processes by which this object can be accomplished consist in heating, roasting, melting, or boiling the ferruginous or aluminous phosphates with caustic lime, or carbonate or sulphate of lime, or any other substance containing lime as its base, so as to obtain a phosphate of lime which can be converted into superphosphate of lime by means of sulphuric acid, as is well known. A similar effect may be produced by heating, washing, melting, or boiling the phosphates with caustic, or carbonate or sulphate of soda or potash, or any other substance containing potash or soda as its base. *Patent completed.*

513 W. ROWE. *Improvements in the construction of buffers for railway carriages.* Dated February 23, 1865.

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

514 H. K. TAYLOR. *Improvements in the means and apparatus employed for protecting bullion, jewellery, or other valuable property contained in safes, from being stolen or damaged by fire.* Dated February 23, 1865.

For the purposes of this invention the inventor deposits the valuables which it is intended to protect in a case, box, or safe of suitable construction (by preference fireproof) mounted upon a truck or upon wheels or castors, so that it can be readily moved for convenience from place to place to have the valuables deposited therein. The door of this case or safe is then securely locked, and it is moved out upon its truck or wheels through the entrance to the ex-

terior of the building, where it is received upon inclines and conducted into another strong box, case, or safe, which may also be constructed of fireproof and burglarproof materials if desired. The door of the first-mentioned safe is first passed through the door into the external case or safe, and a strong bolt or staple on the door of the inner safe passes through an opening in the external case or safe, and is secured thereto by a padlock or other suitable fastening. The door of the external case or safe is then locked over the back of the inner safe, the upper part of the external case or safe being firmly secured to a chain of great strength which passes up over a pulley carried by a projecting bracket or support of adequate strength let into or affixed to the interior of the building. The chain by which the external case or safe is suspended then passes over another pulley, the axis of which is supported by the bracket or otherwise near the front wall of the building, the chain then passing downwards and around the barrel of a winch, on the axis of which there is a toothed wheel actuated by a pinion upon another axis, the external end of which axis is suitably formed for receiving the socket of a winch handle, by which arrangement of apparatus the external safe can be readily hoisted to such a height as may be considered desirable for safety, or out of the reach of being tampered with by burglars. Upon the axis of the barrel there is a ratchet wheel and pawl to arrest the downward movement of the safe when in the act of being raised, the pawl being readily released by a lever when required in the act of lowering. The exposed parts of the chain may be protected by passing through a stout iron tube. *Patent abandoned.*

515 A. and M. MEYER. *Improvements in preparing explosive compounds.* (A communication.) Dated February 23, 1865.

This invention relates, firstly, to the preparation of a fulminating salt in the following manner:—One part of quicksilver is to be dissolved in ten parts of nitric concentrated acid; when quite dissolved it is put into a basin or other vessel, heated by a spirit lamp or fire; when it begins to boil the inventors add twelve parts of alcohol (95 or 100 deg.), and the heat is continued until vapours rise from the vessel; this goes on for a little while, and they then put the basin in a larger vessel containing cold water; when cooled down a sediment is found at the bottom, consisting of a greyish powder; the water is run off, and the sediment washed with clean water until it seems perfectly clean. They then put the whole on a piece of filtering paper, and dry it, when it is ready to be used as hereafter mentioned; secondly, they prepare a mixture to be added to the fulminating salt. They take twenty parts of fine powder, one part of antimony, and two parts of refined saltpetre in powder. These materials are to be well mixed, and are ready then to be used as hereinafter mentioned; thirdly, in the final process for completing the fulminating mass they take five parts of the fulminating salt, one part of the powder mixture, and half a part of Roman cement; these parts are to be well mixed. They then add a small quantity of dissolved gum, just enough to make a paste, which is then ready for use. This must, when dry, be made waterproof by means of grease dissolved and applied with a fine brush. *Patent abandoned.*

516 J. JACOB and R. PILINGER. *Improvements in the method of, and apparatus for, generating steam.* Dated February 24, 1865.

This invention relates to an improved method of heating furnaces of various descriptions, steam boilers, and other apparatus, by means of gases burnt in combination with superheated steam made as dry as possible, and with either hot or cold air. *Patent completed.*

517 W. E. GEDOE. *An improved apparatus for shearing and burring all sorts of woven fabrics.* (A communication.) Dated February 24, 1865.

This invention consists of a square plane or cutting tool hollowed interiorly in the shape of a wide slot or mortise, the narrowest opening of which operates on the fabric by means of two steel blades, which are grooved or fluted on the face of the side fixed to the wood, such flutings being to the number of from ten to twenty-five to the half inch, according to the fineness of the fabric to be operated upon. These blades present a sharp and triangular toothing formed by a bevel on the side opposite the fluting; that is to say, that it is the bevel made on the flutings which forms the toothing. The blades are fixed on the small side of the plane, so that the teeth of one blade may be opposite to those of the other, leaving an interval of from three-sixteenths to a quarter of an inch between the blades, according to the fabric to be prepared, which interval forms a slot or opening through which the waste cuttings pass off. These blades are firmly fixed by means of screws to the wooden holders or bars forming the body of the tool or instrument. The thickness of the blades is about one-twelfth of an inch by from about one inch to one inch and a half in breadth, and the wood of the plane or instrument is from about three to five inches in breadth at its broadest part, and from two to three inches in thickness at the side, the length being variable according to the breadth of the woven fabric to be prepared. This "plane" is formed of two equal parts placed in juxtaposition by means of a pin or spindle at each end, and by a screw at each extremity, which serves to keep the two parts of the tool together. The part which operates on the woven fabric presents a convex surface, so as to facilitate contact of tool and fabric. The apparatus is arranged so as to be set in motion either by hand or by a to-and-fro motion obtained from any mechanical arrangement, or by a circular motion, in which latter case the toothed blades are mounted round a hollow cylinder in sufficient number for the work required. This latter arrangement is especially suitable for effecting the shearing and burring of fabrics (cloths for example), the nap or downy part of which must always be operated upon in the same direction. An iron or steel spindle, the two ends of which serve for crank pins, is passed longitudinally through and secured to this cylinder by cross bars or arms. *Patent completed.*

518 O. W. LANCASTER. *An improvement in cartridges for breech-loading guns.* Dated February 24, 1865.

This improvement consists in constructing central fire cartridges for breech-loading guns with a pin or stud projecting from the side thereof. This pin is simply for the purpose of indicating that there is a cartridge in the gun; it performs no part in firing the charge, but protrudes through a hole made for the purpose in the rear of the barrel or breech. *Patent completed.*

519 H. E. CLIFTON, S. MYERS, and A. HOFFMANN. *Improvements in cap carriers for fire-arms.* Dated February 24, 1865.

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

520 J. K. DONALD. *Improvements in the permanent way and rolling stock of railways.* Dated February 24, 1865.

This invention has for its object to reduce that wear and tear of the permanent way and rolling stock which is due to the jolting or irregular motion of the carriages. The jolting referred to is partly due to the want of continuity in the rails, and this defect is by that invention partly remedied by having the rail ends cut obliquely, so that before each wheel completely leaves one rail length it is partly supported by the next one. The defect is more completely remedied by rolling the rails in halves as though divided vertically and longitudinally. These half rails are bolted together with the joints on one side disposed between those on the other side, and the joints are also by preference cut obliquely. The inside longitudinal faces of the half rails may be made slightly concave towards each other so as to insure perfect contact at the top and bottom edges. *Patent abandoned.*

521 W. ORAM. *Certain improvements in hydraulic pumps in connection with engines of motive power.* Dated February 24, 1865.

This invention consists in arranging two pumps, one at each end of the steam cylinder and piston, and attaching the plunger of one pump to the cross head at the end of the piston rod, a forked connecting rod being employed between the cross head and the crank shaft, so that the pump may occupy the space between the forks, and in a direct line with the steam cylinder. The plunger of the other pump is to be attached to the end of an extended part of the piston rod passing through a stuffing-box in the opposite end of the cylinder, so that one steam cylinder and piston placed directly between the two pumps works them both. *Patent abandoned.*

522 J. HOWARD. *Improvements in steam engines, applicable to ploughing and other agricultural purposes.* Dated February 24, 1865.

In carrying out this invention the patentee adopts a transverse firebox which, in this instance, is situate midway of the length of the boiler, and he constructs a smoke box or flue at each end of the boiler, which smoke boxes he connects with the firebox by tubular flues running longitudinally of the boiler. The heated gases lead off from the smoke boxes to a central chimney, within which the steam dome is situate immediately above the firebox. From the upper part of this dome the steam is taken and conducted by a pipe or pipes through a heated flue to the cylinder or cylinders of the engine. *Patent completed.*

523 S. W. WORRIS. *Improvements in machinery for sawing wood.* Dated February 24, 1865.

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

524 J. SHORTRIDGE. *The making of chain cables, either of iron, shear steel, or cast steel, the links of which are without welds.* Dated February 24, 1865.

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

525 O. J. ROWE. *Improvements in portable, invalid, or bed tables.* Dated February 24, 1865.

In form, when expanded, a table constructed according to this invention somewhat resembles a miniature four-legged table, having four legs, one at each corner, two of which are at each end framed together in one piece, and hinged to the table top so as to fold flat to the under part thereof. A thumb screw inserted through the cross bar connecting each pair of legs serves the purpose of holding them either in the collapsed or extended position, as may be desired, in the one case screwing into a socket in the end frame in a horizontal position, in the other case in a similar socket, but with the screw in a vertical position. This table is made about 8 in. or 10 in. high, or it may be of other required height, and the patentee forms the top either a fixture to the framing, or it may be made movable and hinged so as to be raised in the manner of a writing slope. The slope surface may either extend over the whole area of the table top, or only partially, the other part being reserved for a flat table top. At this flat part he fits it with a drawer to contain stationery and writing materials, or it may be other articles. In like manner a permanent horizontal part of the top may be reserved at each end, and each furnished with a drawer. The slope part of the top is hinged at the lower edge, and furnished with a strut piece at the back taking into notches to regulate the incline, as usual in writing slopes; it also permits of laying it down flat, and at a level uniform with the table top. The slope is provided with a bead at the lower part when inclined to prevent papers slipping off, and with a finger lift and catch at the upper part to secure it in the downward position, and also to lift it when required. *Patent completed.*

526 J. HUNDT. *A new or improved instrument or apparatus for raising weights for moving heavy bodies and for other like purposes.* Dated February 24, 1865.

This instrument or apparatus consists of a cylindrical roller of a length equal to several times its diameter. At or about the middle of the roller, and in a plane at right angles to its axis, one or more arms or levers are fixed, by means of which a rotary motion may be given to the roller. An endless band or loop of cord is fixed at or about its middle to one or more of the arms or levers, and the opposite ends of the loops are fixed respectively to the body to be moved, and a fixed body. By giving a rotary motion to the roller by means of the arms or levers, the loop of cord is wound on the roller, and the said loop of cord shortened. The body to be moved is drawn in the required direction by the shortening of the loop. The winding of the loop takes place at its middle, and both halves of the loop are wound and shortened simultaneously. The arms or levers on the working of the instrument pass between the opposite sides of the loop, and the instrument may be fixed at any point by means of rings sliding loosely on the cord. By sliding one or more of these rings towards the roller, and passing it over the end of one of the arms or levers, the motion of the arm or lever is prevented, and the instrument fixed in the position to which it has been brought. The power of the instrument may be made greater or less by altering the ratio between the diameter of the roller and the length of the levers. The patentee makes the instrument or apparatus of wood or metal, or partly of wood and partly of metal. *Patent completed.*

527 W. WINTER. *Improvements in sewing machines.* Dated February 24, 1865.

This invention has reference to the feed motions of sewing machines, and has for its objects the simplification of such motions by direct action, as well as the obtaining of an option a right or left-handed "feed," that is to say,

machines made on this improved principle may have the carrying foot and feed wheel placed on either side of the needle subject to the nature of the work required. *Patent abandoned.*

528 J. NICHOLAS. *Improvements in converting coal oil into gas suitable for use as an illuminator.* Dated February 24, 1865.

In performing this invention the inventor produces the gas, by preference, by allowing a stream of the oil to come into contact with a heated surface capable of decomposing the oil into gas. He passes the stream of oil into a retort or other vessel heated to a full red heat; the gas thus obtained is first conducted either through the ordinary purifiers used in the purification of common coal gas, or into a gasometer direct. The gas may be burned by any of the modes at present used in the consumption of ordinary coal gas as an illumination. *Patent abandoned.*

529 J. BADCOCK. *Improvements in crinoline skirts, and in fastenings for the steels or hoops of the same.* Dated February 24, 1865.

In constructing crinoline skirts the patentee employs as heretofore hoops of thin steel, and in order to secure these to the fabric of the skirt he places on the hoops at distances apart buttons, which, in place of being made with ordinary shanks, are made with wide metal loops, and through these loops the steels are threaded before their ends are connected to form the hoops. In the fabric of the skirt he forms button holes at distances apart, one for each of the buttons; the hoops are then attached to the skirt simply by passing the buttons on the hoops through the button holes in the skirt. This arrangement allows the hoops to be readily detached from the fabric of the skirt when it requires washing. The hoops are capable of sliding through the loops or shanks of the buttons, so that they adjust themselves to the position of the button holes. This is an important feature of the arrangement, as without it there would be great difficulty in making the button holes exactly to correspond with the buttons. *Patent completed.*

530 G. SCORE. *Communicating with the guard of a railway train by means of a folding footboard.* Dated February 24, 1865.

This invention consists in the employment of a folding footboard extending beyond the carriage at each end, so as to enable the guard, by means of a wider footboard than is now used on railways, to pass from one end of the train to the other. At each end of the carriage the inventor provides a handle or lever, thereby enabling the guard, either with his hand or foot, to turn over the flap, and so pass along the train. A hand rail will be fixed on the side of each carriage, so that the guard will be enabled to pass and repass without danger. *Patent abandoned.*

531 E. P. H. GONDOUN. *Improvements in cotton gins.* (A communication.) Dated February 24, 1865.

The patentee claims, firstly, providing the surface of one or of both the ginning rollers of cotton gins with a series of endless annular or elliptical flutings, grooves, furrows, serrations, or incisions, situated parallel to each other in a slanting or oblique direction in respect to that of the axis of the roller. Secondly, the general arrangement and combination of parts. *Patent completed.*

532 T. ROUTLEDGE and T. RICHARDSON. *Improvements in the treatment and utilisation of certain products obtained in the manufacture of paper or paper stock.* Dated February 25, 1865.

The patentee claims, first, lixiviating the black balls obtained in the manufacture of alkali by means of the spent leys or waste liquors resulting from the boiling process of esparto or alfa grass, straw, or other fibrous substances. Second, the employment or use of the liquor obtained by the process last claimed in the process of boiling esparto, straw, and other fibrous material. Third, obtaining a ley or leys suitable for the treatment of esparto, straw, and other fibrous material, by boiling down the liquors resulting from the process firstly and secondly claimed, and afterwards destroying the organic matter therein by means of a red heat, and finally lixiviating the residuum, as described. Fourth, obtaining a substance which after lixiviation is suitable for leys for the treatment of esparto grass, straw, or other fibrous material, by concentrating or evaporating (to a pasty consistency) the spent leys or waste liquors resulting from the boiling process above claimed, and mixing the same with sulphate of soda, and then submitting the same to calcination as described. Fifth, the obtaining of a ley or leys suitable for the treatment of esparto grass, straw, or other fibrous material, by evaporating or concentrating to a pasty consistency the spent leys or waste liquors above claimed, and mixing the same with sulphate of soda, carbonate of lime, and coal, the ordinary materials of the black ball, and submitting the whole to what is known as the balling process, and then to lixiviation, as is well understood. *Patent completed.*

533 J. H. RAWLINS and J. CHAPPELL. *Improvements in machinery or apparatus used in the manufacture of paper.* Dated February 25, 1865.

This invention has for its object the simplifying the operation of couching paper from a revolving web of wire by contact therewith by dispensing with the cylinder of open or porous surface, described in the specification of a patent granted to the said H. Rawlins, dated the 21st day of January, 1862 (No. 157), as follows:—The patentees take the ordinary Fourdrinier paper machine, with its action reversed or otherwise, as may be most suitable, and depress the wire about the place where it approaches the couch rollers, and at the part where the wire is depressed they place a couch roller of any suitable size covered with the usual jacketing, or with a soft jacket of any elastic material, and run it in rigid bearings, and cause an endless web made of woollen cloth, or any other suitable material, to pass round and between the surface of the couch roller and the wire, when the pulp having parted with a portion of its fluid in passing thereto, and in the act of contact, adheres to the endless web of felt, and is conveyed upon it to be dried by any of the known processes. *Patent completed.*

534 F. CLAUDET. *Improvements in the preparation of certain iron ores or residues for use in the blast furnaces.* Dated February 25, 1865.

Various attempts have been made with a view to aggregate the pulverised residue from ordinary iron pyrites by means of clay and water, and moulding the pasty mixture in the form of blocks or bricks, but they have failed owing to a want of consistence in the bricks when dried, and also to the large proportion of useless matter introduced. By this invention the patentee proposes to remedy these defects

by availing himself of the property possessed by hydraulic cements (such, for instance, as Portland cement or Roman cement when mixed in small proportions with the moistened residues) of forming a body, which, after strong compression and a few days' exposure to the air, becomes a hardened compact mass. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated June 5, 1865.

1833 C. de Bergue, Strand, engineer. *Improvements in the manufacture of iron piers or erections, applicable more especially for carrying bridges at high elevations, or available for sheer legs and lighthouses.*

Dated July 27, 1865.

1947 P. A. F. Bobouf, Rue Buflaut, Paris. *Improvements in the preparation and application of certain colouring matters.*

Dated July 28, 1865.

1954 W. King, Woodside, Finchley. *Improvements in apparatus for retarding the progress of railway carriages and trains.*

Dated July 29, 1865.

1963 B. Latham, civil engineer, Oraydon, and R. Campbell, Buscot Park, Berkshire. *Improvements in drying grass, hay, and other substances, and in the machinery for effecting the same.*

1968 F. KUP, Frankfort-on-the-Maine. *Improvements in gas burners.*

Dated July 31, 1865.

1973 J. J. Stoll, Champlain-terrace, Tulase-hill-road, professor of languages. *A new self-generating continuous motive power.*

1975 J. Ramsbottom, Crews, Obeshire, engineer. *Improvements in the manufacture of hoops and tyres and in the machinery employed therein.*

Dated August 1, 1865.

1987 A. Doull, Westminster, civil engineer. *Improvements in the construction of atmospheric railways and carriages and in working the same.*

Dated August 2, 1865.

2012 E. Sabel, Moorgate-street. *Improvements in machinery to be used in the manufacture of plate or sheet iron.* (A communication.)

2014 H. D. P. Cunningham, Bury House, Alverstoke, Hants. *An improved method of working guns.*

2016 W. H. Freese, Southampton, civil engineer. *Improvements in railway electrical signal apparatus.*

Dated August 4, 1865.

2022 J. Gankroger, Hebdon Bridge, Yorkshire, cotton spinner and manufacturer, and J. Dodgson, Burnley, Lancashire, commission agent. *Improvements in machinery or apparatus for sizing, drying, and beaming yarns of cotton or other fibrous substances.*

2024 E. Wild and W. Weasel, manufacturers, Berlin. *Improvements in wick holders or burners for lamps.*

2026 T. S. Raney, Boston-street, Dorset-square. *Improvements in securing roof lamp glasses of railway and other carriages, which improvements are also applicable to lighting the decks of ships and other situations.*

2028 H. A. Bonnevillie, Forchester-terrace, Bayswater. *Improvements in the construction of axle boxes and bearings.* (A communication.)

2030 T. W. Wesley, Birmingham, gun manufacturer. *Improvements in breech-loading fire-arms, and in revolving fire-arms and in cartridges.*

2032 A. V. Newton, Chancery-lane, mechanical draftsman. *Improvements in machinery for manufacturing cigars.* (A communication.)

Dated August 5, 1865.

2034 H. C. Baudet, Rue Sainte Apolline, Paris, mechanician. *A new or improved keyed musical instrument.*

2036 H. Geering, Birmingham, metallic bedstead manufacturer. *Improvements in the sackings of metallic and other bedsteads, sofas, couches, and other like articles, which said improvements may also be applied to the seats of chairs, railway carriages, and other articles.* (A communication.)

2038 J. H. Johnson, Lincoln's-inn-field. *Improvements in the ornamentation of glass, and in the applications of glass so ornamented.* (A communication.)

2040 A. Millican, New York. *An improvement in stills for the distillation of petroleum and other oily substances.*

Dated August 7, 1865.

2042 A. F. Osler, Birmingham, manufacturer. *Improvements in lamps for burning paraffin oil and other volatile oils.*

2043 A. A. Foubert, St. Heliers, Jersey. *Improvements in apparatus for regulating the passage or flow of steam, water, and other fluids.*

2044 W. Pollock, manager, and J. Stobo, foreman, Leven Bank Works, Dumbarton. *Improvements in apparatus for washing yarns.*

2048 W. Clark, Chancery-lane, engineer. *Improvements in apparatus and fittings to be used in ships for facilitating the loading, unloading, and stowage of their cargoes.* (A communication.)

2050 W. C. Dodge, Washington, U.S. *Improvements in fire-arms.*

Dated August 8, 1865.

2052 H. Fletcher and G. Gore, Gateshead, Durham. *Improvements in apparatus for communicating and signalling between passengers, guards, and drivers of railway trains.*

2054 W. R. Corson, Manchester, architect. *Improvements in the construction of shop fronts and other similar parts of buildings.*

2056 W. Book, Walworth, printer. *Improvements in printing machines.*

2058 S. Middleton, Shoe Maker row, Doctors' Commons, bootmaker. *An improved arrangement of machinery for brushing hair.*

Dated August 9, 1865.

2060 G. Harvey and A. Harvey, jun., Glasgow, engineers. *Improvements in machinery for screwing bolts and nuts.*

2062 H. Cartwright, Dean, Bromsley, Salop. *Improvements in the construction of steam engines.*

2068 J. W. Sumner, Vauxhall Bridge-road, marble merchant, and C. A. Scott, Brompton, civil engineer. *Improvements in the manufacture of bricks and blocks for building and other purposes.*

2070 L. Schod, Warrington, Lancashire, chemist. *Improvements in the production of violet colours from magenta for dyeing and printing.*

Dated August 10, 1865.

2071 M. H. Blanchard, Blackfriars-road, terra cotta manufacturer. Improvements in the manufacture of terra cotta or vitreous stone.

2072 T. F. Henley, Fimlico, engineer. Improvements in heating and evaporating. (A communication.)

2077 T. Alcock, Birmingham, brassfounder. Improvements in machinery to be used in the manufacture of stair rods.

2078 J. Faren, Belfast, flax spinner. Improvements in the process of, and machinery for, cleaning China grass and flax, and removing therefrom the resinous and woody matters that adhere to the useful fibres of the plant.

Dated August 11, 1865.

2093 R. A. Brooman, Fleet-street, patent agent. Improvements in treating and printing threads employed in weaving. (A communication.)

2084 R. W. Armstrong, Delleek, Fermanagh, architect. Improvements in machinery for moulding hollow articles in earth, clay, and other like materials.

2086 T. E. Stephens, Liverpool, law clerk. Improvements in and applicable to railway carriages to enable passengers to pass from one compartment to another, and to give signals on trains in motion.

Dated August 12, 1865.

2090 J. Knowles, Eagley Bank, near Bolton, Lancashire, colliery proprietor. Improvements in machinery for lubricating the axles of colliery and other similar waggons or trucks.

2092 W. E. Newton, Chancery-lane, civil engineer. An improved burglar-proof lock. (A communication.)

2094 H. Woodward, Cannon-street, City, gas engineer. Improvements in gas burners.

Dated August 14, 1865.

2016 R. A. W. Westley, M. D., Camden-road, Camden Town. A combination of improved method, apparatus, and receptacles for storing, preserving, transferring, and discharging certain fluids for sanitary and protective purposes. (A communication.)

2100 J. T. Lockey, Sutton, near St. Helens, Lancashire, engineer. Improvements in and connected with the manufacture of copper.

Dated August 15, 1865.

2104 J. W. M'Dermott, New York, machinist. Improvements in bolt-heading machines.

2108 J. Brown, Ardgowan-square, Greenock, barrister-at-law. Improvements in revolving fire-arms, in projectiles, and cartridges.

2109 W. O. Wilson, corn miller, and J. Wilson, Liverpool. Improvements in self-acting apparatus for extinguishing fire and sounding fire alarms.

2110 M. Henry, Fleet-street. Improvements in the production of surfaces by means of photography. (A communication.)

Dated August 16, 1865.

2112 W. Clark, Chancery-lane, engineer. Improvements in apparatus for taking measurements. (A communication.)

2114 J. Ingham, dyer and finisher, and J. Oulpan, cashier, Bradford. Improvements in the treating of China grass or other vegetable fibrous substances.

2116 J. E. Johnson, Lincoln's-inn-fields. Improvements in machinery or apparatus for the manufacture of paper bags. (A communication.)

2118 W. West, Tredenham House, St. Blaszy, Cornwall. Improvements in preparing lubricating compounds.

Dated August 17, 1865.

2121 S. Phillips and J. Groves, Birmingham, manufacturers. Certain improvements in the manufacture of sa'es.

2122 A. Akeroyd and J. Lister, Bradford. Improvements in shuttles for weaving purposes.

2123 O. Laurence, Euston-road. A new medicine for the cure of the diseases of the stomach (dyspepsy, cardiac, indigestion) and the hemorrhoids.

2125 E. Rimmel, Strand, perfumer. An improvement in the manufacture of metallic capsules.

2127 A. V. Newton, Chancery-lane, mechanical draftsman. An improved mode of, and apparatus for, drying timber, grain, and other marketable products. (A communication.)

2128 N. O. Szerelmey, Belgrave-road, Fimlico. Improvements in the manufacture of paper boards and pipes.

Dated August 18, 1865.

2129 G. H. Smith, North Perrott, Somersetshire, web and twine manufacturer. An improvement in dyeing and preparing hemp and other fibres for the manufacture of yarns and fabrics.

2135 A. and W. Young, Gower-street. Improvements in type distributing and composing machines.

2136 W. E. Gedge, Wellington-street, Strand. Improved machinery or apparatus for reducing the thickness of parts of calf skins or of other skins or hides. (A communication.)

2138 G. Howard, Berners-street, Oxford-street, cabinet maker. An improved method or process for ornamenting walls and other surfaces of buildings. (A communication.)

2139 J. L. Nalsh, Brighton, private tutor. An improved apparatus for illustrating astronomical phenomena.

2141 J. Hope, Bridge-street Brewery, Reading, bottler. Improvements in packing cases or boxes for holding or packing bottles or bottled liquids.

Dated August 19, 1865.

2143 W. and J. W. Wood, Monkhill, near Pontefract, Yorkshire. Improvements in the manufacture of Pomfret cakes, rolls, and pipes, and of lozenges, and in apparatus to be used in the manufacture of such articles.

2144 J. B. Watson, A. Horwood, and O. Brumfit, Pall Mall West. Improvements in constructing constant galvanic batteries for giving a signal or alarm in case of fire, and any other telegraphic purposes.

2146 G. Whitford, Acacia-road. A toy or game called "flying fish."

2148 O. Eukins, button manufacturer, J. Newman, Jeweller, and T. Greaves, manufacturer, Birmingham. Improvements in the manufacture of buttons.

2147 R. A. Brooman, Fleet-street, patent agent. An improved method of twisting threads. (A communication.)

2149 W. E. Newton, Chancery-lane, civil engineer. Certain improvements in machinery for making bricks. (A communication.)

2150 J. B. Austin, Victoria Wharf, Earl-street, Blackfriars. Improvements in apparatus for stopping bottles.

2151 W. Soper, Friar-street, Reading, gun manufacturer. Improvements in breech-loading fire-arms.

Dated August 21, 1865.

2155 F. Jenkin, Duke-street, Adelphi. Improvements in machinery to be used in the manufacture of telegraph cables.

Dated August 22, 1865.

2156 D. G. and S. Staigh, Charles-street, Hatton Garden, merchants and manufacturers. Improvements in the manufacture of keys for pianofortes and other musical instruments requiring such keys.

2157 J. A. Turner, Nutsford Vale, West Gorton, near Manchester, waterproof paper manufacturer. An improved covering for rollers or cylinders.

2158 J. Lockwood, Leeds, engineer. Improvements in steam boiler and other furnaces.

2160 M. J. Lopez-y-Munoz, Havana, merchant. Improvements in machinery for making cigarettes.

2161 C. Marsden, Kingsland-road, manufacturer. Improvements in the construction of electric telegraph cables, and in the preparation of telegraph wires.

2162 D. O. Jones, Pontesford, Shropshire. An improved apparatus to facilitate the cleansing and examination of the bottoms of ships and other submerged structures.

2163 J. G. Avery, Regent-street. A new composition suitable for use as paint and protective coating. (A communication.)

Dated August 23, 1865.

2165 H. Willis, shoe manufacturer, and G. Rice, tailor and draper, Worcester. Improvements in sewing machines, and in winders for sewing machines.

2166 J. H. Scott, Nutsford Vale, West Gorton, near Manchester. An improved furnace for annealing iron and steel wire or rods.

2167 J. Newton, Preston, civil engineer. An improved galley or stretch trap for the prevention of the escape of noxious effluvia from drains or sewers and for preventing the ingress of sand or other solid matters into the same.

2168 L. J. Levisohn, Powell-street West, Goswell-road, commercial traveller. An improvement in syphons.

2170 D. M'Kellar, Glasgow. Improvements in lithographic and copper plate printing, and in the machinery or apparatus connected therewith.

2171 E. H. O. Monckton, Dublin. Improvements in the manufacture of the straw of rye and other straws and grasses into fibre, and utilising the refuse

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated August 31, 1865.

2245 O. Bennett, Tramingham, Middlesex, U.S. A new and useful steam blower or blast apparatus for furnaces. (A communication.)

Dated September 4, 1865.

2270 S. Kettle, Goswell-street. Improvements in water closet apparatus, urinals, and the like, and appliances thereto.

LIST OF SEALED PATENTS.

Sealed September 8, 1865.

684 C. Johnson	717 G. T. Bonfield
695 J. Tann	726 H. Oberoh
697 R. M. Roberts	741 W. Brookes
701 R. Marsden	745 H. A. Bonnevillie
702 H. Hill	758 G. Ralston
705 F. Wise	763 F. Wise
709 J. Deas	772 J. T. Cook and J. T. Cook, jun.
710 G. Evans	848 E. H. Smith
711 R. A. Brooman	859 J. Buckingham
712 R. A. Brooman	912 H. A. Bonnevillie
714 E. D. Hodgson	

Sealed September 12, 1865.

729 A. P. Price	797 H. Potter
730 J. F. Brinjes	820 H. Oakes
738 W. Loeder	832 W. Loeder
740 R. Bell	917 J. Bathgate
748 B. Lawrence	953 J. Vaughan
750 J. Bullough	955 W. E. Newton
759 E. Pilling and J. Harper	1031 W. E. Newton
762 T. Kenyon, jun.	1050 W. E. Newton
768 J. H. Kidd and J. C. Mather	1240 J. H. Johnson
	1592 J. Hayes
	1858 S. Hingley

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the London Gazette, September 12, 1865.

1200 G. P. Dodge. Looms.	1224 R. Fenner. Embossing presses.
1203 W. Latham. Cutting coal.	1229 T. Alcock. Polishing metal tubes.
1213 J. C. Davis. Knife-cleaning machines.	1230 C. W. Siemens. Power of machinery.
1222 J. F. Allender and T. F. Cashin. Fasteners for driving bands.	1231 J. Catillon. Self-supplying pen.
1224 R. Fenner. Embossing presses.	1232 J. B. Lavanchy. Chair ladder.
1229 T. Alcock. Polishing metal tubes.	1235 P. A. le O. de Fontaineau. Ascertaining the degree of torsion of textile substances. (A communication.)
1230 C. W. Siemens. Power of machinery.	1246 J. Stalkart. Ploughs.
1231 J. Catillon. Self-supplying pen.	1250 W. Roberts. Connecting chain cables.
1232 J. B. Lavanchy. Chair ladder.	1252 A. Mackie, H. Garside, and J. Salmon. Distributing printing type.
1235 P. A. le O. de Fontaineau. Ascertaining the degree of torsion of textile substances. (A communication.)	1257 T. J. Mayall. India-rubber.
1246 J. Stalkart. Ploughs.	1260 J. Mitchell. Roads.
1250 W. Roberts. Connecting chain cables.	1261 J. Wadsworth, H. Dusset, and J. M'Murdo. Indexing machines.
1252 A. Mackie, H. Garside, and J. Salmon. Distributing printing type.	1266 I. Swindells. Coal gas.
1257 T. J. Mayall. India-rubber.	1270 J. Buchanan. Furnace fire-grates.
1260 J. Mitchell. Roads.	1275 B. Cooley. Looped fabrics.
1261 J. Wadsworth, H. Dusset, and J. M'Murdo. Indexing machines.	1278 J. O. O. Halkett. Coating iron vessels.
1266 I. Swindells. Coal gas.	1283 T. J. Mayall. Door warts.
1270 J. Buchanan. Furnace fire-grates.	1309 T. J. Mayall. Hose tubing.
1275 B. Cooley. Looped fabrics.	1315 E. Condorion. Tents.
1278 J. O. O. Halkett. Coating iron vessels.	1317 J. Hesford. Stretching cotton.
1283 T. J. Mayall. Door warts.	1484 B. Lawrence. Inkstands. (A communication.)
1309 T. J. Mayall. Hose tubing.	1488 L. Martin. Moulding wheels.
1315 E. Condorion. Tents.	1498 T. Summerson. Foundry cupolas.
1317 J. Hesford. Stretching cotton.	1513 W. E. Newton. Pocket lantern. (A communication.)
1484 B. Lawrence. Inkstands. (A communication.)	1561 W. E. Newton. Steam engine governors. (A communication.)
1488 L. Martin. Moulding wheels.	1621 W. Clark. Preventing railway collisions. (A communication.)
1498 T. Summerson. Foundry cupolas.	1756 J. F. Jones. Paper board.

1757 S. Bates. Bobbin net.

1787 J. F. Jones. Paper board.

2044 W. Pollock and J. Stobo. Washing yarns.

2096 R. A. W. Westley. Fluids for sanitary purposes. (A communication.)

2125 E. Rimmel. Metallic capsules.

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.

2459 J. R. Johnson and J. A. Harrison	2474 G. W. Belding
2461 J. Snider, jun.	2476 A. J. Alderman
2472 J. Hartshorn and W. Redgate	2481 W. Hirst
	2506 W. Richards
	2520 G. Bedson

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

2014 J. Melden	2175 J. Morrison
2069 L. Kaberry and T. Mitchell	2081 L. Vidie

LIST OF SPECIFICATIONS PUBLISHED For the Week ending September 9, 1865.

No. Pr.	No. Pr.	No. Pr.	No. Pr.	No. Pr.	No. Pr.	No. Pr.	No. Pr.	No. Pr.	No. Pr.
2112 O	42593 O	102607 O	42621 O	82635 O	102642 O	6			
2580 O	42594 O	42608 O	42622 O	42638 O	102649 O	19			
2581 O	42595 O	42609 O	42623 O	102637 O	82650 O	19			
2582 O	42596 O	102610 O	42624 O	42638 O	102651 O	6			
2583 O	42597 O	42611 O	102635 O	42639 O	82652 O	6			
2584 O	42598 O	42612 O	102636 O	82640 O	42653 O	6			
2585 O	42599 O	42613 O	82637 O	42641 O	42654 O	4			
2586 O	82600 O	102614 O	42638 O	42642 O	102655 O	10			
2587 O	82601 O	42615 O	102639 O	42643 O	42656 O	4			
2588 O	42602 O	82616 O	42639 O	22644 O	82657 O	3			
2589 O	82603 O	102617 O	102631 O	82645 O	42658 O	8			
2590 O	102604 O	102618 O	102632 O	42646 O	42659 O	4			
2591 O	42605 O	42619 O	102633 O	102647 O	82660 O	4			
2592 O	42606 O	62620 O	42634 O	2					

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

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

Trans. duty 1c per load, drawback 1c						
Task	per ton	per cwt	per lb	per 100 lb	per 1000 lb	per 10000 lb
Quebec, red pine	12 10	12 10	12 10	12 10	12 10	12 10
Quebec, yellow pine	12 10	12 10	12 10	12 10	12 10	12 10
St. John, N.B., yellow	12 10	12 10	12 10	12 10	12 10	12 10
Quebec oak, white	12 10	12 10	12 10	12 10	12 10	12 10
Quebec oak, black	12 10	12 10	12 10	12 10	12 10	12 10
Quebec, white	12 10	12 10	12 10	12 10	12 10	12 10
Quebec, yellow	12 10	12 10	12 10	12 10	12 10	12 10
Quebec, black	12 10	12 10	12 10	12 10	12 10	12 10
Quebec, white	12 10	12 10	12 10	12 10	12 10	12 10
Quebec, yellow	12 10	12 10	12 10	12 10	12 10	12 10
Quebec, black	12 10	12 10	12 10	12 10	12 10	12 10
Quebec, white	12 10	12 10	12 10	12 10	12 10	12 10
Quebec, yellow	12 10	12 10	12 10	12 10	12 10	12 10
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THE
MECHANICS' MAGAZINE.

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THE SCOTT VERSUS THE FRENCH GUN.

OF the 7-inch, 8-inch, and 9-inch guns now being experimented with by the Ordnance Select Committee, only the rifling for the 7-inch has been determined upon by the Admiralty, who, despite the strongly-urged recommendation of the Ordnance Select Committee in favour of the French gaining twist (recently named the "Woolwich" plan), have selected the simpler uniform twist so ably advocated by Captains Fishbourne and Selwyn, of our own navy, as well as by General Gilmore, and other distinguished foreign artillerymen, and adopted by Commander Scott, R.N. Nothing definite has yet been settled respecting the projectiles, which the Committee state ought to be studded, and there are now two new stud plans under trial. In the navy, however, compound shot are generally considered unfit for stowage and transport, as well as unsuitable for the rough usage of naval warfare. It is therefore not unlikely that the want of simplicity and the disadvantages attendant upon compound shot will lead to these being likewise abandoned by the Admiralty. In this event the simpler iron ribs of the homogeneous shot, which form a part of the Scott system, will, doubtless, be substituted. In the Report of the Ordnance Committee upon the shooting of the competitive guns, much stress is laid upon the greater accuracy attainable by the use of studs, but excessive nicety, even if attainable by studs after they have been injured by abrasion, is of far less importance on board ship than a high initial velocity. In this particular the Scott gun had a very marked advantage over the French gun, both with elongated and round shot, as shown by the following table compiled from the official records:—

Name of Gun.	Powder charge.	Weight of elongated shot.	Initial velocity.		Mean range at 2 deg. elevation	Mean difference of range.	Mean distance, deflection.	Cost.	
			Elongated shot.	Round ball.				Shot.	Shell.
	lbs.	lbs.			yards.			£	£
Scott	25	110	1594		1585	17.7	3.7	442	525
French	„	„	1529		1473	63.2	4.3	570	634
Scott	20	„	1502	2162	1473	18.1	3.7	} Mean reduced deflection.	
French	„	„	1444	2081	1366	40.6	2.6		
Scott	12	„	1277	1827	1213	19.7	0.8		
French	„	„	1254	1718	1162	19.7	0.8		
Armstrong 110-pr. ...	„	„			984	10.7	0.7		

This superiority would have enabled the Scott gun to do quite as much damage with its simple iron-ribbed shot, fired with only 20lb. of powder, as the French gun with its studded shot when fired with 25lb. of powder; a difference of great importance in iron-clad warfare. But, in point of fact, the slight advantage in accuracy obtained by the hard metal studs of the shot, which were first cast and then turned, and which were substituted for the French cast shot and zinc studs, was no more than what was due, as demonstrated by the Committee's recent experiments, to the sharper spiral of the French gun, which finished with 1 turn in 37 calibres, the Scott being 1 in 42. Besides this difference there was the greater nicety of fit obtained by turning the shot. The sharper spiral with which the French rifling ended should have given the French gun a decided advantage over the Scott in point of range; instead of which the work done upon the studs of the French projectiles occasioned a great loss of range, as compared with that given by the simpler long iron bearings of the Scott shot, which did not wear down in the same manner.

The firing of shells—which are peculiarly the naval weapon—took place after the Committee's Report had been issued, and the results have not yet been made public. The accuracy of the Scott gun, however, was here equal, or even superior, to the French with the improved hard metal studs and turned projectiles; the Scott shot were merely cast, and, from not being deeply bored into for stud bearings, but, on the contrary, strengthened by iron ribs, were far more fit for penetration as well as less expensive. A temporary expedient, viz., that of facing the iron projections by zinc strips, was tried upon some of the Scott shot, but inferior results were obtained. As compared with the studs of the same metal fitted upon Major Palliser's plan, there was the same marked superiority which a long bearing has uniformly given under similar circumstances over a stud bearing, whether cast upon the shot, as in the French, or screwed into it, as in Major Palliser's plan. By some mistake—or else to compare the hard metal studs, which were not in the original competition—the Committee have contrasted the accuracy of Scott's worst results obtained from the shot which were zinc-faced with the best results obtained from the French gun, instead of comparing results obtained from the zinc facing used by Commander Scott with the results from the studs of similar metal used by Major Palliser.

Mere accuracy, however, does not depend more upon the rifling than upon the length and form of the front of the projectiles. For instance, Sir W. Armstrong's shot, whether fired from the 600, 300, or 70-pounder, proved inaccurate, more especially those fired from the 70-pounder. But a fair result was obtained from all those guns with hollow shot of greater length and sharper front, and the recent good target firing with the Committee's various modifications of studs is solely due to elongating the shot by hollowing them in front, and giving them the spiral instead of the hemispherical form of head, which they erroneously selected for the projectiles for the French, Scott, and Lancaster 7-inch competitive guns. In addition to the better form of

rod during its action are tensile, crushing, and deflective or bending. This latter may be said to be slight in proportion to the former. The friction imposed on the trunnion bearings is due to the angles assumed by the cylinders; this also regulates the friction of the piston rod. Now, in order to define this more clearly the action of the steam must be considered. Let it be presumed that the piston is at the bottom of the cylinder, or that the crank is perpendicular. The slide valve will of course have a lead on the piston, and a given quantity of steam will be admitted into the cylinder before the down stroke is complete. It will be obvious that a load equal to the weight of the cylinder and its appendages and the pressure of the steam on the area of the bottom will be supported by the trunnion bearings. The piston is secured to, or rather hung on, the crank pin; hence its weight has no effect on the bearings in question. Now, suppose the piston to ascend, the steam acts on the under surface upwards, and on the surface of the bottom downwards; hence the load due to the pressure of the steam is continued till exhaustion ensues. The angle assumed by the cylinder at half stroke causes a certain amount of deflection on the rod theoretically, but in practice the sectional area of the rod and the position of the trunnions produce this evil. When the piston is at the top of the cylinder, the steam is admitted by the lead, and a pressure is produced upwards or against the top cover, and also downwards on the piston until exhaustion takes place. Thus the load due to the pressure of the steam tends to lift the cylinder during the descent of the piston; hence the friction on the trunnion bearing is reduced on the under side. In calculating the friction of these bearings the entire surface should be considered, but the lower half will always have the most wear, owing to the causes already mentioned. The friction of the stuffing-boxes of the steam pipes is of course due to the amount and compression of the packing.

There is not the least doubt that a severe strain is sometimes caused by the sinking of the cylinder in its bearings, when the friction may be said to be increased. The friction of the piston rod is due to the nature and depth of the packing. The bush below the packing imparts the greatest friction when the cylinder is at the greatest angle; its principal use is to prevent the packing being disturbed during the oscillation. The lower framing supporting the cylinder, entablature, and crank shaft, requires extra strength and stability. In some cases cross pieces are introduced to receive the crushing strain. It is obvious that, if the stay rods be not of sufficient area, the friction on the trunnion and crank shaft bearings will be greatly increased. To define this more clearly we will assume the action of the steam to be the same as before. The thrust and pull of the piston rod affect the tensile and crushing strains of the rods between the lower framing and entablature as much as any part. The entablature has a tendency to lift the lower frame during the ascent of the crank; hence the friction of the trunnion will be greatly increased if sufficient strength and a proper mode of securing be not strictly maintained. The remaining portion of the frictional surfaces are the same as in screw engines; we will therefore consider the friction of the air pump and valves for the type now under notice. For engines of this class the air pump is either inclined or vertically arranged under the crank shaft. The pumps are usually single-acting, with the foot valves below the piston, the final delivery valves being above the same; the discharge water passes through the piston, valves being secured on the same for that purpose. Now let it be assumed that the piston is at the top of the pump barrel, on descending the water between the piston and the lower valves passes through the piston, or rather the latter passes through the former. The down stroke being complete, the piston ascends, and the water in the condenser rises in the pump, and that above the piston is discharged at the ship's side. This definition of the action of the pump

FRICITION OF ENGINES.

IN a previous article we alluded to the friction present in certain classes of land engines. We now propose to notice that present in marine engines as adapted for the paddle and screw, commencing with the former. The oscillating and the paddle wheel engines are firm allies, hence our remarks will have reference to that type only as regards friction. The arrangement of the oscillating engine, and the mode of working the air pumps, have been previously referred to; consequently the present description will only have reference to the moving parts in contact. The strains imposed on the piston

may seem superfluous, but on further investigating this subject we shall again allude to its action.

Having thus briefly analysed the friction imposed on the frictional surfaces of oscillating engines, we will now allude to that relating to direct-acting engines and return action for the screw propellers. Direct-acting engines are of two kinds, trunk and single piston rod. The shape of the trunk in the present day is circular in section, but the original form was that of an ellipse; that of a parallelogram has been often adopted. In the event of returning to the elliptical form care should be taken to make the gland in separate pieces; if solid, the upper and lower portions of the packing will be more compressed than those at the sides; this was, doubtless, one of the causes for discarding the shape in question. In the case of oblong sectional trunks, an objection exists to the angles—an angular gasket will always leak more or less. Much can be said in favour of the turned or circular trunk. Simplicity of manufacture, uniformity of surface for packing, ample space internally for securing the cross head and adjusting the bolts of the connecting rod, are matters of practical consideration; hence we find the shape we advocate more adopted than any other. The friction imposed on the trunk during its movement is due to the temperature of the steam and the packing in the gland. Much has been said against this latter adherent; it is argued (and with some truth too) that, should the packing be unevenly compressed, an increase of friction would be caused sufficient to stop the engine, or at least greatly impede its progress. Two other evils existing with the trunk system are the cooling surface internally, and the burning of the packing. These, however, may be said to be counteracted by the fact that lubrication will considerably mitigate the effect in question. To ascertain accurately the amount of friction on the trunk stuffing-boxes, we must consider the depth of packing, length of connecting rod, and speed of piston, after which we must ascertain the coefficient of friction, due of course to the causes alluded to.

We will now consider the single piston rod engine. Engines of this type may be termed land engines of the horizontal class located in the hull of a vessel, but with these the air pumps have to be considered. The parts mostly conducive to friction here are the piston rod stuffing-box, and the guide facing. In a previous article we defined the friction imposed on the guide surface; hence we will but lightly touch on the same at present. The push and pull of the piston rod are transmitted to the crank pin, as before explained, with this exception, that an increase of friction may be said to be caused by the reduced length of the connecting rod to that for land engines. Next, as to double piston rod return-action engines. In order to define the friction imposed we will assume a sectional elevation of the steam cylinder and guide, the piston being at the back end. Now, on motion being given to the piston, the piston rods will receive a crushing strain on them, the connecting rod will receive a tensile strain, due to the fact that, when the piston rods push the cross head, the connecting rod pulls the crank and *vice versa*. With reference to the friction imposed on the guides, the cross-head is connected direct to the piston, in this case, in principle as for single piston rod engines, the only difference being in the locality of the details. In each case the crank may be said to follow the piston, *i.e.*, when the piston moves from the shaft, the crank moves after it, and *vice versa*. Our remarks upon the friction on the guide surfaces for land engines apply in the present case. The friction of the crank pin for screw engines is much greater than that of any other kind, owing to the increased diameter, strength being of more importance than decreased frictional surface. To calculate correctly the friction on the crank pin, consideration must be taken of the pressure of the steam, length of the crank and connecting rod, also the weight of the latter. The friction of shaft bearings is

greatest at the plane line, or in a line with the centre of the cylinder. The weight of the shaft and cranks tends to increase the wear at the under portion of the bearings, weight being added. The friction in the present case will be much the same as in the crank pin.

The valve link motions of marine engines are much alike in arrangement and principle of action. That for the oscillating engine has the addition of a sliding quadrant. The link for screw engines is suspended by a separate link or rod, while that for paddle engines is supported by the eccentric rods; hence it may be said the total amount of friction in each case is equal. The slide valve at present generally adopted is the well-known double ported equilibrium valve. The friction incurred by the action of this valve is due to its area, and to a certain extent the pressure of the steam. Should a ring be used at the back its area in working contact should also be considered. To ascertain the frictional load on the valves, the surfaces in contact, the action of the vacuum at the back, and the total surfaces acted on by the steam must be considered; the results will give a correct idea as to what power will be required to move the valve under ordinary circumstances. Double beat valves would cause a great reduction of friction in proportion to the surfaces exposed, but the wear and tear of the gear and seatings raise the idea that in fast moving engines a constant repair would result. The remaining portion to be considered relative to the frictional surfaces is the thrust on the screw shaft. The screw propeller is in principle of action a common spiral, whose motion causes an advance or receding equal to the pitch and number of revolutions. The screw during its motion has a tendency either to leave the shaft or force itself further on the same. The devices and schemes for reducing the friction are numerous. We will select three examples from a number to portray the friction imposed. A series of rings are forged on the shaft below, or rather beyond, the engines. The number of these rings do not seem to be imperative, six to eight being often used. The thrust block in this case consists of a case, cap, and brasses, to fit the shaft, the last collar being outside the brasses. Now it is obvious with this arrangement the collar nearest the propeller must receive the greatest strain, and the remainder in proportion, that is, if the fitting is correct. The second arrangement has collars as in the last case, but the thrust is received by adjusting semicircular strips. By this it will be seen that the friction on each of the collars can be equally distributed. Our present remarks refer only to metallic surfaces in contact. The third example will be the same in principle as the last two, with this exception, that water receives the thrust in the place of metal. This can be readily understood by assuming a box containing the fluid and the shaft passing through the same, a suitable provision being secured on the shaft to cause the required resistance. On the water being compressed of course the thrust will be prevented from affecting the engines. This arrangement is said to produce less friction than any other device yet known, but the failure of the compression of the water by leakage or otherwise would be disastrous in the extreme; we, therefore, prefer the metallic surface to any other in point of safety.

On the reverse action of the engines the thrust of the screw is effected. To meet this a series of discs are sometimes inserted in a casing at the rudder post; the end of the screw boss acting against these discs, stability of location is maintained. In other cases a separate thrust block is secured inside the hull, at the end of the screw alley or tunnel. This latter arrangement is the preferable, as adjustment is easier, and lubrication certain. The stern tube and its stuffing-box may be said to produce a certain amount of friction, but which is not affected by the thrust or pull of the screw. To define the amount of friction caused by the thrust of the screw, will

be to consider the surface in contact, pitch area of the blade, and loss of speed or slip. The action of the waves cannot cause more friction than the actual power of the engines, without the former stopping or reversing the latter. By this the power of the engines may be used, in the place of the area of the blades, in calculating the friction caused by the thrust, the slip being duly considered, as before. We will refer, in conclusion, to the friction caused by the air, feed, and bilge pumps. In the two former, the diameter, or rather the circumference, of the barrel must be considered; for the air pump, the depth of the piston and stuffing-box, of the rod and its diameter. With the feed pump the piston is generally a solid plunger; hence the stuffing-box must be noticed; the same applies to the bilge pump when alike arranged. The friction of the water in these pumps is a matter of consideration, and a bad or imperfect arrangement of the valves greatly reduces the power of the engine. We have already alluded to the vertical action of the plunger; our present remarks refer to those arranged horizontally. The friction of the water is unaffected, whether for vertical or horizontal actions, as the fluid must pass out, or rather be elevated to, the side of the ship above the pump. The seatings of the valves in the present day are perforated. These openings may be said to increase the friction of the water. It is obvious that when the water is in the pump, on compression ensuing, the portion nearest the passages or perforations must first assume the shape of the opening it has to pass through; thus an entire change of form is caused throughout. Now the water, when compressed, forms a more solid mass than when in a natural state; hence it is not erroneous to assume that when the weight has to be taken into account as a load on the piston at all times, the friction will be the greatest. Air pumps with vertical action have therefore a load on the up stroke, and friction of the water on descending. When the valves are inverted, it is obvious that the gravity of the water will greatly assist its egress, and the condenser over the pump will reduce the friction imposed. With surface condensers there is considerable friction when the water passes through the tubes, the fluid having to assume a form similar to that of the tubes themselves, to say nothing of the load on the pistons of the pumps. Weight of matter should always be considered in mechanical appliances, and in none is this more necessary than marine engines.

RIFLE TRIAL.

A VERY interesting trial of rifled arms for one of our Colonial Governments took place at the Rifle Range, Woolwich Arsenal, on the 7th September, in the presence of Major Pasley, R.E., the Military Commissioner for the Colony, and other officers. The rifles, which were selected by chance out of 1,000 arms, were in pattern precisely similar to that known as the "Oval-bore Sapp. Rifle," except that the mountings are of iron instead of brass, and the calibre of the muzzle axis is .365 to suit the .550 ammunition; rate of spiral, one turn in 36in. The range chosen was 1,000 yards. Each rifle was fitted in the machine rest and fired without altering the elevation or direction of the rest. Diagrams of twenty shots with each rifle were taken. These diagrams, which we have inspected, are really so extraordinary that we have great pleasure in giving to them the publicity they deserve. The rifles were "Lancasters," or bore, the bore being .565, quantity of powder 2½ drams, R.F.G. The bullets were .55 ball, wood plug, and the lubrication wax. The cartridges were rolled one cut outside, and the rifles were fired from a fixed rest. The shots made were 20, the misses 0, with each rifle total, 100 rounds, the range being 1,000 yards. The deviations were as follows—No. 1 rifle, mean absolute deviation 30.35in.; No. 2 rifle, 28.35in.; No. 3 rifle, 33.15in.; No. 4 rifle, 26.1in., and No. 5 rifle gave a mean absolute deviation of 30.5in.