

necessitate its being blocked, give five sharp beats on the bell (which must be repeated), and raise the electric signal to danger, which must be maintained as long as the obstruction lasts. 8. No signal is to be considered complete until it has been acknowledged." The acknowledgments given under rules 4 and 6 cause the indicators on the bell to record faithfully to the signalman the fact not only that the semaphore has acted properly, but that its indication has been seen, comprehended, and acted upon by the man at the other station. It gives a clear record of what has been done independent of the volition of the signalman himself, offers a complete check to one man of the performance of his duties by the other, and renders the delivery of a false signal—the cause of many accidents—well nigh impossible. These are points of great importance, and are advantages which render this system of Mr. Preece's far superior to any other plan of electrical signalling.

SCIENTIFIC WITNESSES.

The scientific principles upon which Railway compensation is based must be of a very accommodating character—admitting of expansion and contraction at will—if we may judge by the following case, which was heard last Monday, at the Lord Mayor's Court, before Mr. Commissioner Kerr and a special jury. The case in question was "Suell v. the Metropolitan Railway Company." The amount of the claim was £36,353 for several houses in Liverpool-street and Broad-street-buildings required by the Railway Company. Mr. Hawkins, Q.C., was for the claimant, and Mr. Lloyd for the company. The evidence as to the value of the property was, as usual, of a very conflicting character, the company urging that the claim as presented was quite "appalling." Mr. Commissioner Kerr, in placing the case before the jury, declared that it was the most extraordinary one he had ever heard, and would become a "model" compensation case. What were they to think of the value of scientific evidence, when there was such a difference as more than £20,000 in the opinion of the surveyors and valuers? "What," added the Commissioner, "scientific evidence will come to by-and-bye it will be impossible to say!" In this case the value was, on one hand, about £36,000, and, on the other, under £14,000! It was certainly a most remarkable case, and the jury must settle it between themselves. The jury assessed the compensation at £29,650.

NORTHERN INSTITUTE OF MINING ENGINEERS.

We last week gave a summary of the proceedings of the above Institute, the general annual meeting of which has recently been held in Manchester. We now make some abstract from the papers read. The first paper, which was read on Tuesday, by the secretary, Mr. William Cochrane, was contributed by Mr. Joseph Dickinson, inspector of mines, and was "On some of the leading features of the Lancashire coalfield." Mr. Dickinson summarised the most remarkable points in the Lancashire coalfield as follows:—1. The great thickness of the strata, which constitute it one of the thickest coalfields in the kingdom; North Staffordshire and Somersetshire being two others, which are also of great thickness. 2. The great number of workable coal seams which it contains, which afford every variety of coal, except lignite, that is required for use. 3. The magnitude of the faults by which the coalfield is dislocated, the vertical displacement of the strata reaching to as much as 1,000 yards. Owing to these combined causes, it has not always been found easy to trace the connection of the seams throughout the different parts of the coalfield. A table of super-position, which Mr. Dickinson said might be relied upon as correct, was given, which showed that there are in the Lancashire coalfield about 2,150 yards of strata which actually contain seams of coal. It was possible that some higher beds might yet be discovered under the trias and permian; but most likely that the top, or very nearly the top of the coalfield had already been discovered. There are, besides, the millstone grit, shales, &c., which are here of great thickness, and the mountain limestone below, all of which lie conformably with the coal measures. One of the best natural selections of millstone grit and shale is near Barnley, between the north of Padiham, through Saddington, to near Chatburn. The strata there dip at a steep angle, and the thickness of the whole is apparently about 2,000 yards. Towards the lower portion (chiefly dark shale) the strata become impregnated with limestone, and nearer the bottom thin bands of impure limestone intervene, until the main upper bed of limestone is reached. The limestone strata are apparently of a

medium thickness—probably about 700 yards. There are, therefore, altogether of carboniferous formation:—

Proved coal-bearing strata.....	2,150 yards.
Millstone grit, shales, &c.	2,000 "
Mountain limestone.....	700 "
	4,850

Compared with places further south and north, remarkable transactions are to be observed here. While elsewhere the old red sandstone is mostly of great thickness underneath the mountain limestone, in Lancashire the old red sandstone is almost if not entirely wanting, and the mountain limestone rests upon or against the metamorphic rocks; and, as the old red sandstone is thus disappearing from below the limestone, the millstone grit and the shales above the limestone are simultaneously becoming greatly increased in thickness. Here, too, the limestone begins to be divided by other strata, and at Ardwick, near Manchester, where apparently the thickest part of the Lancashire coalfield has been found, some beds of carboniferous limestone, but possessing the property of the lias limestone of settling in water, are found capping the coalfield. Further north the change still continues, until, on reaching Scotland, the limestone has almost disappeared from below, and is associated with the principal coal measure strata, and at some places the principal coal seams may be seen resting unconformably against the metamorphic rocks, and the transition is completed.

Mr. John Knowles then read a paper "On Direct-acting Pumping Engines and Direct-acting Winding Engines." The author observed that he would take the engine at Cleggwood Colliery, near Littleborough, as a sample of this kind of engine. It was a direct-acting engine, with a cylinder 57 in. diameter, and a 10 ft. stroke. It was placed over the pit and used to pump the water during the sinking of the shaft. The steam was used on the under side of the piston at a pressure of 40 lb. per square inch, and was cut off at a part of the stroke, and when the up-stroke was completed the steam was allowed to go through a regulating valve to the top side and make the down-stroke, which was then ready for condensing for the next up-stroke. The engine had a beam with a small balance to counteract the weight of the draw lift rods. The top set pumps were 80 yd. long with a ram 20 in. in diameter, and the rods were so arranged that their weight would force up the water to the top of the pit. The lower set of pumps had a bucket lift 18 in. in diameter and 46 yd. long, and these rods were balanced by the weights on the engine beam. When the pit was sunk 80 yd., the 20 in. ram pump was put in and connected directly with the top rod, and the lower draw-lift was put to it in the usual manner. During the sinking of the pit, which was an oval one, there was a feeder of 600 gal. of water per minute to contend with, and when the engine stopped it rose up the pit one foot per minute, and when the clacks required changing, the change had to be made in fifteen minutes. Connected with this engine there was an arrangement by which the handles opening the valves could be so arranged that they would open at any speed, and cause the engine either to work fast or slow at the up-stroke or down-stroke, or, if requisite, remain stationary a short time. There was also a registering indicator so arranged that every stroke or part of a stroke was counted which had been at work since the engine started, and it was possible to ascertain the number of strokes it had made since its erection. The first of these indicators was used in 1851 at the Belfield pumping engine, and was found so useful that they had since been adopted at all the pumping engines owned by Messrs. Knowles. One of the advantages of this engine was that there was very little friction between the power exerted upon the piston and the work of raising the rods and water, and of necessity must use less fuel. Another advantage was, that it obviated the risk and chance of such an accident as that which occurred at the Hartley Colliery, as the beam which was used as a balance was kept in such a position that it was almost impossible for it to fall down the shaft. Mr. Knowles then gave some figures from a table, which showed the great saving of this engine in comparison with the old kind of beam engines with cog wheels, slide rods, and L legs.

Mr. Knowles took the engine at the Clifton Hall Colliery as a sample of the direct-acting winding engine in Lancashire, on account of its being the largest erected by Messrs. Knowles, and having a compensating drum. It was also used for winding water, which gave the opportunity of testing its economical value. The cylinder was 42 in. in diameter, and had a 6 ft. stroke, the pressure of steam 45 lb. per inch. The connecting rod was 18 ft. long, the shaft 14 in. square, and of wrought iron. The compensating drum commenced at 15 ft. and ended at 25 ft. diameter. The ropes lapped on the drum from each outside, and their tendency in ascending was to lie against the side of the drum and avoid slipping off. The outside of the drum was made of English oak, and the grooves were cut into it, iron plate guards being on some parts of the scroll. A steam brake was used at this engine, and was under

the command of the engineer, who could throw on the steam at any moment; and it was so powerful that it would stop the main engine in less than two strokes if it was going at full speed with all steam on, but if the steam was off it would stop it instantly. The engineer used the brake in his ordinary work, so that it had always to be kept in order, and, therefore, ready for any emergency. The pulleys over the pit were 8 ft. 6 in. from each other and were 15 ft. diameter, with wrought-iron arms, and the outside rim was arranged to be filled up with timber so that the rope would not be so much injured. At present the engine had not full work, and the average amount of coal raised was 280 tons per day, from a pit 430 yd. deep. The pit was 9 ft. diameter for 220 yd., and 10 ft. diameter for the remaining depth, and had two ropes in it. The cages had two decks, with two waggon of coal containing 7 cwt. each on both decks, making 28 wt. of coal raised at one lift, and it was raised up in 45 seconds, or at the rate of nearly twenty miles per hour. The greatest speed of the cage when in the middle of the pit was 25 miles per hour. There was also a lowering platform used, which was a great advantage. The water cisterns weighed 20 cwt., contained 530 gal. of water, and were used at the end of every week or a fortnight, according to the quantity of water made in the mines. The cisterns were so arranged that when they came to the top they emptied themselves by means of a lever and a movable weight. By this means of winding water, 33 cisterns had been raised per hour, making 290 gal. per minute, and this had been done from 10 to 20 hours together. During this time it occupied two men to fire up the boilers, and notice was taken how many cisterns were raised and the length of time in doing it. The experiments showed that 106,975 gal. could be raised 100 yd. by the consumption of one ton of slack, proving that the system was much better than using beam engines, wheels, and L legs, but not so economical as the direct-acting pumping engine. In deciding upon this important matter, many considerations must be weighed. If the quantity of water to be raised was but small and at a great depth, with sufficient lodge room for a week, then this plan would perhaps be the best—one of the considerations being the great expense of erecting a pumping engine for a small quantity, when the winding engine could easily do the work. If the quantity of water was large, even at any depth, the direct-acting pumping engine would be found to be the most economical in the end, and it was quite certain to be so with a moderate depth.

(To be continued.)

NEW CANNON.

A VERY interesting trial of a small and novel rifled cannon is in progress in America, under Major Laibley's direction. The piece weighs only 167 lbs., yet has endured, without apparent injury, a test with a charge of powder and projectile such as are fired ordinarily from guns weighing over 800 lbs. Nearly 500 shots were fired with it, the charge being 1 lb. of powder and a projectile weighing 7½ lbs.; and the charge has been increased to 1 lb. of powder and a projectile weighing 10½ lbs., ten charges of this kind having already been fired. About 200 more will be, if the gun holds together so long, as it undoubtedly will, and further testing then will be considered a waste of powder. The remarkable and previously unheard-of strength secured in this piece comes from a peculiarity of its construction, a description of which appears in the *Springfield Republican*. The core of the gun is bronze, which after the 2½-inch bore is made is only about ¼ in. thick. On the outside of this core or cylinder fine steel wire is tightly wound to the depth of an inch. The wires pass over diagonally, each successive layer being at right angles with the previous one. After this winding was completed, when the gun was manufactured, it was heated to a high temperature and then plunged into a quantity of molten bronze. The final result is a piece which it is impossible to burst except with a most extravagant and enormous charge, this great strength being secured by the new process of winding the wire as stated. The obvious disadvantage of a piece weighing so little, while possessing the capabilities of one weighing five times as much, is the immensely increased recoil. If this can be overcome in a measure, which is not improbable, and this mode of construction is found to work equally well with large as with small guns, the invention will undoubtedly effect a revolution in artillery and heavy ordnance. The inventor is Dr. Woodbridge, of Little Falls, N. Y., who was one of the first to discover the advantages which might be obtained by rifling cannon and small fire-arms, and who has made several valuable inventions in different departments of mechanics. The trial of his new cannon, the first one manufactured, is made by order of General Dyer, Chief of Ordnance, who will see that the government loses no time in taking advantage of the invention if it proves all that it now promises.

It is proposed to build a bridge across the Hum-ber at Barton. The bed of the river is said to be as hard as the flagged pavement in the streets.

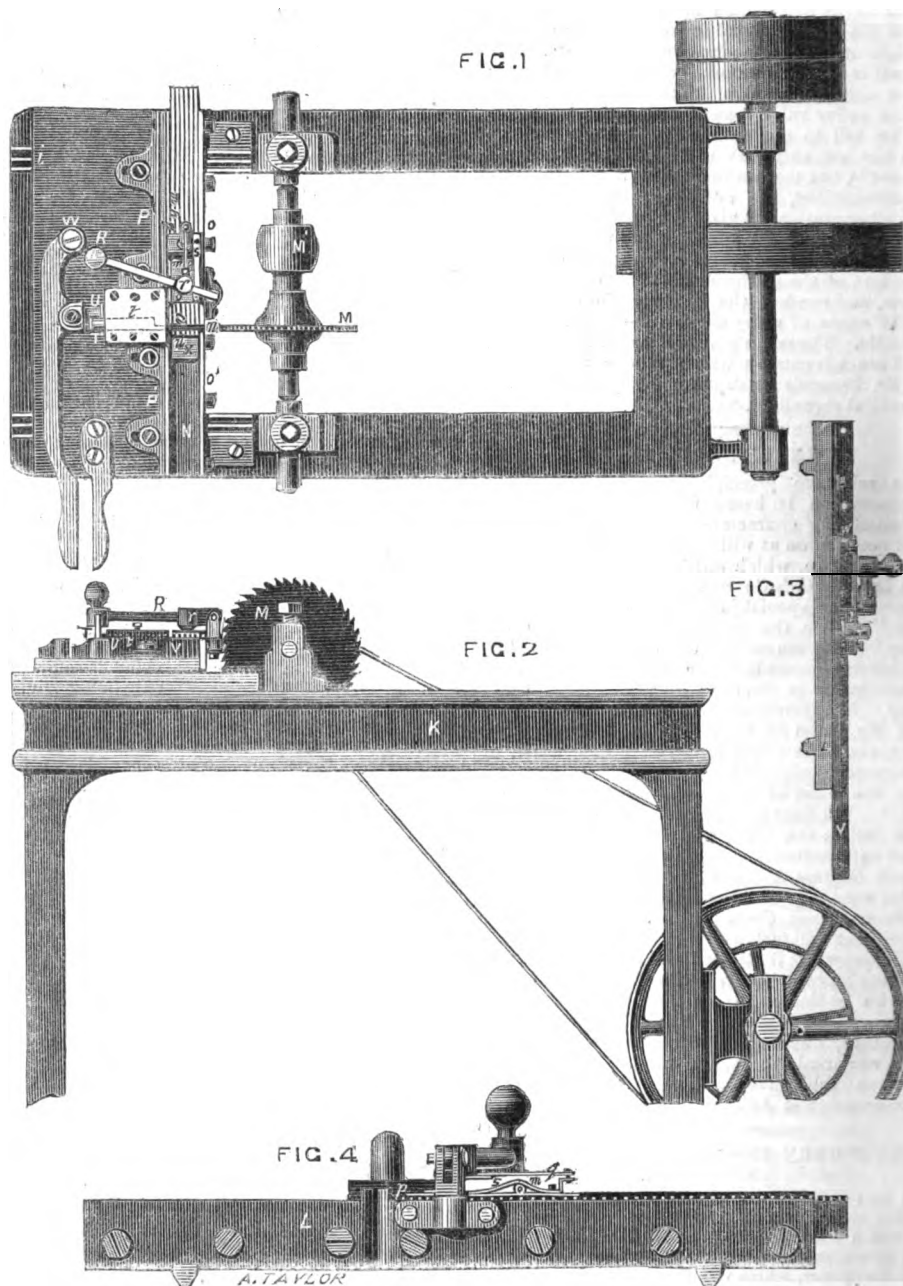
MANUFACTURE OF PRINTING TYPE.

THE object of this invention, which has been communicated from abroad to Mr. A. V. Newton, of 66, Chancery-lane, London, and patented by him, is the production of printing type from materials harder and more durable than type cast from the well-known type metal. This is effected by cutting the type with a machine adapted to the purpose from strips of metal, each having a row of type heads on one edge. The type heads are made of copper by the electrotype process, the following being the mode of proceeding:—A complete fount of type is set up in rows with a blank intervening between each type equal in thickness to a saw cut; between the first row of type set up in the manner described and the next row a ruler is placed, the top edge of which is about one-eighth of an inch below the faces of the type heads. In this manner a form of sufficient size is produced, and from it moulds are taken to be used in electrotyping the heads. As soon as the electrotyped plates produced in such a mould are of the required thickness they are removed from the moulds, and the cavities on the reverse of the plates are filled with soft solder or tin. The electrotyped plate of type heads is then cut into strips, each strip forming a connected row of type heads of copper, by means of a machine, which consists of a table fitted with an adjustable guide bar, and with a circular saw that projects up through the table. To the side of the fixed guide bar a shorter guide bar is pivoted, so that its free end may be raised or lowered as desired. Permanently secured to a projection of the pivoted bar is a plate which forms the actual guide for the plate to be sawn, as it stands in exact line with the saw and in front of it. The saw and guide plate are each of the same thickness as that of each of the spaces between the rows of type heads in the plate to be sawn. When the sawing operation is to be performed, the pivoted bar is raised, and the plate of type heads is placed under the guide plate, which, fitting the spaces between the rows of type heads, adjusts the electrotyped plate in exact line with the saw. The plate is fed up to the saw by hand.

The bodies of the type may be made in several ways, one of which consists in casting a strip of type metal on to each of the rows of type heads above described. In casting the bodies a mould may be conveniently used, consisting of two cast-iron bars, each about 15 in. long, and 2½ in. wide, and connected by a hinge in such manner that they may be closed on each other as the jaws of a clamp, or opened at will. A strip of brass or steel is fastened to the inner face of one bar, and in thickness equal to the desired thickness of the type bodies intended to be cast. The jaws of the clamp or mould are grooved longitudinally to receive a bar of cast iron with a longitudinal groove on a middle line along one side thereof, the groove being about one-eighth of an inch in depth, and in width equal to the desired width of the type intended to be produced. In the groove of this bar a row of the above-described type heads is laid face downwards, and the bar is then placed in the clamp or mould, which when closed is filled with melted type metal that unites with the row of type heads. These strips are afterwards cut up into single type by means of a cutting machine.

Another way of making the type bodies consists in soldering strips of rolled metal to the rows of type heads above described. From a sheet of rolled brass or zinc, equal in thickness to the desired thickness of the type to be produced, strips about seven-eighths of an inch wide are cut, which strips are made straight and smooth on their edges. The strips are also each provided with two or more shallow grooves on one side, which grooves form the notches in the single type eventually to be produced from these strips. A cast-iron plate is then provided with a number of grooves on one surface, about three-eighths of an inch in depth, and in width equal to the desired thickness of the type to be made. In each of the grooves a row of the above-mentioned copper type head faces is laid down, and on top of each row of heads one of the above-mentioned brass or zinc strips is placed, each strip being moistened on one edge with soldering acid. The whole is then exposed to heat sufficient to melt the solder or tin which fills the cavities of the type heads, when the plate is withdrawn from the heat, and as soon as the solder or tin cools sufficiently the united strips and heads are removed from the grooves. The strips are after-

MANUFACTURE OF PRINTING TYPE.

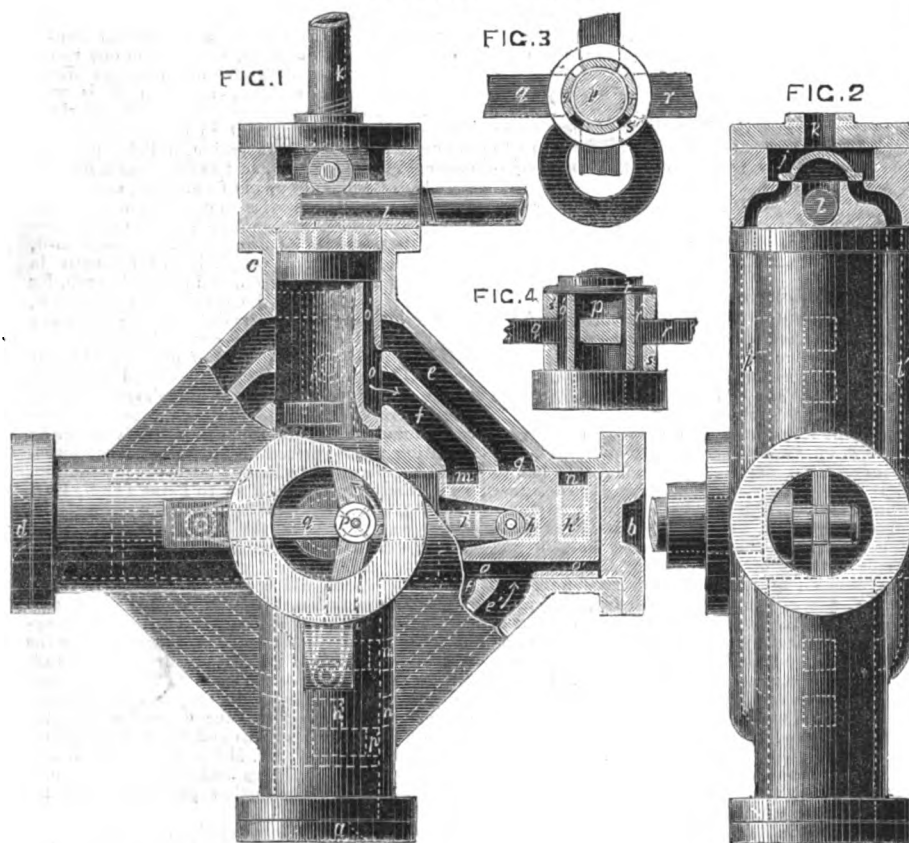


wards cut up into single types by means of the cutting machine to be now described.

In the engraving fig. 1 is a plan of the cutting machine last referred to; fig. 2 is a side elevation of the same; fig. 3 is an end view of the carriage; and fig. 4 is another end view of the carriage. K is the bed plate provided with two V-shaped grooves *i*, in which a sliding carriage L is mounted for the purpose of bringing the strips to be cut under the action of a circular saw M, and after each complete cut withdrawing the strips from the saw before moving them up for another cut. To this carriage most parts of the machine are attached. The circular saw M is keyed to a shaft which carries a driving pulley M'. The saw shaft turns in socket bearings carried by bearing blocks fixed to the bed plate K. N is a transverse channel in depth equal to the height of the type bodies, and formed by two guide bars O O', and P P', of which the bars P P' are adjustable. The channel N is divided by the cut *n* into two sections, one of which holds the strips while being cut, and the other receives the types as they are cut off. Q is a sliding bar shaped as shown in fig. 1; this bar slides in a dovetail groove on the top of the bar P; it has a hinge joint *m*, and a small angular hook *p*, shown in fig. 4. The sliding bar Q is connected with a lever R by a link *q* and pivot joint *r*. By means of the bar Q and lever R the number of strips placed in the channel are together moved forward before the saw into the position proper for them to hold while being cut, the hook *p* facilitating the motion of the strips in the channel by catching into the spaces

between the type heads. S is a spring which raises the loose end of the bar Q when this bar is relieved from the pressure of the lever R. As soon as the strips in the channel are moved so far forward as to bring the spaces between the type heads in a line straight with the saw and the cut *n*, a small bar T sliding in the box *t* is pushed forward through the spaces between the type heads so that the end of the bar enters the cut *n*. By this means the type heads are accurately adjusted in the position necessary for them to hold while the types are being cut off, in order that the cutting may be performed without injury to the face of the type. The gauge bar T brings the types as they are cut from the strips to the outside of the bar T, so that they stand upright and enter the section O' P', of the channel M, as shown at *u*, fig. 1. This gauge bar T also enables the machine to cut letters of various sizes consecutively or in alphabetical order without altering the adjustment of the machine; one strip may therefore contain all the letters of the alphabet. U, figs. 1 and 2, is a block which moves in the box *t*; it projects about half an inch beyond each end of the box *t*, and is connected with a lever V by a link and pin; the lever V has its fulcrum at W. The block U, in connection with the lever V, makes a gripping jaw, the office of which is to hold the strips and the type being cut therefrom firmly in their true positions while the cutting operation is going on. As soon as the person operating the machine has closed the gripping jaw he withdraws the gauge bar T, and moves the carriage up to the saw. X, fig. 1, is a movable block of metal fitting into the

HICKS' STEAM ENGINE.



section $O' P'$ of the channel N ; its function is to keep the cut-off types in an upright position, after each cut is completed. When the strips are moved forward into a proper position preparatory to a fresh cut, they press against the cut-off type and force them against the block X , which yielding to the pressure so applied moves towards the outer end of the channel a distance equal to the thickness of the type being cut off. The operation of cutting is carried on until this last-named section of the transverse channel is filled with cut-off types. The types are then pushed out into a galley in a composed condition ready for packing or printers' use.

HICKS' STEAM ENGINE.

MR. WILLIAM CLEVELAND HICKS, of New York, civil engineer, has obtained letters patent for improvements in steam engines which consist in a novel arrangement of the cylinders, pistons, and valves, whereby the piston and valve are combined and are also enclosed within the same cylinder. By this means all external valves, valve gear, and steam chests are dispensed with, and all the principles of operation found in the ordinary slide valve engines are retained, securing thereby simplicity, economy of construction and repairs, portability and durability. In the arrangement, four cylinders are employed, the pistons in which receive the pressure of the steam or other fluid in one direction only, or are what is called single-acting. In the annexed engravings, these are shown as standing at right angles to each other, or in the form of a cross, the inner ends being open and having a crank in the centre or equidistant from each of the inner ends and as shown in fig. 1, in which a is the first cylinder, b the second, c the third, and d the fourth. The cylinders are connected with each other by two steam channels e and f , one of which e is for direct steam and the other f for the exhaust, although in reversing the engine e becomes the exhaust and f the steam passage. The pistons are cylindrical and take up sufficient space to lap over the openings of the steam channels e and f where those enter the cylinders and are shaped as shown at g . In the sides of the piston channels or recesses are cut, on opposite sides proper to meet the steam passages, when the piston is moved along the cylinder, so that they shall stand over their openings. It is to be understood that the valve does not operate the steam for its own cylinder, but always for the cylinder next preceding it. Thus the valve in the cylinder a regulates the flow of steam to

and from the cylinder b , and b for c , c for d , and d for a . There are six steam openings into each cylinder, viz., e and f leading from b to c , and e' and f' leading from a to b on the opposite side, and so likewise for the other two cylinders, and lying in the same plane. The other two openings enter on opposite sides of the cylinder at a right angle to those first named and as shown by the dotted lines h and h' and i and i' in cylinders a and b . The openings h and h' , as also the similar openings in the other cylinder, all lead to one common receiving pipe for the admission of steam, as shown at k , figs. 1 and 2, k' being the branch pipe for connecting all the cylinders with it. The openings i and i' also lead in like manner to one common exit pipe l through l' in like manner. The valve j , fig. 2, is shown as closing both pipes, and the engine is accordingly at rest. The valve on each piston acts precisely as the D slide valve of ordinary engines. At n are recesses on one side of the valve g . One of these n passes round one quarter of the circumference of the cylinder on the under side, while m extends in like manner one quarter on the opposite or upper side. It will be thus seen that when the piston g has moved along so that the channel n stands opposite e it will also be over the opening h , so that steam will pass at once into the cylinder c . The same is also true of m , for when that recess is opposite f it will also stand over the opening i , and the steam can flow out of the cylinder c as shown. On the opposite side of the piston g there is another opening for receiving and discharging the steam according to the working of the valve in a . This opening is seen at o and extends through the narrow channel o' up and through the piston, thus communicating with the steam space between the piston and the head of the cylinder; as shown, it overlaps the two ports e' and f' , and acts in that respect like an ordinary slide valve. The crank is placed in the opening in the frame at the inner ends of the four cylinders as seen at p , that being the crank pin. Four connecting rods, each attached to one of the four pistons, are joined to the crank pin. As the cylinders stand at right angles to each other there is necessarily always one or two pistons in action upon the crank, so that when any pair of pistons which stand opposite to each other are at the end of their strokes the other two will be at the half of their stroke. Thus the piston in a is at half stroke, moving toward the crank, c is also at half stroke retreating from the crank, and b and d at the extremity of their respective strokes. Now, it is when the pistons are at half stroke that the valves begin to operate upon the steam for the

preceding cylinder, either to admit or exhaust the steam as may be required. It will be seen that the recess n' in the valve in cylinder a is just ready to lap the channel e' and cover the opening h' , thus admitting steam at once to the cylinder b above its piston g . This channel will be kept open until the piston in a has completed its stroke and returned back to the half stroke, for then the piston g will have completed its stroke and be ready to return; it must, therefore, be allowed to exhaust its steam. The recess m' will now have come to the opening i' and channel f' , thus at once exhausting the steam, for the two half strokes of the piston in a are just equal to the whole stroke of g . The piston g acts in like manner for the valve for the cylinder c . The piston in the latter is returning for a new stroke and is accordingly exhausting its steam; the channel f is accordingly in connection with the escape passage i through the recess m , as shown, and the same operation takes place for the cylinders c and d . Thus it will be understood that in each cylinder there is contained, beside the piston, a valve operated directly by the piston to admit and exhaust the steam to and for the next cylinder. The valve j is for the purpose of starting, stopping, and reversing the engines. When this valve is drawn so that the steam admitted at k passes from the top of the valve into k' , the steam will be exhausted through l' by the under side of the valve, and vice versa, the crank turning according to the direction the steam takes in these two pipes.

Figs. 3 and 4 are enlarged views of the crank, showing the manner of attaching the connecting rods. As the cylinders all lie in one plane, the ends of the connecting rods all meet and abut upon the crank pin, some device must be resorted to to keep them there. The end of each of the connecting rods terminates in a crosspiece q' on the connecting rod q and r' on the opposite rod r ; each crosspiece on its face is hollowed out to fit the crank pin and press against it. These faces are less than a quarter of a circle, in order to leave room for the vibration of the rods as seen in figs. 1 and 3. The connecting rods are kept pressing up to the crank pin by means of two rings which embrace the whole four of the cross arms, one ring being between the crank and the connecting rods, as seen at s , fig. 4, and the other above the rods and extending out to the end of the crank pin as at s' , figs. 3 and 4. These rings are kept in place by a cap t , fig. 4, screwed to the end of the crank pin p . The operation is as follows:—Steam being admitted through k , the valve j is drawn, so as to allow it to flow through k' , whence it will pass by the branch pipes to each of the cylinders, a b c d . The piston g is just at the end of its return stroke and in the position ready to receive steam. The position of the recess n' of the valve in cylinder a is just at the edge of the port or opening into the channel e' and likewise at the steam aperture h' . So soon as the said recess passes these openings, a continuous channel is at once formed, and the steam flows through o into the cylinder b above the piston, and accordingly drives the latter toward the crank. At the same time that the piston in b is receiving the effect of the steam admitted through the cylinder a , the piston in b is performing the office of regulating the flow of steam into and from c , the piston in this latter cylinder having performed its stroke is exhausting its steam, and it will be seen by the direction of the arrow flowing back through f and i to the final discharge l . The lower face of the narrow channel o' forms a "cut off" by lapping over the port in e' as soon as the piston has performed one half of its stroke, in which position it is shown in cylinder c . This lap may be made adjustable as to length by a sliding piece, and, therefore, regulates the expansion to any degree desired.

Several variations can be made in this engine. It is not necessary that the channels f and e be separate; they may be included in one and may terminate in the cylinders above the pistons, so as to omit the passage o and o' ; the cylinders need not also stand in the position shown in the engravings, but may be placed parallel to each other. Steam has been described as the fluid used for the motive power, but water, gas, or other fluid may be employed, and the engine also be employed as a pump.

The telegraph wire which was erected some years ago for the transmission of messages to and from her Majesty the Queen during her residence at Balmoral, has just been partially destroyed in a wilful manner by some person or persons at present unknown.

Correspondence.

LONDON ASSOCIATION OF FOREMEN ENGINEERS.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—My attention has just been directed to a lithographic circular, dated July 15, 1865, addressed to the heads of a London engineering establishment and signed "Henry Grissell." It has reference to what is termed in the document itself "The Foreman's Association Superannuation Fund," but which I assume to mean, "The Superannuation Fund of the London Association of Foremen Engineers." If I am correct in this assumption, and it is impossible for me to be mistaken, because the context of the circular demonstrates the fact, I must beg of you to be kind enough to insert this letter in the next number of the MECHANICS' MAGAZINE.

Mr. Grissell, in publishing and distributing the circular in question, has done great injustice to the Association of which I am chairman, and I do not hesitate to state that he has also disseminated statements which are at variance with truth. It is not necessary for me to recapitulate particulars as to the origin of the superannuation fund of the society; they are already well known to most of your readers, and I do not desire to occupy your valuable space unnecessarily. I may, therefore, refer at once to the assertions of the circular, copies of which have been, I am told, forwarded to all the donors to the fund and to many other engineering employers. The opening paragraph runs thus:—"Mr. Henry Maudslay, Mr. England, and myself, having had many communications with the Foreman's Association, with regard to the proper application of the fund raised for donations from some of the masters, which will amount to over £500, and we being of opinion that the application of the fund will not be in accordance with the wishes of the donors generally, I am requested by Messrs. Maudslay and England to say, that it is our united opinion a private meeting should be held by the masters who were donors to this fund, and other employers, for the purpose of hearing a statement from us, and of taking counsel together as to what course should be pursued under the circumstances." Mr. Grissell further invites the "masters" to assist at such a conference, and "to have a dinner together at their own expense, at the 'Ship and Turtle,' Leadenhall-street, on as early a day as possible," and he adds, "we feel that very little good will result from working with the present Association in such a matter, that we had better originate a 'London Engineers' Pension Society,' and invite such of our foremen, clerks, draughtsmen, and other assistants above the rank of operative artisans who may feel inclined to subscribe to or otherwise join the society."

Now, Sir, I maintain that the members of the London Association of Foremen Engineers have great reason to complain in respect of the insinuations levelled at them in the foregoing literal extracts, and I, as their representative, as well as on my own account, am determined that they shall not pass uncontradicted.

I beg to assure the generous donors to the superannuation fund of the Association, that the money given by them will be dispensed precisely in the way prescribed in the printed appeal which was sent to them before their donations came into my hands. Whatever the "opinions" of Messrs. Maudslay, Grissell, and England may be—and one of them has not subscribed at all to the fund—I state as a positive fact that they, and not we, have endeavoured to divert the contributions of donors to other purposes than those for which they were subscribed. Mr. Grissell himself frequently urged the necessity of assimilating the rules of our Society to those of the "Butchers' Charitable Institution," a very good institution in its way no doubt, but having nothing whatever in common with our own. The same gentleman endeavoured in committee to obliterate altogether the word "Foremen" from the title of the fund, and subsequently to make it legal for masters' nominees, not members of the Association at all, to become participants in the benefits of the superannuation fund. These and many other equally inadmissible propositions were made and over-ruled in committee, and hence the animosity of the writer of the circular.

It would not have become me to put forth these statements publicly, had Mr. Grissell not invited me to do so by the course he has now taken. To remain silent in presence of the "circular," might be construed into an admission of its truthfulness, and that I cannot allow.

The committee of which the three gentlemen, in company with four ordinary members of the Association, are members, has not yet made its report, and yet we have a publication put forth by them completely *ex parte*, and, as I contend, of the most unfair character.

I appeal to the donors invited to the "Ship and Turtle" to withhold their judgment until the whole of the facts are before them. If they are then dissatisfied, I am sure no member of the London Association of Foremen Engineers will object to their donations being returned to them.

The formation of another society I have nothing at all to do with. Our own had gone on admirably until, in an unfortunate hour, Mr. Grissell was invited to, and did, preside at one of its anniversary festivals. Discord has scarcely been absent from its ranks since, but I have no fear for its future, nevertheless.

It only requires the friendship of employers generally, and it can afford to be indifferent as to particular instances of misconception and prejudice.

I am, Sir, your obedient servant,
Royal Mint, E.C. JOSEPH NEWTON.
July 26, 1865.

CELLULAR BRIDGES.

SIR,—Want of time has alone prevented me from replying earlier to the letter of your correspondent, published in your number of June 20th, on the subject of Paine and the Sunderland Bridge. Your correspondent, "The Writer of the Article" in your number of June 9th, objects to the remarks made upon it in my letter published in your number of June 23rd, on two principal grounds,—first, that his article did not assert that which I was led to think it did, namely, that Paine was the designer of Sunderland Bridge; and secondly, in reply to my observation, that I was unable to satisfy myself of the resemblance or identity of Paine's and Burdon's methods of construction, he states that this point is set at rest by the admission of Mr. Milbanke, a contemporary of Burdon, and associated with him in the pecuniary matters connected with Sunderland Bridge. I must inform your correspondent that no change has taken place in my opinion in consequence of his remarks. On the first point, I submit that the language used by your correspondent, if not asserting in direct terms that Paine was the designer of Sunderland Bridge, is capable of no other construction. He says, "Moreover, it can be pretty well proved that the bridge across the Wear, at Sunderland, generally considered to have been designed by Burdon, was really made from Paine's model." Your readers will judge how far the above expressions justified my opinion that Paine was set up by your correspondent as the designer of Sunderland Bridge. On the next point, as to my inability to satisfy myself of the similarity of Paine's and Burdon's methods of construction, I must also say that the only new point advanced by your correspondent, namely, the allusion to the opinion of Mr. Milbanke, has not at all changed my opinion. In order to throw a light upon the question of the similarity or dissimilarity of the two modes of construction, let us place side by side your correspondent's description of Sunderland Bridge as constructed, and an extract from the specification of Paine's patent, a document which it might fairly be assumed would be in accordance with the construction of Paine's arch and model. Your correspondent writes, "In this bridge (Sunderland), which consists of a single arch, of 240ft. span, and 30ft. rise, the radiating voussoirs of the stone arch are imitated by similarly-formed perforated blocks of iron." And he adds, "this was the very plan adopted in Paine's experimental arch, and in the model left at the ironworks where the Sunderland Bridge was made." The following extract from Paine's specification describes his method of construction:—"The curved bars of the arch are composed of pieces of any length joined together to the whole extent of the arch, and take curvature by bending. These curves, to any number, height, or thickness, as the extent of the arch may require, are raised concentrically one above another, and separated, when the extent of the arch requires it, by the interposition of blocks, tubes, or piers, and the whole bolted close and fast together (the direction of the radius is the best) through the whole thickness of the arch, the bolts being made fast by a head pin or screw at each end of them." It certainly does appear to me that the above descriptions differ most materially. In the first, voussoirs, similar to those in stone arches, are said to be imitated by similarly-formed perforated blocks of iron. Where, I should wish to ask, is the resemblance to be found to the above in the framed-up arch of Paine, with its continuous bars, curved by bending, separated by blocks, tubes, or pins, and all bolted together radially? As regards the statement attributed to Mr. Milbanke, that he had good grounds for saying that the first idea of Sunderland Bridge was suggested by Paine's bridge, all I can say is (as I have already done in my first letter) that, whilst thinking this highly probable, it does not, in my mind, deprive Burdon of the merit of invention. It appears to me that, to take the first idea of something about to be constructed from an already existing object, does not by any means necessarily imply the existence of the same mechanical properties in both. There may be copies as regards the mere forms of things, without any, or much, resemblance in their properties. This, I think, holds in comparing Paine's and Burdon's method of constructing arches. In general form they no doubt resemble each other considerably, as indeed must needs be the case in all arches consisting of concentric

members joined together by radiating pieces; but whilst, in Paine's construction, the arch, as it appears to me, would be flexible to a highly detrimental degree, Burdon's voussoirs, each cast in one piece, would, I think, certainly give much more stiffness and resistance to rocking, although it is well known that even with this advantage Sunderland Bridge was greatly deficient in this respect. Alluding to first ideas in invention, if Paine took the original idea of his arch, as he says, from a spider's web, the resemblance was in form alone, since there appear no other properties in common between the two. So Burdon, seeing Paine's arch, might have taken his first idea of Sunderland Bridge from it, introducing, however, properties of strength in construction not to be found in Paine's arch, for which therefore he would be entitled to full credit, and might probably have maintained his right as a patent invention if tried in a court of law.

It may perhaps not be out of place to add that in the Coalbrookdale Bridge, erected in 1777, eleven years before the date of Paine's specification, a considerable portion of the arch consists of concentric numbers of cast iron connected together by radiating pieces, presenting, therefore, a somewhat similar appearance to Paine's mode of construction. To it, therefore, as well as to Paine's arch, Burdon's attention may have been directed when studying the subject, and this appears all the more probable from the resemblance of the filling in of the haunches in this bridge and the one at Sunderland, in both of which open circles of iron are used. In conclusion, I should put a very different construction upon the circumstance of Paine's application to Mr. Milbanke for compensation for the use of his patent in Sunderland Bridge from that arrived at by your correspondent, for it certainly appears very remarkable indeed that, if the close resemblance assumed by your correspondent, between Paine's constructions and Sunderland Bridge really existed, and Mr. Milbanke's opinion corroborated this view, Paine and his friends should have refrained from further prosecution of his claim legally.

I am, Sir, your obedient servant,
GEO. H. PHIPPS.
London, July 24, 1865.

TO CORRESPONDENTS.

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

Advertisements are inserted in the MECHANICS' MAGAZINE at the rate of 6d. per line, or 5d. per line for 6 insertions, 4d. 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 6 o'clock on Thursday evening.

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

RECEIVED.—J. R.—J. H.—G. S.—W. W.—H. and Son.—J. H. T.—R. P.—J. M.—W. R.—T. H. E.—W. H.—W. H. P.—J. F. E.—A. W.—G. N.—G. H. P.—W. W.—T. H. E.—A. W.

S. H. C. (Nott.)—The best water meter is that by Mr. C. W. Siemens, of London, of which there are more than 10,000 in use in England alone.

LEBA.—The best method of preventing escape of heat from an engine is to carefully clothe every exposed part. The cylinder should be encased with a steam jacket, and the steam jacket itself, and all the steam pipes, top of boiler, &c., protected by covering with a layer of 3 or 4 in. of sawdust, ashes, or other good non-conductor of heat. By this means a considerable saving will be effected.

W. HETTERINGTON (Birkenhead).—According to your description there appears to be an infringement, but the point is a nice one, and requires the careful opinion of a patent agent.

J. H. (Bolton).—No further information has transpired with respect to the discovery by M. M. du Moncel, and M. Carlier, that electro-magnets with uninsulated wire do twice as much work as those with insulated wire.

IMPROVEMENTS IN SHIPBUILDING.

WHEN it is remembered that in the frame alone of a ship not an inch of material used in construction is brought to form in the ordinary way without moulds, any plan for reducing the expenditure of labour and materials must meet with general approval. Such a plan has been worked out by Mr. T. H. Eastlake, of Pembroke Dock, who proposes, by means of apparatus of a very simple character, to dispense with a great number of the made moulds used in iron and wooden shipbuilding, by the introduction of an apparatus consisting of a flexible rod, so governed by controlling rods as to allow of its being adjusted to many of those curved portions of a ship's hull or lines for which moulds are required. In the engraving, fig. 1 represents a

IMPROVEMENTS IN SHIPBUILDING.

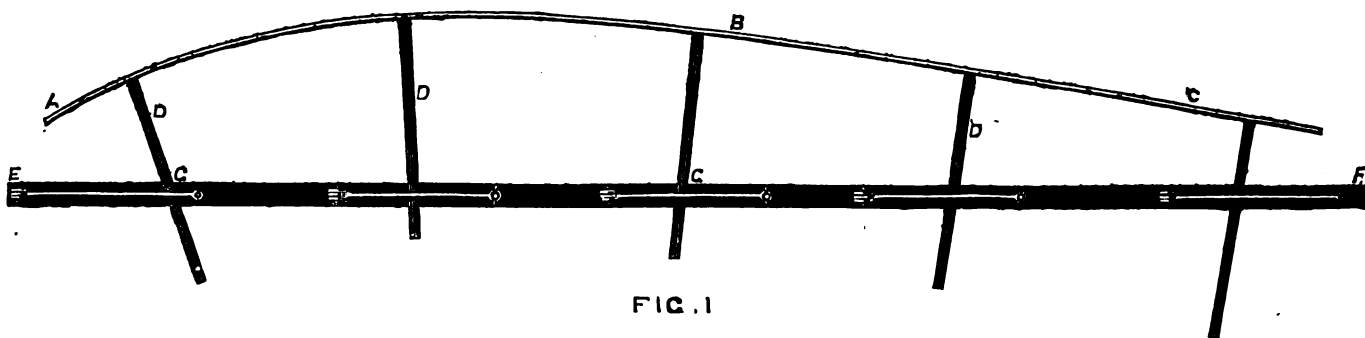


FIG. 1



FIG. 3.

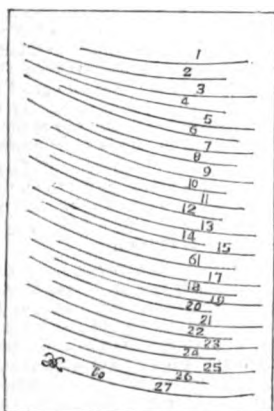


FIG. 4.

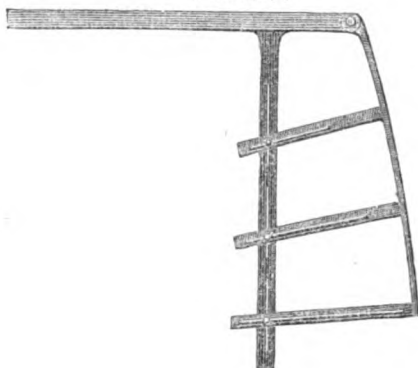
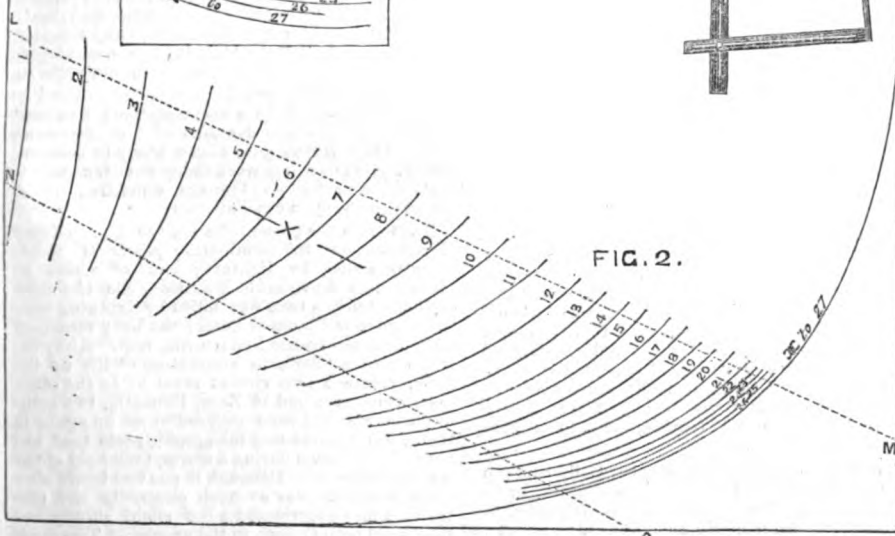


FIG. 2.



plan and side elevation of one arrangement of the apparatus. A B C is the flexible rod, to which are attached controlling rods D D, the ends of which are secured upon the rigid bar E F, when the flexible rod is brought to the required form. The controlling rods are here shown to be secured by means of hinged clamps G G, held down by thumb nuts, but other methods for effecting this may readily be adopted. If considered advisable, the controlling rods may be hove in and out by a rack and pinion, or in any other manner; the rods, if necessary, being made to work square to the rigid bar E F, instead of square to the flexible rod, as shown. The following description illustrates some of the methods of using the apparatus. First, taking the case of an iron ship constructed on the longitudinal system:—Let fig. 2 represent part of the body plan, and L M, N O, the projections of two longitudinals; then the curves —X— will be the moulding edges of the short pieces of angle iron, forming the outside of the frames between the longitudinals, for each of which moulds would be required by the angle-iron smiths. To dispense with these moulds, the curves —X— are transferred to a board, fig. 3, by means of the apparatus, keeping them only sufficiently apart to allow of their being marked with a distinguishing number, so as not to increase the size of the board unnecessarily. This board should then be placed alongside the swelling slabs, in order that the angle-iron smiths may take off the mouldings with the

apparatus as required; and to prevent the latter from being injured by contact with hot iron, the whole for any portion of it may be made of steel.

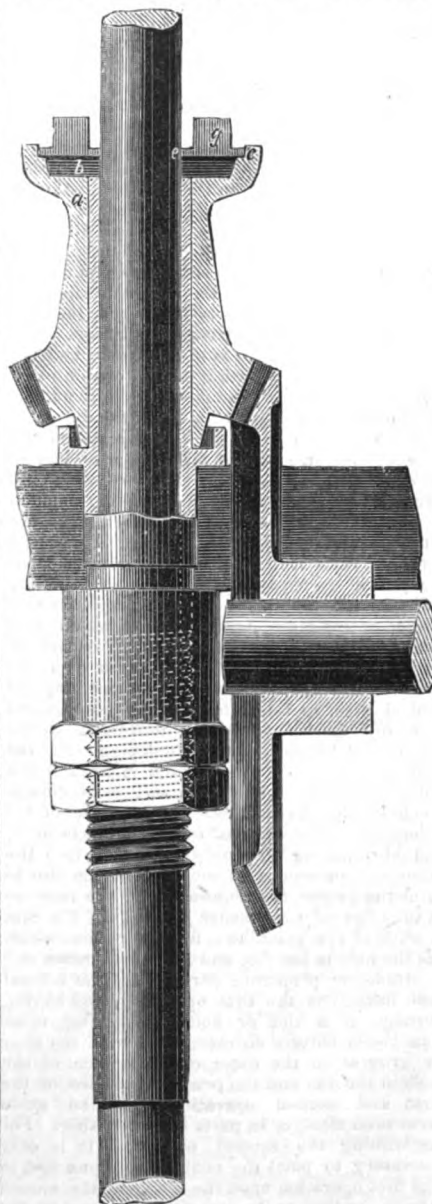
The longitudinals when used, and also the recesses for armour in ships of war, divide the vertical frames into short lengths; this would permit the use of a short, and, consequently, light apparatus, for a great portion of the frames. For moulding brackets, a slight modification of the apparatus would be necessary, and as an illustration how modifications may be made to suit particular cases, fig. 4 shows a form which may be used in fitting beam-knees to the side. The apparatus could also be applied in fitting the curved edges of deck stringers, and bulk-heads, and for taking the sny and sheer of the edges of the plating, &c.

In the case of a wooden ship, let fig. 2 again represent part of the body plan, and L M, N O, two diagonals representing the heads and heels of the first futtocks of the frame. The method pursued in this case would be similar to that before described; the curves —X— being transferred to the board, fig. 3, and taken to the saw-pits and ship's side, for the use of the converters and workmen in moulding the timbers. As in the ordinary method of moulding the timbers, with but few exceptions, the form is given by spots at the heads and sirmarks, through which a batten is penned by the workmen; it will be seen that the adjusting of the apparatus, when compared with the usual system, is no ad-

ditional labour, while the moulds are dispensed with. As may be perceived, the board, fig. 3, when planed, will do for other ships, but in the smaller shipyards these boards are unnecessary, as the draughtsman or foreman could adjust the apparatus to the lines on the floor, and thus mould the timbers direct. In cases where the ordinary moulds are considered preferable, the apparatus could be applied in transferring the curves from the floor (or elsewhere) to the mouldstuff for cutting-out.

SPINNING MACHINERY.

THIS invention, which has been patented by Messrs. Edmund Calvert and Thomas Edmeston,



of Walton-le-Dale, Lancaster, relates to those descriptions of machinery in which bobbins or

tubes are employed, and consists in placing a plate or platform on the top of a chamber or recess formed in the top of the washer wheel or bobbin braid used for driving the bobbins or tubes. It also relates to apparatus for manufacturing the said parts. The aforesaid plate or platform is made of cast or sheet metal, or other suitable material, in the form of a washer, having on its outer edge one or more projections, which are fitted into recesses on the outer edge of the washer wheel or bobbin braid, so that both revolve together. There are also one or more raised parts or projections on the top of the plate or platform, for the purpose of fitting into a corresponding slit or slits in the ends of the bobbins or tubes, and causing them to revolve.

The accompanying engraving represents an elevation, with part in section, showing the application of one of the improved plates or platforms to one of the washer wheels or bobbin braids used in machinery for preparing, spinning, and doubling fibrous materials. The washer wheel or bobbin braid is marked *a*; it has at the top a circular chamber or recess *b*, having its edge formed as a circular ledge *c*, in the edge of which there are recesses. The plate or platform is marked *e*; it has projections at its outer edge, and at the top raised parts or projections *g*. The circular edge of the plate rests in the ledge *c*, and the projections in the recesses, so that the plate is held to and turns with the wheel, and at the same time forms a lid or cover to the chamber *b*, the projections *g* being fitted into slits in the ends of the bobbins or tubes. It will be readily seen that flannel or other fibrous material can be placed in the chamber and saturated with oil for lubricating the spindle and washer wheel, and that the plate or platform covers the chamber and prevents fibres and dust from becoming mixed with the oil, and the bobbins or tubes from becoming oily and dirty, and also that the projections or drivers on the top of the plate can turn the bobbins or tubes with steadiness.

The apparatus for manufacturing the improved plates or platforms of sheet metal is as follows:—In an ordinary screw lever or eccentric punching machine is fixed a die, having a circular hole in the centre corresponding in size with the hole required in the plate or platform, and also one or more rectangular or other shaped holes corresponding in shape with the raised parts required on the top of the plate or platform. In the ram or slide of the punching machine is fixed a punch, the centre or nipple of which corresponds in size and form with the hole in the centre of the die before mentioned. The upper part of the punch is of sufficient diameter or size to admit of fitting into it one or more small punches corresponding with the rectangular or other shaped hole or holes in the die. If it is required to make the raised parts on the plate or platform square, the bottom of each of the small punches must also be square, with only three cutting sides, the fourth side being rounded or inclined in order that the punch shall not cut the metal on that side, but bend it over as a burr, and raise it to a perpendicular position as the punch proceeds downwards, and thereby form one of the raised parts or projections on the top of the plate; other forms of raised parts can be made by forming the dies and constructing the small punches of the shapes required, and the first operation consists in punching the central hole, and forming one or more raised parts during one downward movement of the ram or slide of the punching machine. For the next or second operation a die is fixed in the punching machine having in it a hole corresponding with the required form and size of the external circular edge of the plate or platform, and also having slots or grooves cut into the outer circumference of the hole in the die to form the projections required to fit the recesses in the edge of the washer wheel. In the ram or slide of the machine is fixed a punch, which fits the hole in the die, and has at its bottom end a nipple or projecting part fitting the central hole formed in the first operation, and having through it a slot or hole for holding cross punches or cutters corresponding with the slots or grooves in the outer circumference of the hole in the die, and the punches and dies for the first and second operations can be made from solid steel, or in parts fitted together. For performing the second operation it is only necessary to place the central hole punched in the first operation upon the nipple of the second punch, so that, as the ram or slide descends, the punches and dies will shape the external edge of the plate or platform, and complete its manufacture

Miscellaneous.

Among the numerous mines in Devon and Cornwall now paying good dividends to the fortunate shareholders are many which at one period of their history were abandoned for want of capital. At the present time there are several mines in the state of transition arising from the exhaustion of the patience or capital—or both—of the old adventurers, and the resumption of working by new subscribers. Among the most recent, and at the same time most promising, of these, is the Devon Wheal Lopes Mine, situated in the parish of Bickleigh, Devon, and which was formerly worked for copper, tin, and lead, of which there are large deposits. A company has just been formed for the purpose of resuming the workings of this mine, and has been incorporated under the "Companies' Act, 1862," by which no shareholder is liable beyond the actual amount of his own shares. The nominal capital of the company is £20,480, in 1,024 shares of £20 per share, and of this amount it is not expected that more than £12 per share will ever be required to be called up. We should not omit to notice that one of the most important features in the prospects of the company, and which has mainly led to its formation, is the existence of an extensive deposit of blende (zinc), which until recently was a worthless mineral, but now is of great value. It is estimated that £20,000 worth stands in one level alone, which can be at once removed on the mine being unwatered. From the numerous favourable and well authenticated reports there can be no doubt of the value of the mine, and very little fear of its speedy success.

A case of spontaneous combustion has just occurred on board the Hamburg schooner "Ingelborg," Captain Peter Blohm, which loaded a cargo of coals at Hartlepool, and sailed thence on Saturday last for Hamburg. All went on well till they reached the Dogger Bank on Sunday last, when suddenly an explosion took place, blowing the ship's deck high up into the air. The captain was the only one injured, his face, eyes, and hands being much burnt; the rest of the crew escaped unhurt. They had just time enough to get into the stern boat and leave the ship when she went down.

The competition at Wimbledon for two prizes given by Dr. Erhardt, the inventor of a new description of gunpowder—one a £10 cup and the other a revolver pistol—took place at the latter end of last week. Dr. Erhardt's object was to test the efficiency of his powder by actual shooting at the target. There were numerous entries for the prizes, but the practice was not good. The new powder is white. It is made up of two constituents, which are separately non-combustible, but when mixed the compound becomes more powerful than gunpowder. The ammunition was made up in the form of a whole cartridge, with only 7-8th drachm of the new powder. It was evident, however, that the ammunition was not suitable, for the bullets stripped, and the practice was wild. Subsequently it was found that by loading with the same amount of powder, and loading with a close-fitting Metford bullet, good practice was made, the bullets going up with great force.

The vexed question as to whether California contains oil or not seems to have been decided, as the first shipment of one hundred and twenty gallons of crude petroleum from Humboldt County arrived at San Francisco on the 13th ult.

In the parish of Gwennap, Cornwall, is situated the hill of Carn Brea, on the northern side of which are the celebrated Carn Brea Mines, the district being one of the finest for mining known in Cornwall. Adjoining Carn Brea Hill is that of Carn Marth, on the northern declivity of which is situated the valuable mine known as the West Trelawney. The almost fabulous returns from some of the mines by which it is surrounded might of themselves be sufficient to render this site valuable. But there is to be added the strong encouraging fact that the lodes of many of the extraordinary mines in the vicinity traverse West Trelawney. A company called the "West Trelawney Mining Company, Limited," registered under the Companies' Act, 1862, has been formed to work this mine; the capital is £30,000 in 10,000 shares of £3 each. Considering that this mine is literally surrounded by others of renowned wealth, it will be seen that the prospects of this company are free of the ordinary risk of mining enterprise. Workings have already been carried down to the depth of 50 fathoms, and its further development, if properly conducted, appears to be certain of similar discoveries to those made in its neighbours, and of similar good results to the shareholders.

At a banquet given in connection with the Russian Exhibition of Manufacture, a desire for free trade was evinced by several speakers. A manufacturer of China was showed how impossible it was that he could compete with English porcelain, when the clay which he required could be imported from England at 5s. 9d. per cwt., and Russian clay, of rather superior quality, could only be purchased in Moscow at 8s. 9d. the cwt. Mr. Shipof, an iron

manufacturer, and the leader of the protectionist party at Moscow, said that all Russia had to do was to follow the example of England, which had maintained protection as long as it had suited her, and which even now protects the manufacturers of stearine candles and the distillers of spirits.

A new method of fastening brooches and other similar articles of use and ornament, is due to Mr. Blackham, a Birmingham manufacturer. The fastening of the brooch is relieved from undue pressure in any one part, and instead of a soldered joint, so liable to rupture, the hinge is formed by a coil of the metal of which the pin is made, and so acquires the necessary spring by fitting into a strong socket. The sharp end of the pin does not project over the body of the brooch, but is held secure within a projecting shield.

At ten minutes to six on the evening of the 13th inst., a severe shock of earthquake visited the town of Pollan in Styria, and its environs. The shock was felt in a north-westerly direction, and was accompanied by a very strong undulatory motion, which continued for about three seconds. Another shock was experienced the next morning at a quarter to ten o'clock, but was weaker than that of the previous night. Shocks were likewise felt on the same day at about the same time, in Hartberg and Fehring. Three shocks occurred on the 13th, at two minutes past six in the evening at Fürstenfeld, having a north-easterly direction. By the last of these, which followed each other in rapid succession, the walls of several buildings were cracked.

The well-known marble quarries of Massa-Carrara, near Leghorn, which are stated to be the principal source for obtaining white and veined marble, are about to be purchased and extended by a company with a capital of £140,000.

The first ordinary meeting of Reuter's Telegram Company (Limited) was held last Monday. The report stated that the net profits of the last six months amounted to £6,645; and that after the payment of all charges, and of a dividend of 8 per cent. per annum, a balance of £2,443 would remain to be carried forward. Mr. Reuter said that, during the last six years the receipts had steadily increased, and the present income was almost entirely secured for several years by contracts in this country and abroad.

That Paris would be a maritime port has long been the dream of the denizens of that charming city. That dream now seems likely to become reality. One day last week there were ten steamboats of considerable tonnage unloading their cargoes on the Quai des Tuileries.

Dr. Boudin has presented a note to the Academy of Sciences on the fulminating power of bodies recently struck by lightning and of which he adduces two remarkable instances. On the 30th of June, 1854, a man was killed by lightning near the Garden of Plants at Paris; the body remained for some time exposed to a pouring rain. After the storm two soldiers, in attempting to lift up the body, received two violent shocks. In the other case, which occurred at Zara, Dalmatia, two artillerymen who had been ordered to set up again in their former places two telegraphic posts that had been thrown down during a storm, took hold of the telegraphic wire. Although it was two hours after the storm, there was so much electricity left that the men first experienced a few slight shocks, and then were both thrown to the ground. The hands of both were scorched, and one of them did not even for a time show any signs of life. The other, in attempting to get up, sank down again, and in so doing touched a comrade, who was coming to his assistance, with his elbow. The third man was then thrown down in his turn, experienced various nervous effects, and his arm was marked with a burn at the spot where he had been touched by the other man's elbow.

Being fully convinced that publicity is the best security for premises containing valuable property, Mr. Walker has adopted the following method of closing and securing his shops since the burglary at his establishment in Cornhill. The system adopted is to protect the front of the shop by means of an iron railing in lieu of shutters. By this plan the shop is perfectly open; the gas being left burning every passer-by at night is thus enabled to view the whole of the interior as well as in the day.

Mr. Gale and Mr. Stunders have had an interview, at Woolwich Arsenal, with several members of the Ordnance Select Committee, for the purpose of laying before them their new invention for rendering gunpowder non-explosive. Some experiments were made, with which the committee were highly satisfied, and expressed their intention to take the matter at once into their consideration.

We understand that the Austrian Government has received and accepted an invitation of the English Government to have the Austrian flag represented at the review of the fleets at Plymouth. It is also stated that the Austrian propeller corvette "Erzherzog Friedrich," Capt. von Wipplinger commander, will be at this review. Invitations have also been sent to Italy, Prussia, and the small naval Powers.

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,—37, 51
BUILDINGS AND BUILDING MATERIALS,—67
CHEMISTRY AND PHOTOGRAPHY,—50, 56
CULTIVATION OF THE SOIL, including agricultural implements and machines,—34
ELECTRICAL APPARATUS,—70
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c.,—32, 43, 44, 45, 69
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals,—38, 39, 42, 47, 64, 68
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.,—26, 27, 36, 49, 53, 58, 60, 61
GENERAL MACHINERY,—25, 62, 63
LIGHTING, HEATING, AND VENTILATING,—33, 40, 41, 57, 65
METALS, including apparatus for their manufacture,—46, 59
MISCELLANEOUS,—31
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.,—28, 30, 35, 48, 52, 55, 66
SHIPS AND BOATS, including their fittings,—29
STEAM ENGINES, &c.,—None
WARFARE,—None

25 J. F. JONES. *Improvements in machines for making paper board.* Dated January 4, 1865.

The object of these improvements is to produce paper board in a continuous, indefinite length by a peculiar construction and arrangement of parts, as hereinafter described. In papermaking two distinct classes of machines have been employed—the cylinder machine, in which a cylinder takes the pulp from a vat, in which it runs and deposits it upon a felt that passes between press rollers; and, second, the Fourdrinier machine, in which a wire cloth apron is employed which receives the layer of pulp and deposits it upon the felt to be run through the press rollers in the same manner. These improvements combine in a degree the qualities of both these classes of machines. A suitable frame is employed on which is mounted, in any desirable manner, a large hollow cylinder composed of two end rims or rings, connected at a short distance from the periphery by longitudinal rods, on which rests a covering of wire cloth, permitting the passage of water filling the entire space between the said rings. The cylinder may be supported in any convenient manner, and revolved by any suitable means. Around this cylinder in a circle, and at a suitable distance therefrom, are arranged pressing rollers. These rollers may extend entirely or only partially around the cylinder. They are made adjustable in reference to the cylinder by means of pressure rollers and coiled springs, or other suitable devices. The induction roller at the top has a pressing device, so arranged as to force the said roller away from the cylinder to admit the pulp, and the other rollers have the pressing device so arranged as to force the rollers down to the work. The boxes of these rollers may be kept in position by means of set screws. Around the said rollers passes an endless wire mesh apron. The distance between this apron and the cylinder is sufficient to allow the necessary depth of pulp to form the required thickness of board. The distance between the cylinder and apron may be varied by the said screw and spring or other convenient means. The pulp from the hopper passing between the cylinder and endless apron is compressed into a web, then carried around to the last roller of the series by the motion of the cylinder and rollers; it is taken up by an adjustable coupler, the latter being situated at an angle equidistant from the said roller, and another roller placed in an exterior projection on the circular frame supporting the said rollers surrounding the cylinder. This coupler is made adjustable by means of a spring and set screw, and presses the web against the two rollers. A felt passes around the roller on the exterior of the circular frame, and another roller in the frame of the machine, on which felt the web is carried between the said roller in the frame and a similar roller directly above. Within the cylinder is situated a shallow re-entrant or trough, preferably occupying the whole diameter of the interior, and having a suitable discharge spout at one end. This trough catches the water that is pressed from the pulp at the top of the cylinder. The suction box employed is composed of three longitudinal grooved rollers made of india-rubber or other suitable material situated within the cylinder at the top. The two upper ones reach the wire cloth surrounding the cylinder, and the lower one works between the other two, forming a tight enclosed space between the three rollers and the cylinder. These rollers have suitable end bearings and an escape pipe open from the said enclosed space. The inventor employs also a vibrating or reciprocating bar in the hopper, for the purpose of interweaving the fibres of the pulp, and properly feeding the same into the space between the cylinder and the endless apron. This bar is preferably formed with rings and intermediate spaces, and receives its motion in any convenient manner. *Patent abandoned.*

26 G. KENT. *Improvement in apparatus for cleansing and polishing knives.* Dated January 4, 1865.

For the purposes of this invention, in order to give elastic support to the strips of leather employed in knife cleansing and polishing machines, the patentee employs strips of cloth of woven horsehair or other strong hair or bristles. These strips of woven cloth are (by preference) folded in their length, and their edges are fixed, producing when desired in each case a hollow tubular support at the back of the strip or piece of leather to which it is applied. These woven elastic supports do not project so far from the surface to which their edges and edges of the strips of leather are fixed as the outer edges of the strips of leather project; hence the elastic woven supports do not act or come in contact with the knives. In the place of, or in conjunction with, these woven elastic supports, hollow tubular vulcanised india-rubber supports are employed. These hollow tubular supports of india-rubber may be made into com-

plete tubes formed with longitudinal fins or projecting ridges to facilitate their being fixed parallel with the edges of the strips of leather which they are to support; or narrow strips of sheet vulcanised india-rubber may be folded longitudinally, the edges thereof being fixed at the backs of the strips of leather which they are to support; or a sheet of vulcanised india-rubber may have several folds formed, in order that the strips of leather may be supported by the several folds of the india-rubber. In some cases steel-tempered wire is employed, bent into vandykes—one vandyke bend resting on other such vandyke bends or strips of steel ore used in combination with the above or separately, with numerous cuts at the upper edges in order to form numerous narrow springs. The elastic supports are applied at the backs of the strips of the leather, so as not to project so far as the strips of leather, in order that the elastic supports may not, when they are in use, come against the knives which are in the machines. *Patent completed.*

27 N. THOMPSON. *Improvements in stoppers for bottles, jars, vessels, and tubes, also for ordnance and fire-arms.* Dated January 4, 1865.

This invention has for its object improvements in stoppers for bottles, jars, vessels, and tubes; also for ordnance and fire-arms, and consists in constructing a stopper of a ring of a soft yielding elastic substance placed between two discs or parts, an upper and a lower one, to one of which is hinged or jointed a lever, which, when turned on its hinge or axis, is caused to act on the other part in such manner as to move the two parts towards each other; when the discs or parts are drawn towards each other by turning the lever, they compress the elastic material between them, and cause it to bulge or protrude outwards all round the discs or parts, and the lever is so formed as to retain the parts from again separating until the lever is turned to allow them to do so. *Patent completed.*

28 W. H. ROY. *Improved means of checking the receipts of railway clerks.* Dated January 4, 1865.

The chief object of this invention is to enable railway companies to retain a counterpart of all excess of luggage and fare vouchers or receipt tickets issued to passengers by ticket collectors and clerks, and thereby to give to such companies a complete check upon all their servants who are empowered to receive moneys on this class of traffic. To attain this result, the patentee prints in duplicate blank forms of tickets on paper of two different colours, to make a marked contrast between the one to be delivered, when filled up, to the passenger, and the other (the original) to be retained by the company. These tickets he binds up together, so that the original and counterpart tickets will alternate throughout the book, that is to say, all the sheets of original tickets which are intended to remain in the book and be filled up by the station clerk or ticket taker, as the case may be, shall have a counterpart on the leaf following it, and these counterpart tickets shall correspond in position to or underlie the original tickets bearing the corresponding numbers. The original ticket, or that which is to be retained by the company, he proposes to print on white paper, and the counterpart on orange, or such other colour as will contrast well with the white. This marked distinction in colour will enable any casual looker-on to assure himself that the collector or clerk is following his instructions by filling up the white ticket to be retained, and thus preparing simultaneously the receipt or voucher for payment of excess charge for delivery to the passenger. *Patent completed.*

29 W. WATSON. *Improvements in apparatus for propelling vessels.* Dated January 5, 1865.

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

30 C. PICKWORTH. *Improved means of communication between passengers and guard and between the guard and driver of a railway train in motion.* Dated January 5, 1865.

One object of this invention is to enable passengers in a railway train to communicate by signal with the guard when the train is in motion, and another object is to enable the guard to communicate with the driver. The means employed to communicate between the passengers and the guard consist of a hollow tube of metal or other material made in divided lengths, but united when the train is made up, so as to form a hollow tube secured to the railway carriages, and reaching from or over one end of the train to the other, and ending in or near the van, brake, or carriage of the guard or other person in charge of the train. The signal is communicated from the passengers to the guard by means of the balls of metal, wood, ivory, or other material, such balls being placed (one for each compartment of every carriage) in cups or other recesses above, but in connection with the tube, and retained in their places until a passenger pulls a wire or cord, when one of the balls will be released and will fall into the tube, and will, by the means hereinafter mentioned, be impelled through the tube into the said van, brake, or carriage, when, falling upon a metal gong or the spring of an alarm, it will immediately attract the attention of the guard or other person in charge of the train. The balls may be numbered or marked so as to denote the particular carriage and compartment from which they have been sent. The means to impel the balls through the tube consist of pneumatic pressure from fans or blowers connected by suitable machinery with the engine, and so arranged as to force a continuous current of air through the tube when the train is in motion. The communication between the guard and driver is obtained by means of a separate tube through which the guard may send written messages or signals to the driver of the engine in hollow balls; this could be worked by means of a fan or blower in the guard's van, and worked by hand or otherwise. *Patent abandoned.*

31 G. H. DAVIES and J. W. JONES. *A novel and improved means of advertising.* Dated January 5, 1865.

Provisional Protection has not been allowed for this invention.

32 J. W. BRANFORD. *The purposes of washing, squeezing, and mangling linen, woollen and other textile fabrics.* Dated January 5, 1865.

The documents relating to this invention cannot at present be seen, an extension of time for filing the final specification having been petitioned for.

33 J. M. KIRBY. *Improvements in the means of, and apparatus for, generating steam and heat.* Dated January 5, 1865.

In performing this invention the patentee proposes to construct a chamber of iron or other metal, or fire-bricks, by preference in the form of an inverted cone or dome, with

There is abundant room for enterprise in Virginia, for the Petersburg News says that in the whole commonwealth there is not, as far as it knows, a glass factory, a button factory, a paper mill, a broom factory, a manufactory of wooden ware, a brass foundry, a porcelain factory, a chair factory, a carpet mill, a pin machine, an agricultural implement factory, a manufactory for cutlery, a type foundry, a factory wherein a single article of printer's use is made, a brewery, a calico print factory, a lock factory, a linen factory or a cotton factory above capacity for the commonest work.

The Belgian Government has presented to the Chambers an important *projet de loi*, modifying again the Customs' legislation of Belgium. According to this *projet de loi*, pig-iron, which now pays an import duty of 8s., will pay only 4s. The duty on iron, which is now 2s. 6d., will be reduced first to 1s. 8d. and then to 10d. In July, 1866, worked pigs will pay 2s. 6d. and 1s. 8d. only after July, 1866, instead of 3s. 4d. as at present. Worked iron will pay only a duty of 4s. 2d. and 3s. 4d. after July, 1866. The duty on unwrought steel will be reduced to 4s. 2d. Engines and machinery, which now pay £1 12s. per ton, will pay only £1 4s. and 16s.; and the duties on iron and steel will be reduced successively from £2 8s. to £2 and £1 12s. per ton. Rolled zinc and lead will enter free of duty. As regard tin-plates, the duty, which is now 5s. per ton, will be reduced immediately to 4s. 2d., and in July, 1866, to 2s. 6d. per 2 cwt.

The question of the best and safest material for the construction of water tanks for ships is being discussed in France. Galvanised iron, it seems, has been employed in the French navy, but this is condemned by M. Roux, the author of a memoir on the subject, who finds zinc in the water kept in such tanks, and in such quantities that he considers the liquid unfit for domestic uses. M. Roux has also made experiments on the preservation of water in tanks that have been ungalvanised by removing the coating of zinc with hydrochloric acid, which we may suppose to represent plain iron vessels. In one of these he placed distilled water, in another water issuing from the green sand and containing some chloride of sodium, and in a third river water containing more chloride of sodium. He found the largest proportion of oxide of iron with the distilled and river water. He recommends for the Imperial navy water tanks tinned inside and galvanised outside, but he does not say how such tanks are to be made.

Among the most recent propositions for effecting communication between passengers and guards in railway trains, is Mr. Godfrey Sinclair's "Wing Signal." It consists of two discs or wings placed outside the end of the carriage. On pulling a chain inside, the discs are released and fall outward, becoming visible to the guard, whose sole occupation during the journey between stations is to watch for these signals. To enable him to do this his van is to be widened one foot on each side, and a window inserted which shall command along the side a view of the train. We fear this widening of the guard's van would prove a fatal objection to Mr. Sinclair's invention, if even the actuating principles of the signal were better. As it is they are far from perfect, being only a complicated system of chains and rings.

Referring to the late loss of life on the Matterhorn a correspondent suggests in a contemporary the following mode of proceeding on very dangerous ground. The party should first be tied together, with a good slack of rope between each. Starting close to one another, the leader should advance, and, if necessary, out steps, whilst the remainder, planted firmly in the best position to receive a shock in case of the first slipping, wait till he has gone to the end of his tether. He should then plant himself as the rest had done, and number two advance to him, the rest all stationary. The second having fixed himself, number three advances, and so forth.

Our readers may remember Howell's plan of communicating between passengers, guard, and driver, by means of a tube running the whole length of the train, through which balls or other articles are caused to pass by expansion with bellows, to give indications. We understand the proprietors of the patent now propose to exhaust the tube by connecting it with an annulus on the funnel of the smoke box, as a more economical method than any hitherto tried.

A public meeting has just been held at the Alexandra Hall, Blackheath, to promote the objects of the South-Eastern Industrial Exhibition, for the districts of Deptford, Greenwich, Woolwich, Lewisham, &c., which, by permission of the Admiralty, will shortly be held in one of the wings of Greenwich Hospital. The chair was occupied by General Alexander, who, in an address of some length, referred to the success which had attended similar exhibitions in various parts of the metropolis, and promised the undertaking his hearty support. Mr. E. J. Reed, Chief Constructor of the Royal Navy, referred to the importance of such exhibitions, as tending to create a spirit of emulation amongst working men. Resolutions in accordance with the objects of the meeting were adopted.

a furnace beneath. The floor of the chamber, which forms the top of the furnace, should be horizontal or flat. Behind the furnace a flue is constructed, and an opening is made for the ingress of cold air, which rushes into the chamber by a pipe fixed in an oblique position, so that the air readily ascends therein. At the top of the chamber is an exit pipe for the heated air and steam, and brickwork is set up to enclose or complete the chamber. Through the front of the chamber a water supply pipe is passed, extending close to the middle of the chamber, down which water is allowed to flow slowly, so as to drop upon the hot plate or floor, and thus become instantly converted into steam. Coal or coke may be used in the furnace, but jets of gas or flame from oil will in most cases be found sufficient. *Patent completed.*

34 J. SKELTON. *Improvements in ploughs.* Dated January 5, 1865.

This invention relates to improvements in the construction of ploughs, whereby the patentee is enabled to shift either of the mould plates free of the land side or furrow by the simple turnwrest handle either to the right or left, or by any other equivalent mechanical contrivance, such as a lever or screw shaft, while by the same action the other plate is thrown forward together with the gutter for commencing the return furrow. The turnwrest handle is fixed between the two plough arms or directors; it actuates a shaft at the end of which a pinion or toothed wheel is fixed, gearing with a horizontal segmental toothed rack or quadrant set on a vertical axis, and connected to the two mould plates; it is, therefore, obvious that, by winding the turnwrest handles in the required direction, one or other of the plough moulds will be shifted free of the furrow as first stated. *Patent completed.*

35 J. E. WILSON. *Improvements in locomotive engines, and in the springs of railway carriages.* Dated January 5, 1865.

In constructing a locomotive engine according to this invention it is preferred to employ four pairs of wheels, each with an outside crank pin, which are coupled together, and also to two crank pins on cranks at the end of a central crank shaft, which is driven by two steam engines situated between the side framings. In order that locomotive engines may, notwithstanding their length, pass freely round curves, the forward and hinder axle boxes have a short play between their horns, so that the forward and hinder axle can move endways with their boxes a short distance. In coupling the wheels together, the crank pins or journals for the coupling rods are made spherical, in order to allow for the endway motion of the axles when passing round a curve; a slight play is also allowed between the cranks on the driving shaft and the connecting rods. In constructing springs for railway carriages, in order to render them more suitable for varying loads, flat straight bars, by preference of tempered steel, are used, and they are so arranged that, when there is a light load in the carriage, only part of the elastic bars come into action, and, consequently, present the desired elasticity, more and more of the elastic bars coming into action to support the load as it becomes greater and greater. Between the succeeding bars constituting the complete spring, and near the ends thereof, are blocks having between them and the next elastic bars spaces sufficient for the elastic play of the bars which receive and support the load, but as the weight of the load becomes greater and greater, the first bars which receive the load come in contact with the blocks between them and the next elastic bars, and are supported thereby and by the elastic bars by which the blocks are supported, and so on till all the elastic bars come into action. *Patent abandoned.*

36 A. V. NEWTON. *Certain improvements in sewing machines, and mechanism for driving the same.* (A communication.) Dated January 6, 1865.

This invention relates to that class of sewing machines which produce what is termed the lock stitch. Instead of a traversing shuttle being used, as heretofore, for taking up the loop of the vertical needle, an oscillating bobbin holder formed with a brake is used to catch the loop of the needle thread, open it out, and pass the bobbin through the loop. *Patent completed.*

37 J. C. AXON and W. ANDERSON. *Certain improvements in the construction of tubular boilers, and in the means of cleaning the tubes of such boilers.* Dated January 5, 1865.

The main feature of novelty in this invention is the combination of a horizontal cylindrical case, containing within it cylinder forming a fire chamber, ashpit, and flue, with a second cylindrical case fitted with tubular flues like the boiler of an ordinary portable engine, the water spaces in the two divisions of the boiler being connected by necks or tubes which unite the two cases and form passages through which the water can circulate freely. In some instances the patentees make the internal or fire chamber cylinder of the same length, and in others shorter than the enclosing or outer case. When the length is contracted they employ the space thus gained beyond the fire chamber cylinder as boiler space, and insert therein short lengths of fire tubes which conduct the flame and heated gases through the extended portion of the boiler. The flame and gases then pass upwards and return through the tube in the second case, and after circulating around the annular water space in the lower cylindrical case pass thence through an up-take to the chimney. The improved boiler may be set in brickwork, or it may be constructed as a self-contained boiler, as desired. *Patent completed.*

38 G. A. BUCKHOLZ. *Improvements in apparatus for hulling grain, and for reducing granular substances.* Dated January 6, 1865.

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

39 T. PICKFORD. *Improvements in preparing and keeping aerated beverages.* Dated January 6, 1865.

The patentee claims mixing and bottling, or otherwise enclosing, in order to keep for subsequent use aerated liquids and spirits, or other suitable liquors, in combination. *Patent completed.*

40 J. E. VIGOULETE. *Improvements in the treatment of carbonaceous minerals, and in the apparatus for preparing agglomerated fuel.* Dated January 6, 1865.

The object of this invention is, firstly, the application of processes embodied in former patents along with other processes to minerals, such as shale containing carbonaceous matter mixed with argillaceous, earthy, or stony substances, so as to render their carbonaceous portions available for fuel; and, secondly, the construction and arrangement of apparatus for effecting the processes embodied in the said former patents upon combustible matters, so as to produce blocks of agglomerated fuel. In applying the agglomerated processes to minerals containing carbonaceous matters the

patentee first reduces the minerals to powder, and if they are already rich in carbonaceous matter he adds sufficient coal or other fuel dust to render the mixture readily combustible. He then agglomerates the mixture, bearing therein the earthy or other incombustible ingredients, which being in small quantity do not interfere greatly with the combustion. When the earthy or other incombustible substances are present in large quantities he separates them as far as possible from the carbonaceous matter by sifting and washing the pulverised mineral, and he then agglomerates the carbonaceous residue, adding if necessary coal or other fuel dust before agglomeration. The apparatus which he employs for agglomerating the dust of fuel is intended to effect successively and continuously three operations—viz., mixing the fuel dust with lime in a dry or nearly dry condition, puging the mixture with alkaline silicates in solution, and moulding the mixture into blocks convenient for transport. *Patent completed.*

41 J. C. BAYLEY and D. CAMPBELL. *Improvements in lamps for burning the vapour of volatile fluids.* Dated January 6, 1865.

This invention consists, firstly, in the application of a current of air for the purpose of keeping the fluid in the burner tube and reservoir of the lamp cool, thereby ensuring perfect safety from explosion by overheating. The invention consists, secondly, in a method of regulating the amount of light, which the inventors do in the first arrangement by a cover fitting closely over the outer surface of the burner, and which contains holes or projections so arranged that, by shifting the said cover or regulator more or less, one or more of the apertures may be closed. The cover or regulator referred to may in the second arrangement either form part of the said jacket or be fitted independently. *Patent abandoned.*

42 J. LEBAUDY. *A new system of boiling grain sugar in vacuo.* Dated January 6, 1865.

After having run into the apparatus a certain quantity of syrup dissolved and clarified by the usual process, and when sufficiently condensed, the patentee introduces into the usual apparatus employed for that purpose a quantity of grain sugar, such as is produced from the cane and beet-root manufactures, or from the refineries, varying the proportions according to the quality of the syrup, that of the grain sugar introduced therein, and the quality of the sugar desired to be produced. The introduction of the grain sugar is naturally and easily performed by the action of the vacuum, no matter by what mechanical means produced, and may be accomplished at once or by successive changes. The dissemination of the grains of sugar is immediately effected by hard boiling, and may be also facilitated and accelerated by some peculiar disposition of the orifice of introduction. The grains being thoroughly separated are, in the first place, washed and purified, and, consequently, bleached; subsequently, by means of successive overcharges of syrup, as practised in the ordinary process, they become bigger by being covered with fresh coats of crystallisation, while at the same time they provoke in the syrup the formation of fresh crystals which adhere to them in such a manner as to produce a homogeneous mass. *Patent completed.*

43 J. A. CASTREE. *Improvements in looms for weaving.* Dated January 6, 1865.

This invention relates to double looms in which two pieces of fabric are woven at one and the same time on the same level. The warps for the two fabrics pass between the dents of two separate reeds attached to one or more reed caps, and to one loath or batten, there being two shuttle boxes and one or two slots on the same level. Instead of using two picking sticks only for actuating the pickers and shuttles, the inventor employs a picking stick at each end of the lathe, and either one or more as may be found desirable in the middle, but one in preference. The picking stick or sticks pass through a slot or slots in the lathe or lathes, and are worked by tappets or projections on the tappet shaft or on shafts parallel with the shuttle boxes and slots. When desired, instead of forming a slot or slots for the centre stick or sticks, he divides the lathe into two parts, leaving between them a space merely sufficient to allow the traverse of the stick or sticks. In all cases there will be three or more pickers and picking rods, and when there are four picking sticks, each picker will be driven by its corresponding stick, but when there are three picking sticks the centre stick acts alternately upon two pickers, one at each side. *Patent abandoned.*

44 B. DORSON, W. SLATER, and R. HALLIWELL. *Improvements in machinery for ginning cotton.* Dated January 6, 1865.

This invention consists, first, in applying to saw gins of the ordinary construction two perforated metal cylinders, each furnished with an internal damper, and, secondly, in applying to saw gins a lattice cloth or creper to collect and deliver the cleaned cotton in any required position. *Patent completed.*

45 J. ORAW and J. MACADLAY. *Improvements in weaving ornamental fabrics.* Dated January 6, 1865.

The weaving of two-faced ornamental fabrics, or fabrics presenting a distinct and complete pattern on both faces, with warps differing in colour from any of the wefts, and woven so as to constitute essential parts of the design, and produce varied chameleon effects, substantially as set forth. *Patent completed.*

46 A. REYNOLD. *Improvements in smelting zinc ores, and in apparatus employed therein.* Dated January 6, 1865.

This invention consists in the arrangement of a furnace (such as a blast furnace), a flue, and condenser, as hereafter described, so that zinc, otherwise called spelter, can be smelted from its ore in it instead of in the retorts that are ordinarily employed. The zinc passes off in vapour with the smoke at the top of the blast furnace, and, in order to retain the zinc in the metallic form, air must be carefully excluded at the top of the furnace, or preferably coke must be placed in the flue, or charcoal may be employed instead; the coke will be heated by the smoke, or it may be heated otherwise, so as to reduce the zinc to the metallic form. The inventor leads the flue into a chamber or series of chambers for condensing the zinc from the smoke. This condensing chamber may be either a large room or a series of spaces, or of pipes or otherwise, and may be cooled externally by water. The smoke, after leaving the condenser, may still carry some zinc with it, which should be removed by passing the smoke through a condenser with water in it, or otherwise. The blast furnace may be of the same construction as that generally used for smelting lead slags. The coke in the flue would be placed near the part where it leaves the blast furnace, and the flue would be a little larger in this part than in others, to prevent stopping the

draught. It would be better to throw in the zinc ore at stated intervals through a door at the top of the furnace, and to moderate the blast while the zinc is passing off. *Patent abandoned.*

47 W. C. THURMAN. *Keeping the substance of eggs fresh and sweet.* Dated January 6, 1865.

This invention consists in heating the substances of the egg, without the shell, until the white and yolk are thoroughly mixed. The patentee then strains the mixture through muslin or similar material, and then mixes with it sugar or salt, in which state it may be preserved quite fresh for an indefinite period. The egg must be submitted to moderate heat to facilitate its combination either with the sugar or salt. *Patent completed.*

48 C. DE BERQUE. *Improvements in locomotive engines.* (A communication.) Dated January 6, 1865.

This invention consists in constructing locomotive engines with, or in applying thereto, an air chamber or chambers and valves and valve gearing, whereby, when the steam is shut off and the valve gearing reversed, the cylinders may be converted into force-pumps for condensing or pumping air into the said air chamber or chambers, whereby the gradual increase of pressure thus produced may oppose a gradually increasing and elastic pressure or resistance to the pistons, and consequently to the accumulated inward motion of the locomotive or train. The air so compressed may press on pistons in small cylinders working timber or metal friction blocks or brakes placed against the iron driving-wheels of the engine, or against the wheels of the tender, or the rails for assisting the retardation. *Patent abandoned.*

49 G. HASSELTINE. *Improvements in machinery for shaping and trimming the heels of boots and shoes.* (A communication.) Dated January 6, 1865.

This invention consists in so constructing and arranging machinery that the heel of a boot or shoe can be shaped and trimmed by the single operation of turning the boot or shoe about half way round on the centres on which it is adjusted in the machine. *Patent abandoned.*

50 T. RICHARDSON and M. D. RUCKER. *Improvements in treating guano.* Dated January 6, 1865.

The patentees claim the application and use of a solution of phosphoric acid and sulphuric acid of a soluble phosphate of lime, dried up or absorbed by means of any absorbent material or drier, for improving the fertilising action of guano, in the manner stated. *Patent completed.*

51 J. ROBERTSON. *Improvements in furnaces, ashpits, and flues for the consumption of smoke and noxious products of combustion, and in the apparatus or means connected therewith.* Dated January 6, 1865.

This invention relates to certain improvements in the construction and arrangement of furnaces, ashpits, and flues, the chief objects of which are to consume the smoke and other noxious products arising from combustion, together with a large saving of fuel. According to one modification it is proposed to have an air-tight door in the ashpit with an orifice formed in it into which a tube is inserted leading from fanners or other apparatus for forcing or drawing air into the ashpit, thence up through the fuel and along the flues. Instead of this arrangement, perforated tubes may be introduced into the ashpit near the fire bars, and air forced up through these perforations into the fuel and flues; and perforated tubes may also be introduced into the furnace and so arranged in it that, when the air is forced into the tubes, it acts upon the burning fuel in small currents by passing through the perforations. *Patent abandoned.*

52 E. TYER. *Improvements in apparatus used in train signalling on railways.* Dated January 6, 1865.

This invention has for its object improvements in apparatus used in train signalling on railways. Hitherto, in signalling trains by means of the step-by-step or dial telegraph, very great uncertainty has been found to exist from what is technically known as tripping. This is caused in numerous instances by the transmitting key used by the signalman, worked at too great a speed, causing the distant instrument to trip or lag behind, and thereby exhibit one particular signal at a station and quite a different one at another station. At other times the tripping has been caused by bad contact, especially where alternately reversed currents have been employed, the requisite time for the efficient working of the instrument not having been allowed for in the construction of the transmitting key, the electric currents being sent faster than the mechanical arrangements can keep pace with. No, in order to avoid these irregularities, the patentee arranges this instrument in pairs, in such manner that, if it is required to transmit two or more currents along the same wire in the same direction, the indication on the dial will only record one signal, and this arrangement has the further advantage that, after the signalman has forwarded one signal, which appears on the dial of the distant instrument, he can transmit two, three, or more intimations, generally known as bell or gong call signals, in rapid succession without altering in any way the previous signal exhibited on the dial plate of the distant instrument. *Patent completed.*

53 G. REYNOLD. *Improvements in the construction of escapements for watches and other timekeepers.* Dated January 6, 1865.

This invention has for its object the so constructing the escapements of watches and other timekeepers in which balance or swing wheels are employed as to render the overturning of the balance impossible. For this purpose the impelling pullet, which receives the impulse from the teeth of the escapement wheel, is carried on the axis of the balance or swing wheel, as is usual; the unlocking or discharging pullet is not carried on this axis, but a pinion in the axis gives motion to a second and larger pinion, which is by preference formed with three times as many teeth as the pinion on the axis of the balance or swing wheel. The unlocking or discharging pullet is either carried on the axis of this larger pinion, or motion is transmitted to it from this pinion. By this means the balance wheel must make three complete revolutions before it can trip or overturn. *Patent completed.*

55 G. B. GALLOWAY. *Improvements in motive power and means of communication between passengers while travelling and appliances connected therewith.* Dated January 7, 1865.

These improvements consist in the application of principles involved in part described in the specifications of former patents granted to the present patentee, dated respectively March 16th, 1859 (N.º 551), and October 31st, 1857 (N.º 2,765), and in motive power and means of communication as between passengers while travelling, and appliances

connected therewith. The invention consists in the combination of air and water, which the patentees jointly or separately force into steam boilers, generally by a suitable arrangement of feed pipes and valves in connection with the furnaces or any other parts of boilers; and in respect to boilers for locomotive purposes applicable for the purpose of transit by sea or land, he proposes, instead of surrounding the upper tubes with water (as is now the general practice), to fill the space with atmospheric air, in order that it may combine with the steam which arises from the water by which the fire spaces and other parts are surrounded. And where larger boilers are required for other purposes, he adopts the construction of boiler and furnaces by which he causes the smoke and gases to pass over a coke furnace or fire by a suitable arrangement of the flues and tubes (similar to the plan described in the specification of patent No. 651 before referred to) before it passes into the uptake or chimney, and as a further means of economising power, he causes the boiler feed pipes to pass over or underneath, or by the sides of furnaces or fireplaces; and he also forces water and atmospheric air through pipes by a regulating feeding process, so that steam or motive power shall be attainable at the end of such pipe, which may be at once applied to engines, or may be first received through a pipe having a steam valve affixed in it (connected with an accumulator in which it shall be subjected to greater heat, if required), or through a separately constructed fireplace as a means of superheating it prior to its being applied as motive power. Or he produces motive power through the use of any of the known agents by which electricity is produced, and applies electricity in combination with water or air, or both, by and through suitable arrangements, such as pipes, valves, and accumulators; and in respect to furnaces, instead of allowing the gases from them to pass off so quickly as they do at present, he proposes to continue the tubes in a circular or other direction to as great an extent as the construction of the boiler will admit, the object being the more complete utilisation of fuel; and for this object he may also split up the flame in its passage through the tubes by angular divisions, which he shall place horizontally within them. The invention comprises many features which we cannot here quote in detail. *Patent completed.*

56 B. W. BENTLEY and W. H. BAILEY. *Improvements in finishing photographs, and in the machinery employed therein.* Dated January 7, 1865.

This invention relates firstly, to improvements in finishing photographs on paper after they are mounted on the cardboard or other description of mount, whereby the individual features of such photographs are caused to stand out in relief more or less the same as in nature, and consists in subjecting the mounted photographs to pressure under improved photographic press whereby an exceedingly smooth surface is produced, and afterwards placing such mounted photographs upon leather or other suitable matrix, beneath a die fixed in a fly lever, embossing on the suitable press, and causing such die to descend upon such mounted photograph, in order more or less to raise the most prominent parts of the picture, and cause them to stand out, so obtaining a picture in relief. The dies for producing such effect may be engraved, etched, or sunk in the ordinary manner, or they may be made by any of the well-known photographic processes of engraving, or by the bi-chromatized gelatine process. By means of this invention the patentees are enabled to produce medallion portraits in relief; imitation cameos may also be obtained by colouring the background according to taste. The invention cannot be fully described without reference to the drawings. *Patent completed.*

57 E. BEAVER and C. W. FISHER. *Improvements in the construction of vacuum pans.* Dated January 7, 1865.

In carrying out this invention the patentees construct these improved vacuum pans so that the steam, hot water, or other heating medium used, shall be introduced into the ends of one-half, or thereabouts, of the number of heating tubes placed across the interior of a vacuum pan at one side or end of the pan, and into the ends of the other half, or thereabouts, of the number of heating tubes at the other or opposite side or end of the pan. Thus the upper evaporating tubes of a pan may receive the heating medium at one side of the pan, and the lower tubes receive the heating medium at the opposite side; or the distribution of the tubes having the heating medium passing through in opposite directions may be arranged in the vacuum pan in any other way which may be preferred for the purpose of producing an equivalent result. *Patent completed.*

58 J. ATKINS. *Improvements in the manufacture of metallic bedsteads, which improvements are also applicable to the manufacture of other metallic articles.* Dated January 7, 1865.

This invention consists in connecting together certain of the parts of bedsteads and other metallic articles by the process of casting, the said improvements being also applicable to the joining of such parts of other metallic articles as may be conveniently joined by the process of casting. *Patent abandoned.*

59 W. BAKER. *Improvements in the manufacture and refining of iron and steel.* Dated January 7, 1865.

This invention relates to improvements in the manufacture and refining of iron and steel when such iron and steel are produced either by what is known as the Bessemer process or by similar processes, such as, by the injection of air or of steam, or of air and steam, or when such iron and steel are produced or refined in and by means of what are known as air reverberatory or puddling furnaces, such furnaces being so constructed as that air or steam or air and steam may or may not be injected into or upon the molten metal. The object of the invention is to cause and facilitate the removal of certain impurities sometimes contained in cast or pig iron or other fusible compound of iron and carbon, such impurities, in addition to others usually present, being phosphorus and sulphur. The separation of these elements from the molten metal is effected by the employment and use of metallic zinc, which the inventor finds combines with and causes the separation from the molten metal of the phosphorus and of the sulphur in part or entirety. *Patent abandoned.*

60 J. J. BLACKHAM. *Certain improvements in brooch and other like fastenings.* Dated January 7, 1865.

This invention consists in superseding the necessity for the ordinary hinge joint common in the attachment of pins to brooches or other like fastenings requiring a pin or bar at the back by coiling the wire of which the pin or bar may be composed into a small circle or circles, thereby forming a spring at that end similar to the manner in which the same portion of a nursery pin is or has been

made, and in the like manner to the construction of such nursery pins herein referred to. The patentee proposes protecting the points of brooch and other like fastenings by securing a piece of wire or its equivalent to the back or end of the brooch that not only forms a loop catch or shield for holding the point end of the pin or bar, but also forms a shield around the pins to protect it from injuring the wearer or others that may be brought in contact with it, such as infants or young children while being nursed. *Patent completed.*

61 T. HORREX. *Improvements in brushes for brushing the hair, which improvements are also applicable to brushes for other purposes.* Dated January 7, 1865.

These improvements have for their object to remedy these evils by forming the part, or the principal part, of the brush in which the bristles are set, capable of being detached from the base or back thereof for purposes of cleansing or otherwise, and of being readily re-applied again when a cleansing has been effected, and by dividing the bristles into rows or sets which are fixed in separate slips or bars of wood or other similar material, connected and held together by canvas or otherwise, to form joints as hinges between them, by which, when this part of a brush is removed from the back or body, it may be folded at any of these hinge joints to admit of the rows of bristles being separated or opened, and freely cleansed from their roots to their points by a brush or other cleanser, without the necessity for soaking or other immersion of them in hot or other water or fluid. One or more rows of bristles at each side of the brush may be permanently attached to the back, and be used as cleansers for the other movable portion of them. The holding of the movable portion to the back or base may be by a wire or wires passed through it, and through projections from the back or body, or by other suitable means. *Patent completed.*

62 J. F. JONES. *Improvements in machinery for the manufacture of paper board.* Dated January 7, 1865.

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

63 A. BARLOW. *Improvements in jack and slubbing "frames."* Dated January 9, 1865.

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

64 J. H. JOHNSON. *Improvements in machinery or apparatus for cleaning rice, coffee, and other grains or seeds having an outer hull or inner pellicle.* (A communication.) Dated January 9, 1865.

This invention relates to that class of machinery for cleaning rice, coffee, or other grain or seed of a like nature, wherein the grain or seed is cleansed by attrition in a vessel or mortar, such attrition being produced by the action of a screw-bladed propeller revolving horizontally near the bottom of the said vessel or mortar. According to this invention it is proposed to roughen the surface of the vertical propeller shaft, or to make it of stone or other substance of a grinding or gritty nature, or to enclose the propeller shaft in a long tubular collar or casing composed of stone or other substance of a grinding or gritty nature, or to make such part of the apparatus of metal having its surface roughened, by which means a better rubbing and cleansing action on the substances under treatment is obtained. *Patent completed.*

65 J. WELSH. *An improved method of lighting street lamps, and in the apparatus or means connected therewith.* Dated January 9, 1865.

This invention essentially relates to a very simple apparatus to be used for the lighting of street and other lamps, and has for its object the doing entirely away with the ladders now in use, and not only to enable the lamplighter to reach and light the lamps with greater ease, but also to enable him to light a much greater number in the same period of time than he has been able to do hitherto. It has also for its object the enabling of private parties to light their gaseliers, lobby lamps, stair lights, shop window lamps, lamps in the front of public and private houses or buildings, and lamps otherwise situated, without the use of steps, ladders, or chairs, and consequently the doing away of the great inconvenience and danger now attending these and other modes. The apparatus consists of a hollow stem or tube fixed to a rod or handle which the lamplighter carries in his hand. Within the hollow part of the stem there is arranged a sliding rod, acted upon by a spring also in the interior of the stem; this spring maintains the rod by its pressure in the lowest or uppermost position which it is capable of assuming within the tube. At the lower part of the tube a slot is made, and through this slot a knob or handle passes, connected to the interior sliding rod, the use of the knob being that the thumb or finger may be applied to it, and an upward or downward motion imparted to the rod. In one modification the upper end of the sliding rod is formed with a vertical hole in it to receive a lucifer or other match, and the tube is extended above this point and closed over on the top, its interior surface being roughened, so that when an upward motion is imparted to the sliding rod the match is struck against the roughened surface and at once ignited. When used for lighting street lamps the part of the apparatus holding the match is placed through the central opening at the bottom of the lamp, and when in proximity with the jet the percussive action is imparted to the rod, the match is ignited, and the fire is communicated to the jet. When used for lighting the lamps of public or private houses or buildings the apparatus and the mode of procedure is the same as when used for lighting street lamps, but the apparatus is in general of smaller dimensions. The top of the rod carrying the lighting apparatus is fitted with a hook or key which the person who carries the lighting apparatus places upon the usual thumb handle of the plug of the gas cock, and by giving a lateral or vertical motion to the rod, the cock is turned, and the gas ready to be ignited. *Patent completed.*

66 L. WEBBER. *Improvements in bits for horses and other animals.* Dated January 9, 1865.

In constructing a bit for horses and other animals according to this invention, the bit is composed of four cheeks or branches, two to come on each side of the mouth of the horse; the two cheeks on each side are of different lengths, and are connected together at their upper ends by a pin joint. Each cheek carries at its lower end a ring, to which a rein is to be attached; the two shorter cheeks are also prolonged a short distance above the point where they are pin jointed to the longer cheeks, and at the upper ends of these prolongations they are furnished with other rings by which they are connected to the headstall. To these rings is also attached a light chain, which is to pass behind the lip of the horse or other animal; the two shorter cheeks, which come one on either side of the mouth

of the animal, are connected together intermediate of their length by a transverse bar which forms the mouthpiece of the bit. The two longer cheeks are also joined together by a similar cross bar, which, when the short and long cheeks or branches on either side of the bit are nearly parallel with each other, comes behind and corresponds with the bar connecting the shorter cheeks. When the rein connected to the rings of the shorter cheek is pulled on, the cheeks merely act as levers to draw back the mouthpiece of the bit, as in the ordinary snaffle bit; when, however, the rein connected to the rings of the longer cheek is pulled on, the bit acts as a curb, the cheeks being then caused to separate the one from the other by turning on their pin joints, so causing the cross bars which form the mouthpiece of the bit to separate the one from the other, and by this means produce additional pressure on the jaws of the animal. It will thus be seen that the bit combines the advantages of a snaffle and a curb, and that the muffle and the curb can be used either separately or jointly. *Patent completed.*

67 J. CALKIN. *Improvements in taps.* Dated January 9, 1865.

This invention has reference to an improvement in the ordinary description of taps applicable to gas, steam, or other fluids, with the view to obviate the danger of the said taps being inadvertently turned on, or imperfectly turned off, whereby greater security against waste or leakage resulting therefrom is obtained, and consists in employing in connection with the stem of the plug (by which the tap is turned), a catch or spring tap movement, so arranged as to admit of its taking into a corresponding notch formed externally in the band of the tap, by which means the plug, when thoroughly turned off, is securely held or retained in a fixed position until released through the medium of the thumb and finger whilst turning on the tap. *Patent abandoned.*

68 W. DAVIES. *Improvements in machinery for the manufacture of "cavendish," "negrohead," and other tobacco.* Dated January 9, 1865.

A machine constructed according to this invention may consist of, say, one, two, or more horizontal rollers, cylinders, or drums, mounted parallel to each other (when more than one is used), and revolving in suitable bearings, or in a stationary frame. Immediately above each of these lower rollers the patentees mounts one, two, or any required number of rollers of the desired width, which work in vertical sliding bearings within the stationary frame, each of which bearings have connected thereto a vertical link rod, the lower end of which is jointed to a horizontal weighted lever, having their fulcrums on the inner end, and which levers he fits on their outer ends with sliding weights to regulate the pressure. The lower rollers he drives by tooth, friction, or other suitable gear, in the same direction, and the upper rollers he also drives in the same way, but in the opposite direction to the lower rollers. In connection with these pressing rolls he uses a number of trays, which trays he forms with stout edges on the two longitudinal sides, the ends of the bottoms being so tapered as to enable them to readily enter between the pressing rollers when the same are in motion. The tobacco to be pressed he spreads evenly upon these trays or troughs previous to passing it through between the rollers, when he passes them between the upper and lower set of rollers, which gives the required pressure. A reciprocating motion may be given to the rollers, so that each portion of the tobacco on the trays or troughs may be acted upon by the rollers several times, when the pressure of the rollers may be increased or diminished, as found desirable. To convert the tobacco into a cake or slab, the upper pressing rollers he forms of such a width as to cover the space between the two vertical edges of the trays. *Patent completed.*

69 E. A. and G. H. BIGHTOLLER. *Improvements in flyers for preparing cotton and other fibrous materials for spinning.* Dated January 9, 1865.

This invention relates to those flyers which are provided with pressers, either single or double, and consists in an arrangement whereby the inventors are enabled to obtain what is commonly called a soft bobbin, but in a compact form. According to the usual plan, when pressers are used, the silver, after passing through an aperture in the neck of the flyer, is drawn partly around the periphery thereof before it passes down the leg, and more twist than is necessary for the after process of spinning is, therefore, required in order to resist the strain or drag to which the silver or thread is subjected. This invention consists in avoiding this strain or drag around the neck of the flyer, so that the inventors can make a silver with least twist, such as is usually made by the ordinary flyer without presser. To accomplish this they cause the silver or thread to issue from the neck of the flyer in a line with the leg thereof, and it therefore passes direct to the said leg, and then to the presser and bobbin as usual. *Patent abandoned.*

70 B. P. BIDDLE. *Improvements in theodolites.* Dated January 9, 1865.

The chief parts of the ordinary theodolite are a telescope with a spirit level attached, a vertical arc for taking angles of altitude and depression, a horizontal limb and compass for taking horizontal angles, and the bearing of objects, and two parallel plates with four conjugate screws, by which the instrument is adjusted. Now this invention consists in constructing theodolites with two telescopes parallel to each other (one on each side of the vertical arc), the object glasses of which are reversed; there is a level immediately above the two telescopes, so that when the instrument is set at zero (and the conjugate screws are properly adjusted) it is perfectly level. *Patent completed.*

PROVISIONAL PROTECTIONS.

Dated April 5, 1865.

964 J. Bethell, King William-street, City. Improvements in building barges, ships, and other vessels.

Dated May 4, 1865.

1243 G. Jones, Giltspur-street, City. Improvements in paper hangings.

Dated May 18, 1865.

1374 J. Mitchell and G. Tilford, engineers, Sheffield. An improved method of testing railway and other springs.

Dated May 20, 1865.

1391 C. Bradley, Oldham, Lancashire, mechanic. Certain improvements in machinery for spinning and doubling cotton and other fibrous substances. (A communication.)

Dated May 26, 1865.

1440 H. E. Newton, Chancery-lane, mechanical draftsman. Certain improvements applicable to spinning, weaving and knitting machines. (A communication.)

Dated June 12, 1865.

1595 E. T. Hughes, Chancery-lane. Improvements in the means of producing from roseaniline blue and violet colouring matters soluble in water. (A communication.)

Dated June 15, 1865.

1619 T. Rothwell, Ramsbottom, Lancashire. Improvements in rubbing or rolling woollen or cotton cardings, and in apparatus connected therewith.

1623 G. E. Way, Norfolk-street, Strand. Improvements in the manufacture of pianofortes. (A communication.)

Dated June 20, 1865.

1657 J. Parrish, O. Thatcher, and T. Glascock, Goswell-street, fireproof safe manufacturers. Preventing the forcing or wedging open iron safes, iron doors, and strong rooms.

Dated June 23, 1865.

1681 C. Ravelli, Bedford-square, officer Italian army. Improvements in turntables.

1682 M. D. Rosenthal and S. Gradenwitz, Church-row, Houndsditch. New or improved compositions in imitation of ivory and woods, to be employed in the manufacture of umbrella-tips, umbrella and walking stick handles, and other useful and ornamental purposes.

Dated June 26, 1865.

1699 J. Nugent, Bickenhead, shipwright. Improvements in means or apparatus for communicating signals on railway trains in motion.

1703 C. Worrean, engineer, Commercial Wharf, Kingsland-road, and G. Evans, Gloucester-place, Portman-square. An improved pulping and compressing machine for the treatment of peat as a fuel and gas for illuminating purposes.

Dated June 28, 1865.

1716 H. G. Fairbairn, St. Luke's, engineer. An improved mode of combining and forming small coal or coal dust into lumps, blocks, or otherwise, to be employed for the purposes of fuel.

Dated July 5, 1865.

1773 J. Braithwaite, Crook, near Kendal, Westmoreland, machinist. Certain improvements in machinery or apparatus for turning and cutting wood and other substances, to be employed in the manufacture of spools or bobbins, or other similar articles.

Dated July 6, 1865.

1781 T. S. Pridaux, Piccadilly. Improving draught beer, ale, porter, and cyder.

1783 J. H. Smith, Oxford-street, manufacturer. Improvements in harmoniums, organs, or other musical instruments, a part of which invention is applicable to turning over the leaves of music.

1785 C. F. Clans, Fearnhead, near Warrington, Lancashire, chemist. Improvements in obtaining sulphates and carbonates of potash and soda.

1791 J. W. Swan, Gateshead, Durham, chemist. Improvements in the production of printing surfaces by photographic agency, and in obtaining prints therefrom.

Dated July 7, 1865.

1793 J. M. Macrum, Hill street, Knightsbridge. Improvements in the manufacture of iron. (A communication.)

1795 A. F. Morelle, Boulevard Sebastopol, Paris, civil engineer. An improved portable pocket gas generator or gazogene.

1797 I. Peel, Bowling, grease manufacturer, and W. Hargreaves, Little Horton, Bradford, machine maker. Improvements in manufacturing grease from soapbuds.

1799 H. D. P. Cunningham, Bury, Hants. An improved mode of training guns.

1801 F. A. Wilson, Abingdon-street, Westminster. Improvements in carriages for breech-loading ordnance.

1803 J. Bullough, Baxenden, near Accrington, Lancashire, manufacturer. Improvements in looms for weaving.

1805 E. Green, Mortimer-street, upholsterer, and J. W. Heineke, Great Portland-street, engineer. Improvements in fire-arms.

1807 G. Fentiman, Upper East Smithfield. Improvements in the preparation of paints.

Dated July 8, 1865.

1809 I. Baggs, Chancery-lane, electrical engineer. Improvements in the production of artificial light, and in the apparatus connected therewith.

1811 G. B. Woodruffe, Chesapeake, mechanical engineer. Improved apparatus for gauging and marking the width of tucks and pleats on fabrics under operation in sewing machines.

1813 E. A. Erooman, Fleet-street, patent agent. Improvements in the manufacture of cast steel. (A communication.)

1815 J. Byford, Long Melford, Suffolk, farmer. Improvements in reaping and mowing machines.

1817 C. O. Papengouth, Russell-square. Improvements in constructing ships and vessels.

Dated July 10, 1865.

1821 R. A. Brooman, Fleet-street, patent agent. Improvements in steam carriages and in adapting wheels for common roads to railways. (A communication.)

1823 F. Taylor, Carey-street, Chancery-lane. Improvements in fountains.

1825 J. Jones, Liverpool. Improvements in the manufacture or "making up" of trousers.

1827 H. Fearnsley, Halifax, mechanician, and O. Smith, Basley, Yorkshire, mechanic. Improvements in machinery for washing, wringing, mangling and drying domestic clothes or other fabrics and fibrous substances.

Dated July 11, 1865.

1829 J. Souter, sea, toy merchant and manufacturer, and T. Christie, teacher, Edinburgh. Improved means for marking progress in the game of croquet and other games.

1831 H. A. Dufrené, South-street, Finsbury, civil engineer. Improvements in the treatment of copper and nickel ores. (A communication.)

1833 H. A. Dufrené, South-street, Finsbury, civil engineer. An improved process for obtaining oxygen. (A communication.)

1835 B. Fothergill, Cornhill, consulting engineer. Improvements in regulating or controlling the power employed in actuating sewing and other machines of a like nature.

Dated July 12, 1865.

1839 S. B. Howlette, Chelsea. A new instrument or anemograph for delineating and registering the direction and force of the winds.

1841 H. Blair, Kearsley, Lancashire, manufacturing chemist. Improvements in the production of gas from aqueous vapour, and in the application thereof to heating purposes.

1843 J. Saunders and J. Piper, Cookley Iron Works, Kidderminster. Improvements in apparatus employed in the manufacture of tin andterne plates.

PATENTS APPLIED FOR WITH COMPLETE SPECIFICATIONS.

Dated July 12, 1865.

1837 T. C. M'Keen, Irvington, U.S. A diving apparatus for submarine purposes.

1838 T. C. M'Keen, Irvington, U.S. A new and improved mode of elevating ships or boats in the water, to enable them to pass over sand bars, shallows, and the like, and for raising sunken vessels.

Dated July 13, 1865.

1844 G. C. Collyer, St. George-street, East, and O. L. Roberts, St. John-street, Clerkenwell. Utilising the stalks, smalls, and waste of tobacco for certain purposes.

Dated July 14, 1865.

1846 H. A. Bonnevill, Portchester-terrace, Baywater. Improvements in copying letters, plans, and other manuscripts, and in the apparatus and substances employed therein. (A communication.)

LIST OF SEALED PATENTS.

Sealed July 21, 1865.

202 E. King	246 G. Haseltine
215 S. L. and A. Fuller	249 V. Barq
and O. Martin	253 W. Clark
226 A. A. Orell	271 M. Henry
233 J. E. Massey	313 E. Hottin
237 J. Hind	739 J. Seaman
238 E. Helsham	1368 T. Faucheur
243 J. Twibill	

Sealed July 25, 1865.

252 J. Raines	347 A. A. Larmath
254 E. Blakeslee	394 E. J. Hill
255 E. T. Hughes	429 J. Graham
261 W. Teall and A.	507 S. Whitfield
Gibson	609 G. Haseltine
262 J. Naylor	670 S. Whitfield
264 G. Carter	913 A. V. Newton
293 J. Maynes	914 A. V. Newton
295 J. H. Johnson	973 R. Maynard
297 T. Routledge	1062 J. Todd
303 M. Blank	1165 W. E. Newton
304 W. Clark	1371 W. Mauwaring
321 C. R. Markham	1380 E. A. Raymond
322 J. Booth	1549 E. A. Brooman
334 H. B. Barlow	

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the London Gazette, July 25, 1865.

675 G. Wright. Agricultural implement.
 694 G. Carter. Toast racks.
 697 R. M. Roberts. Metallic ores.
 700 J. Wright. Heating furnaces.
 702 H. Hill. Securing safes.
 705 F. Wise. Colouring matters. (A communication.)
 717 G. T. Bousfield. Vapourising hydrocarbon liquids. (A communication.)
 730 J. F. Brinjes. Cooling animal charcoal.
 737 J. Farrar and E. Booth. Mining coal.
 745 H. A. Bonnevill. Railway brakes. (A communication.)
 748 B. Lawrence. Increasing the mechanical value of steam. (A communication.)
 750 J. Ballough. Looms.
 755 J. Cookson and P. Billington. Blowing smiths' fires.
 756 T. Ogden. Lapping machines.
 759 E. P. Hing and J. Harper. West stop motions for looms.
 761 J. Walls. Drawing off liquors.
 782 T. Kenyon, jun. Fixing cloth.
 772 J. T. Cook and J. T. Cook, jun. Breech-loading fire-arms.
 779 W. Menelaus. Working puddled balls.
 780 A. R. Mackenzie. Locomotive engines.
 789 W. Clark. Cutting pasteboard. (A communication.)
 793 B. J. Webber. Thrashing grain.
 797 H. Potter. Wastel quorn.
 799 W. J. Coleman. Clarifying beer.
 804 A. Paraf. Printing cut on fabrics.
 815 D. Mackenzie. Indicating patterns.
 824 G. H. and J. A. Casteer. Looms.
 826 J. C. Morgan. Stoves.
 828 W. Simons and A. Brown. Dredgers.
 843 L. Wilverson. Ornamental metallic chains.
 852 C. Matthews and J. Freeday. Furnaces.
 866 J. O. Thompson and J. M. Green. Railway carriages.
 874 R. Young and C. F. O. Glasford. Seaweed.
 890 A. Chaplin. Instantaneous lowering of ships' boats.
 895 W. E. Newton. Expressing liquids from pulpy substances.
 936 W. Bulstrode. Steam cultivation.
 985 R. Garrett, jun. Reducing wheat.
 1031 W. E. Newton. Submarine telegraph cables. (A communication.)
 1189 A. C. Henderson. Water wheels. (A communication.)
 1245 W. F. Stanley. Straight line dividing engines.
 1325 G. and G. W. Simmons. Lithographic impressions.
 1375 R. T. Birt. Traps for catching rabbits.
 1391 C. Bradley. Spinning cotton. (A communication.)
 1392 W. E. Newton. Raising oil from wells. (A communication.)
 1462 L. Diele. Looking drawers.
 1487 J. Calvert. Locks.
 1562 J. R. Cooper. Central fire breech-loading fire-arms.
 1804 J. Griffiths. Self-acting brake.
 1823 G. E. Way. Pianofortes. (A communication.)
 1785 O. F. Clans. Carbonates of potash.
 1829 J. Souter, sen., and T. Christie. Marking progress in the game of croquet.
 1844 G. C. Collyer and O. L. Roberts. Utilising the stalks of tobacco.

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.

2044 J. Dickson	2104 H. Rawson and F. Staples
2051 J. Wilcock	2108 W. Clark
2056 R. A. Brooman	2110 H. A. Jowett
2057 C. A. Day and T. Summers	2121 T. Sagar and J. Rocliffe
2088 T. King	2176 W. E. Newton
2096 A. Vignon	2147 A. Boyle and T. Warwick
2097 W. Clark	2175 A. V. Newton
2099 R. Bell	
2103 W. Clissold	

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

1686 J. B. P. A. Thierry	1879 J. Taylor and J. Nimmo
1674 D. Adameon	1764 A. V. Newton
1677 J. Cooke	

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending July 15, 1865.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
1057	0	4	2156	0	8	2171	0	8	2184	0	4
2146	0	10	2159	0	4	2172	0	4	2185	0	4
2147	0	8	2160	0	6	2173	1	4	2186	0	4
2148	0	6	2161	0	8	2174	0	8	2187	0	4
2149	0	10	2162	0	8	2175	0	4	2188	0	2
2150	0	8	2163	0	8	2176	0	4	2189	0	4
2151	0	4	2164	0	4	2177	0	8	2190	0	4
2152	0	4	2165	0	4	2178	1	2	2191	0	4
2153	1	2	2166	0	4	2179	2	4	2192	0	11
2154	0	4	2167	1	2	2180	0	4	2193	0	4
2155	1	0	2168	1	8	2181	0	4	2194	0	6
2156	0	4	2169	1	10	2182	0	4	2195	0	8
2157	0	4	2170	0	8	2183	3	4	2196	3	6

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

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

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

Teak -	load	£12	0	£13	10	Archangel, yellow -	£13	10	£14	10
Quebec, red pine -	3	10	4	15	St. Petersburg, do. -	11	0	13	0	
St. John, N.B., yellow -	0	0	0	0	Memel -	8	0	10	10	
Quebec oak, white -	5	5	6	0	Gothenburg, yellow -	10	0	11	0	
" birch -	3	10	4	10	" white -	9	0	11	10	
" elm -	3	10	8	0	Goffe, yellow -	10	10	11	10	
Danish oak -	3	5	6	0	St. Petersburg, do. -	9	10	11	0	
" fir -	3	10	3	10	Christiansburg, per Cn.					
Memel fir -	3	10	4	10	Latvian, by 4 by 8 in.					
Riga -	3	5	6	0	yellow -	18	0	23	0	
Swedish -	3	10	2	10	Desai lank, Danzig,					
Masts, Quebec red pine 6 in.	1	10	0	0	St. Petersburg, do. -	0	14	1	8	
" yellow pine 6 in.	0	6	0	0	Finnish, do. -	0	5	0	8	
Lathwood, Danzig, fm 7 in.	8	10	0	0	Oil, do.					
" St. Petersburg 7 in.	9	10	0	0	8al, pale -	10	0	0	0	
Deals, per Cn., 12 ft. by 3					Spermac, do. -	90	0	0	0	
by 4 in., duty 4s. per					White, 8th Sea, pale -	60	0	0	0	
load, drawback 2s.					White, 8th Sea, pale -	41	0	45	0	
Quebec, white spruce 14	0	15	0	0	Oliver, Galipoli -	54	0	0	0	
St. John, "	12	0	15	0	Cocoonut, Cochon -	41	10	45	0	
Yellow pine, per re-					Palm, une -	36	10	36	1	
duced Cn.					Limeoil -	32	0	0	0	
Canada, 1st quality -	18	0	20	0	0	0	0	0	0	
" 2nd "	13	0	14	0	0	0	0	0	0	

IRON.

Welsh Bars, in London -	per ton	£ 7	15	0	to	£ 8	0	0	2 1/2
Nail Rods -	do	8	10	0					
Hoops -	do	9	15	0					
Sheets, single -	do	10	10	0					
Staffordshire Bars -	do	9	15	0					
Bars, in Wales -	do	7	0	0					
Rails -	do	7	0	0					
Foundry Pigs, at Glasg. No 1	do	2	15	6					
Swedish Bars -	do	12	0	0					

STEEL.

Swedish Keg, hammered -	do	15	0	0					
Swedish Fagot -	do	16	0	0					

COPPER.

Sheet & Sheathing, & Bolts -	per ton	91	0	0					
Hammered Bottoms -	do	101	0	0					
Flat Bottoms, not Hamrd -	do	96	0	0					
Cake and Tough Ingot -	do	88	0	0					
Best selected -	do	82	0	0					
Staffordshire Copper -	do	91	0	0					
Yel. Metal Sheathing & Rods -	per lb.	0	0	7 1/2					

LEAD.

Pig, English -	do	19	0	0					
" Spanish Soft -	do	16	10	0					
Sheet, Patent -	do	22	10	0					
Sheet -	do	20	0	0					
White -	do	26	0	0					

TIN.

English Block -	per cwt.	94s	0d						
do Bar -	do	90s	0d						

THE MECHANICS' MAGAZINE.

LONDON: FRIDAY, AUGUST 4, 1865.

SAFETY GUNPOWDER.

IT is but little more than a month since we announced in a short paragraph that Mr. Gale, of Plymouth, had discovered a process by which gunpowder could be rendered non-explosive, and its combustible properties restored at will. Since that time Mr. Gale's invention has undergone a series of trials the most searching that could be devised, and to which he most readily submitted it. The result is that the non-explosive gunpowder has passed successfully through the earlier stages of its existence, and has rapidly come to be looked upon as a practical fact. Of the value and importance of such a discovery it would be difficult to form an estimate. Some idea thereof, however, may be realised when we call to mind the effects of the gunpowder explosion at Erith, on the 1st of October, 1864, which shook all London, and was felt many miles beyond. Dire as was the result, it would have been infinitely worse if the breach made in the river wall by the explosion had not been stopped in time, for about 4,000 acres of land were positively imperilled. Had the flood passed Woolwich and Greenwich by the large sewer, the whole of the southern and eastern parts of London would have suffered, being more or less below the level of high water. But even these aggregated misfortunes would not have borne comparison with the results which would follow an explosion of gunpowder in some of our vast magazines which are situated in densely-populated localities. It is when viewing the question in this light that the real value of any reliable method of storing gunpowder with perfect safety becomes apparent. The experiments which have been made from time to time to test the merits of Mr. Gale's protective powder, are of such a character as to establish beyond a doubt the correctness of the principles upon which the invention is based. The most recent tests were those applied at Wimbledon, last Saturday, and they conclusively prove the efficiency of the safety powder. In vessels filled with gunpowder, mixed with the protective powder, slow matches were placed, and the result was the ignition of a grain here and there which had not been perfectly protected. Vesuvians thrown into the powder quietly went out, and the introduction of a red-hot poker made no difference in the condition of things. Lord Bury's proposition was, perhaps, the most convincing of all, when carried out. This consisted in surrounding a quantity of pure gunpowder with some of the prepared powder and firing the former. This was effected at Wimbledon on Saturday, by placing the gunpowder in a sort of pit inside the vessel, and carefully covering it over with the protected powder; when the former exploded it simply blew what was above it into the air, and had no effect in igniting the mass which lay beneath and around it. When we bear in mind the permeating character of the flame of gunpowder, any material or substance remaining unscathed under its influence may indeed be assumed for all practical purposes to be safe. After the experiment a portion of the surrounding mass was riddled in the usual way, and the residue exploded as ordinary powder will explode. This test, then, may be considered to be tolerably conclusive.

Unquestionably, many advantages will arise from the practical use of this invention. Not the least will be the absence of that fear which must ever be more or less present with those who dwell in the vicinity of powder magazines. Then there is the cost of transport, which, for gunpowder in its ordinary condition, is very

heavy, being somewhere about £7 10s. per ton for a given distance. Were the powder rendered perfectly harmless, only 10s. per ton would be charged for the same distance. The maximum proportions Mr. Gale observes are three of protective powder to one of gunpowder, so that for four tons of protected, or safety powder, there would be only one ton of gunpowder, which would therefore cost £2, but this would be as against £7 10s., which would give a saving of no less than £5 10s. per ton for carriage. Much difficulty arises in storing gunpowder, as Government regulations prohibit large quantities being stored in one place, however well situated it may be for the purpose. And it is no easy matter to obtain sites for stores of this dangerous material, but if protected there need be no limit to the extent stored. Nor would any difficulty arise as to where the stores should be located, inasmuch as all fear of explosion would be at an end, and even carelessness might be left to do its worst.

Not less surprising, perhaps, than the results attained are the simple means by which the end is accomplished. No complex chemical composition lies at the bottom of the matter to give it undue importance. It is surrounded by no array of high-sounding names, but the whole secret is summed up in a little simple powdered glass. The cost is about 30s. per ton, and there is no difficulty in obtaining the material, which must be reduced to a fine powder. Old broken bottles will henceforth be at a premium, and the protectors of our orchard walls may disappear to be converted into protectors of our powder stores. The coating of the gunpowder by admixture with the glass powder is a very rapid operation, and the restoration of the two substances to their normal conditions by sifting is as quickly effected. There is only one condition requiring consideration, and that is, an arrangement of sifting machinery capable of meeting the demands of an emergency. The requirements of the army and navy also have to be provided for in this respect, but this is a matter of mechanical arrangement which will not long be left unsettled. Another advantage accruing from the adoption of Mr. Gale's treatment is one that deserves special notice, and that is, the powder is preserved in a perfectly dry state, so as to be fit for use under any circumstances or conditions of storage directly the coating is removed. The experiments have proved this system to be a perfect success, and it bids fair to become one of the most useful inventions of the time.

THE HISTORY OF AÉROSTATION.

IN resuming our notice of Mr. Hutton Turnor's interesting and instructive work, we are led first to observe that the aeronaut must possess many good qualities. Perhaps the most prominent among them is physical courage; at any rate aërostation does not at present offer any inducements to men at all deficient in this respect, nor is it likely to be followed by them for its own sake. But it may add to the courage of some who have not a sufficient amount of that commodity to trust themselves mid-air, to know that the percentage of accidents to aeronauts has been exceedingly small, considering the number of ascents made and the imperfect state of the science. M. Depuis Delcourt gives a list of 504 aeronauts down to the year 1848, and out of several thousand ascents made by them only ten lives were lost. These casualties were owing to the following causes: First, to the inherent perils of the Montgolfière, from which cause five persons were killed, viz., MM. Pilâtre de Rozier, Romain, Olivari, Bittorff, and Zambecari; Madame Blanchard owed her death to the fireworks she was exhibiting; Mr. Harris owed his to ignorance of the art; M. Mosnent by an exhibition of bravado came to an untimely end; Mr. Windham Sadler lost his life from stormy weather, and Mr. Cocking from his unfortunate parachute descent. So that it will be seen that there is a comparative

rarity of accidents, and those which have occurred have been due to very exceptional causes. Pursuing the subject down to the present time the number of aeronauts may be approximately taken at 1,500 and the ascents at about 10,000, whilst the number of deaths have only been 15, a very small number in proportion to those arising from the navigation of the seas. We may here observe that of the total number of ascents made, Mr. Green himself made 249, whilst 535 more were made by other members of his family. Down to the year 1864 Mr. Coxwell had made the surprising number of 520 ascents.

The Montgolfières and Charlières had two years of uninterrupted success in 1783-4. In the first year the aeronauts numbered but five; in the second, however, their number had increased to fifty-seven; in 1785 there were no less than ninety-five ladies and gentlemen who had associated their names with this branch of science. The first lady to undertake a free ascent was Madame Thible, who ascended at Lyons in 1784. The first English lady to ascend was Mrs. Sage. During the two years above referred to, ballooning had become very general in England and on many parts of the continent, although in France the greatest attention was given to the subject, and consequently there the greatest progress was made. Prior to M. Montgolfier's discovery, M. Jean Pierre Blanchard, an ingenious Frenchman, had busied himself in attempts to fly by mechanical means, but had never succeeded in effecting his object. When the discovery of the aërostatic machine was made, however, he resolved to utilise one for a lifting power, adding thereto the wings of his former plan for guiding his course through the air. After some scheming, he constructed an inflammable air balloon, twenty-seven feet diameter, and having a car, to which he added a pair of wings and a rudder. He also introduced an umbrella or parachute between the balloon and car, by which he hoped to check the fall should the balloon burst. On the 2nd of March, 1784, M. Blanchard made his first aerial voyage from the Champ de Mars in this balloon, which, however, obeyed only the wind, the wings and rudder being utterly useless. The machine crossed the river, passing over Passy, and after encountering several contrary currents Blanchard landed at Billancourt, near Sèvres, after a voyage of one hour and a quarter. It was about this time that balloons of both kinds, but especially air balloons, became very common in England as well as in other parts of Europe. All classes of people were prosecuting experiments, and by night as well as by day balloons were flying in all directions. To Mr. Tytler belongs the title of the first aeronaut in Great Britain. He ascended in a Montgolfière from the Comely Gardens, Edinburgh, on the 27th August, 1784, and made a voyage of about half a mile, descending on the road to Restalrig. Mr. Tytler was the first, and, with the exception of Mr. Smeath (1837), the only aeronaut to use a Montgolfière in this country. The next ascent in England was of far greater importance, and was that effected by Vincent Lunardi, from the Artillery Ground, London, on the 15th September, 1784, with a balloon which was inflated with inflammable air. The machine was launched at about five minutes after two in the afternoon, and Lunardi descended at Colliers Hill, five miles beyond Ware, in Hertfordshire, at twenty-five minutes past four, having made the journey in two hours and twenty minutes. Mr. Turnor has devoted considerable space to the interesting narration of Lunardi's ascent, which is given chiefly in the words of the aeronaut himself, who wrote a descriptive account at the time in a series of letters to the Chevalier Compagni.

Ascents now began to be of frequent occurrence in all parts, a journey of 150 miles being made in Paris, whilst M. Blanchard and Dr. Jefferies crossed the Channel from Dover to Calais. The deaths of MM. Pilâtre de Rozier and Romain in June, 1785, however, somewhat checked the ardour of enthusiasts in this direc-

tion for a time. These intrepid *aéronauts* lost their lives in an attempt to cross the Channel from France in a balloon on the combined principles of the *Charlière* and the *Montgolfière*. While at a considerable elevation, and soon after their ascent, the machine took fire, and in a few seconds the corpses of the ill-fated adventurers were stretched upon the earth. M. Garnerin's descent in a parachute took place on the 21st of September, 1802; at a height of about 10,000ft. above the earth he released himself from his balloon, and descended with an oscillating motion, reaching the ground in safety. The introduction of coal-gas, instead of hydrogen, by Mr. Green, was the most important advance in *aérostation* since M. Charles's great improvement. Mr. Green's large coal-gas balloon bore himself, Mr. Holland, and Mr. Mason from Vauxhall Gardens, to Weilburg, in the Grand Duchy of Nassau, a distance of 500 miles, in eighteen hours. In the United States, *aérostation* has been prosecuted with great zeal. Mr. J. Wise, the most practical of American *aéronauts*, has left a lucid history of his art, which was published at Philadelphia in 1850. He made his first ascent on the 2nd May, 1835, from Philadelphia, and landed at Haddonfield, about nine miles distant, after a voyage of an hour and a quarter. Mr. Wise has exploded his balloon when high up in the air, to show that the fragments, with the network, under such circumstances, form a parachute, which moderates the rapidity of the descent, and shields the *aéronaut* from danger. The longest flight on record was made by Mr. Wise, Mr. La Mountain, and others, who started from St. Louis for New York. They succeeded in following the course they had mapped out for themselves until they had crossed Lake Erie, when they were caught in an adverse current of air and forced to abandon their original design, after having travelled 1,150 miles in less than twenty hours. Mr. Low, another American *aéronaut*, has constructed what he terms an *aërial ship*, the greatest circumference of which is 387ft., with a capacity to hold 700,000 cubic feet of gas, and a lifting power of 22 tons. The machine is furnished with many novel appliances for the purpose of elevating, depressing, and directing the machine; and in this machine Mr. Low proposes to cross the Atlantic in fifty or sixty hours. The latest accounts of the progress of this science in America state that a new flying machine is in course of construction at Hoboken, N.J., under the direction of the Government. In this machine a propelling power is sought by the introduction of large spiral fans, which are to be worked by an engine placed in the centre of the vessel, which is canoe-shaped, and built of copper, with iron ribs, and will weigh, when completed, about six tons. As the machine is progressing very rapidly towards completion, we shall look with interest for the results of its working.

The balloon had not been perfected by M. Charles more than eleven years when it was proposed to render it of service in military operations. In the early part of the French revolutionary war ingenuity and science were called into active exercise, and the French Academy recommended balloons as a means of reconnaissance. Under its auspices, therefore, but with the utmost secrecy, an *aëronautic* school was established at Meudon, where fifty young military students were admitted for training. An effective *aérostatic* corps, with four balloons, was the speedy result, which was distributed to the four divisions of the army. At the battle of Fleurus, in June, 1794, Colonel Coutelle ascended to a height of several thousand feet, remaining stationary at will by means of a rope and windlass. The observations made were communicated to General Jourdan by signals, and he was thus enabled to gain a decisive victory over the Austrians. The most recent instance of a successful balloon ascent for military purposes was conducted by the Federals during the late American war. The reconnaissance was made

on the 27th March, 1862, by Professor Steiner, accompanied by Colonel Burford and Captain Maynardier, and it established the fact that shells had been thrown at too great a range to be sufficiently effective against the Confederate batteries, which defect was therefore speedily remedied. There is no reason why balloons should not be used in warfare at moderate elevations to assist, reconnoitring officers in obtaining information with respect to the character of the surrounding country, or the movements of the enemy. They need not be within range of the enemy's projectiles, and a slight elevation only would be needed, as at an altitude of 500ft. objects may be distinguished at a distance of twenty miles on a clear day. If the balloon were even struck, its descent would be by no means so rapid as generally imagined. When the great Nassau balloon fell into the sea in 1850, sixty rounds of ball cartridge were fired into it—the bullets passing completely through it—before any perceptible effect was produced in its size by the escape of gas.

Mr. Coxwell, throughout his *aëronautic* career of some twenty years, has always been a persistent advocate of balloons for military as well as for scientific purposes. In 1854 he invented and used a system of telegraphic war signals, and has constantly spoken of *aërial* reconnaissance as a useful and practical operation. Of late years, however, he has carried his views in some measure into effect, having made several *aërial* experiments at Aldershot and at the Royal Arsenal, which created a desire on the part of military men to pursue the subject further. Mr. Coxwell was accompanied by Captain F. Beaumont and Lieutenant Grover, of the Royal Engineers, in the above ascents, which took place under the sanction and with the approval of the War Department some two years ago. Since that time Mr. Turnor has made many ascents with Mr. Coxwell for military purposes, and a long list of officers has been added to the annals of *aérostation*. Mr. Coxwell's last military ascent was made on the 27th ultimo, on which occasion he was, for the first time, a passenger in the car of his own balloon. The object of the ascent was to initiate others into the art, with which view Mr. Coxwell appointed Captain F. Woodgate, late of the 2nd Life Guards, practical *aéronaut* to the balloon, while Captain Rowley, of the 2nd Life Guards, undertook to trace the exact course with the Ordnance Map, and to mark every noticeable feature within view. The aim of the observers was to ascertain, under the existing conditions of the atmosphere, how far small objects could be seen with the naked eye, and with a glass, from an altitude not exceeding half a mile. On comparing these results with other observations under different states of the sky and clouds, inferences may be drawn as to the relative distances such objects can be seen from a similar height under opposite atmospheric conditions. In the second place, Mr. Coxwell was desirous that military observers should be able to estimate off-hand the extent, elevation, and depression of portions of the country they were traversing. It was demonstrated that when the height is moderate, by placing the hands before the eyes and thus isolating a spot on the landscape, there is little difficulty in detecting undulations which are not apparent to an unpractised eye. A journey of about thirty miles was thus made, and the observations are to be continued, so that the public will doubtless in time have Mr. Coxwell's detailed results. In these proceedings we cannot but be forcibly reminded of the French Corps of *Aérostiers* formed some seventy years ago, and of Mr. Low's balloon staff, which was occupied with M'Clellan during the American war. The results in both cases were of service to the cause on behalf of which the science of *aérostation* was enlisted, and we do not see why a balloon corps should not assist in the operations of our own forces.

To bring the history of *aérostation* down to

the latest period would be to notice M. Delamarne's sailing balloon, which ascended from Cremorne Gardens on Wednesday last. We may intrench upon Mr. Turnor's prerogatives as a chronicler of these events, but we have no fear of spoiling his next edition. The monster balloon, which M. Delamarne guaranteed should navigate the air as steadily and readily as a ship does the ocean, ascended from the lawn of the gardens at seven p.m. precisely, and for a few minutes followed the current of the air. The wind being light from the north-west the colossal machine sailed towards the south-east of London. We observed that the windsails and rudder of "*L'Esperance*" were in rapid revolution, and the balloon "came up to the wind" and made a perfect revolution in mid-air. It then sailed directly over Battersea Park, when, apparently at the will of the inventor, it rapidly descended; soon, however, it rose high into the air and sailed gallantly away to the south as far as London Bridge, and there, making a well-defined turn, it recrossed the river and scudded away across Surrey, passing near the Crystal Palace, and as night closed in was seen steering in the same direction. From this it appears that it is possible to navigate a balloon through the air. M. Delamarne will make his second ascent in "*L'Esperance*" on Monday next. The application of *aérostation* to scientific purposes we have already noticed, and at page 32 of our issue for the 21st ult., we gave the results of Mr. Glaisher's most recent ascents, made for the purpose of scientific research. Those who desire to know more upon the subject will find an immense store of information in Mr. Turnor's book, which, from beginning to end, is replete with facts bearing upon the subject. Mr. Turnor has earned for himself the reputation of having become the historian of the principal *aërial* researches. He has gathered together and most judiciously arranged information from all quarters of the globe, and his work cannot fail to meet with the success it deserves. *Aérostation* as a science is beginning to be better understood and more widely appreciated, and Mr. Turnor has done it a service for which he deserves great credit. His book will give an impetus to the art, and wherever it is read it will doubtless create new desires and appetites for the pursuits of which it treats. It is, moreover, a valuable record of events, and must rank as a standard of reference upon all questions affecting the subject of *aérostation* to the present time. The illustrations are very numerous, and consist chiefly of excellent photozincographs, which were executed at the Ordnance Survey Office, Southampton, under the superintendence of Colonel Sir Henry James and Captain Helsham Jones, R.E. There are also many well-executed wood engravings which give life to the pages. The only fault to be found lies at the door of the binder, who appears to have inserted the photozincographs haphazard, and without the slightest regard to the localities indicated in the reference list appended to the contents. We hope, however, to see this remedied in a second edition, to which Mr. Hatton Turnor's book will assuredly come.

PADDLE-WHEEL ENGINES.

THE question of marine engineering is a very wide one, and the thousand and one so-called improvements which have been made from time to time in marine engines would occupy a lifetime to analyse, and the result would be of very little practical value. But something more than a mere idea may be gained by a consideration of the various engines used for marine propulsion. They may be divided into two general classes, viz., paddle engines and screw engines. We will take the former and inquire into the merits of the variously constructed examples which go to make up the class. First, then, the side-lever engine may truly be said to be the ancestor of marine engines. This

old and tried friend, however, has many enemies, but for all this it has a few redeeming points. In order clearly to illustrate our views, we will describe each arrangement *seriatim*. The cylinder is situated in the hull of the vessel, usually near the bottom; motion is given to the crank by the beams and a connecting rod between the same. The air pump and those for the feed are worked by the beam in principle of action, as the steam piston works the whole or rather imparts the first motion. The slide valve, irrespective of its class, is worked by a common eccentric and rod connection, the reversing action being attained by or with the ordinary lift lever, and that for starting or moving the valve. The condenser in some cases is of the surface kind, and in others of the ordinary injection type. The feed and bilge pumps are generally on each side of the air pump barrel, but in some instances these pumps receive motion direct from the beam, being situated under the same. The foot and delivery valves of the air pump are generally at the top and bottom of the barrel, located at the side nearest the cylinder. Having given a somewhat cursory glance at this class of engine, we will analyse its qualities. The cylinder situated near the base line is correct in theory and practice. In all cases, for marine purposes the heaviest portion should be located as low in the hull of the vessel as possible, to prevent the rolling motion being increased. The arrangement of the beams admits a great length of connecting rod, a fact worthy of attention. There is also another gain in the adoption of the beams, viz., an equalisation of weight, consequently a great reduction of the straining of the moving and fixed portions in comparison with those arrangements where the equality of action is absent. To further explain this, suppose the beam a simple lever, which in practice it is; it can, therefore, be readily understood what facility there is for retaining an equal motion throughout the stroke as far as the crank is concerned. Cornish engines have been proverbial for their economical working, which is due to their arrangement and the expansion of the steam. We do not advocate the side-lever engine when space is of importance, but notice the arrangement merely to point out its superior qualities, which are often overlooked. The next type to be noticed is the inclined direct-acting engine. The arrangement is generally as follows:—The cylinders are secured side by side near to or at the footplate level. The positions of the slide valves are not alike in all the examples; in some instances the slide is at the top or upper portion of the periphery of the cylinder, while in other cases the sides of the cylinder are deemed the preferable location. Each position has its advantages; the valve at the top affords great facility for access to the valve, while that at the side dispenses with the weigh shafts and levers. The position of the air pumps is generally inside the outer frames, motion being given to the pistons by a bell-crank lever, connected by a rod to the crosshead of the steam piston rod. The feed and bilge pumps are worked either by eccentrics or from the crosshead of the air pump. It may be added that in some examples the air pumps receive their motion from an intermediate crank between the inside bearings. This latter mode is preferable to that of the levers, &c., where the breadth or beam of the vessel will admit. The arrangement now under notice is more applicable for vessels of light depth and draught than any other kind. This is simply due to the distribution of the machinery and angle, or rather line of action of the engines. Surface and injection condensers are often introduced, but more often the latter kind, &c. &c. High-pressure engines are not generally adopted for marine purposes, but in some instances we have known locomotive boilers with direct horizontal engines

secured on the upper portion of the boiler as prime mover for small vessels.

Our next example for comparison is that of the trunk kind, vertical action. We are aware that this class of engine is often railed against, and doubtless with just cause. One of the evils is the cooling surfaces of the trunks, due, of course, to the alternate exposure of the same to the atmosphere and steam. This defect, bad as it is, can be greatly reduced by filling the trunk with heated tallow. It may be argued that in a gale such a waste would occur that the expense would be more than the consumption of fuel to work the entire engine. As a ship has a greater tendency to roll than to pitch, we would cover the upper portion of the trunks with copper or tin segments, and thus greatly reduce the overflow, or, rather, the waste. The present mode of tightening the packing of the stuffing-boxes of trunk engines is not indicative of great simplicity of action. Any ordinary mind but slightly conversant with mechanics can readily understand that a number of bolts, or rather nuts, say eight to sixteen, will occupy more time and attention than one or two. Now the gland of the stuffing-box of a trunk engine is analogous to our example for comparison. It is obvious that the time and attention requisite for one bolt must be equally dispensed to produce a correct action. The exact compression of packing is a matter of the highest importance. A gland that is unevenly screwed down is the greatest barrier to the working of the engine. To further explain this, suppose a packing four inches deep, and on tightening the gland it is one sixty-fourth out of the perpendicular, four inches of the rod will always be semicircularly embraced tighter than the opposite half, while the loose side will have a tendency to leak steam from the bottom. If this evil be great in the case of a piston rod what can be said or presumed in the case of a trunk thirty inches in diameter. As, however, it is unfair to condemn without suggesting a remedy, we will further consider this matter. In no case whatever can packing be properly or evenly compressed without the gland be moved parallel with the centre line of the piston rod. To turn exactly a number of nuts at one and the same time with one or two spanners, is tedious and incorrect. However expert a man may be, the exactness of mechanism will always supersede the action of the human hand. A vessel at sea, be it remembered, should not have to stop her engines under any pretence of repair, while, at the same time, a leakage of the packing will cause a loss of vacuum. Now, to counteract or rather abolish these evils, mechanical means for adjusting the gland would be a boon; we will, therefore, describe some recent improvements in this matter that have come under our notice.

Messrs. Maudslay, Sons, and Field some time since used a simple and ingenious contrivance for tightening the gland of the piston rod stuffing-box while the engine is in motion, and in some cases the packing has not been withdrawn or renewed during the voyage out and home, often extending over some months. Two bolts only are used, each being fitted with a nut having on it a toothed pinion, which gears into worms suitably fixed. On giving motion to the spindle of the worm, the same works the nuts, or rather the pinions, both at the same speed, and thus imparts a correct motion to the gland, which last compresses the packing evenly without nipping the piston rod. For trunk engines the glands must necessarily have a larger number of bolts, say double, or four in number at the least. In order to apply the above arrangement in this case, mitre gearing must be adopted, so that an equal speed could be given to each nut, using only one spanner or handle. Another arrangement for trunk glands, which we believe has been tested with success, is as follows:—A toothed ring gears into a series of spur pinions virtually nuts in action. The ring is sufficiently large to encompass the trunk without contact.

Motion is given to the ring by a ratchet and pinion, or a worm might be used if preferred; the number of the bolts and nuts in this case is not imperative. On motion being given to the ring, the pinions respond at an equal velocity with each other, and thus impart a parallel motion to the gland. Having thus far investigated the evils of trunk engines, allusion will be given to the arrangement. The connecting rods are generally inserted or rather secured as deep in the trunks as the diameter will admit. Messrs. Rennie have long ago obviated the difficulty of adjusting the brasses of the pin by boring longitudinally a hole centrally of the rod. By inserting therein a steel rod the brasses can be adjusted by the lower end of the rod, the upper end being operated on by a cotter whose exact position above the trunk is maintained by set nuts. The cylinders in the present type are secured perpendicularly as near the base line as possible, or as practice will allow. The condenser and air pump are located between the cylinders, the latter being worked by cranks on the intermediate shaft. In some cases eccentrics are used, but the crank motion is more generally preferred.

The next class of marine engine selected for comparison is the universal oscillating type. Engines of this class are perhaps more simple in the transmission of their power than those of any other; nevertheless, evils are still in existence which require mitigation. The stuffing-boxes of all classes of engines are the weak points, and the oscillating engine has its full share in the shape of piston rod and trunnion stuffing-boxes. In the case of the glands it is well known that there is a great difficulty in adjusting them while the cylinder is in motion; in fact, to attempt a correct compression with the ordinary bolts and nuts, practice shows to be a presumption. To obviate the evil here alluded to, would be to adopt a contrivance similar to that we have pointed out for trunk engines. The condenser in the present case commences near to or rather between the cylinders and the exhaust steam pipe, and is centrally situated, forming, in fact, the gudgeon. The gland in most cases is in motion with the engine, due to the stuffing-box being part of the cylinder. Now, where the former is fixed to the steam-exhaust portion of the condenser, it is obvious that the gland is stationary, and thus an adjustment of the gland can be more readily attained. The same remarks will apply to the gland on the supply-steam side; the portion of the steam pipe must in all cases be fixed; therefore, the stuffing-box could be cast with the same, or in principle the same, as that we have just alluded to. The present evil of tightening the gland would be greatly mitigated by the adoption of the means and connection we have noticed; in fact, the great barrier to a perfect vacuum would be considerably lessened. The general arrangement of the air pumps and condensers for oscillating engines is in all cases pretty much alike. In engines of large power the air pumps are arranged angularly. The means adopted for guiding the piston rod of the air pump are guides of the ordinary kind, but latterly these have been superseded by small trunks. The present arrangement of the foot and delivery valves is doubtless suggestive of great improvement. It will be well here to exemplify our meaning. Let it be assumed that a foot valve is out of repair, say split, loose, or the guard off: the action of the air pump would naturally indicate the fault. If there were not a separate door by which to obtain access to the foot valves (which, by the way, too often there is not) the top cover must be first removed, and in order to do this the connecting rod must be unjointed, the packing removed or loosened, and the trunk, and piston, can then be lifted entirely out from the pump barrel. After this the engineer must assume an uncomfortable position, say inverted or double, ere the damaged valve can be replaced. It may be said that good india-rubber valves can be obtained which

shall last the entire voyage, and hence our remarks are applicable to general repair; but in some instances accidents occur which produce the disarrangement we have alluded to. We, therefore, maintain that each portion of a marine engine should be separately connected, and that independent access should be imperative. The modes for working the feed and bilge pumps are not much varied; some firms prefer eccentrics, while others take advantage of the vibratory motion of the cylinder. We have thus far devoted our remarks to the merits and demerits of four classes of engines, all adapted for the paddle-wheel. Our conviction is, that each arrangement possesses certain good traits sufficient in themselves to warrant further development. The side lever engine, by its peculiar action, has less wear and tear than the later types. The direct-acting engine is correct in principle, but chiefly applicable for the purpose we have mentioned. The trunk engine is perhaps as simple as any perpendicular stationary cylinder engine yet known, but the cooling evil of the trunk demands further attention. The last arrangement, the oscillating engine, requires development ere it can approach perfection.

THE LONDON ASSOCIATION OF FOREMEN ENGINEERS.

WHEN shall we hear the last of the small squabbles of the London Association of Foremen Engineers? This society has been recently paraded before the public as if it were the most important body in London instead of being about the smallest. The smallest people are generally the most fussy. They are very particular about vindicating their dignity and letting the world know that they are people of vast consequence. After all, they manage to attract very little notice, and they never fail to find their level. How different it is with really important people! They are quiet, reserved, and truly dignified. You don't find them trotting themselves out. They neither talk of their good qualities nor parade their sorrows. They settle their differences at home with as much secrecy as possible. As with men so with societies. There have been, from time to time, important controversies with regard to the internal management of the Institution of Civil Engineers and that young, strong, and growing body, the Society of Engineers. But these societies manage matters without their chairmen or secretaries rushing into the scientific papers and proclaiming to the whole world any differences which may exist in their councils. How very differently the Association of Foremen Engineers manage matters. Take, for instance, the small dispute now going on between that society and Mr. Grissell. Some eighteen months or more since Mr. Grissell presided over the annual dinner of the Association, and, yielding to his benevolent promptings, offered fifty pounds towards its superannuation fund, providing nine others would subscribe a similar sum. The Association, much obliged for the offer, immediately placed itself in a begging attitude, circularised again and again the heads of the engineering establishments in London, and, after much solicitation and repeated appeals, got together the five hundred pounds. But, contrary to experience, it expected to enjoy the benefactions of charity and independence at the same time. When the begged money was got together, the question arose how and by whom it should be appropriated. Mr. Grissell, Mr. Maudslay, and others who subscribed, very naturally wished to have a voice in the distribution of the money. After many conferences and much ado, so, it appears, a majority of the committee thought. Mr. Newton, thinking that his dignity was offended, resigned, and so we thought and hoped there was an end of the matter. Vain hope! Once more, however, this matter, with which the scientific world has nothing whatever to do, is dragged before the public. Mr. Grissell, it appears, has sent a

circular to the donors and other engineering employers in relation to the formation of another society; and very proper, too, we should say. Mr. Grissell does not crave indulgence in the scientific press for his lucubrations, but his circular no sooner appears than Mr. Newton's wounded dignity actuates him once more to rush to the papers, and to proclaim for the twentieth time how hardly he and the Association have been dealt with. We, however, think that they have been treated most generously—in fact, tenderly. We should have thought that Mr. Newton would have been satisfied with his many preceding letters, and the reports of committee meetings on the subject. We beg to ask Mr. Newton, and any others, if they feel sufficiently interested in the matter, what have these small differences in a small society to do with the scientific public of this country? How long are the scientific papers to be inflicted with a controversy which should never have gone beyond the donors and the recipients of the money? And how long is an Association which calls itself scientific, to waste its time and energies, as is now the case with the Foreman Engineers? We are sure our readers must be sick of a subject which wisdom would never have submitted to their notice; and we are also sure that some of the most thoughtful members of the Association are heartily tired of it. If one half of the time wasted in this business had been appropriated to the reading and discussion of scientific papers, the Association would be thought much more of than it is at present. It appears that now there is some difficulty in getting a scientific paper read, but judging from what has transpired, we should say that every facility is given to discussions on begging circulars, and to conferences on who should and who should not have a voice in the appropriation of benefactions. We have not seen Mr. Grissell's circular, but, judging from the parts quoted by Mr. Newton, we consider it a very proper one. Let there be a new society established by all means, and when it is established we hope that it will find some better employment than consuming its time in petty squabbles. If, however, squabbles must come, let them be settled without such constant explanation to the scientific public who have little or nothing to do with them.

THE HOLLAND GUN AND SHELL.

IN our last impression we noticed the trial of a small rifled cannon of novel construction which is being brought out in America. The inventor is said to be Dr. Woodbridge, of Little Falls, N.Y., who has made several valuable improvements in different departments of mechanics. The description given of this piece is that the gun has a core of bronze, which, after boring, is left about a quarter of an inch thick, the bore of the gun in question being two inches and a half in diameter. Outside this cylinder fine steel wire is tightly bound to the depth of an inch. Each layer of wire is coiled on diagonally, and at right angles with the one immediately preceding it. After the wire is coiled on to the required thickness, the gun is highly heated and then plunged into a bath of molten bronze. By this method of manufacture great strength is secured, as evidenced in the trial of the gun by Major Laidley, who fired nearly five hundred shots with the piece in question, the charge being one pound of powder and a projectile weighing seven pounds and three quarters, the weight of the latter being subsequently increased to ten pounds and a quarter. Since our notice, however, it has come to our knowledge that the principle upon which the Woodbridge gun is constructed is not a new one, neither is Dr. Woodbridge the inventor, as is claimed for him by the Americans. In November, 1854, Mr. John Simon Holland, an engineer of Woolwich, Kent, and who is attached to the steam department of the Admiralty, obtained a patent for improvements

in the manufacture of guns, his proposed method of construction being similar in all respects to that of the Woodbridge gun. For small guns he takes small iron or steel wires, and winds them round a centre core in layers one over the other, forming right and left handed spirals. These are afterwards cemented or braised together by brass or gun metal, so as to form one compact body. In the manufacture of heavier ordnance, he uses rods or square bars of somewhat larger size but coiled in a similar manner to those in the smaller guns, and cemented or braised together as in the former case. One great advantage derived from the use of bars or wires of a square section, is the extra strength and solidity imparted to the piece by the close proximity of each bar. In the use of the circular rods, interstices are liable to be left which of course weaken the gun. Mr. Holland endeavoured, but we need not say without success, to induce the Government to adopt his system of construction, the importance of which it appears is now being realised in America.

Before quitting the subject of Mr. Holland's patent, we will notice another improvement for which the inventor has had no credit. It should be premised that Mr. Holland's patent lapsed at the end of three years by reason of non-payment of the tax due at that time. Such were the prospects of the inventor with reference to his patent that he had no inducement to protect himself any further. No sooner, however, had the patent lapsed than the Armstrong shell was brought out, although its construction was kept a profound secret. In a paper read before the Institution of Civil Engineers on "Ordnance and Projectiles," by Sir William Armstrong, the author refers to a segmental shell which he had "adopted." This shell was none other than that invented by Mr. Holland, and patented at the same time as his gun. All who know the principle of the segmental shell will have no difficulty in recognising it in the following description of Mr. Holland's shell:—The shell or grenade has a cavity within it for the reception of powder; between that cavity and the external case, a number of pieces of metal are closely packed in one or more layers, in such a way that when the shell bursts, by the explosion of the powder, the pieces of metal become independent missiles. We do not adduce these circumstances as being of novel occurrence in the history of invention—unfortunately they are stereotyped facts,—but we desire to do a small act of justice while we may to Mr. Holland. He is undoubtedly the author of an invention which, if it arrives at maturity, will assuredly reflect credit only on those who are the immediate cause of its appearing, while the remote cause of its existence will of course remain unnoticed and unknown.

NOTES ON NEW DISCOVERIES AND NEW APPLICATIONS OF SCIENCE.

Natural Groupings of the Elements—Classification of Carbon and Silicon—M. Troost's Researches on Zirconium—The Metals in Cerite and Gadolinite—Dr. Stahlschmidt's Researches on the Combination of Iron with Nitrogen—Unprecedentedly Pure Iron—Observations on the Transparency of the Sea.

AMONG the sixty or so elementary substances known to chemists, are a number of well-marked natural groups, or families, the members of which are in each case associated together by a graduated similarity of properties, together with certain relations between their atomic weights. Fluorine, chlorine, bromine, and iodine constitute, for example, one such group, the distinctive characteristic of which is the power, possessed only by these four substances,—the four "halogens," as they are called,—of combining with hydrogen in the proportion of atom to atom. One atom of either of these elements will combine with one atom of hydrogen, the

combination taking place in each case without condensation, so that the compound formed by the combination of one gaseous volume of either halogen with one volume of hydrogen occupies two volumes, or as much space as the two elements occupied while uncombined, and in each case the resulting compound is a powerful acid, gaseous, fuming, condensable, and soluble in water. While possessing this general property in common, these four elements, or rather the three of them which are best known, namely, chlorine, bromine, and iodine,—it is doubtful whether fluorine has ever been isolated,—exhibit in other respects a marked gradation of properties. Thus, at ordinary temperatures chlorine is a gas, bromine a liquid, iodine a solid. Liquefied chlorine boils at -76° deg., Fahr., bromine at 145° deg., iodine at 347° deg. Liquefied chlorine is transparent, liquid bromine transparent only when in extremely thin strata, liquid iodine completely opaque. Gaseous chlorine is yellowish, gaseous iodine purple, and gaseous bromine intermediate, or orange red. The specific gravity of liquid chlorine is 1.33, that of liquid bromine 2.97, and that of solid iodine 4.95. The three elements stand in the same order as regards their chemical energy, chlorine being the most energetic and iodine the least so, and bromine being intermediate in energy between the other two. All the properties thus enumerated,—except the last, which is in the inverse ratio,—are in the direct order of the atomic weights of the three elements, the atomic weight of chlorine being 35.5, that of bromine 80, and that of iodine 127. Chlorine, bromine, and iodine thus form one of Dumas' "triads," the atomic weight of the middle term of which is very nearly the mean of the atomic weights of the two extreme terms,—80 differing by only 1.25 from the half of 162.5, or of the sum of 35.5, the atomic weight of chlorine, and 127, that of iodine. The relation between the atomic weights of these three elements and that of fluorine, the other member of their group, is not so apparent, the atomic weight of fluorine being 19, or 1.25 more than half that of chlorine. Another group of elements exhibiting as striking a general similarity and as regular a gradation of properties is constituted by oxygen, sulphur, selenium, and tellurium, each of which combines with hydrogen in the proportion of two atoms to one. The atomic weight of oxygen is 16, that of sulphur 32, that of selenium 79.5, and that of tellurium 129. In this group, the element having the lowest atomic weight, oxygen, has exactly half the atomic weight of sulphur, or of that one of the three other members of the group whose atomic weight is the smallest, and those three other members of the group, sulphur, selenium, and tellurium, form a triad, the atomic weight of the middle term of which, selenium, differs by only 1 from the mean of the atomic weights of the two other terms,—the atomic weight of selenium being 79.5, while 80.5 is the half of the sum of 32, the atomic weight of sulphur, and 129, or the atomic weight of tellurium. Of the three elements of this triad, the one with the lowest atomic weight, sulphur, has the most chemical energy, the least specific gravity, and the lowest fusing point; the one with the highest atomic weight, tellurium, has the least chemical energy, the greatest specific gravity, and the highest fusing point; and the one with the intermediate atomic weight, selenium, is intermediate also both in density, in the strength of its chemical affinities, and in respect of the temperature at which it fuses.

Other groups of elements, the members of each of which have some general properties in common, while possessing others in graduated order, corresponding, either directly or inversely, to that of their atomic weights, and each group moreover including one or more triads, the members of which respectively are related to each other after the manner of those of the two triads specified above, are constituted by nitrogen, phosphorus, arsenic, anti-

mony, and bismuth; by lithium, sodium, potassium, rubidium, and cesium; by glucinum, magnesium, zinc, cadmium, and mercury; and by calcium, strontium, and barium. It is to be presumed that the other elements form other such groups, but the manner of their grouping has not as yet been very distinctly recognised. M. Troost, however, has just thrown a little new light on the matter. There has been much difference of opinion as to whether or not carbon, boron, and silicon were to be regarded as belonging to the same group of elements, and also as to what family of elements aluminium belongs to. M. Henri St. Claire Deville long ago grouped together carbon, boron, silicon, zirconium, and aluminium, but only a very small minority of chemists have till now accepted this classification. In "Watts's Dictionary of Chemistry" carbon and silicon are classed with titanium, tin, tantalum, and lead; boron is classed with gold, molybdenum, vanadium, and tungsten; and aluminium with the metals of the iron family. Other authorities classify these elements in still other ways, but M. Troost has been studying zirconium, and his researches with respect to that element go far to justify, —on grounds, however, which cannot very well be reproduced here,—Deville's hypothesis that zirconium belongs to the same class as carbon, silicon, and aluminium, and that it and they, with boron, form a group apart. M. Troost finds that zirconium is intermediate in its properties between the metalloid silicon and the metal aluminium, just as, in the nitrogen group of elements, antimony is intermediate between the metalloid arsenic and the metal bismuth.

Zirconium is too rare a substance to be likely ever to occupy any important place among the materials of the arts. It occurs only in the "zircon," or "jargon," and in "Eudialite," which are silicates of zirconia, the oxide of zirconium; in "Æschynite" and "polymignite," which are titanates of zirconia; and in "Sillimanite," which is a silicate of zirconia and alumina. All these are very rare minerals, the most abundant of them being the zircon, which, when colourless and transparent, —and also when coloured brown or red, in which state it is known as the "hyacinth," or "jacinth,"—ranks among the gems. The first to analyse the zircon was Klaproth, who discovered zirconia in 1789. In 1808 Sir Humphry Davy demonstrated that zirconia is an oxide, and in 1824 Bezelius first eliminated its base, which he obtained by the re-action of potassium upon its potassio-fluoride, in the form of a black powder, very like plumbago. By heating the double fluoride of zirconium and potassium with excess of metallic aluminium to the temperature at which iron melts, in a crucible made of gas-retort carbon, M. Troost obtains zirconium in thin laminæ, lying one above the other like the leaves of a book. These laminæ are composed of small crystals, very hard and brilliant, and having a specific gravity of 4.15. By another process M. Troost has obtained zirconium in graphitoid scales, so that this element, like carbon and silicon, can exist in three states, that is to say, as an amorphous powder, in a form analogous to that of graphite, and in the crystalline form.

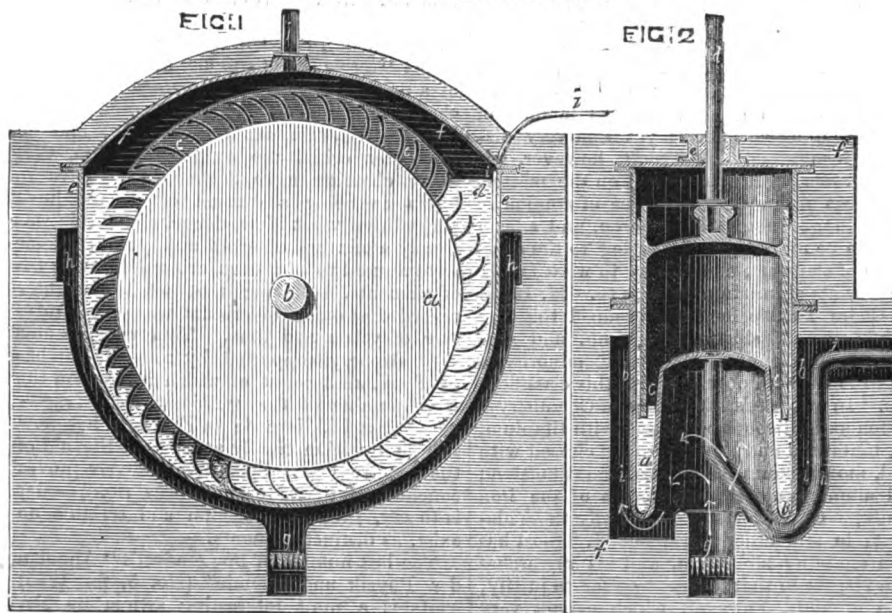
A word about the equally rare metals which are found in the minerals "cerite" and "Gadolinite." In 1788, Captain Arrhenius discovered in the quarries at Ytterby a black mineral, which Gadolin analysed six years afterwards, and found to contain a previously unknown earth. Ekeberg gave to this earth the name of "yttria," and to the mineral yielding it that of "Gadolinite." After a while, yttria was found to contain more oxides than one, for, in 1802, Ekeberg extracted oxide of glucinum from it, Berzelius found oxide of cerium in it in 1815, and in 1839 Mosander found the oxides of lanthanum and didymium in it, while in 1843 he believed that he detected in it the oxides of still two other metals, which he named "erbium" and "terbium." Cerium, lanthanum, and didymium had previously been found in another

mineral, called "cerite," which occurs only in an abandoned copper mine at Riddarhytta, in Westmanland, Sweden. Now, what Mosander called "terbia," and supposed to be the oxide of a new metal, which he named terbium, so closely resembles in its properties, on the one hand, yttria, the oxide of yttrium, and on the other erbia, the oxide of erbium, that many chemists have declined to believe in terbia as being a distinct earth, and have alleged that what Mosander named terbia was simply a mixture of erbia and yttria. Some have refused to add even erbium to their list of elements, believing that what Mosander regarded as oxide of erbium was only a mixture of yttria and lime. This view seemed very strongly supported by some researches by Popp, an account of which is given in the May number of the "Philosophical Magazine," but M. Marc de la Fontaine has now set the question finally at rest, by the aid of the spectroscope. Spectrum analysis proves conclusively that Mosander was right,—that is to say, that both erbium and terbium do exist, as distinct elements.

The last number of Poggendorf's "Annalen der Physik und Chemie" (No. 5, for 1865) contains a most interesting article by Dr. Stahlschmidt on "Nitride of Iron." Dr. Stahlschmidt seems to have been more successful in obtaining this compound than anyone else who has yet experimented upon it. He adopts the process of Regnault and Fremy, which consists in passing ammoniacal gas through a tube containing sublimed protochloride of iron, and heated to dull redness. The chloride of iron and a portion of the ammonia react upon each other, the chlorine of the ferrous chloride combining with an equivalent of the hydrogen of that portion of the ammonia which undergoes decomposition to form therewith hydrochloric acid, which combines with the undecomposed portion of the ammonia to form sal-ammoniac, and the iron thus set free combining with the nitrogen of the decomposed ammonia, to form therewith the compound NF_3 . The sal-ammoniac, together with two of the three equivalents of hydrogen in the decomposed portion of the ammonia,—only one of the three having combined with the chlorine of the chloride of iron,—fly off, the nitride of iron remaining behind. This nitride contains about twelve per cent. of nitrogen, and Dr. Stahlschmidt hence regards it as consisting of four equivalents of iron combined with one equivalent of nitrogen, and thus as constituting an ammonium in which all the hydrogen is replaced by iron. He accounts for the difficulty which other experimenters have found in obtaining this compound in quantity, and of constant composition, by the fact that nitride of iron is decomposed by hydrogen at the temperature at which the nitride is formed, and very rapidly at a slightly higher temperature. Hence, as free hydrogen, in large quantity, is one of the products of the reaction between ammonia and chloride of iron, the greatest quantity of nitride of iron will be obtained when that reaction is conducted at the lowest temperature at which it will take place. Dr. Stahlschmidt finds the most suitable temperature to be somewhat below dull redness.

By decomposing nitride of iron by means of hydrogen, Dr. Stahlschmidt has obtained metallic iron in a state of very remarkable purity. The iron thus obtained is described as being of "a silver-white colour, extraordinarily ductile, and so soft that it may be cut with ease by an ordinary knife. It oxidises in the air as easily as ordinary iron, and in moist air more easily. It possesses also the property of condensing water on its surface when in contact with atmospheric air." Its specific gravity is as low as 6.03,—which is very remarkable, seeing that the specific gravity of the purest iron hitherto known, that obtained by electrolysis, is as much as 8.1393, and that of commercial bar-iron about 7.8. The iron obtained by Dr. Stahlschmidt, in the way indicated, dissolved in acids without leaving the slightest residue,

IMPROVED MOTIVE POWER.



and would thus seem to have been purer than any iron ever yet obtained by any other method.

Father Secchi and M. Cialdi communicated to the Academy of Sciences, at one of its late sittings, an account of some observations recently made by them on the transparency of the sea at different depths. Their experiments were conducted on board a vessel near Civita Vecchia, at distances from the coast varying from six to twelve miles, the sea, at the time of each experiment, being quite clear and tranquil. They found that the maximum depth at which a white disc, about ten feet in diameter, remained visible from the surface, when the sun was 60 deg. above the horizon and the sky quite clear, was about one hundred and forty feet. In descending, white discs appeared first of a light green colour, and next of a clear blue, and then the blue became gradually darker and darker, until, at the depth mentioned, the discs ceased to be distinguishable from the surrounding medium. Yellow or sand-coloured discs ceased to be visible much sooner than white discs, becoming invisible at depths varying from fifty-five to eighty feet, according to their tint. These results, as Father Secchi observes, are "worth being known by sailors."

IMPROVED MOTIVE POWER.

THIS invention relates to a mode of obtaining motive power by the action of steam or other elastic fluid on surfaces immersed, as hereafter described, in a bath of liquid metal. It has been patented by Mr. David Clovis Knab, of No. 12, Abingdon-street, Westminster, civil engineer. Fig. 1 of the accompanying engraving represents one form of engine by means of which this principle may be carried into effect. *a a* is a wheel or disc mounted on the driving shaft *b* and fitted at its circumference with buckets *c c*, serving as recipients to the motive fluid; *d d* is the metal to be liquified, contained in a case *e e e* hermetically closed by the cover *f f*. In the sides of this case *e e e*, are set stuffing-boxes, through which pass the extremities of the driving shaft *b*, *g*, furnace by which the metallic bath is heated to the required temperature; *h h*, flue by which the products of combustion are carried off after circulating round the case *e e e*; *i*, pipe by which the motive agent is carried to the bottom of the metal bath; *j*, eduction pipe for the expended fluid.

In supposing, for example, that steam is adopted as the working medium in the engine above described, the bath *d d* may be composed of lead and tin, or other suitable metals or alloys, which are reduced to and maintained in fusion by the furnace *g*, the depth of the liquid mass being proportioned to the amount of pressure required. The steam generated in a boiler mounted apart in any desired position is led by the inlet pipe *i* from *i* to *m*, and acquires in its passage the same temperature as that of the surrounding

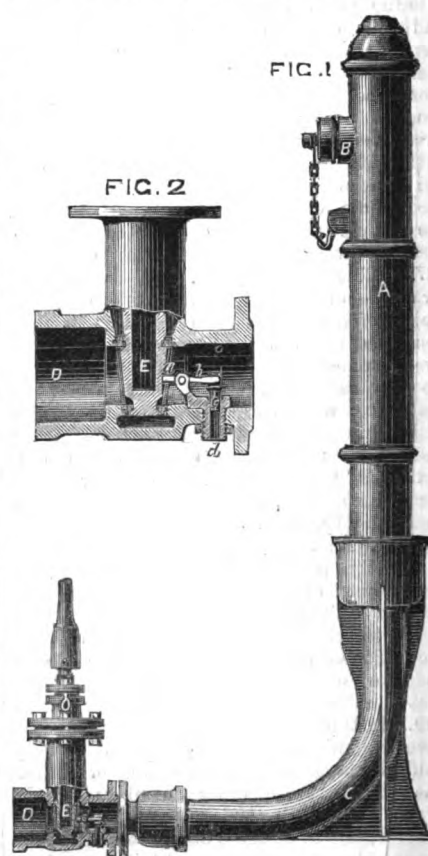
liquid metal. On reaching the point *m* it passes into the recipients *c* of the disc *a*, displacing the liquid metal contained therein, and so on successively from recipient to recipient, till carried by the revolution of the wheel to the surface of the bath, from whence it escapes by the eduction pipe *j*. It may here be remarked that the liquid metal produces by its density the same effect as the mercurial column of the barometer, and that the motive fluid expands, as indicated by the engraving, with mathematical regularity from the moment of its introduction at the point *m* to its issue in *n* at the surface of the bath. From the preceding example it will be readily understood that the vapours of ether, ammoniac, methylene, sulphurous acid, and other highly volatile products may be substituted for that of water, the nature and temperature of the metallic bath being modified accordingly. With motive agents of this class the bath may be composed of any easily fusible metal, such, for instance, as the alloy of lead, tin, and bismuth, known as D'Arcet's metal, and be maintained at a minimum temperature of 212 deg. Fahr., the surplus heat being applied to superheat the fluid admitted at any desired pressure, and thus increase the motive power by the whole amount of the dilatation. The bath might even, if so desired, be composed of mercury.

Fig. 2 represents a form of engine which may be used when heated air is adopted as the motive medium. *a a* is the metal to be liquified, contained in a vessel *b b* the bottom of which forms a chamber above the furnace; *c c c* is a bell-shaped plunger of cast or wrought iron, working vertically in the vessel *b b*, and corresponding with the driving piston of the ordinary steam engine; *d*, rod, passing through a collar *e e* set in the brickwork *f f*, and transmitting to the driving shaft the motion of the plunger *c*; *g*, furnace; *h h*, pipe by which the air is admitted from a pump placed in any suitable position; *i i*, flue in which the products of combustion circulate round the vessel *b b* on their way to the chimney through the conduit *j*. The cold air forced in by the pump is first heated to a certain extent in the portion of the pipe *h* which passes through the conduit *j* and the corresponding portion of the flue *i*. From the lower bend upwards this pipe is exposed to the direct action of the fire, and the air thus brought to the required temperature passes into the plunger *c c* through the opening *k*. When the up stroke of the plunger is completed, as seen in the figure, the air is exhausted by the action of the pump, and is cooled in its return by any suitable means; the plunger then descends to its starting point, and so on alternately. All leakage of the motive fluid is rendered impossible by the pressure of the liquid metal, whatever may be the form of engine employed.

HYDRANTS.

THIS invention, for which a patent has been taken out by Mr. Richard Chrimes, of the firm of Gnest and Chrimes, of Rotherham, in the county of York, brassfounders, consists in the employ-

ment of a small valve in combination with a sluice valve in such a manner that, when the sluice valve is open and the hydrant or firecock in use, the small valve will be shut, and *vice versa*. When the sluice valve is closed, the hydrant or firecock being out of use, the small valve is opened by a projection on the valve of the sluice pressing upon a lever which is connected with the small valve, thus opening such small valve, and allowing the water to flow out of or escape from the elbow pipe, so as to empty the same and prevent it from being frozen. Fig. 1 of the engraving represents a side elevation and partial section of a hydrant having these improvements applied thereto, and connected to a fixed street-watering standpost, the sectional portion showing the hydrant valve closed and the frost valve fully open, the standpost and hydrant being in consequence completely empty, and therefore not liable to injury from frost. Fig. 2 represents an enlarged section of a portion of this hydrant, showing more clearly the arrangement of sluice and frost valves. *A* is the street standpost provided with the usual screwed nozzle at *B* for the attaching of a hose; *C* is the hydrant elbow, to which the standpost is secured in any well-known or other convenient manner. The communica-



tion between the elbow *C* and the main or other water supply pipe at *D* is opened or closed, as required, by the sluice valve *E*, operated upon in the usual manner. On the back of this sluice valve there is formed a small projection *a*, which, after the orifice of the sluice valve is closed, and before such valve is completely home in its seat, presses upon the tail *o* of a short lever *b*, the opposite end of which is connected with the frost valve *c*, situate between the sluice valve and the stand pipe, and opens such frost valve so as to allow the stagnant water in the hydrant elbow and standpost to flow off after the sluice valve has been closed. The projection *a* is so placed with regard to the lever *b* that the sluice valve will be actually closed before the frost valve *c* is opened, whilst, on the other hand, the frost valve *c* will be closed by its own gravity before the sluice valve is opened, there being sufficient play in the sluice valve after its orifice is closed to permit of the opening of the frost valve. It will thus be seen that by this arrangement it is impossible to place the valve in such a position that both will remain open, which position would cause an unnecessary waste of water through the frost valve. *d* represents a screwed nozzle, to which a pipe may be fitted for carrying off the waste water from the frost valve into a drain or sewer.

NORTHERN INSTITUTE OF MINING ENGINEERS.

(Continued from page 53.)

The next paper was "On an Improved Plan of Drawing Coals," by Mr. Robert Aytoun. The author stated that the weight of the rope used in drawing coals absorbs a great part of the power employed. In deep pits, for every ton of coals drawn there might be from two to three tons of rope drawn also. The author's improvement consisted in hanging another rope, of the same weight and length as the one previously employed, by its two ends to the under sides of the two cages, and passing it under a pulley at the bottom of the pit to keep it in its place. By this expedient the rope was perfectly balanced in every position, one half ascending while the other half was descending, and the engine was absolutely relieved from the burden of the ropes and cages at the mere expense of the friction caused by the additional rope, which was trifling. Pits whose depths required stronger and heavier ropes than could be worked on the present unbalanced system might be worked (in the author's opinion) on the proposed system successfully, and with engines of moderate power; for the entire weight of the ascending rope and cage being balanced by that of the descending ones, the engine has nothing to do but to raise the coals and overcome the friction caused by the weight of the ropes, cages, and coals. Having thus shown the applicability of the new system to existing machinery, the author next proceeded to point out the simplification of which it permitted. Instead of the lofty pit-head frame and its two pulleys, he places a single large pulley over the mouth of the pit, corresponding to the one at the bottom. The drawing rope is to be placed over this pulley, and the cages are to be hung to its two ends. This rope, connected to the lower one by the *media* of the two cages, may be considered as an endless rope or band stretched between the two pulleys, and completely balanced in every possible position. All the working barrels, pins, fuses, &c., in common use, are to be laid aside, and their place supplied by a connecting rod driven by the engine. This sets the pulley in motion either way, and the pulley, by means of the friction between its surface and the rope, communicates motion to the rope and the cages with their loads.

The author next described the application of this method in practice, pointing out its numerous advantages. Wherever a large delivery of water or coals is required, this system of drawing is, in the author's opinion, peculiarly applicable, for the load to be lifted at a time may be greater than by any other system, partly in consequence of the greater weight and strength of rope which this system admits of, and partly because the power of the engine is not wasted on unproductive work, but is almost wholly employed in raising the load, while the speed is also much higher; hence, a much larger output can be maintained by this system than by any other. This system is supposed to be peculiarly adapted to the use of safety cages. There is a screw which moves the lower pulley, and tightens the rope. In doing so it compresses the springs of safety cages, and keeps the clutches or claws clear of the guide rods. This removes the only objection which is now urged against the use of safety cages, as it permits them to have powerful springs to overhaul the broken rope, without there being any danger of their catching the guide rods while the rope is entire.

Mr. Marley, at the request of the chairman, delivered an address, which he had been able only partially to write, on the subject of safety cages. After referring, in passing, to Fourdrinier's, White and Cnant's, and Aytoun's, he proceeded to describe *Jalows's*, and the impression it had made on himself after careful trial. This invention is described as a very ingenious method of releasing the clutches by a spring, which flies into action as soon only as the cage acquires the velocity of a falling body. The spring, instead of being held in tension as usual by means of the rope, is kept down by means of a weighted cap. If the rope breaks, the cap begins to fall, but the cap, having the force of gravitation diminished by the upward pressure of the spring, allows the latter to expand, and thus to bring the clutches into action. Unless, therefore, the descent be very rapid, or in jerks, this modification appears little liable to catching, when at required—a source of much inconvenience and danger. Mr. Marley gave several instances of the practical utility of the invention and read the testimonials of a number of practical men in its favour.

As observed in our previous notice there was no meeting at the Royal Institution on Wednesday, but the sittings were resumed on Thursday, when Mr. P. V. Maddison read a paper in explanation of the pumping engines at present in use at the Thornhill collieries. The engine, he said, was horizontal, and working at high pressure with a cylinder 38in. diameter and 5ft. stroke, and a fly-wheel 22ft. diameter. The stroke in the pumps was 4ft. 6in. and could be varied 6in. either way. The working barrels are 18in. in diameter, the total length of each set being 261ft., the two lifting and

delivering independently. The maximum speed yet worked was eight strokes, but ten or twelve might be considered safe. At eight strokes 864 gallons of water were raised 261ft. The pressure, which was formerly 45lb., had recently been reduced to 35lb., and this was the pressure at which the above data had been obtained. The object of the paper was explained to be to show that efficient pumping arrangements might be arrived at by other than direct action.

This was followed by a paper from Mr. Gilroy, "On a Coal-washing Machine," being the one in use at the Ince Hall Coal and Cannel Company's collieries, at Ince, near Wigan. The machine consists of a line of spouts attached at one end to the slack or duff hopper of the nut screening apparatus, and is continued to each row of coke ovens, or, if necessary, to each oven. By means of valves, water and slack are admitted together or separately, as required, into the spouts. The slack is conveyed to the ovens by water, any earthy matter being deposited at the bottom of the spouts whilst in transit. The distance from the screens to the ovens is about 600ft. The spouts have a fall towards the ovens, and they are supported by poles about 60ft. apart. There are also various dams along the spouts. The quantity of Arley mine slack washed daily is 120 tons, yielding about six per cent. of the refuse. The water wanted is 80 to 90 gallons per minute. The attendance costs 3s a day, or 0.3d. per ton on the slack; and the advantages of the method were stated to be simplicity of arrangement, economy of first outlay and in cost of working and upholding, and efficiency, which advantages were fully admitted in the discussion that ensued.

Mr. Greenwell then read a long and elaborate treatise "On Tail Ropes," which, he said, had been prepared at the request of the South Lancashire and Cheshire Coal Association, and which was the joint production of himself and Mr. C. Berkley. An account of the mode of conveying coal tubs by endless chains in Lancashire and Cheshire collieries was followed by a description of the tail-rope principle, by which large quantities of coal may be conveyed very long distances underground, along level or undulating planes, by engine power, as illustrated in the practice at Marley Hill colliery, Durham. The engine is placed in a chamber under the waggon way, in the rear of the shaft. It has two horizontal cylinders 20in. diameter, 3½ft. stroke each. On the main shaft is a fly-wheel 5 tons in weight, and a spur-wheel 6ft. diameter, into which, on opposite sides, two spur-wheels, also 6ft. diameter, work with sliding gear. On each of the shafts of these spur-wheels is fixed a drum, 6ft. diameter and 3ft. wide. Two boilers, 40ft. long and 5½ft. diameter, with egg ends, and wheel flues at the surface, and a steam pipe, 582ft. long and 7in. internal diameter, supply steam. The pipes are covered with dry hair felt, closely lapped with tarred small line, and the whole coated with boiled tar and sand. There is near the engine a receiver, 10ft. long, 3½ft. diameter. The ropes are of iron wire, weighing 7lb. per fathom, and measuring 2 7/8ths in. circumference. The length of rope required is three times the length of the plane. An experiment had given the following results:—The engine drew 70 loaded tubs on a practical level, 420 yards in two minutes. There were 5,863 yards of rope in motion, weighing 20,520lb. In this length there were 240 rollers, amounting to 4,380lb., and 250 sheaves, 7,125lb.—total, 3,205; so that the resistance was 1143 7/8lb. The weight of the full tubs was 105,840lb., equal to a resistance of 1290 7/8lb. The total resistance, therefore, was 2434 4/8lb., which, multiplied by 630ft., the rate per minute, gave a total resistance, in pounds moved one foot per minute, of 1,533,722 4/8lb. The pressure of steam was 29lb. per square inch, representing power 3,826,468lb. moved one foot per minute. The effective performance of the engine was therefore forty per cent. of the indicated power (no reduction being made for friction of engine, resistance of atmosphere, &c.). The usual reduction of one-third from the indicated power would make the effective power 60.1 per cent. of that of the engine. In five days 25 tons 2 cwt. of coal was used, and the quantity of coal and fire-clay drawn along the planes was 2,805 tons; the engine being employed not more than ten hours per day. Ten men and six boys were employed. The cost of bringing 159,553 tons 13 cwt. of coal over the ways in one year was £1,503 10s. 9d., or 1.663d. per ton per mile. The same amount of work formerly required twenty-four horses, and cost £2,500 per annum. But, in addition to this, the same machinery would bring the coal double distance, which would require forty to fifty horses. The only disadvantage of the machinery was that any derangement involved the entire stoppage of works during repairs; but, everything being strong, good, and well appointed, such occasions should be rare. During the year in question the pit worked 280 days, the average daily quantity being 569 tons, all brought to the shaft by the engine.

The closing meeting was held on Friday morning, when Mr. Embleton read a paper "On a Coal-cutting Machine," the one he had selected being *Carrett's*. The machine had been in operation

since March last, and during the whole of this period the rate of boring the coal was 8 1/10ft. per hour. The cost had been 4.2-10d. per ton. The average depth was 3ft. 6in., sometimes it had been 3ft. 9in., and sometimes 3ft. 3in. The greatest distance cut was on the 16th May, when 153ft. were cut in eight hours, being at the rate of 19ft. per hour. The eight hours included stoppages, but the actual time the machine had been working was five hours, which gave 30ft. per hour. The minimum amount of work done was on the 13th June, when eight yards were cut in eight hours, and that also included stoppages. The coal in the seam averaged two tons to the yard. A discussion ensued, after which Mr. Daglish read the report of a committee appointed by the council of the Institute to consider the subject of safety lamps. He said the appointment had arisen from the statement of Mr. Greenwell to the President, Mr. Nicholas Wood, that under certain circumstances safety gauzes gave off a vapour which was inflammable, and that it was possible an accident might arise from that cause. The first series of experiments had been made upon the gauze itself, and he produced a diagram in illustration of the experiments. One portion showed the introduction of gauze into a red hot pipe, and when that was done the inflammable vapour went off from the gauze and was ignited by the red hot pipe. But it was to be observed that the heat of the lamp was internal, and that, therefore, the gauze was not in that case immersed in a red hot atmosphere. In the next instance a red hot pipe had been introduced into the interior of the gauze, and in that case there had been an appearance of flame on the outside of the gauze. It was supposed from that the flame was ignited at the end, and so passed along the outside. Under this impression a shield had been fitted upon the gauze, and after that was done the flame could not be observed beyond the shield, so that the conclusion was, that if they had a lamp with the heat internal, there could be no passage of flame beyond it. He then referred to some experiments which had been made with a view to ascertain what was the cause of the inflammable vapour arising from the gauze, and there was no doubt that the cause was the oil used in the manufacture of the gauze. It did not exist in the wire, but was brought into the gauze in the course of weaving, and the oil was so identified with the iron that it could not be brushed off. They never could practically place a lamp in the position of being red hot, because that required time, and while the time was passing, and the gauze was growing hot, the vapour was volatilised, and passed away before the red heat had been attained. When they got the gauze red hot, then it was safe, because the oil had been vapourised. The committee were of opinion they had proved that even if it were not so, and the gauze could be made red hot, the flame could not pass. In conclusion, he said the committee intended to proceed with the experiments. They had only recently got into form an apparatus for testing the lamps by placing them in an atmosphere impregnated with fire-damp, and whirling them violently, so as to place them under conditions which would fully try their capacity to resist the danger.

The concluding paper, by Mr. Daglish, was descriptive of a water gauge invented and constructed by himself. He explained that the gauge was not so long as the gauge ordinarily used in the north, that the principle was exactly the same but the form different; the scale was divided equally on each side, it had the pressure markings on each side, one of the tubes was bent over, and a small hole at the top to prevent dust from getting in; the scale was moved by a threaded screw, the cost the same as the ordinary gauge, and it was not so liable to breakage. Mr. Daglish presented the gauge to the Institute.

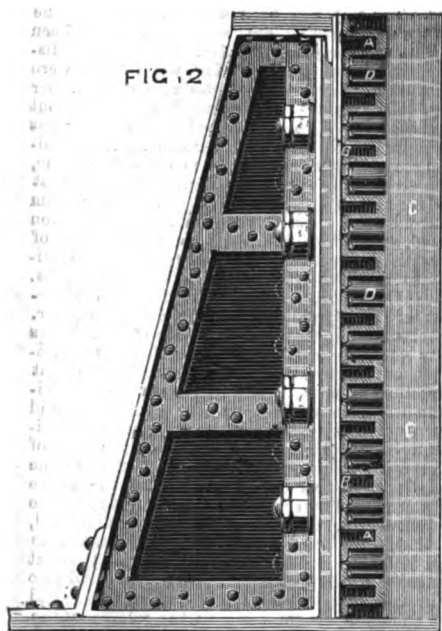
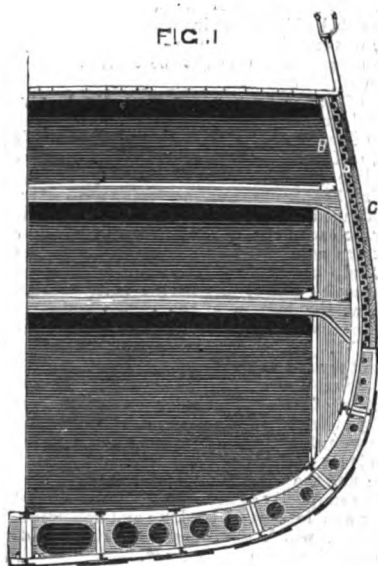
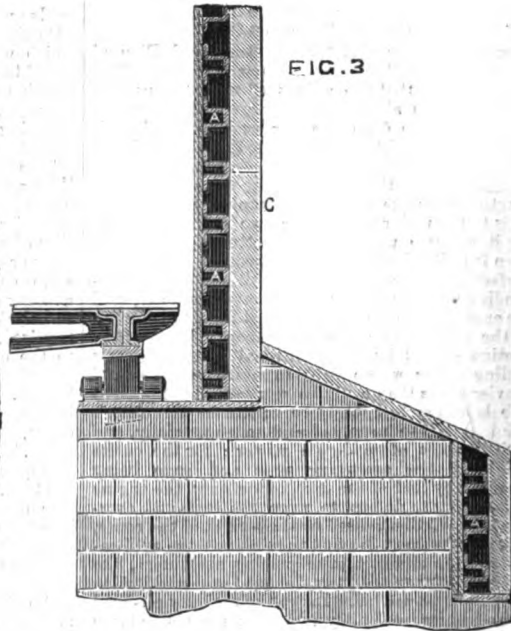
COMBINED FUNNEL AND MEASURE.

The accompanying engraving represents a very useful article which has recently been patented through the Scientific American Patent Agency by Mr. S. R. Dummer. To those engaged in



businesses involving the frequent use of the funnel, or to the careless who never put anything in the same place twice, this invention will prove con-

ARMOUR PLATED SHIPS.



venient, for it is impossible to misplace it or detach it from the vessel it is used with. This article combines the advantages of a vessel or measure with a funnel for decanting liquids, so that no waste occurs in emptying the measure into the funnel, and none from the funnel, as the fluids pass into the bottle. The engraving shows the form of the article and the use to which it may be applied. The measures are graduated on the sides and furnished with a guard at the top from which a spout protrudes. This spout is to be inserted in the bottle as shown, and the measure elevated, in which position it can be left until empty; it is not necessary to hold it, as the measure sustains itself. Fluids of all kinds can be more economically measured in this vessel than in others, and there is a saving in labour and the cost of utensils from the combining two articles, which are usually separate, in one.

ARMOUR-PLATED SHIPS.

MR. JOHN HUGHES, of Millwall, engineer, has just patented some improvements in the construction of armour-plated ships, forts, and other like structures. His invention relates to the construction of ships of war by strengthening them with hollow stringers or girders running longitudinally, vertically, or otherwise. These stringers are riveted to the skin and frames of the vessel, and form the backing for the armour plates; the spaces between the stringers, and also the hollow in the stringers, may be filled with wood or any composition that may be found suitable.

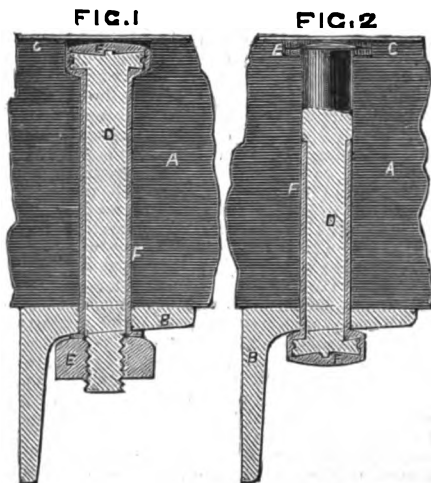
Fig. 1 of the accompanying engraving is a section of a portion of a vessel of war, showing longitudinal hollow stringers applied as a backing to armour plates to strengthen the same. The stringers also act as longitudinal girders to the structure. The hollow stringers are made with double flanges, as shown, to enable them to be riveted to the inner skin B of the vessel. CC is the armour-plating, which is fixed by bolts DD (fig. 2), passing through the skin B, and plating C, and between the stringers. Fig. 2 is a section of a portion of a wrought-iron shield, with hollow stringers A applied thereto. This figure also shows more clearly the mode of securing the stringers to the structure. Fig. 3 is a section of a portion of a wrought-iron tower (with revolving platform), for land fortifications. A A are the hollow stringers as before, and CC the armour plates. The masonry is also protected by hollow stringers.

BOLTS FOR SHIPBUILDING.

MR. JOSEPH HORATIO RITCHIE, junior, of No 106, Leadenhall-street, London, has recently patented an invention which has for its object the insulation of bolts used in the construction of ships or vessels, more especially those built with iron frames planked with wood, so that if iron bolts are employed they shall not be wasted by

the galvanic action caused by their contiguity to the copper or yellow metal sheathing; or, on the other hand, if yellow or composition metal bolts are used, they shall not have any injurious effect on the frames through which they pass. In order to accomplish this object, he covers the bolts entirely or on those parts contiguous to the dissimilar metals with caoutchouc, or caoutchouc and gutta-percha, or other mixture in which these form essential ingredients hardened by the process known as vulcanisation.

The engraving shows two examples of the application in shipbuilding of bolts so covered. The bolt D, shown in fig. 1, is an iron bolt suitable for being driven from the outside of the plank. The bolt passes through the plank A and angle iron B, which is a portion of the iron framework



of the vessel, and is set up inside by the nut E, the insulating covering of vulcanite or ebonite F being between the iron bolt and the metal sheathing C. The iron head of the bolt is in this figure shown to be entirely covered with the insulator, but in cases where great percussion has to be borne by the head, it may be found desirable to allow a portion of the centre of the iron head to project a little above or be flush with the surface of the vulcanite so as to receive the heavy blows; the portion of iron thus left uninsulated may, after the bolt is driven, be easily covered with any insulating material, such as marine glue or a solution of caoutchouc or shellac. This form of head is especially suited to the long bolts used in timber-framed vessels. The bolt D, shown in fig. 2, is a yellow or composition metal bolt driven from the inside through the iron frame B and plank A, its end being secured outside the plank by being clenched on the ring E, the insulating covering F being in this case between the yellow metal bolt and iron frame. The metal heads of the bolts may be made of various forms so long as the shape is such that the coating of vulcanite shall be firmly attached to the metal

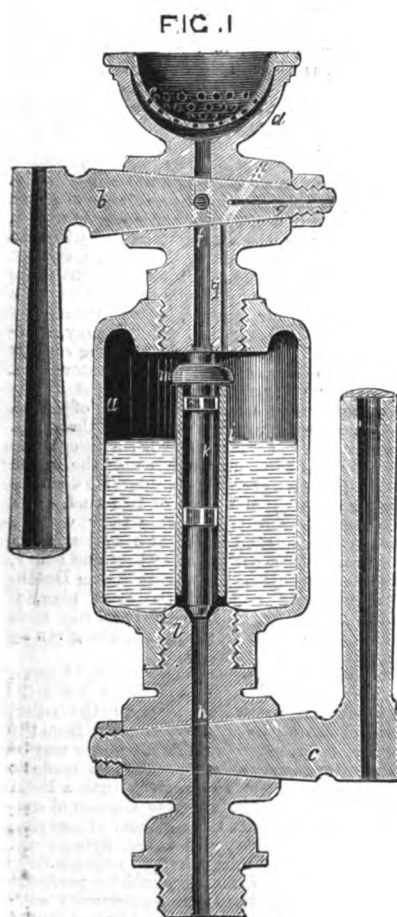
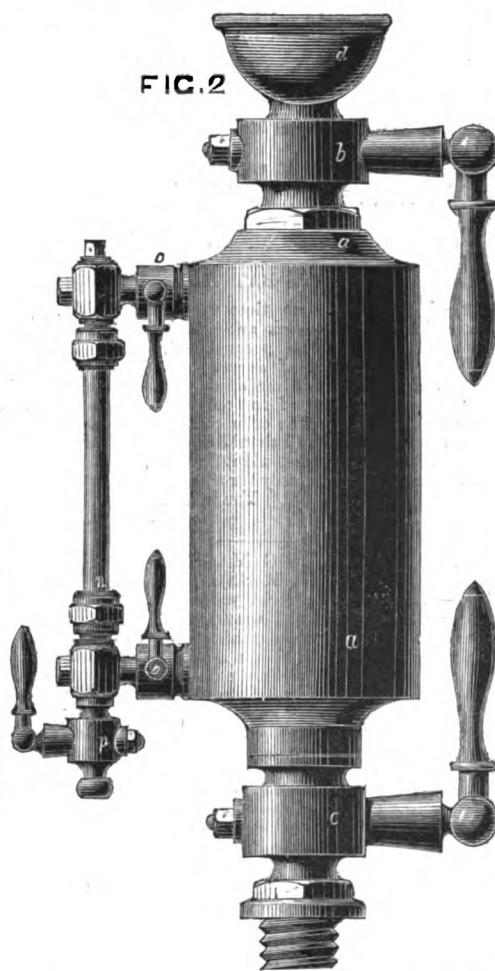
head, but the form of head shown in the engraving answers the purpose.

The composition of the vulcanite or ebonite should be such that it shall at the same time be tough as well as hard. A compound of caoutchouc masticated with from 4-10ths to 5-10ths its weight of sulphur laid on the bolt in a plastic state, and tightly bound thereto with tape or other material, and exposed to a heat of 300 deg. Fahr. for from three hours to four hours, answers the purpose well. In laying on the covering great care is necessary in order not to enclose any air either between the surfaces or otherwise, so that the contact may be perfect and the material free from holes. Although only two examples of insulated bolts suitable for being used in shipbuilding are given, yet the iron screw bolts for fastening deck planks, the twisted iron screw bolts for the keel plates of iron-framed ships, the knee and rider bolts of timber-framed vessels, and many other bolts used in the construction of ships and vessels may in like manner be covered or partially covered with a compound of sulphur and caoutchouc, or caoutchouc and gutta-percha, or a mixture in which these are principal ingredients, such compound being vulcanised as already explained.

THE "FIELD" BOILER.

RATHER more than nine months since some three dozen tubes on the Field system were fitted to a 25-horse power Cornish boiler, which is working with three boilers of similar power, at the Cardle-works of Messrs. J. C. and J. Field, of Lameth. The object was to increase the evaporative power of the boiler in question. The tubes, which are of 2½ in. external diameter, and 1 ft. 6 in. long, were fixed behind the bridge of the boiler by drilling slightly conical holes in the firetube, which is only 3-8ths of an inch thick; the tubes were drifted in by means of a suitably tapered mandrel. The boiler has been constantly at work ever since, having done night and day duty during six months of the time, and full day work for the remaining three months. It was opened three months after the tubes had been put in, and they were found in good order, and required no cleaning. The same results were observable when the boiler was again opened at the end of six months. On Monday last the boiler was opened for inspection for the third time, and we are enabled, from personal examination, to state that on this occasion the tubes were practically quite clean, and there has been no leakage whatever since the tubes were applied. The working result is that a saving of 20 per cent. has been effected by their adoption. The boiler, now doing easily, work which it previously had great difficulty in accomplishing, a much smaller quantity of fuel being used now than was consumed before the tubes were fitted. It is also worthy of remark that a thick deposit of sediment had collected on the tube of the boiler, throughout its length, with the exception of the area immediately contiguous to the Field tubes where it was perfectly free from the deposit.

IMPROVED LUBRICATOR.



IMPROVED LUBRICATOR.

MR. RICHARD TOWNSEND, of Sheffield, engineer, has obtained letters patent for an improved tallow cup or lubricator for the cylinders and valves of steam engines, steam hammers, and other purposes, which consists principally of a closed vessel of a cylindrical or other shape provided with a tap at the top, and also a second tap at the bottom; so far it is like an ordinary double tap cup. The upper tap is furnished with an open cup, in which is a perforated plate or sieve for preventing any impurities in the tallow or oil from passing into the vessel. This tap and cup are for charging the vessel with tallow or oil without removing any screw plug; there is also a second small opening drilled diagonally or otherwise through the plug of this tap, which, when the tap is opened, allows the air in the vessel to escape at the side as the tallow or oil descends from the open cup. In the annexed engraving fig. 1 represents a vertical section of the improved lubricator, and fig. 2 is an external view of a lubricator to which a gauge is fitted. *a a* is the vessel or grease cup to contain the tallow or lubricating material, provided with a tap *b b* at the top, and a second tap *c c* at the bottom. The upper tap *b b* is furnished with an open cup *d d*, containing a perforated false bottom or sieve *e e*, fitted in loosely. The plug of the tap *b b* has one opening *f f* through it, for the admission of the tallow to the interior of the cup and also to allow the tallow or grease to flow out of the same. By having only one opening through the plug of this tap a great advantage is gained, as it lengthens the bearing of the plug and renders it much less liable to leak than where two openings are used, as in the double-tap cups hitherto employed. From the lower tap *c c* a vertical tube *i i* rises inside the cup above the tallow or oil, and inside this tube is a rod *k k*, the two ends of which are ground conical

and act as a double piston valve, the upper end serving to close the opening of the tap *b b* and the lower end serving to close the opening of the tap *c c*, the length being such that the opening of one valve will close the other, and *vice versa*. At the bottom of the tube *i i* are openings *l l* to allow the tallow or grease to flow through the tap *c c* when the lower valve is opened. On the rod *k k* are two pistons ****, which fit the inside of the tube *i i*, but are grooved in order to let the steam pass up the pipe above the oil or tallow when the lower valve is opened, so that the oil or tallow being in equilibrio can descend through the openings *l l* by its own gravity. Near the top of the rod *k k* is a cone *m m* to prevent any sediment or other impurity which might pass through the sieve *e e* from getting into the working parts of the valve.

In the engraving the lubricator is represented as in working position, with the upper tap closed and the lower one open. To feed the cup with tallow or oil all that is requisite is to close the lower tap and open the upper one, and then to pour in the tallow or oil through the sieve *e e* in the open cup *d d*, after which the upper tap is closed and the lower one opened, as shown in fig. 2. *n n* is a glass gauge tube provided with two taps *o o* to put it in communication with the top and bottom of the cup or vessel *a a*, and a tap *p* for emptying or cleaning the tube. This form of arrangement of lubricator is most suitable for oil or other liquid lubricating material, as it shows the height of the liquid and the gradual disappearance of the same.

ON THE EMISSION OF LUMINOUS RADIATION AT A RED HEAT.*

BY M. P. DESAINS.

M. PROVOSTAYE and I, a dozen years ago, proved that at a red heat different substances may have very different powers of emission for light. And we have also given some indications as to the relative values of light emitted at this red heat by the same extent of surface of oxide of copper, platinum, and gold. In our experiments oxide of copper had about ten times the emissive power of gold. Platinum was between the two, but nearer the second. In the

researches which I now submit to the Academy, I proposed to myself to extend to a larger number of bodies the study of the luminous emission at a red heat; the results I have obtained may be summarised in the following manner:—At a red heat, and in a perpendicular direction, oxide of copper, oxide of cobalt, green oxide of chromium, brown oxide of manganese, and red oxide of iron have for light emissive powers which are virtually equal. Under these circumstances a coating formed of sulphate of lead and a little borax also emits luminous rays very easily. It is a little less brilliant than the preceding substances, but more so than platinum. Platinum is more so than gold, and this metal, lastly, more so than a layer of oxide of zinc rendered adherent by borax. To be more definite, we might, I think, assume that representing by 100 the normal emissive power of oxide of iron and of the bodies we have classed with it, that of platinum would be about 32, that of gold 10, while that of oxide of zinc would not exceed 5, if indeed it amounted to this number. I may finally add that a coating obtained by mixing together chalk, a little borax, and water, appeared in one experiment to approach oxide of zinc in the feebleness of its emissive power.

In the researches the results of which we published in 1854, we heated to redness the coatings whose emissive power we desired to study, by applying them on a small plate of gold or of platinum, which could be traversed by an electric current. In my new experiments, without abandoning this mode of heating, I usually preferred to apply the oxides submitted to my observations on plates of gold or platinum which were heated by eolipyles. These plates, which were tolerably thick, were not appreciably altered in shape during the experiments. When, without attempting to make any measurements, it is simply desired to show the difference of emissive power for light, a plate of this kind is taken of about 25 or 30 square centims., and on one of its faces two lines are traced at right angles passing through its middle, and thus dividing it into four contiguous portions; on one of these the metallic lustre is left, the second is covered with oxide of zinc, the third with oxide of iron, the fourth with oxide of copper. When the coatings are dry, the plate is placed in a dark chamber and heated with a flame of alcohol or of gas, which strikes against that face which has no coating. As soon as the temperature had reached a red heat, all the effects which we have indicated were observed. If photometric observations are to be made, it is important to take precautions for preventing rays emitted from the source of heat from being mixed with those which come from the surfaces investigated. In this case the plate may be fixed at the end of an earthen tube whose internal surface has been blackened or covered with oxide of iron. The external face of the plate is heated, and the other is observed by placing the photometer near the open end of the tube. The extreme smallness of the luminous emissive power of oxide of zinc has surprised me; but although I have greatly varied my experiments on this point, they have all led to the same result. I shall not detail them; I will merely mention one which appears to prove that the small emissive power of this oxide is not at all due to the fact that, from want of conductivity, it only attains at its external surface a temperature materially lower than that of other coatings applied on the same body.

I took a platinum plate, and having completely covered it with zinc-white, I covered half the plate thus whitened with a layer of oxide of iron above that of oxide of zinc; lastly I heated it, and even in this case I found the oxide of iron twenty times as luminous as the other. Oxide of zinc is one of those bodies which at about 100 deg. have virtually the same calorific emissive power as oxide of iron or lampblack. Seeing how little light it emits at a red heat, I compared at this temperature its calorific emissive power with that of oxide of iron, and I found that it was about six-tenths of that of the latter. Hence at a red heat the ratio of the emissive powers of these two substances is far greater for heat than for light. This difference, however, is but natural, seeing that of the total sum of the rays which at redness each sends to the thermoscope, there is a strong proportion of obscure rays, which have no influence on the results of the photometric measurements. The thermoscopic measures refer to the total emission; the photometric measure only applies to a particular class of radiations; it omits all those whose wave-length is above a certain limit.

What has been said refers merely to the effect of luminous emission properly so called. The appearances change, the relative lustre of incandescent bodies is modified, when to the emitted rays are joined the reflected or diffused rays, as in the case when the surfaces observed are placed in the middle of an incandescent space. These changes are easily explained, and can be readily produced in the following manner. A porcelain tube is taken about 0.06 metre in diameter; it is bevelled at one of its ends; then after having closed this end by a platinum plate half covered with oxide of iron, it is introduced into a furnace. The other end of the tube is open, and projects from the furnace. It is heated; the plate becomes red first, and the oxide appears far

* "Philosophical Magazine," translated from the "Comptes Rendus," July 3, 1865.

more brilliant than the platinum; but when the sides of the tube are incandescent, the difference in lustre of the metal and of the oxide diminishes or disappears; and then in order to change the function, that is, to make the platinum appear more brilliant than the oxide, it is sufficient, by changing the arrangement of the fire, to make the metallic plate distinctly less hot than the side of the tube whose light can reach the eye by reflexion from the metal. When in making this experiment the plate which closes the tube is observed with a polariscope, it is easily seen that at first, when the plate alone is incandescent, the light which comes from the platinum to the eye is polarised in a plane perpendicular to that which passes through the axis of the tube and the perpendicular to the plate. In the second phase of the experiment, when the oxide of iron and the metal have the same lustre, the indications of polarisation disappear. Lastly, when the platinum appears more brilliant than the oxide, the rays which come from the metal to the eye are polarised in the plane passing through the axis and the perpendicular, which shows that then it is the reflected light which predominates in the pencil coming from the platinum.

Correspondence.

CELLULAR BRIDGES.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE."

SIR,—Your correspondent, Mr. Geo. H. Phipps, has resumed the controversy respecting the Sunderland Bridge. How far it may be interesting to your readers I cannot say. It appears to me that it is now only a matter of opinion between Mr. Phipps and myself, from which the public can gather no possible instruction. I shall, therefore, be as brief as possible in my rejoinder. Mr. Phipps twice observes that no change has taken place in his opinion in consequence of my remarks. I never looked for any such result, nor did I write to promote such an end. My remarks were made, in the first instance, for public information, and when their correctness was questioned, I simply advanced the authority upon which they were based. My article and subsequent letter thereon state the case as clearly as it can be put. I believe in Mr. Milbanke's admission that the Sunderland Bridge resembled Paine's model, because he had the opportunity of judging, and because, had it been otherwise, Mr. Milbanke would certainly not have laid himself or his friends open to an action at the suit of Mr. Paine for compensation by such an admission. Besides, Mr. Milbanke distinctly observes that he has "good grounds" for his statement. Mr. Phipps institutes a comparison between the Sunderland Bridge and Mr. Paine's specification, and finds a material difference. It would have been marvellous if he had found them coincident. Paine's arch was a modification of his patented description, and was not constructed *precisely* in accordance with the wording of his specification, although he observed the spirit.

But I think the matter really lies in a nutshell. Burdon was about to design a bridge; he looks about him and finds Paine's model, from which he draws his ideas. Mr. Phipps himself admits the probability that Burdon worked upon Paine's model, and, moreover, that he worked, too, upon the design of the Coalbrook-dale Bridge, erected several years previously. And yet, in the face of this admission, Mr. Phipps denies to Paine any credit whatever in the matter. As to the circumstance of Mr. Paine not prosecuting his claim for compensation, this was prevented by his being in France at the time, in which country he filled an important political position. Besides, the character of the man was at variance with the pursuits of money-grubbing and patent-mongering, so that had he even been in England and not have prosecuted his claim, it would by no means have proved that the claim did not exist. Paine was by no means a rich man, but he worked more for honorary than for pecuniary reward. His was the higher, nobler, truer spirit of labour, the aim of which was public usefulness. As to Burdon having improved upon Paine's design by the introduction of properties of strength, Mr. Phipps only advances this as a suggestion, whilst, with regard to Paine's bridge, Mr. Phipps constructs one theoretically from Paine's specification, quite ignoring the bridge of 110ft. span erected first at Rotherham and then removed to Paddington, where it was reconstructed and remained standing for a year. It is unnecessary and would be tedious to reproduce the facts and arguments contained in my article and letter in support of my position. I will, therefore, simply re-state my views, and leave it to those who care to do so, to wade through and form an independent opinion from what has been previously written by Mr. Phipps and myself. My conclusion is that, in the words of the article, "the bridge across the Wear, at Sunderland, generally considered to have been designed by Burdon, was really made from Paine's model." Not that the bridge is an exact copy of the model, but that the latter was the design upon which Burdon based his construction.

This conclusion does not attribute to Paine the credit of having directly designed Sunderland Bridge, but it involves what I have every reason to believe was the case, viz., that the Sunderland Bridge was constructed after Paine's model, and that, although Burdon may have worked out the design of the bridge, yet his ideas were based upon Paine's principle, and that Burdon was, therefore, less the original designer of the bridge than he is generally supposed to be.

Your obedient servant,
THE WRITER OF THE ARTICLE.
[Unless some new facts of public interest are elicited by a continuance of this correspondence, it must terminate here.—Ed. M. M.]

DANIELL'S BATTERY.

SIR,—I have for some time used a Daniell's battery of four cells to work an electric clock, the copper being inside the porous cell, which is supplied with sulphate of copper by a bottle inverted over each cell. After some weeks a large deposit of metallic copper forms on the inside of the porous cell, and I find the cells cracked, or rather burst in various places. I should be obliged if any of your electrical readers could inform me, through your columns, of any remedy for this.

Yours, &c.,
J. F. E.

MECHANICAL FLYING MACHINES AND FLYING STEAM ENGINES.

SIR,—About seven or eight years back you published in the *MECHANICS' MAGAZINE* an account of various mechanical flying machine models which I had constructed, one of which, a light screw, turned round by the contraction of an india-rubber spring, was not long since brought forward by a foreigner as something new, and as evidence of the practicability of making a flying machine of sufficient size and power to carry passengers. Many persons would perhaps like to know why the thing has not yet been accomplished. The answer is, that no motive-power engine of continuous action has yet been produced of less weight than a high pressure steam engine, of the same power, and no steam engine hitherto constructed has had sufficient power in proportion to its weight for the purpose, excepting the little models or toys mentioned hereafter. The American machine recently mentioned in the *MECHANICS' MAGAZINE*, if it is intended to be driven by an ordinary steam engine, may perhaps fly for a short distance, subject to one proviso, viz., that the steam engine and boiler be left on *terra firma*, and not otherwise. To make a mechanical flying engine of sufficient size to carry up a considerable weight is comparatively a simple matter, because a sufficient amount of motive power can be previously accumulated or stored up in springs, or otherwise, so as to allow of a large amount of power being used in a short time in proportion to the weight of the machine.

The size of the wing or screw surface acting upon the air is a trifling matter in comparison to the all-important one of great motive power in proportion to weight; the pressure upon the wing surface may be anything between 1lb. and 1,000lb. to the square foot; in other words, it is simply a question of speed of wing whether it be like the gentle action of a light kite on a calm day, or of the pressure and immense speed of a jet of high-pressure steam. A heavy flying bird, such as a crow, will probably be a good example as to the speed at which the wing or screw of a flying machine should strike the air. Supposing the bird to be flying at about twenty miles an hour through the air, the stroke of the wing may be estimated at about thirty miles an hour. Assuming, therefore, the speed of wing surface necessary for the flying engine to be thirty miles an hour, let us consider for a moment what the ordinary steam engine is capable of doing at that speed in proportion to its weight. On one of the Government trials of a steam ship (writing from recollection) the performance of a marine engine of 80 tons weight, boilers and water included, gave a screw thrust of only three tons, and with a speed of screw probably not anything like thirty miles an hour. A flying engine, therefore, driven by a marine steam engine would be of no use unless its power, without increasing its weight, could be increased over twenty-six times, or its weight be brought within 1/26th of its present gravity.

Next, try a railway passenger engine, of thirty or forty tons, and, although it will show more power in proportion to its weight, it would be found totally wanting at the speed, and, instead of flying, would have some difficulty even in running along a common road at the very humble pace of four or five miles an hour, and a rise or obstacle, like Holborn-hill, would bring it to a dead stop. And lastly, consider the performance of one of the best steam fire engines, which I saw stated in the *MECHANICS' MAGAZINE* or *Engineer*, to amount to a horse power nominal per cwt.—a nominal horse power means 33,000lb. raised 1ft. in a minute, or 1lb. raised 33,000ft. in a minute. Take the latter, which in miles gives 375lb. per hour, divide this

by 30 (the requisite speed) and it leaves only 12½lb. as the maximum power per cwt. to be obtained by action against the air of the most powerful steam engine of the present day in proportion to its weight; but even this is without making any deduction for weight of water and fuel, or for the machinery by which its power is to be made available against the air.

The question, then, arises—is it possible to construct a steam engine sufficiently light and powerful for the purpose? If the question were propounded to the engineering world, they would probably almost to a man give a verdict against its possibility. I think it is possible, but not by any type of steam engine at present in use. Numerous failures would, of course, occur in the attempt, but of ultimate success I have no doubt. It is, however, a subject not to be taken up hastily. It took me eight years and twenty thousand experiments to work out the compressed moist air engine, more commonly known as the silent locomotive. Models may, however, be made to fly short distances by using rapidly a large amount of steam power previously stored up. A small circular boiler made of light sheet iron is capable of containing a sufficient amount of steam pressure which, when rapidly discharged through a proper aperture against the air, with a force more than the weight of the boiler, will cause the boiler to fly rocket-fashion by recoil a considerable distance. I have made many small boilers of this kind, some of which carried more than double their weight, and by attaching one such to a light boat floating on water, the recoil force carried away boat and boiler, and the little ship became a veritable Flying Dutchman. A cylindrical boiler on the same plan, if provided with a pair of light fixed wings, will scale a considerable distance, from the impulse given by the steam discharge.

If a spherical boiler be attached to a light screw and the discharge be taken at a tangent, it will drive the screw with sufficient force to carry up the boiler, and, if the discharge be allowed to issue from the end of a long lever, much more lifting power may be obtained. Supposing a boiler could be made to supply about twenty times more steam than a Field boiler of the same weight, and was capable of continuing its work without the necessity of carrying much more than one charge of water, flying could be accomplished by a screw driven by reaction from a lever jet, and the machine would be perfectly under control. I have tried some experiments with a boiler of about one-horse power nominal, but I could not obtain practically a direct lifting power from the air by the steam jet of more than about two pounds without leverage. In my next letter I purpose to give the particulars of the steam boiler and engine, which, I think, would be found to fulfil all the requirements of power within the limited weight, and which would also consume a very small quantity of water and fuel.

I am, Sir, your obedient servant,
Lilford-road, Camberwell, JAS. PARKER.
August 1, 1865.

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

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

To insure insertion in the following number, advertisements must 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.

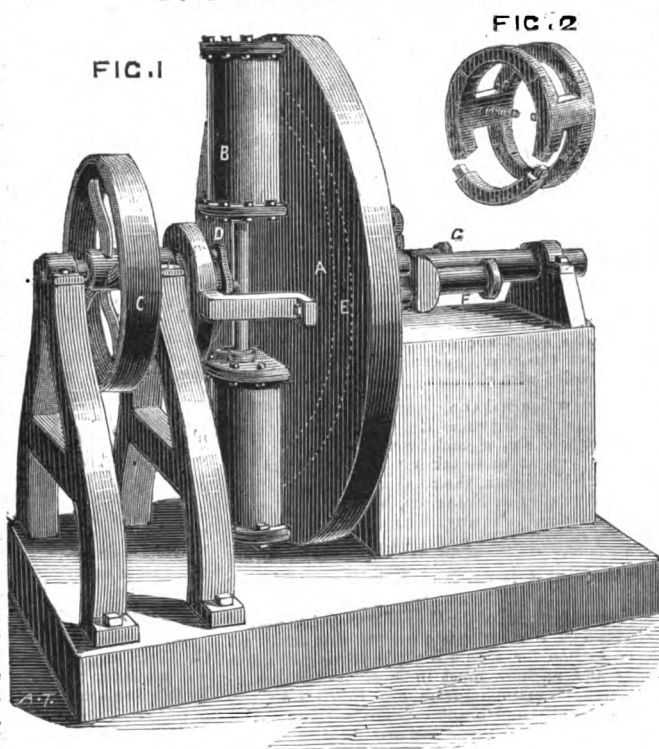
RECEIVED.—V. B.—J. N.—G. S.—W. H. T.—W. W.—R. P.—Col. D.—W. H. M.—J. H.—R. T. T.—W. V.—T. H. E.—J. B. B.—J. P.

DOUBLE-CYLINDER REVOLVING ENGINE.

ROTARY engines, in one form or another, have occupied the attention of inventors for many years, and changes in the form or details of them, with a view to render them economical and efficient, are continually being made. The engine here illustrated, which has been invented by Mr. Joseph L. Foster, of Virginia, Nevada Territory, is not a rotary engine, inasmuch as the pistons in such machines travel continuously in one direction, but this combines a reciprocating motion of the piston with a rotary one of the cylinder, and adds the weight and momentum of that detail to the force exerted by the piston.

The following description, for which with the engraving we are indebted to the *Scientific American*, will render the principle and main parts

DOUBLE-CYLINDER ENGINE.



familiar to the reader. The wheel A, on which the cylinders B are placed, is set below the centre of the shaft and pulley C, half the length of the stroke. When, therefore, steam is admitted to the pistons, they, on being forced out, act against the crank D, and turn the cylinders and wheel around. The steam is let into the cylinders by the ports E (shown in dotted lines), through the steam pipe F, and the exhaust pipe is at G. There are two branches to both of these pipes, and when steam is let into one, by turning a valve the engine revolves in one direction, and is reversed by admitting steam to the other branch. It is intended to have two sets of cylinders, or four in all, the piston rods crossing each other at right angles, and one pair of cylinders set further from the shaft in order to allow the rods to work on different cranks on the same shaft. The yoke H is fitted to a bearing I, thus distributing the labour on the main shaft. By having four cylinders there is no dead centre, and the force is continuous at all times.

Fig. 2 shows the packing rings, which keep the wheel steamtight at the point where the steam is introduced. These rings fit in a circular chamber behind the wheel A, and are made in sections so that the entire chamber will be prevented from losing steam by the expansion of them in every direction. The cylinders are lubricated by a cup on the steam pipe. This engine, says the inventor, is particularly useful for propellers, on account of the ease with which it may be reversed and the velocity of piston it is capable of attaining. It is also claimed to be simple and efficient, and that two revolutions of the pulley are obtained from one reciprocating movement of the pistons.

THE PEACE JUBILEE.

A LITTLE band of fifty energetic workmen have formed themselves into a committee and are resolutely co-operating, sparing neither time nor money, to give effect to an idea. This idea, which is fast becoming a realised fact, is the formation of an exhibition of the fruits of peaceful labour, and the results of skilled work of the artisans of England and France. This exhibition is to be held at the Crystal Palace, in commemoration of the fifty years of peace which have subsisted between the two countries above named. In furthering the views of the committee, about a thousand skilled workmen are assisting to organise the display in honour of this event. This Anglo-French exhibition is being carried out in the most independent manner by the working classes, on whom it reflects the highest credit. We understand that the work was begun, has been continued, and will be ended, without prompting or extraneous assistance, by men who are, in the usual and general acceptance of the term, working men. The committee have paid all preliminary expenses, and beyond a canvass for wealthy names to a guarantee fund—which has been very successful—patronage of every kind has been courteously and firmly declined. The Crystal Palace Company have let them a space, and their relations are strictly those of landlord and tenant. We trust the public will ratify the steps taken by the French and English committees, and, by visiting the display, relieve the promoters from a heavy responsibility. The Exhibition will be opened on Monday, the 7th of August, by the working men themselves. The English committee, with delegates from Paris, Lyons, Nantes, Rouen, and other French towns, will formally open the portion of the Crystal Palace containing the display at noon on the day named. Prizes will be given for excellence of workmanship, and a very highly-

finished bronze commemorative medal will be presented to every exhibitor as a souvenir of the peace jubilee.

CUTTING HARD STEEL.

IN a recent report of the Franklin Institute, the secretary, Henry Morton, Esq., gives the particulars of the apparatus lately constructed for the Institute, to repeat Perkins' experiment of cutting hardened steel with a soft iron disc rotating at a high velocity. A disc of steel, such as is used for circular saws, but annealed so as to be very soft, is mounted on a steel spindle, which carries also a three-inch cast-iron pulley, and the whole is then carefully balanced until it will rest indifferently in any position, on two straight edges. This spindle, &c., is then mounted in cast-iron swivelled bearings. A belt 2 in. wide on the pulley is driven from a 36-in. pulley on an ordinary shaft, which carries also a 10-in. pulley, to which motion is given by a 4-in. belt from a 48-in. pulley on the engine shaft. The engine was run 120 revolutions per minute, which would give, with every allowance for "slip," between 5,000 and 6,000 revolutions per minute to the disc. At this velocity the hardest files were cut like soft wood, with the production of a blaze of light and showers of sparks, without the least injury to the edge of the soft disc. The materials of this apparatus were furnished by Mr. Joseph Saxon, of Washington, with a general description of the machine originally made by him for Mr. Jacob Perkins in London, and in the above-mentioned apparatus this description was followed, except where the improvements of modern machinery warranted a deviation. The most important of these deviations was in the use of cast-iron swivel bearings. In these the mobility of parts necessitates an equal distribution of the pressure and friction over the whole surface of contact, and thus renders possible the use of a material otherwise so unfit as cast iron. The friction is in fact by this means brought between the steel and oils, and in no respect between the solid surfaces at any point.

THE EXPANSION OF THE DIAMOND.

By M. H. FIZEAU.

THE following article on the expansion of the diamond and of crystallised protoxide of copper under the influence of heat, appears in the *Chemical News*:—In pursuing my studies on the propagation of light through bodies at various temperatures, I was led to make several new observations on the expansion of several bodies which have not yet been studied from this point of view. From the nature of the results obtained, as unforeseen as varied and singular, it will be seen that it would be scientifically interesting to multiply as much as possible

such determinations, and especially to apply them to natural groups of bodies, well defined either by their chemical composition or their crystalline form, so as to follow under the most varied circumstances, the modifications to which this order of phenomena is susceptible, and to discover, if possible, by what law they are regulated. The field of these researches is evidently of great extent, and but a very limited portion has as yet been explored. However, there are already a certain number of amorphous or crystallised bodies, especially those which crystallise in the regular system, whose expansions have been determined by the method employed in these researches, and in which, by means of the length of the wave of light, the most minute changes of volume in bodies only a few millimetres thick may be estimated.

I will not here enter into the details of the various important improvements suggested by experience, made in the apparatus, but will reserve them for another memoir containing the whole of the observations. In order accurately to ascertain the temperature of the body experimented upon, the small steel tripod supporting it was placed between two concentric stoves of thick copper, by which means the heat was uniformly distributed, and the height of the temperature very accurately taken. Further, the displacement of the fringes or rings at the surface of the body, during the changes of temperature, was watched with a small lens, and thus very precisely estimated. Among the bodies of which I have determined the expansion, two present a remarkable phenomenon which has not hitherto been observed in any other body: this is, an expansion so slight at low temperature that great care and special observations were requisite to detect and exactly measure it. These two bodies are the diamond and protoxide of copper, both crystallising in the regular system, translucent, and with the highest indexes of refraction, but differing from each other in composition and in their chemical and physical properties. Moreover, not only is the expansion very slight in these two substances, but it very rapidly decreases as the temperature becomes lower, exactly as with water at about its maximum of density, so that it would by analogy appear that these two solid bodies might present the phenomenon of a maximum of density—that is to say, that their co-efficient of expansion, first positive and decreasing, would become nothing at a certain temperature, and then negative. The determinations hitherto made agree well with this supposition, and render probable the existence of a maximum of density for the diamond and for oxide of copper. The following are the results of experiments:—

Diamond.—The first observations were made on a large plate of diamond 1.5 mm. thick, for which I am indebted to the kindness of M. Halpen, then on several stones variously cut, and among others on a beautiful brilliant procured for me by M. Mellerio. I thus observed the very slight expansion of this substance, and found that the co-efficient of expansion diminishes rapidly with the temperature, but, to obtain precise measurements of these always very slight expansions, it is necessary that the diamond should unite certain conditions of size as well as of dimension and parallelism in the cut faces, conditions which are perfectly realised in one of the most valuable stones in the museum collection. This beautiful stone, which has a slightly yellow tint, weighs 1.94 grain and is .625 mm. thick. The administration of the museum having entrusted it to me to determine its expansion, I took eleven series of measurements, each comprising eleven distinct observations made at different points of the stone, and at temperatures between 18 deg. and 77 deg. From these experiments it would appear very probable that the diamond has a maximum density at about 38.8 deg. In the above only the linear expansion has been considered; now, the crystals of the regular system, as the diamond and oxide of copper, expand equally in all directions (Mitscherlich): to ascertain the cubical expansion, the linear expansion must be multiplied by three.

Crystallised protoxide of copper.—The crystals of this substance are sometimes remarkably transparent to red light. I cut a small crystal of this body into a prism, and found that it refracted the light much more than the diamond. For its refraction index with the most refrangible red ray which traversed the substance, I found $n = 2.8984$, and with the simple red ray emitted by lithia vapour in a flame $n = 2.8489$. Two sufficiently pure crystals from Chessy, Rhône, one octahedral, the other dodecahedral, being in some parts transparent to red light, were experimented upon; their thickness was 9.844 and 10.570 mm. Six series of measurements of twelve observations each gave concordant results, and showed decisively that the expansion of oxide of copper is, especially at low temperatures, much less than that of the diamond, and furthermore, that the value of the co-efficient also varies more rapidly, so that this co-efficient becomes rapidly smaller as the temperature decreases, and tends to become null at a higher temperature than the diamond, the increases of the co-efficient being always in proportion to the increase of heat.

Up to the present time we know only of water and some saline solutions—that is to say, of bodies in a liquid state, which present the phenomenon of the maximum of density; the existence of a phenomenon of this kind in solid bodies ought to introduce new data to the theories relative to heat, and throw a light on the molecular constitution of bodies.

Miscellaneous.

An important case has been argued before the United States Court at Cincinnati, in which the Western Union Telegraph Company apply for an injunction against the United States Telegraph Company, to prohibit them the use of the wires they have erected along the lines of certain railroads, to which the Western Union claim exclusive right. The United States Company built their lines on the ground that the railroad was a public highway, as far as the use they made of it was concerned, and the Western Union have no right to the monopoly. A decision has not yet been made.

At the recent meetings of the Northern Institute of Mining Engineers, Mr. Gilroy, of Ince Hall Collieries, exhibited a dissecting model of the smoke consuming ventilating furnace in operation at the Ince Hall Colliery, Wigan. These furnaces are fed with fresh air, the supply being regulated by a fire-brick scale stopping in the flue of each furnace, thereby consuming the smoke, and rendering separation doors between the downcast shaft and furnaces unnecessary.

The new Act for regulating locomotives on turnpike and other roads will come into operation on the 1st September. Three persons are to work a locomotive, and one is to proceed on foot with a red flag as notice of the approach of the locomotive. On a turnpike road or public highway a locomotive is not to proceed at a greater speed than four miles an hour, and in a city, town, or village, at not more than two miles an hour. The City of London, the Metropolitan Board of Works, and other local authorities are to appoint the hours during which the locomotive may pass through the streets. The Act is only to continue in force for two years, and may be regarded as an "experiment" on locomotives in public thoroughfares, both in the metropolis and in the country.

Among the most recent scientific discoveries in France may be mentioned a method invented by M. Néant for keeping afloat a vessel about to sink, and putting out any fires that may happen to break out on board. His plan is to attach a certain number of balloons made of india-rubber, and inflated with air, to the sides of the sinking vessel. M. Chattemann proposes to render vessels externally incombustible by whitewashing the wood with chloride of lime. This, he thinks, would prevent the rapid propagation of the flames, and allow sufficient time for extinguishing them.

The following process of encaustic is given by M. Bocklin:—Moist plaster of Paris is painted with water colours as usual. When the design is perfectly dry, it is painted over with a hot solution of wax and resin, and this coating is burnt in with a strong heat. The wax sinking in fixes the colour, and gives together with its compound with resin a solid transparent surface which effectually protects the painting from injury by damp or dust, the colours at the same time being greatly heightened and improved.

The City Engineer of St. Louis has reported on the contemplated railway bridge across the Mississippi at that point. He estimates the expenses at 3,322,200 dol., of which the city should subscribe 1,500,000 dol., the merchants, &c., 732,000 dol., and the several railroad companies the balance. He thinks such a bridge would save to St. Louis annually 1,800,000 dol. The plan he recommends is a tubular iron plate bridge, without a draw, to pass which steamboats must lower their chimneys to the hurricane deck.

Mr. John Pouncy, of Dorchester, the inventor of photographic-carbon printing, who has already received the medals of the French and Scottish photographic societies, has just been awarded the medal at the International Photographic Exhibition at Berlin for his photographs in printers' ink. Mr. Pouncy gave a demonstration, a few weeks since, before the Professor of Photography, the Demonstrator of Chemistry, and a select party of savants, all of whom expressed their unqualified praise and approbation of Mr. Pouncy's method, which Sir David Brewster, before a numerous audience in Edinburgh, at a meeting of the Photographic Society of Scotland, designated one of the most interesting and important ever submitted to the institution.

It is now settled definitely that the French Great Exhibition of 1867 will be held in a temporary building to be erected on the Champ de Mars. It is stated that the building will be surmounted by a glass dome which will reduce those of Captain Fowke to insignificance.

A naval committee has just inspected the working of Commander Scott's new iron gun carriage intended for heavy armament at sea. The carriage was mounted with one of Mr. Anderson's 12-ton guns (smooth-bore), placed in front of a wooden section of a ship's broadside, in order to illustrate the working of the carriage in various manoeuvres as at sea. The training and running out the gun for action was done by the simple working of the machinery in the hands of four men only, instead of hauling at the blocks and tackle as formerly by ten or twelve men. The compressor was worked by a single man, and the transporting gear by two. By this means the gun can be removed to any part of the deck required with extraordinary facility. The running-out gear is worked by an endless chain, and the elevation and depression of the gun was carried out with ease by a single man. The committee, who spent a considerable time in the inspection of the new gun-carriage, appeared perfectly satisfied with the result.

A Warsaw journal announces that the plan for a telegraphic line between Russia and America has been approved and signed by the Czar. The Russian Government undertakes to complete the line as far as Nicolajewsk, the remaining portion, from Nicolajewsk to San Francisco, being at the charge of the American company. The capital of the latter amounts to 10,000,000 dol.; and bonds representing 8,434,600 dol. have already been issued. It is intended that this route shall be finished in five years.

In a recent report of the Committee of the General Ship Owners' Society, it is observed that as the act of last session for regulating the proving of chain cables and anchors must in a great measure be frustrated if manufacturers are licensed to test their own work and grant certificates thereof, it is hoped the Board of Trade will introduce an amendment to prevent that evil.

Bottle labels may be made indestructible by coating them with white of egg, and steaming them until they become opaque, and then drying them in an oven at 212 deg. The albumen becomes hard and transparent, and is unaffected by oils or acids.

Italy now possesses a fleet of 98 vessels, 74 of which are ships of the line and 24 are transports. The ships of war consist of 18 ironclads, 21 screw steamers, 25 paddle-wheel steamers, and 10 sailing vessels. The nominal power of the engines in the war steamers is 23,140 horses; they reckon 1,260 cannon and 20,383 men. In the transport service the engines are of 4,350-horse power, and the ships are provided with 43 cannon, and manned by 1,882 seamen.

We understand that the Scottish Granite Company, who have supplied from their quarries at Mull the granite for the base of the Prince Consort Memorial in Hyde Park, have acquired by purchase the Glasgow Granite Works.

The new description of boom constructed at Chatham Dockyard, under the direction of the Floating Obstruction Committee appointed by the Admiralty, has been removed to the entrance of the harbour, where it is moored in readiness for the trials to be made with it, under the superintendence of the members of the committee. The paddle-wheel steam frigate "Gladiator," 6, 430-horse power, Captain E. D. Aplin, has been specially appointed by the Admiralty to be used in the trials to be made against the boom.

Notwithstanding the earnest efforts of the directors of the United Kingdom Electric Telegraph Company to develop telegraphic communication, so as to render the shilling rate remunerative, the company has not been able to earn a dividend. The uniform rate has therefore been abandoned after a fair trial, and a new tariff substituted. The revenue has been considerably increased since the alteration in the tariff, and the company is now earning a dividend. The public have even now reaped benefits from the operations of this company which it would be difficult to exaggerate. The charge from London and Glasgow, &c., to Lancashire and Yorkshire is 1s. 6d. instead of 4s., and from London to Scotland 2s. in lieu of the former high tariff. The mileage of this company's line amounts to 1,672 miles, and of wires to 9,506 miles.

We learn that the Massa-Carrara marble quarries, to which we alluded in our last as about to be purchased and extended by a company, are quite distinct in locality, and to a certain extent in quality, from those of Carrara, so long known to the world. Massa-Carrara is a town totally distinct from Carrara, and is so called merely to distinguish it from two other towns in Italy equally called Massa.

Instructions have been issued by the Admiralty for a second trial of the breech-loading carbine on Terry's patent, to be made on board her Majesty's ship "Excellent," at Portsmouth, under the supervision of Captain Astley C. Key, C.B., with a view to its further adoption in the army and navy, the

18th Hussars, Cape Mounted Rifles, and other regiments being already supplied with this weapon. The first trial of the carbine took place on board the "Excellent" in 1868, when 1,800 rounds were fired from it without cleaning, and its efficiency appeared, by the official reports, to have been fully proved by the results of the trials.

It is proposed to erect a monument, in the form of a marble statue, to the memory of Sir Joseph Paxton, and to place it in the garden of the Crystal Palace at Sydenham, close to the residence where he died, and surrounded by so many objects with which his name and genius are now inseparably associated. The monument of a man such as Paxton was ought to have a wide popular character stamped upon it, and doubtless this memorial will be eagerly supported by thousands of all classes, whose love of the beautiful he did so much to cultivate. Mr. George Grove has undertaken the duties of honorary secretary to the fund which is being raised.

The first supply of the eight-inch rolled armour-plates for the iron-clad frigate "Bellerophon," has been received at Chatham Dockyard from the establishment of Messrs. Cammell and Co., of the Cyclops Ironworks, Sheffield, the firm which has undertaken to prepare the whole of the plates of the above description required by the Admiralty. The eight-inch plates are intended to cover the reconnoitring tower which is now being erected on the fighting deck of the "Bellerophon," slightly abaft of the mainmast.

On Tuesday last the new station of the London, Chatham, and Dover Railway at the Crystal Palace was opened to the public. Visitors to the Palace by this line are now set down within twenty yards of the great centre transept entrance, and upon the high level, so that they alight on the level of the garden floor. There is a covered way from the station to the Palace door, and passengers may on wet days enter the building without the aid of umbrellas.

Most persons who have crossed Westminster Bridge of late have doubtless observed the new system of guttering recently laid down. The gutter is of cast iron, about 9in. wide, and has a raised edge some 8in. high which divides it from the road. In this ridge, holes are left at intervals for the surface water from the road to pass through. But such has been the foresight of the engineer, that at the very times when its use is required it is inoperative. This arises from the wheels of vehicles filling the holes with mud as neatly as a druggist fills his pots with salve. So that, after several hundred pounds have been spent, attendants are required to keep the passages clear with pickers!

We understand that the Danish Government has under consideration a projected line of railroad from Copenhagen, traversing the southern part of Zealand, and the islands of Falster, Lolland, and Fermen, through Holstein, direct to Hamburg. The communication between the islands would be established by three fixed bridges, leaving only the channel between Rodby and Fermen, which may be crossed in one hour by steamer. If completed, the journey by this line from Copenhagen to Hamburg will be accomplished in seven hours.

The *Building News* states that during the past few years a considerable falling-off has been experienced in the supply of water from London wells. There is scarcely a well in the metropolis in which the yield of water has not materially decreased. The greater portion of the water used by brewers is now obtained from the water companies' supply. This deficiency is all the more noticeable as engineers have recently had wells deepened without an increased supply. The most probable cause of the failure is the multiplication of wells.

The Industrial Exhibition at Dunedin, New Zealand, which was opened on the 12th of January, was closed on the 6th of May, and during this period more than 29,000 persons visited it. There were 700 exhibitors and 1,598 exhibits. That portion of the exhibition contributed by the Australasian colonies, embracing, as it does, the extensive and varied collections of natural history, and classified samples of materials employed in constructive works, will be preserved in various local museums, where they will form a nucleus, receiving constant accessions from the results of future discoveries.

The following suggestions for the public safety on railways have been submitted for the consideration of the Board of Trade:—1. When any part of the line is under repair, the drivers and guards to be informed of the precise spot, with orders to reduce speed when within a mile of it, and to go over it at a rate not exceeding five miles an hour. 2. The spots under repair to be conspicuously indicated by special signals. 3. The signals to be of an entirely different description from those used for other purposes, and to be observed in all cases where the repairs cannot be completed in the intervals of the trains.

It appears that in the year ending March last, the revenue from the penny stamps was £519,288 8s. 3d., and the net produce was £500,249 18s. 6d.

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 chronologica 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,—94, 103, 110, 113, 119
BUILDINGS AND BUILDING MATERIALS,—77, 92, 130, 131
CHEMISTRY AND PHOTOGRAPHY,—72, 84
CULTIVATION OF THE SOIL, including agricultural implements and machines,—100
ELECTRICAL APPARATUS,—75, 98
FIBROUS FABRICS, including machinery for treating fibres, pulp, paper, &c.,—73, 80, 90, 117
FOOD AND BEVERAGES, including apparatus for preparing food for men and animals,—79, 115, 123
FURNITURE AND APPAREL, including household utensils, time-keepers, jewellery, musical instruments, &c.,—87, 99, 102, 104, 108, 114, 120, 126
GENERAL MACHINERY,—74, 85, 86, 89, 96, 109
LIGHTING, HEATING, AND VENTILATING,—81, 112, 127
METALS, including apparatus for their manufacture,—None
MISCELLANEOUS,—71, 76, 88, 91, 93, 132
ROADS AND VEHICLES, including railway plant and carriages, saddlery, and harness, &c.,—95, 97, 101, 107, 116, 121, 122
SHIPS AND BOATS, including their fittings,—83, 105, 118, 125, 128
STEAM ENGINES, &c.,—82, 111
WARFARE,—78, 106, 124

71 F. WISSE. *An improved method of preserving from fire books and other articles in safes.* Dated January 9, 1865.

This invention consists in fitting or placing inside the safe a box or apparatus formed with small holes and containing any material (unburnt kail alum for example) which in its normal condition has no injurious effect on the iron of the safe, and which on the heat reaching such a high temperature as would injure the contents of the safe, immediately generates steam so as to damp the books and other articles in the safe, and thereby preserve them from fire. *Patent completed.*

72 E. PETTIT. *Improvements in giving permanence to photographs and in ornamenting photographs.* Dated January 10, 1865.

In carrying out the first part of this invention the inventor coats or covers the collodion side of the photographs, or the side of the glass on which the picture is situated, with plaster of Paris, cement, wax, or other opaque or semi-opaque substance, either white or tinted with colour, and he afterwards covers the plaster of Paris, cement, wax, or other substance, with a coating of metal, which coating may either be applied by the electrolytic process, or be applied in the form of thin sheets or foil attached by any adhesive matter. Secondly, the invention consists in ornamenting transparent glass positive photographs by coating or covering, either wholly or in part, that side of the glass on which the picture is situated with coloured materials, such as velvet, silk, or other fabric, gold and silver leaf and coloured bronzes, and afterwards coating the photograph when permanency is required. *Patent abandoned.*

73 S. S. BROWN. *Certain improvements in the manufacture of lint.* Dated January 10, 1865.

This invention has for its object the production in a more rapid and economical manner than heretofore of that description of raised pile fabric known by the name of lint, and chiefly used for surgical and therapeutical purposes. The knives, cutters, or scrapers employed are placed at an angle to the fabric, and are under an arrangement stationary, and the fabric movable, so as to make the knives, cutters, or scrapers come in contact with the cloth or other fabric used in the manufacture of lint at the same time. *Patent completed.*

74 J. C. BROWN. *An improvement in machines for cutting match splints, toothpicks, and similar articles.* Dated January 10, 1865.

This machine consists of a series of knives fixed into the surface of a cylinder, and arranged in combination with a mechanical contrivance for revolving a block of wood, against which the said knives or cutters are pressed with sufficient force to cut the surface of the said revolving block into narrow splints, and combining therewith a knife or cutter to shave the splints from the surface of the block. *Patent completed.*

75 E. W. LADD AND L. OKETLING. *Improvements in hydrometers.* Dated January 10, 1865.

In order to overcome the inaccuracy resulting from the weights not floating at the exact divisions of the scale, the inventors construct the successive weights of metallic alloys having a composition which shall give to each of them a desired specific gravity, the object being to employ such alloys of various specific gravities as shall regulate the bulk of that portion of the hydrometer which shall be immersed in the liquid under examination, and thereby ensure accurate indication. *Patent abandoned.*

76 W. BAYLIS. *Certain improvements in standards for strained wire or rod fencing.* Dated January 10, 1865.

These improvements in the iron standards for supporting the wires or rods in ordinary iron fencing consist in forming rectangular or other angular lateral openings from the side of the standards into the holes for the wires or rods to lie in. *Patent abandoned.*

77 H. CHAMBERLAIN. *Improvements in machinery or apparatus for the manufacture of compressed bricks.* Dated January 10, 1865.

This invention relates to a peculiar construction and

arrangement of machinery or apparatus for the manufacture of compressed bricks from what is known as granulated clay, whereby two, three, or more distinct and separate pressures are applied to the clay at each revolution of the main shaft. *Patent completed.*

78 A. AND M. MYER. *Improvements in breech-loading fire-arms.* (A communication.) Dated January 10, 1865.

This invention has for its objects the formation of breech-loading fire-arms in which, with the same mechanism, the breech of the gun can be raised for loading, and at the same time the needle be fixed in position for firing, and by a retrograde movement of the same mechanism the breech, when loaded, be returned to its proper position. We cannot quote the details. *Patent completed.*

79 T. B. BELGRAVE. *Improvements in preserving meat.* Dated January 10, 1865.

This invention consists in submitting meat to be preserved to the action of sulphurous acid gas in a closed chamber until it shall have become saturated—that is to say, until it is incapable of absorbing any more. *Patent abandoned.*

80 W. CLARK. *Improvements in preparing or treating wood and other vegetable fibrous materials for the manufacture of pulp for paper.* (A communication.) Dated January 10, 1865.

This invention relates to the application of aqua regia for the purpose of destroying, dissolving, and effecting the disintegration of all the gummy portions of ligneous matters without injuring the cellular tissue. *Patent completed.*

81 D. GATTAFFENT AND F. PONTIFEX. *Improvements in artificial fuel.* Dated January 10, 1865.

This invention consists in so making the pieces of artificial fuel that they will not pack or lie close together, but will at all times preserve numerous and regular interstices between the pieces or blocks in whatever manner they may be thrown together. *Patent abandoned.*

82 J. F. SPENCER. *Improvements in regulating and working the valves of steam and other engines.* Dated January 11, 1865.

The immediate object of this invention is to economise steam, air, or gas as a motive power, by introducing into more general use distinct and separate admission valves, and improved escapement gear, and with such valves and gear materially increasing the speed of the piston. We cannot quote the details. *Patent completed.*

83 H. COUTANCHE. *Improvements in reefing and furling sails.* Dated January 11, 1865.

This invention consists in attaching to, or forming in a piece with, a "pearl" or "tub," which is free to travel up and down the mast, what the patentees term claws or grips which embrace or partially embrace the yard round which the sail is wound. These claws or grips are made of a metal frame united by rods loose in the frame, and covered with india-rubber, gutta-percha, or other substance to reduce friction as much as possible, so that as the sail is wound round the yard, the loose rods revolve and materially facilitate the raising and lowering of the sail. *Patent completed.*

84 A. F. LENDRY. *A new or improved topograph.* Dated January 11, 1865.

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

85 W. E. GEDGE. *An improved apparatus for cutting iron, gas, or other pipes.* (A communication.) Dated January 11, 1865.

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

86 W. E. GEDGE. *Improved pinners for gas and other pipes.* (A communication.) Dated January 11, 1865.

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

87 W. E. GEDGE. *An improved elastic mattress or bedstead.* (A communication.) Dated January 11, 1865.

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

88 R. A. BROOMAN. *Improvements in engraving upon crystal, glass, and silicious substances.* (A communication.) Dated January 11, 1865.

The object of this invention is to produce engravings by chemical means upon crystal, glass, and silicious substances by the reaction of hydrochloric acid upon the hydrofluates (fluorhydrates) of fluorides of ammonium, potassium, sodium, and lithium. Thus, by causing the hydrofluates of fluorides of ammonium, of potassium, of sodium, or of lithium, to act upon a solution of hydrochloric acid on one hand, and anhydrous metallic chlorides upon a mixture of hydrofluoric acid and hydrochloric acid on the other hand. The inventor produces engravings either by means of printed or hand-drawn reserves, or by the direct application of the said mixtures by a pen, or brush, or like instrument, upon crystal, glass, and other silicious substances. *Patent completed.*

89 J. RAMSBOTTOM. *Improvements in steam hammers and in apparatus employed in combination with steam hammers.* Dated January 11, 1865.

This invention consists, first, in supporting the hammer blocks of duplex steam hammers upon rollers mounted in fixed bearings. The second part of the invention relates to the apparatus required for supporting and moving the articles to be hammered, and it consists in supporting the rails upon which the truck for the ingot travels on a rocking frame or platform, or in traversing the said rails laterally for the purpose of keeping the article to be hammered midway between the hammerheads, so that both sides of the article may be struck simultaneously; also in supporting the ingot or other articles to be hammered in centres fixed to headstocks, one or both of which is or are movable, to provide for the elongation of the article; or the article, particularly when of cast steel, may be provided with pivots or gudgeons at the ends, and supported in V bearings, or on anti-friction rollers, or separate trucks, the distance between which is at liberty to increase as the article becomes elongated by the hammering. The V bearings or anti-friction rollers can be raised by screws or inclined planes to keep the article, as regards the vertical position, in line with the centre of the hammer blocks. This invention consists, thirdly, in applying steam or other power for giving motion to the trucks supporting the article to be hammered. *Patent completed.*

90 R. TEMPERT. *Improvements in machinery for spinning and carding cotton and other fibrous materials.* Dated January 11, 1865.

This invention relates principally to the machines commonly called devils or breakers, for tearing up and opening

rags, cop bottoms, and other similar fibrous materials, and consists in applying to such machines two or more feeding rollers in combination with a dish or trough. This part of the invention is applicable to carding engines. The invention also consists in applying to devils or breakers two perforated drums, and two delivering rollers placed one above the other, for the purpose of separating the fibres and delivering them in two distinct pieces. The invention also consists in driving the various parts of such machines by means of V friction pulleys. Also in the application of an extra cutting knife to the circumference of the tearing cylinder, which knife detaches the unbroken material from the cylinder, and allows it to drop into a space or spaces provided by opening one or more dampers. The invention further consists in driving the tippler or tumbler for dropping the cardings into buckets by means of a ratchet wheel and catch, and in holding it in position by a square block acted upon by a spring. *Patent completed.*

91 O. M. BATHIAS. *A counter or registering apparatus applicable to various purposes.* Dated January 11, 1865.

This apparatus consists of a box of metal or other material which is hermetically closed, and furnished on one side with a glazed aperture for reading off the indications. A shaft is fitted in this box, carrying at one end a ratchet wheel in which a pawl takes, set in motion by the machine of which it is desired to ascertain the speed. In addition, there is mounted on the said shaft a number of ten-sided discs, each bearing numerals arranged according to the indications it is desired to obtain; on the flat side of each disc is fixed a ten-toothed wheel, a pin projecting about one-eighth of an inch being fixed on the inside of the first disc. There is also a number of five-toothed pinions mounted on a shaft and gearing with wheels mounted on the disc spindle, from which arrangement it results that at every revolution of the wheel, the pin mounted on the left side of the disc gears at a given moment with the pinion, causing it to turn, and also the disc bearing the numerals, which advances one figure every turn the toothed wheel has performed a complete revolution. *Patent abandoned.*

92 J. F. HEATHER. *The construction upon new principles of keys and locks.* Dated January 11, 1865.

This key consists of one or more cam plates fixed to a spindle at right angles to its axis, and this spindle fits into barrels in the lock, while the cam plate or plates project beyond the barrels. The lock has two chambers, and the key being inserted into the barrel of the first chamber, and turned round in the ordinary manner, unlocks the key hole of the second chamber, and then enters the barrel of this chamber. The key being now again turned, moves two plates or sets of plates, one by means of the motion given to the barrel, and the other by means of the action of the key plate upon levers, slides, rods, or other movable pieces. *Patent abandoned.*

93 A. G. LOCK. *Improvements in extracting and purifying fats and other products from bones and other animal substances, and in apparatus for the same.* Dated January 11, 1865.

For the purposes of this invention the bones or other substances are placed in a vessel of iron or other material of cylindrical or other suitable shape, having a steam-tight movable cover, and fixed or hung on pivots for the convenience of filling and emptying, and the steam is admitted direct on the contents. To this vessel a water-jacket may be attached, connected with a cold water cistern for producing a vacuum. *Patent completed.*

94 A. COOPER. *Improvements in furnace flues for the consumption of smoke.* Dated January 11, 1865.

This invention consists in erecting underneath the boiler, or in the flue of fired boiler, one or more bridge walls, but by preference the inventor adopts three, the said bridge walls being placed at convenient distances apart, and constructed of bricks or stones, or other suitable material. On the top of the said bridge walls he places or builds a bridge of cast iron, fire bricks, sandstones, or other suitable material, connected together by means of a bolt or bar of iron passing through each and all of them, and secured on the outside of the boiler walls by a nut and washer, or other suitable appliance. *Patent abandoned.*

95 R. CHIDLEY. *Improvements in the construction of railway carriages.* Dated January 11, 1865.

The chief object of this invention is so to construct railway carriages that, when a number are brought together, they will form a saloon the whole length of the train of passenger carriages, and thus afford easy communication through the whole length of the train. The patentee also proposes to improve the ventilation, and to facilitate the warming of such carriages. *Patent completed.*

96 J. G. JONES. *Improvements in machinery used for condensing atmospheric air, and in machinery worked by compressed air, employed in getting coal, stone, and minerals.* Dated January 11, 1865.

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

97 I. GOODLAD. *An improved apparatus for communication between railway passengers and guards.* Dated January 12, 1865.

In carrying out this invention each vehicle carries its own length of wire or other rope and connections, running over pulleys through the compartments of each vehicle to a lever in the guard's compartment, on one end of which is a quadrant working on a pin or spring bolt that strikes the gong in the guard's van. In each compartment there is a handle running on the rope, to which is attached a steel split cotter, passing through the roof of the vehicle to a spring catch, under which is laid a small red flag; on a passenger pulling a handle in the compartment he will at once strike the gong, and draw the split cotter, when the flag will immediately spring up. To allow for expansion and contraction, the lever in the guard's compartment can be adjusted to any length with balance weight. *Patent abandoned.*

98 J. FULLER. *Improvements in the coverings of telegraph conductors and cables.* Dated January 12, 1865.

It has been found in practice that aerial telegraphic cables are much injured by gun-shot and blows from various missiles. To obviate this the inventor covers the cable with metal, either by winding wire spirally round the cables or lapping the cables round with a metal tape or band, or by other suitable means. *Patent abandoned.*

99 E. T. HUGHES. *Improvements in elastic mattresses and bedding.* (A communication.) Dated January 12, 1865.

The top of the elastic mattress is formed of a metallic network similar to that used for garden seats, which network is composed of interlaced wire, and which, after being

made to the required size, is held to the framework of the mattress at the head and at the foot by means of a corresponding rod which passes through or is attached to the ends of the network. To each of these rods is hooked a number of short rods, cords, or bands, each having at one end a hook, and at the other end a ring, and through these rings, and also through other rings screwed to the end cross bars of the framework, a cord is passed, which is afterwards tightened and made fast. The longitudinal sides of the metallic network are made fast by wings or hooks to corresponding wire ropes connected to the framework, and when the metallic network is detached from the framework, it may be rolled up from the foot to the head, or vice versa. The bed provided with the mattress may also be folded in two, the strength of the metallic network and springs and other parts being varied as required according to the amount of elasticity desired. *Patent completed.*

100 W. RUSS. *Improved apparatus for distributing liquid manure.* Dated January 12, 1865.

The object of this invention is to facilitate the distribution of liquid manure over pasture and other lands, whether such liquid manure be derived from sewage works or produced by the admixture of guano or other fertilising substance with water in the act of distributing the same as it is continuously supplied to the apparatus. In order to adopt this apparatus to varying circumstances a box is affixed to the frame for holding pulverised guano or other dry manure. In this box is mounted a pulley, round which passes an endless band, fitted with caps for carrying up a regulated quantity of manure, and discharging it into the hopper. A similar but smaller pulley is mounted in the hopper to receive the cap band. This band is driven by straps from driving pulleys on the drum axle. Two straps are used for this purpose, one being crossed in order to permit of the cap band being driven in the proper direction for delivering manure with the hopper, whatever may be the direction of rotation of the drum. Fast and loose pulleys will necessarily be required for throwing these straps alternately into and out of action. By the use of the manure box and cap band, not only may the quality of the liquid manure used be modified, as desired, but any available water may on occasion be used in lieu thereof, the fertilising element being introduced from the dry manure box. *Patent completed.*

101 F. BARNES, D. HANCOCK, and E. COPE. *The application of electro-magnetism as a brake power for railway and other carriages and machines.* Dated January 12, 1865.

When the patentees apply this invention to the wheels of a railway carriage, they fit the magnets by preference on the under side of the said carriage and in a suitable frame. This frame is mounted on grooved wheels free to travel within certain limits between rails or guides, and the magnets in the frame are in communication by wires with a battery, or with batteries, in the guard's van or on the engine. At all times, except when the brake power is applied, the magnets are somewhat withdrawn from the wheels of the carriage, and are so maintained by a spring or springs united at one end to the frame carrying the magnets, and at the other to a bar fixed by preference at or near the central part of the under side of the carriage, but on the current being applied the magnets are thereby caused to advance against the wheels, and in so doing the grooved wheels, and with them the frames and magnets travel along the guides or rails, and, as the magnets approach the wheels, the rotation thereof is stopped. Where the wheels are not wholly formed of metal the patentees apply plates of metal to them. Upon the wires being disconnected the magnets recede from the wheels between the rails or guides, as before described, and so return to their normal position, the spring or springs before referred to being the power used to draw them back. They prefer to apply the magnets alternately to the wheels, but they may be applied to all the wheels, and this can be done to every carriage, as all the frames carrying their magnets are connected together by wires, so that, upon the circuit being completed by the guard, driver, or other attendant, brake power may be instantaneously applied to all the wheels throughout a train, and the power at the same time regulated according to the intensity of the current employed. *Patent completed.*

102 R. A. BROOMAN. *Improvements in instruments or apparatus for teaching and transposing music.* (A communication.) Dated January 12, 1865.

This apparatus is made either circular or rectilinear, and is formed with two scales, one of which is fixed, and is the typical scale, while the other is caused to move opposite the fixed scale, in order that the solution of any desired scale may be obtained. The invention cannot be described without reference to the drawings. *Patent completed.*

103 M. HENRY. *Improvements in furnaces.* (A communication.) Dated January 12, 1865.

The furnace constructed according to these improvements consists of three portions, one of which is a cupola furnace, high furnace, or blast furnace, another portion is a reverberatory furnace, and the third is an ascopile, or other contrivance for generating and injecting jets, currents, or blasts of steam or other aëriform fluid. These portions are thus combined:—The cupola, high furnace, or blast furnace is placed or set above the reverberatory furnace, and communicates therewith in such manner that matters contained in the former may after treatment therein fall or run into the latter, and the ascopile or equivalent contrivance communicates with the other parts of the apparatus so as to inject currents or blasts of steam or aëriform fluid into the metal or matters as they are running down or passing from the upper portion or cupola, high, or blast furnace into the lower portion or reverberatory furnace. *Patent abandoned.*

104 G. GAZE. *Improvements in tills, and the means of securing and checking money taken by servants.* Dated January 12, 1865.

This invention consists in the application of an audible signal to a revolving or movable till, which exposes the coin after it is introduced, and working such till in combination with a locked till or receptacle into which the coin drops, and an open till in which coins are kept for giving change. *Patent completed.*

105 R. F. MOLL. *Improvements in apparatus for examining, cleaning, and repairing the bottoms and sides of ships while afloat, which apparatus is also applicable for other purposes.* Dated January 12, 1865.

Instead of making the whole of a ship's bottom and sides accessible at the same time, as done in the dry docks, the inventor makes only a part (but any part) of a floating vessel's bottom and sides under the water line accessible at

the time, by isolating the part from the water line on the one side to the water line on the other side across the keel. This is intended to be done by one or more apparatus (if more than one they are to be connected or not connected with each other), and to be made of two or more parallel flexible or elastic bars or substances connected at their outer parts with a material which bends and may be thin, but it must be sufficiently strong to resist the pressure of the water. *Patent abandoned.*

106 G. H. DAW. *Improvements in breech-loading firearms.* Dated January 12, 1865.

For the purposes of this invention the breech plug or plate is arranged to turn on an axis so that it is capable of being moved back to admit of a cartridge being introduced into the breech end of the barrel. Through the breech plug or plate there is a sliding rod or striker, which being struck by the hammer is forced inwards so as to strike the cap or detonating priming at the back end of the cartridge. The hammer, as has before been the case, is formed in such manner that on its descent it presses against the back of the breech plug or plate, and wedges or holds it securely against the breech end of the barrel, the last part of the motion of the hammer acting to drive the rod or striker against the priming. The cartridges used are such as have been extensively employed; they are each by preference formed of paper or cardboard, having a flanged meter end, the diameter of the flange being somewhat larger than the interior diameter of the barrel, and the case of the cartridge is drawn back by an instrument similar to what has before been used, but it is now acted on by a curved projection on the lower part of the hammer. The extracting instrument partly embraces the under part of the back end of the cartridge, so that when the breech plug or plate is moved back, the curved projection acts on the extracting instrument, and moves the cartridge back also. The extracting instrument is fixed at the end of a rod or stem which slides freely in a passage below the barrel or other convenient position. *Patent completed.*

107 J. B. HILL. *Signals to be used for communicating between persons travelling in railway carriages and the guards or conductors or other officials in charge for the time of the train of which such carriages form part.* Dated January 12, 1865.

This invention consists in the use of a board or boards, plate or plates, or flat pieces or pieces of wood, iron, or other suitable material, and of any dimensions, which may be suitable for being carried on the outside of the roof of every passenger railway carriage or compartment thereof, and so constructed as to be capable of being made to spring up or to turn either upon horizontal hinges or about an axis in any convenient position by means of a cord, handle, or other suitable apparatus placed or suspended inside the carriage in such a way that any person inside the carriage who wishes to communicate with such official may cause the board or plate to spring up or turn flatways towards the guard or other official, so as to be seen by him by day, or to conceal a light from him by night. *Patent completed.*

108 J. KNIGHT. *Improvements in the manufacture of crinoline skirts.* Dated January 13, 1865.

This invention consists in punching holes in the ends of the steel or wires employed, and connecting the said steel or wires together by rivets or eyelets, thus dispensing with the clips or other fastenings heretofore employed. *Patent abandoned.*

109 F. G. MULHOLLAND and T. DUGARD. *Improvements in bearings for general mechanical purposes, and the application of fluid metallic in lieu of oleaginous or other lubricants to prevent friction.* Dated January 13, 1865.

In carrying out this invention the inventors employ spherical or cylindrical bodies working and confined in chambers of various shapes and forms (to suit the requirements of the particular application desired), and either wholly or partially immerse the said bodies in mercury, so that they, while rotating or travelling, are constantly surfacing themselves by being in contact with the fluid metal, and thereby rendering unnecessary the use or application of any other lubricating material. *Patent abandoned.*

110 W. S. LONGBRIDGE and J. MASH. *Improvements in furnaces.* Dated January 13, 1865.

This invention consists, first, in dispensing with the use of metal fire or grate bars, and using instead thereof slabs or forms of fire clay, or other similar or suitable fire-resisting material, such slabs having perforations or apertures through them, and their external surfaces corrugated, or of such form that when two or more of such slabs are placed together there may be apertures between them, and through which perforations and apertures atmospheric air passes to the fuel under combustion. *Patent completed.*

111 W. BROOKES. *Improvements in steam engines.* (A communication.) Dated January 13, 1865.

These improvements relate to using steam which has acted on one side of the piston of a steam engine, to act thence equally on the piston of a second cylinder. In carrying out these improvements steam is admitted but once during each revolution of the crank, by which great economy is obtained over the ordinary system of working steam engines. One piston rod may be connected to two pistons, each in a different cylinder, and one cylinder has an area double that of the other. The invention cannot be described in detail without reference to the drawings. *Patent completed.*

112 A. J. SAX. *Impregnating air for hygienic or therapeutic purposes with the vapours or emanations arising from tar, creosote, or other suitable liquid, antiseptic, antiputrid substances, or disseminating in the air for the said purposes suitable pulverised substances.* Dated January 13, 1865.

For the purpose of impregnating the air of rooms or other confined places with the vapours or emanations arising from tar or other similar liquid antiseptic or antiputrid substances, the patentee makes use of suitable apparatus, presenting a series of surfaces to be coated, by immersion or other suitable means, with tar or other appropriate antiseptic or antiputrid liquid substances, or suitable mixtures of them, and either in the cold or in the heated state. *Patent completed.*

113 R. LEWIS. *Improvements in boilers for generating steam.* Dated January 13, 1865.

This invention consists in substituting for the ordinary tubes in multitubular boilers, a simple undulating tube which may be placed either horizontally, laterally, or vertically, as may be found convenient; the heated gases generated in the furnace passing by a circuitous route to the chimney are retained much

longer in contact with the heating surface than is the case where the tubes in ordinary multitubular boilers are employed, and thus a large percentage of heat is absorbed by the water, and consequent saving of fuel is effected. *Patent abandoned.*

114 J. WEEKS. *Improvements in umbrellas and other like articles.* Dated January 13, 1865.

This invention consists in connecting the upper notch—that is to say, that part of an umbrella or other like article to which the upper ends of the ribs are attached, to a metal tube or rod of less diameter than that of the stick of the umbrella, and in fitting the lower end of such tube or rod to the top of the stick, which must be carried up beyond the point to which the runner carrying the stretchers may rise in order that such runner may travel on the stick. The stick should be tapered off to make a neat joint between the tube or rod and the stick, and the patentee prefers to use a taper ferrule to cover the joint; or the ferrule may be formed in a piece with the tube or rod. By the employment of the tube or rod he is enabled to reduce the diameter of the notch and the upper ends of the ribs resting, when the umbrella is closed, upon the tube or rod, the thickness of the umbrella is even less than at any other part. *Patent completed.*

115 W. AGAR. *Improvements in machinery or apparatus for cleaning and decorticating grain.* Dated January 13, 1865.

This invention relates to a peculiar combination of machinery or apparatus for cleaning and decorticating rice and other grain, and consists in the employment of one or more stones revolving inside a perforated horizontal cylindrical screen, which is caused to revolve in the same direction but at a lower rate of speed than the stone or stones, and is provided internally with a series of ledges for carrying up a portion of the grain to be cleaned and decorticated and allowing it to descend again. *Patent completed.*

116 T. G. PAGANO. *Improvements in the construction and paving of roads and other surfaces.* Dated January 13, 1865.

This invention consists in combining blocks of granite, and other suitable stone by a certain alloy or compound of metals into slabs with which a road is paved. The blocks of stone are placed in a rectangular box or frame, small interstices being left between the blocks. Into these interstices a melted alloy or compound of iron, zinc, and lead is run, by which the several blocks of stone are formed into a slab. The proportions of these metals may be varied to some extent, but it is preferred to combine them in about the following proportions:—One part by weight of iron, two parts by weight of zinc, and four parts by weight of lead. *Patent abandoned.*

117 W. WILKINS. *Improvements in the manufacture of looped fabrics in warp machinery.* Dated January 13, 1865.

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

118 A. and E. PAUL. *A new or improved hydraulic steering apparatus and rudder brake.* Dated January 14, 1865.

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

119 G. DAVIES. *A method of, and apparatus for, preventing incrustation or calcareous deposits in steam boilers.* (A communication.) Dated January 14, 1865.

This invention consists in preventing incrustation or calcareous deposits in steam boilers substantially in the manner and by means of the apparatus hereinafter described:—To the upper part of the boiler above the water line and near to one end is screwed or otherwise firmly fixed a short rod, extending from the inner surface of the boiler downwards towards the water-line. This rod carries a metal block which is insulated from the rod (and, consequently, from the body of the boiler) by a lining of glass, porcelain, or other non-conductor of electricity. The metal block has two projections about midway between the water-level and the top of the boiler, one of which carries a rod extending towards the end of the boiler, near which the apparatus is fixed, and terminating in a ball or sphere from which project several pointed wires. To the opposite projection one end of a coiled wire is attached by means of a pin or screw, the other end of the said wire being connected by means of a pin or screw to the upper part of the boiler, at a point as far distant as practicable from that where the short rod above named is attached. *Patent completed.*

120 W. H. RICHARDS. *Improvements in sleeve links, which improvements are also applicable to other dress fastenings and ornaments.* Dated January 14, 1865.

This invention consists of the improvements hereinafter explained in the parts of sleeve links by which the attachment of the dress is effected. As applied to a sleeve link the invention is carried out as follows:—On the inner side of the body of the sleeve link the inventor attaches a plate having a raised hollow bar or channel in its middle, in which hollow bar or channel a rod is made to slide, one end of the said rod protruding from the edge of the body of the sleeve link; he joints or hinges to the edge of the under side of the sleeve link a hooked bar or tongue extending nearly from side to side of the sleeve link. He makes the jointed hooked bar or tongue by preference of steel, but other metals or alloys having sufficient elasticity may be employed. Across the raised hollow bar or channel, and at the side opposite to that at which the hooked bar or tongue is hinged, a slot or opening is made, in which slot or opening the free end of the hinged bar or tongue can be made to engage, and from which it can be withdrawn. The free end of the said bar or tongue is bent inwards, or nearly doubled upon the other part, so as to form a small hook or snap. In order to fasten the link the hooked tongue or bar is passed through the sleeve in the ordinary way, and closed or shut down upon the back of the body of the said link. On the closing of the hooked bar or tongue the hook or snap at its free end bears against one edge of the slot across the raised bar or channel, and by pressure upon the said bar or tongue; the hook or snap enters the said slot and engages or snaps therein. The sleeve link is thereby securely attached to the sleeve. *Patent abandoned.*

121 R. LWA. *Improved apparatus to be employed for communicating between the passengers and guard of a railway train.* Dated January 14, 1865.

This apparatus consists of a powerful detonating cap, which is exploded by means of a hammer, and lights a candle in a red or other coloured lantern, at the same time that a red or other coloured flag is released and thrown out by spiral or other spring. The whole is contained in a metal or other case (fixed to the top of the carriage) which protects it from the effects of the weather and the

lid of which only flies open at the time the signal is given. The apparatus consists principally of an anvil or nipple upon which a large and powerful detonating cap is placed, and a hammer controlled by a powerful spring. The hammer is held by a detent, which is released by pulling a wire or end inside the carriage. The anvil or nipple is perforated, and immediately behind it is a candle in a coloured lantern, the wick of the candle being so prepared by any suitable combustible compound that the explosion of the cap shall instantly light the same. Part of the hammer forms the cap or cover of a cylindrical case, which contains a red or other flag which is projected by a spiral spring the instant that the movement of the hammer withdraws the cap or cover from the case above named. *Patent abandoned.*

122 R. A. BROOMAN. *An improved apparatus or ligometer for ascertaining and indicating the strength of liquids.* (A communication.) Dated January 14, 1865.

This apparatus is intended for the testing of various liquids used in commerce, such as alcohols, wines, and generally all liquids of organic origin. The apparatus is based on the action or principle of capillary tubes. If a liquid rises in a capillary tube, the height of the raised column depends on the composition of the liquid; on the other hand, by means of tables or gauges previously constructed the measure of the height shows the composition of the liquid. The apparatus consists essentially of a capillary tube of about one-fifth of an inch in diameter; it carries a double gauge or scale one part in equal divisions, the other in divisions corresponding to the different degrees of the liquid under trial—alcohol for instance, if wine be the liquid experimented on. The inventor does not limit himself to any particular arrangement of apparatus, but the following is what he considers the most convenient:—He closes the vessel which contains the liquid by a moveable cover surmounted by a frame. A capillary tube of about one-fifth of an inch in diameter, free to slide between holders formed in the top of the frame and in the cover, passes through the centre of the cover and enters the liquid in the vessel. A gauge also passes through the cover and terminates at bottom in a point to the level of which the liquid in the vessel should be filled. The gauge is formed with a double scale, one scale being divided into equal parts, and the other into alcoholic degrees. A thermometer also passes through the cover to indicate the temperature he introduces a strip of card-board or other suitable material through a slot in the top of the frame to facilitate the reading off. The action is as follows:—The liquid is poured into the vessel up to the level indicated by the point of the gauge; it is drawn up into the capillary tube, the height at which the liquid column stops is noted, and the gauge shows the corresponding alcoholic degree. *Patent abandoned.*

123 A. V. NEWTON. *Improvements in machinery for pressing and cutting tobacco.* (A communication.) Dated January 14, 1865.

The object of this invention is to construct a machine that will press tobacco preparatory to cutting it, and then cut it up fit for use in an efficient and expeditious manner, it being found necessary to press the tobacco into a compact state before the cutting commences. The invention also includes an improvement in the cutters for cutting tobacco. The cutting of tobacco while in a state of compression, as it must be, has heretofore presented a very serious difficulty. The juice, which is forced out of the tobacco by the pressure to which it is subjected by the cutting action, accumulates on the face of the cutter to such an extent as to stop the cutting action until cleaned. This tendency to accumulation is due to the practice of forming that face of the knife or cutter which is towards the mass of tobacco flat, and in the plane of the cutting edge, giving all the bevel to obtain a cutting edge to the outer face. This difficulty is obviated by making the inner face of the cutter, which is towards the mass of the tobacco, incline outwards from the plane of motion of the cutting edge. The invention also includes a simple and efficient combination of machinery for readjusting the feeding motion, which advances the tobacco to the knives by which it is cut, to cut it fine or coarse as may be desired. *Patent completed.*

124 W. ANSELL. *Improvements in breech-loading firearms.* Dated January 14, 1865.

This invention consists of improvements in the locking and unlocking action of breech-loaders constructed upon the break down and snap principle. A slot is cut vertically through the under part of the body to receive a stud or catch upon the under side of the breech end of the barrels. In this slot a bolt works through the break off; the bolt itself is slotted in the direction of its length to receive a bent lever secured by the side pin; a spring attached to the underside of the back strap, and bearing upon the rear of the bolt, keeps the bolt up to its work. The fore end of the bolt is formed into a beak to adapt it to engage in the catch upon the stud formed upon the under side of the breech end of the barrel, so that when the barrels are closed down upon the body, the bolt snaps into the catch. The bent lever protrudes through the fore end in front of the trigger guard, but only a sufficient length for the forefinger to operate in drawing it slightly back, by which operation the beak of the bolt is withdrawn from the catch, and the parts are released for charging; the action of closing them down again fully securing them for discharge. *Patent abandoned.*

125 T. BOUWSE. *Improvements in fog and storm signals, buoys, and spindles.* (A communication.) Dated January 14, 1865.

In carrying out this invention the patentee constructs a buoy of plate iron, or other suitable material, watertight; he so forms the outline of this buoy and so ballasts it that it will always maintain the upright position when at rest, and the outline is such that it will be easy in the water under circumstances of violent movement of the waves. He also so forms the buoy that a slight movement of the water rocks it from side to side with easy motion, and under severity of storm it will not bury or foul with its moorings. He so forms the top of the buoy that any weight of water is readily shed. On the top of the buoy he constructs a substantial spindle, having for its framework an iron shaft, which shaft stops at the bottom of the buoy, and is the central construction of the buoy; about this iron shaft he builds a guard of plate iron, or other suitable material, in such manner, and of such outline of form, as to part the overbearing waves without undue strain to the construction. On the top of this spindle he hangs in substantial manner a large bell, which bell is proportioned to the size of the buoy, the whole being built with a view to having the tones of the bell distinctly heard at greater or less distances. He moors this buoy by means of an iron

strap so connected with the framework of the buoy that the buoy itself acts with perfect freedom without fouling; this strap also connects with the buoy in such manner that the impingement of current or wind has no tendency to keep the buoy out of its vertical position. This strap is connected by a chain with an anchor at any depth of water required. This method of construction of the shaft and the iron strap and arrangements for mooring is applicable to the buoys, spindles, and spars in common use, and would render them far more useful and reliable than they are by the present mode of mooring them. *Patent completed.*

126 G. COLVEN. *An improved ornamental flower box.* Dated January 14, 1865.

This invention relates to that class of flower box which is intended to be placed in windows and similar localities, and consists in making such boxes so as to be not only divisible, but of a highly ornamental character. The main portion of the box is composed of wood, and made of any desired size and shape, lined with zinc embedded in pitch, with a view to the preservation of the woodwork. The exterior sides and ends of the box are covered with panes of glass, which are painted, gilt, or otherwise ornamented on the inner surface, and laid upon a layer of pitch applied to the exterior surfaces of the box, which preserves the wood as well as the ornamental work on the glass. The edges of the panes of glass are covered and secured by a rebated moulding of wood or metal which overlaps the edges of the panes. When circular, oval, or round-ended boxes are required, bent glass is used, and the zinc lining of course is made to conform to the contour of the box. *Patent abandoned.*

127 J. YOUNG. *Improvements in producing gases and vapour in a heated state.* Dated January 14, 1865.

One method which is employed to produce the gases and vapour in a heated condition consists in using a hollow cylinder placed upright and containing coke, charcoal, coal, or other such material. The material contained within the cylinder is set fire to near the bottom, and air is forced into or drawn through it by the draught of a chimney. When the contents of the cylinder have attained a high temperature, the current of air is stopped, and steam is blown in at the top, being forced down through the heated material, after which there issue from the bottom hot carbonic oxide and hydrogen with more or less steam. The apparatus heretofore referred to may be placed horizontally instead of vertically, or in an inclined position. Instead of using a cylindrical vessel, one of any other suitable shape may be employed. In addition to using steam to pass through the apparatus, as heretofore described, carburated hydrogen or other gas or vapour may be used along with steam or separately. *Patent completed.*

128 J. LILLEY. *Improvements in ship and other compasses.* Dated January 14, 1865.

The objects of these improvements are to obtain steadiness and precision in the magnetic needle or indicator. For this purpose, in addition to the magnetic needle or indicator as usually employed, the inventor uses another magnetised bar or needle, which is suspended in spirit or other liquid that will not freeze at ordinary temperature. The chamber containing the liquid and the additional magnetised bar is placed below the ordinary or indicating needle or medium, and as the upper needle will adjust itself with the south pole thereof to the north pole of the lower one, he forms the lower needle or bar of power sufficient to control and govern the upper one, which is marked to indicate accordingly. The lower needle or bar is formed with a centre cone by which it is suspended upon a central pivot, and there is a communication through its chamber by a rod or shaft, and arms or levers and screw, or other adjustment, by which the bar suspended in the spirit may be raised off its pivot, and the upper portion of its cone pressed against a corresponding conical support provided for it, and there held when desired. *Patent abandoned.*

129 F. C. FOURCAU. *Improvements in the construction of roofs or coverings for buildings.* Dated January 14, 1865.

The main object of this invention is to dispense with nails in the roofs or coverings of buildings usually used for securing the slate or other material thereto, and it consists in replacing the said nails by, and in the employment of, metal hooks or clasps for sustaining the said slates by holding them between them, and by fixing them to the frame, which may be of wood or metal, in such manner that, no matter what power the wind may exert, the slates cannot be raised or blown off the roofs of buildings. *Patent completed.*

130 J. B. FARRAR and J. HIRST. *Improvements in machinery for preparing, spinning, doubling, and winding wool, mohair, alpaca, silk, flax, cotton, or other fibrous substances.* Dated January 14, 1865.

This invention consists, firstly, in the employment of warps, wharves, or pulleys, or grooved rollers, as rotating guides for guiding and conducting spindles, rovings, or yarns, instead of fixed guides or twineels, which are now employed for such purpose. Secondly, in the application to guide boards or lap boards of spinning frames of brushes for broken ends to catch on, so as to prevent making double-yarn instead of the guard plates now in use for that purpose. *Patent completed.*

131 W. EDWIN. *The working of all stage scenery in theatres.* Dated January 14, 1865.

In this new method of working stage machinery grooves are only used at the upper part of the scenes, and are arranged on wooden rails which run parallel from one side of the fly on the top of the theatre to the other, and are supported in the centre from the roof of the building. The grooves run on the parallel rails by means of small wheels, and have weights attached to one end, which are connected with a line running through a block, and so arranged as to pull the scenes off the stage as soon as the force which threw them on is removed. In the centre of the parallel rails a large drum or wheel is placed, and beyond it a smaller one, the relation in size depending upon the distance the scenes have to traverse. The grooves are connected to the large drum in such a manner by lines that one revolution causes the two halves of the scene on opposite sides of the stage to come together. *Patent abandoned.*

132 H. J. ROGERS and J. M. SCHOLFIELD. *Improved means of closing the mouths of bottles or other vessels.* Dated January 14, 1865.

The first part of this invention relates to improved means of closing the mouths of bottles or other vessels by means of a stopper of glass, earthenware, or other hard material. In the interior of the mouth or orifice of the bottle or

vessel, the inventors cast or form a screw thread, and immediately below this they contract the neck or opening so as to form a shoulder. Upon the body or barrel of the stopper (which fits inside the mouth of the bottle or vessel) they form a corresponding screw thread, and below that they form an annular groove, in which they place a ring of cork, or other suitable elastic substance. The upper part of the stopper is of a larger diameter than the barrel, forming, as it were, a flange, the edge of which is milled or fluted, and upon taking the stopper by this milled edge and screwing it into the mouth or orifice of the bottle or vessel, the ring of cork or other substance will be pressed forcibly against the shoulder above named, and thus a perfectly fluid-tight joint will be obtained. The second part of the invention relates to improved means of securing ordinary corks in the mouths of bottles, and is especially applicable to such bottles as are used to contain soda or mineral waters, sparkling wines, or other effervescent or aërated beverages or liquids, and consist of a wire clip or clasp attached to the neck of the bottle, and capable of being passed over the top of the cork; in place of the strings or wires ordinarily employed for that purpose. *Patent abandoned.*

PROVISIONAL PROTECTIONS.

Dated April 21, 1865.

1115 E. Wilson, Pall-mall. An improved lamp or signal for calling cabs or other vehicles by day and night.

Dated May 2, 1865.

1225 T. H. Campbell, Lieut.-Col. Royal Artillery, Madras. Improving and strengthening shields of steel, iron, or other material for ships, fortifications, and other constructions.

Dated May 31, 1865.

1492 R. Howarth, Gloucester-crescent, Paddington. Improvements in apparatus for increasing the safety of railway passengers and trains, signalling, lighting, and forming a communication between all parts of such trains, also for securing the carriage doors.

Dated June 12, 1865.

1588 G. Bonelli, ex-chief director of telegraphs in Italy, Rue Sainte Appoline, Paris. A new or improved method of obtaining or producing optical illusions.

Dated June 15, 1865.

1622 M. P. W. Boulton, Tew-park, Oxfordshire. Improvements in generating steam.

Dated June 24, 1865.

1697 W. Clark, Chancery-lane, engineer. Improvements in the means and apparatus for consuming smoke. (A communication.)

Dated June 28, 1865.

1724 P. Javrosco, Panton-square, Coventry-street. Improvements in apparatus for the decantation and raising of petroleum and other oils.

Dated June 29, 1865.

1728 R. H. Leese, Eaton-terrace, St. John's Wood. Improvements in machinery or apparatus for cutting, punching, and bending sheet metal. (A communication.)

1730 R. A. Brooman, Fleet-street, patent agent. Improvements in printing threads employed in weaving. (A communication.)

1732 G. Lizars, gas meter manufacturer, Rue Lafayette, Paris. Improvements in dry gas meters.

1734 W. E. Newton, Chancery-lane, civil engineer. Improvements in preventing the incrustation of steam boilers. (A communication.)

Dated July 30, 1865.

1738 H. P. Tipper, Willenhall, Staffordshire, roll turner. Improvements in manufacturing gun barrels and tubes of cast steel and homogeneous iron.

1739 F. Delamare-Deboutville, Fontaine la Bour, France. Improvements in and applicable to machinery for doubling and drawing cotton and other fibrous substances.

1742 R. A. Brooman, Fleet-street, patent agent. Improvements in apparatus for tuning pianos. (A communication.)

1744 W. H. Davey, Blundell-street, Caledonian-road, engineer and machinist. Improvements in washing machines.

Dated July 1, 1865.

1748 W. R. Lake, Southampton-buildings, Chancery-lane, consulting engineer. An improved mode of pressing and moulding clay, sand or cement, for making bricks, and for other purposes. (A communication.)

1752 J. Calvert, Strand, civil engineer. Improvements in apparatus for propelling ships and other vessels.

Dated July 3, 1865.

1754 C. de Bergue, Strand, engineer. Improvements in locomotive engines. (A communication.)

1756 J. F. Jones, Rochester, U.S. Improvements in machines for making paper board.

1758 G. and D. Hurn, Norwich, manufacturers. Improvements in the manufacture of mats, matting, and brushes.

Dated July 4, 1865.

1762 S. Wright, Smethwick, Staffordshire, coachsmith. Improvements in axles for carriages.

1764 W. Clapperton, manager, Johnstone, and A. Lyle, cooper, Greenock, Renfrewshire. Improvements in apparatus for setting up caaks or barrels.

1765 S. B. Labouret, Rue St. Appoline, Paris, builder. Improvements in construction of suspended bridges, roads, aqueducts, or other ways.

1768 W. Jenkins, Derrystone-villa, Abergavenny, Monmouthshire. Improvements in the manufacture of lamp oils.

1770 R. A. Brooman, Fleet-street, patent agent. A new or improved method of dissolving pitch. (A communication.)

Dated July 5, 1865.

1772 F. N. Gibborne, West Strand, engineer and electrician. Improvements in apparatus for giving signals on board ships, and which are also applicable for other purposes.

1776 J. Jobson, Derwent Foundry, Derby, and J. F. Dickson, Leicester. Improvements in the conversion of wrought or malleable iron into steel, and in the means of apparatus employed therein.

Dated July 6, 1865.

1780 H. Beigel, Finsbury-square. Improvements in the means of obtaining or producing oxygen applicable to various useful purposes.

1782 G. Carter, Willenhall, Staffordshire, smith. Improvements in locks and latches, and in staples and spindles for the same.

1784 W. Thomson, LL.D., Glasgow College, and C. F. Varley, Fleetwood House, Beckenham. Improvements in electric telegraph.

1785 J. H. Johnson, Lincoln's Inn-fields. Improvements in railway switches. (A communication.)

1787 J. F. Jones, Rochester, U.S. Improvements in machinery for the manufacture of paper board and paper.

1788 W. E. Gedge, Wellington-street, Strand. An improved automaton lay-figure. (A communication.)

1789 A. V. Newton, Chancery-lane, mechanical draftsman. Improvements in the manufacture of boxes suitable, among other uses, for containing paste, blacking, and other cheap marketable articles. (A communication.)

Dated July 7, 1865.

1794 P. M. O. Béziel, Boulevard Sebastopol, Paris, jeweller. Improvements in the manufacture of chains, bracelets, necklaces and other articles of jewellery.

1796 E. H. Waldenström, Manchester, mechanical engineer. Certain improvements in machinery or apparatus to be employed in the manufacture of metallic bolts, rivets, and spikes.

1798 T. Sheldon, Sedgley, Staffordshire, manufacturer. An improvement or improvements in the manufacture of the handles of smoothing irons or sad irons, which said improvement or improvements may also be applied to the manufacture of the handles of various other articles.

1802 J. Hopkinson, Regent-street, pianoforte manufacturer, and J. Whitelock, Commercial-street, Leeds. Improvements in organs, harmoniums, and other similar keyed wind musical instruments.

1804 J. George, Kings Holme, Gloucestershire, engineer. An improved manufacture of coffins and air-tight receptacles.

1806 W. Goulding, Ayleston-street, Leicester. Improvements in ornamental fences and baskets to contain flowers and other articles.

1808 J. Willis, Stockbridge Works, Sheffield. Improvements in the construction of portable dark tents or chambers for photographers.

Dated July 8, 1865.

1810 W. E. Newton, Chancery-lane, civil engineer. An improved brake for retarding the progress of wheel carriages. (A communication.)

1812 J. F. Heather, M.A., Marlborough-road, Old Kent-road. Improvements in the construction of locks and keys.

1814 B. Collins, manager, and J. Butterfield, merchant, Manchester. Improvements in machinery for cutting fustian and like fabrics.

1816 H. A. Dufrené, South-street, Finsbury, civil engineer. An improved self-acting apparatus for obtaining a circulation of volatile liquids. (A communication.)

Dated July 10, 1865.

1818 G. T. Livesey, South Metropolitan Gas Works, Old Kent-road. Improvements in treating ammoniacal liquors for purifying gas and other purposes.

1819 H. Schooling, North Side, Bethnal Green. A new kind of pearled or ornamented confectionery.

1824 W. S. Underhill, Newport, Salop, engineer, and A. H. and J. Corden, Chatswell, Staffordshire, farmers. Improvements in reaping machines.

1826 R. Hinson, Liverpool, hotel keeper. Improvements in food for horses and in the preparation of the same.

Dated July 11, 1865.

1836 M. H. Keene, Victoria Iron Works, Croydon. Improvements in traction engines. (A communication.)

Dated July 12, 1865.

1840 A. Denayrowicz, Golden-square, Liout, French Imperial Navy. Improvements in apparatus and equipments used by persons employed under water, part of the improvements being also applicable for the use of persons employed where noxious gases or vapours prevail.

1842 J. E. Wilson, Grasmere, Torquay, Devonshire, civil engineer. Improvements in the permanent way of railways.

Dated July 13, 1865.

1845 A. Mackie, publisher, and J. P. Jones, machinist, Warrington, Lancashire. Improvements in apparatus for "setting up" or composing type for printing.

Dated July 14, 1865.

1847 W. Meddowcroft, Hammersmith. Improvements in the construction of rollers for window blinds, and in apparatus connected therewith.

1849 J. Clayton, West Bromwich, Staffordshire, furnace builder and contractor. Improvements in ingot moulds, and in casting metals.

1851 J. M. and J. M. Murphy, Cork. Improvements in staining and graining woods.

1853 S. Tripp, Dane's Inn, Strand, solicitor. Improvements in the means of securing envelopes for enclosing letters and other papers.

1855 A. E. Molin, Fahlun, Sweden. Improvements in separating gold from ore containing copper and gold.

Dated July 15, 1865.

1859 W. Hughes, Manchester, engineer. Improvements in presses. (A communication.)

1861 W. R. Lake, Southampton-buildings, Chancery-lane, consulting engineer. Improvements in flexible gas tubing. (A communication.)

Dated July 17, 1865.

1863 S. Dummere, John-street, Hampstead. An improved mattress and palliase for the use of the nursery, invalids, and hospitals.

Dated July 18, 1865.

1865 J. Thornton, Cleckheaton, Yorkshire, machine maker. Improvements in means or apparatus for opening and straightening wool, cotton, and other fibres.

1869 A. Barclay, Kilmarnock. Improvements in steam boilers or generators.

1871 W. A. Richards, Clarence-road, Holloway, commercial clerk. An improved pouch or receptacle for holding tobacco and other similar purposes.

Dated July 19, 1865.

1873 A. H. Platt, Philadelphia, U.S., physician. The use and application of paper, printed or otherwise ornamented with water colours, for covering floors and other analogous purposes as a substitute for carpets and oil cloths, and of an improved coating or varnish to be applied to the same to protect its surface from injury and wear.

1875 T. and H. Metcalfe and T. Clayton, Manchester. An improved apparatus for cooling liquids and cooling or condensing vapours or gases.

1877 D. McCrammen, Gourrock, Renfrewshire. An improved process of preparing seaweeds and other vegetable substances for the production of guano, felt, alkaline, salts, and iodine.

1879 C. Nicholas, Cheltenham, Gloucestershire, plumber. A new or improved apparatus for supplying disinfecting liquids to waterclosets, urinals, and other places requiring the same.

1881 H. E. Gilles, Old Broad-street. Improvements in processes and machinery for producing fibres suitable for being spun from rags or remnants of woven or other textile fabrics made of silk, wool, cotton, or other fibrous materials.

1883 W. Edwards, Birmingham, cabinet maker. Improvements in protecting crinoline steel, stay buses, springs for leggings or gaiters, and other similar fastenings.

1885 G. Nimmo, Jersey, U.S. An improvement in the mode of uniting different metals, such as iron and copper, or alloys, to form compound metallic castings.

1887 T. H. Ince, Westminster Palace Hotel, barrister-at-law. Improvements in shoeing horses.

PATENT APPLIED FOR WITH COMPLETE SPECIFICATION.

Dated July 20, 1865.

1893 R. C. Bristol, Chicago, U.S. Improvements in slide valves.

LIST OF SEALED PATENTS.

Sealed July 28, 1865.

274 E. P. Colquhoun and J. P. Ferris

275 E. P. Colquhoun and J. P. Ferris

279 J. Sainty

280 J. Hughes

287 O. A. Wheeler

288 A. S. Stocker

292 O. Lungley

298 W. Vale

307 F. Row

324 W. H. and F. O. W. Latham

334 H. Masters

335 C. Henderson

351 C. Field

370 A. V. Newton

376 R. Lord

396 A. V. Newton

421 J. von der Poppenburg

1858 O. F. Cotterill

Sealed August 1, 1865.

301 B. L. Mosely

310 J. A. Phillips

315 R. A. Brooman

319 R. M. Alloway

326 R. Shaw

328 A. Steven

353 J. O. C. Halkett

371 J. Dale

380 W. E. Newton

401 R. W. Thomson

408 E. J. C. Welch

NOTICES OF INTENTION TO PROCEED WITH PATENTS.

From the London Gazette, August 1, 1865.

784 J. Vero. Brushes.

785 J. C. Stevenson. Hyposulphite of lime.

774 I. Philippshalt. Yarn.

777 E. T. Crawshaw and I. A. Lewis. Puddled iron bars.

791 J. Smith and S. A. Cheese. Valves for hydraulic engines.

792 W. Berry. Cutting bread.

800 A. P. Tronchon. Fire-arms.

805 J. Wright. China clay. (A communication.)

809 W. M. Baker. Argand gas burners.

820 H. Oakes. Worsted carding.

826 T. Roberts and L. Luc. Continuous self-acting machinery.

833 R. Lublinski. Parasol tip fasteners.

835 J. Green. Cutting the threads of screws.

841 G. F. Marchisio. Obtaining light.

848 E. H. Smith. Sewing machines.

850 J. Dodd. Spinning mules.

851 W. Richardson. Cotton gins.

859 J. Buckingham. Oil feeders. (A communication.)

863 J. Bruckshaw and W. S. Underhill. Traction engines.

864 F. le Roy. Non-conducting composition.

868 J. Williams. Ornamenting glass articles.

870 J. Millar and J. Lang. Printing ornamental fabrics.

876 F. A. Mocquard. Gas burners.

878 F. W. Webb. Steel tyres.

882 J. Wright. Forging machines.

884 W. Irlam. Cranes.

887 E. and F. A. Leigh. Carding cotton.

888 F. A. Leigh. Bridges.

889 R. Holroyd and J. H. Bolton. Drying warps.

891 J. Player. Heating blast for furnaces.

899 W. Brookes. Reducing iron. (A communication.)

900 A. A. Croll. Sulphate of alumina.

901 A. Turner. Winding yarns.

906 J., D. B., and O. Swarbrick. Steam boilers.

907 L. Bridge. Looms.

915 H. H. Smith. Mounting photographs.

922 J. Lewis. Wringing machines. (A communication.)

928 A. W. Pearce. Looms.

948 A. and H. Illingworth. Preparing wool.

949 W. Brookes. Motive power. (A communication.)

950 C. Martin. Polishing forks.

952 W. Clark. Polishing shot. (A communication.)

980 G. Davies. Increasing the illuminating power of hydrocarbon oils. (A communication.)

1008 G. Davies. Preventing the fouling of ships. (A communication.)

1048 G. Jackson. Rests for cues.

1078 J. Dougan. Distilling hydrocarbons.

1109 F. Wise. Gas regulators. (A communication.)

1134 J. Howard and E. T. Bousfield. Motive power.

1159 J. C. Wickham and A. E. Deiss. Waterproof fabrics.

1296 F. Myers. Wet gas meters.

1395 W. and G. B. Smith. Wet gas meters.

1543 A. I. L. Gordon. Telegraphic communication.

1673 S. Godfrey. Furnace bars.

1679 J. Gale, jun. Gunpowder.

1690 M. A. Muir and J. M. Ilwham. Preventing noxious exhalations.

1724 P. Jacovenco. Raising of petroleum.

1730 R. A. Brooman. Printing threads. (A communication.)

1843 J. Saunders and J. Piper. Tin and terne plates.

1885 G. Nimmo. Uniting metals.

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.

2100 J. Loech and B. Mathew

2101 J. Dickson

2111 J. and H. Redgate

2126 R. Low and W. Duff

2130 W. Spence

2141 E. Burnett

2148 E. T. Hughes

2169 J. W. Woodford

2180 G. Haseltine

2181 G. A. Biddell

2297 C. E. Spagnoletti

2311 S. A. Bell and T. Higgins

2338 T. Clements, P. and J. Llewellyn, and J. W. James

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

1731 W. Hartley

1784 C. Mather

1811 W. Smith

LIST OF SPECIFICATIONS PUBLISHED

For the Week ending July 29, 1865.

No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.	No.	Pr.
2222	s. d.	8 2232	s. d.	4 2242	s. d.	4 2252	s. d.	8 2261	s. d.
2223	0	4 2233	0	4 2243	0	4 2253	2	4 2262	0
2224	0	4 2234	0	8 2244	0	4 2254	0	8 2263	0
2225	1	0 2235	0	8 2245	4	4 2255	2	8 2264	0
2226	1	8 2236	0	6 2246	10	2 2256	2	8 2265	0
2227	0	4 2237	2	2 2247	0	8 2257	0	8 2266	0
2228	0	4 2238	0	4 2248	8	8 2258	10	2 2267	0
2229	0	4 2239	0	8 2249	0	4 2259	0	4 2268	0
2230	0	4 2240	0	4 2250	4	4 2260	0	4 2270	0
2231	0	4 2241	0	4 2251	0	8 2269	0	4 2278	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-building, Chancery-lane.

LATEST PRICES OF MATERIALS USED IN CONSTRUCTION.

TIMBER, duty 1s. per load, drawback 1s.												
Teak	-	load	£12	0	£13	10	Archangel, yellow	-	£13	0	£14	10
Quebec, red pine	-	3	10	4	15	St. Petersburg, do.	-	11	0	13	0	
yellow pine	-	2	15	3	15	Finland	-	8	0	10	10	
St. John, N.B., yellow	-	0	9	0	0	Manila	-	10	0	15	0	
Quebec oak, white	-	5	5	6	0	Gothenburg, yellow	-	10	0	11	0	
birch	-	3	10	4	10	white	-	9	0	10	0	
elm	-	3	10	5	0	Geele, yellow	-	10	0	11	10	
Danish oak	-	3	5	6	0	Rodierman	-	9	0	11	0	
Memel fir	-	2	15	3	10	Christiana, per C.	-	10	0	11	0	
Riga	-	3	5	2	0	yellow	-	10	0	11	0	
Swedish	-	2	10	2	10	Decal bank, Danial	-	18	0	23	0	
Mast, Quebec red pine	-	6	10	8	0	over 40 ft. 3 in.	-	0	14	1	8	
Lathwood, Danial, fm	-	7	10	8	0	POMICE STONE per ton	-	1	0	1	0	
St. Petersburg	-	8	10	9	10	Seal, pale per ton	-	10	0	0	0	
Doals, per C., 12 ft. by 3	-	by 9 in., 4 ft. by 3	-	load, drawback 2s.	-	Whale, 8th Sea, pale	-	11	0	45	0	
Quebec, white	-	14	0	18	0	Olive, Gallipoli	-	54	0	0	0	
St. John	-	13	0	18	0	Cocunut, Coch. ton	-	41	10	45	0	
Yellow pine	-	per	13	0	15	Palm, fine	-	36	10	26	0	
	-	duced C.				Linsod	-	31	15	0	0	
Canada, 1st quality	-	18	0	20	0	Rapessed, Eng. pale	-	45	0	9	0	
2nd	-	18	0	14	0	Cottonseed	-	47	0	23	10	

THE
MECHANICS' MAGAZINE.

LONDON: FRIDAY, AUGUST 11, 1865.

NAVAL AND MILITARY SIGNALLING.

FROM the earliest periods of the world's history, circumstances have not failed to arise in which men have been placed beyond the reach of the human voice. These conditions have called for the adoption of a system of signals as a means of communication, and form, colour, sound, and motion, have all—either separately or in combination with each other—been enlisted for signalling purposes. Two thousand years ago naval signals were of the simplest possible character. All that was done was to hang a red flag or a brazen shield from the admiral's galley, and to move it in various directions. These motions indicated to the ships under his orders the movements they were to make. The plan was, of course, very imperfect, but it was sufficiently effective for the small slow-moving craft of those days. A Greek writer of the period referred to maintains the importance of military signalling, and himself invented a very efficient system. The progress of this class of signals was at one time much in advance of that of the other service. This was doubtless owing to the greater difficulties which arose in the course of military operations, from conditions in the contour of the country and other causes, and which led to the invention of more perfect arrangements. But in course of time ships increased in size, new methods of propulsion were adopted, and means of conveying orders, entirely independent of verbal communication, were necessary. Coloured flags were first used for this purpose, but this change was not necessitated until nearly the end of the seventeenth century, and no systematic arrangement occurred until nearly a hundred years later. This was about the time of Lord Howe's celebrated victory on the 1st of June, 1794, on which occasion he had only the means of making 183 signals. But such progress was made in naval signalling that four years later flagships were able to make 310 signals. This result, great although it was for that time, suffers by comparison with the system of the present day, inasmuch as the vessels of the Royal Navy can now display about 14,000 distinct signals, whilst those of the merchant service can show no less a number than 70,000. The advance in military signalling, however, by no means kept pace with that of the sister service, owing to the want of some simple system which combined rapidity of transmission with certainty of action.

At the commencement of the present century—and even some few years previously—attention had been called to the necessity of having a perfect system of day and night signals. The consequence was the appearance of numerous inventions of more or less merit—those of the latter class certainly preponderating—which proposed to effect the desired end. Among others we may notice the system adopted in 1801, by Mr. James Boaz, who, by the use of mechanical contrivances, endeavoured to render signalling less liable to error than it had hitherto been. His principle was to spell the words he wished to communicate, letter by letter, the actual form of each letter being produced. This was effected by a very ingenious arrangement of twenty-five lamps, which were placed in the form of a square, within a frame or case, fitted with a front board which was perforated with twenty-five holes, one for each lamp. Each lamp was capable of being obscured when necessary by a cover, which fell over the orifice in the board through which the rays from the lamp were otherwise emitted. These covers were connected by cords or chains with a series of

boards working on pivots, and placed beneath the lamp frame. In signalling, a certain number of the lamps had to be obscured, leaving only those visible which would convey to the observer the idea of each letter composing the word signalled. To produce this effect there were twenty-five slides, each being marked with a letter of the alphabet. Each slide was provided with certain projections, which, when the slide was pushed in, came in contact with so many of the pivoted boards as were connected with the covers of the lamps required to be exposed. The pivoted boards thus received an instantaneous tilt, by which the required cords or chains were drawn down, and the whole of the necessary lamps exposed. For day signals a similar arrangement was employed, the lamps being replaced by hinged shutters, which were turned edgewise to the observer when they were not required to be seen. Eight years after the appearance of Boaz's signals Lieutenant-Colonel Lindsay patented a system which was not without merit. For day signals Colonel Lindsay used a triangular object suspended on a centre, and his system of signals depended upon the different positions of this object, and the combination of these positions with those of a circular body capable of being revolved around the triangular one. For night signalling lanterns were placed in various positions. The whole system was of a comparatively simple character. Later on, in 1827, Rear-Admiral Raper made a further step in advance by the invention of a system of signals which consisted, first, in classing the signals according to their significations, and distinguishing the classes from each other by combinations of flags and pendants, and second, when colours were not visible, the employment of the distant signals by which they were made to express every signal. Eleven flags and eleven pendants were required, and the Admiral relied on the distinction between the two for determining the general nature of his signals. By this system the chances of error which previously existed were considerably lessened, and a step in the right direction was attained, the system being in advance of any then in use.

Whatever may be the principle of any system, it is very obvious that the best will be that which depends the least upon colour for its perfect action. At certain distances, and under certain atmospheric conditions, all colours resolve themselves into either light or dark, and it then becomes impossible to distinguish their character further in this respect. The ranges also at which the several colours can be distinguished vary considerably, so that in any system in which colour is an essential feature, its effective range will be that at which the least penetrative colour in it is visible. Beyond this range there is the probability that any two flags or signals of similar form would be mistaken one for the other. These observations apply equally to day and night signals, to the latter, however, with especial force. In colour-signalling by day, advantage is taken of reflected light, but by night transmitted light must be used, and every coloured glass interposed between the light and the observer greatly diminishes the effective range of the signal. A red colour diminishes the range about one-third, green somewhat more, whilst blue almost obscures a light. Besides these, there are other manifold difficulties standing in the way of a good system of signalling by colour for naval purposes, so that it is hardly to be wondered at that, whilst the day signals as used in the navy number some 14,000, it has hitherto been considered that only fifteen can with certainty be made at night. Nominally the night system of the navy is capable of making one hundred and three signals, but really only fifteen can be depended upon. The various methods for increasing the number of signals by the addition of mast-head lights, rockets, blue lights, and guns, are open to objections, and have, in fact, been condemned by some of our most experienced signal officers, serious

accidents having resulted from their failure. The great disproportion that exists between the number of signals produced by the ordinary system of naval signalling by day, and those given at night, can only be referred to the idea which appears to have prevailed, that all improvements must be founded on the principle of the flag system. Hence the glaring deficiency observable in night signalling, which has been fettered and kept back by considerations such as those to which we have just alluded. But we have lived to learn that there is really no difficulty in signalling by night, to a greater distance even than by day, and that any number of signals required can be made in the most simple and effective manner.

Until very recently there was a lack of simplicity and certainty in extended operations by day, and an almost useless, because exceedingly limited, system only was available at night. Now, however much labour may be bestowed upon the matter, so long as it is pursued as inseparable from the flag system, so long will the difficulties be insurmountable. It is only by acting upon an entirely different train of thought that anything like a simple and efficient system of night signalling can be arrived at, and to strike out a new path in this direction requires a spirit of considerable originality and boldness. In a paper read before the Society of Engineers by Mr. Francis Wise, C.E., the results of the careful investigation of the subject by such a spirit, are evidenced in the production of a most perfect system of night signals, of which the author of the paper has given a very elaborate description. The inventor of this system is Commander Colomb, R.N., to whose ingenuity and perseverance the navies of the world stand indebted in no ordinary degree. This system is known as the "flashing system," and, as carried out by the inventor, it is applicable to, and entirely overcomes the difficulties attendant upon, night signalling, which by it is enabled to be carried on with even greater ease, and to a greater distance, than signalling by day. It further reduces the process to a very simple matter in the transmission and reading of signals, and the method of operation is to be learned by any practised signalman in a few hours. Commander Colomb's system is the result of long experience in the requirements of the subject, combined with an extensive series of carefully-conducted experiments carried on under circumstances of actual practice. One uncoloured light only is employed, which is contained within a lantern, glazed in such a manner that the light when uncovered is visible from any point of view, and upon the alternate exposure and obscuration of this light the system is founded.

Colomb's system of signals is equally available by day as by night, but, as in all the commercial, as well as warlike navies of the world, the question of night signalling was in a much more defective state than that of signalling by daylight, the inventor's plans have so far made much greater progress as a night than as a day system. Hitherto, the only method by which ships could communicate in daylight with each other or with the shore by signal has been by the use of coloured flags. This plan, as already observed, greatly limits the range at which signals are available. It is also a very slow and cumbersome method, only approaching the speed of other systems when the distance is small, and when, as in large men of war, a great number of men can be spared to work the flags. Therefore it is that the officers and men of merchant ships are little aware, as a rule, of the great benefits to be derived from proper and frequent signal communication. It has been found by careful experiment that no signals by coloured flags can be distinguished at a greater distance than six miles and a half. At the shortest distances and with all proper appliances, a message cannot be transmitted at a greater speed by flags than one word per minute, whilst at five miles distance the speed

decreases to one word in six minutes. Though flag signals are thus slow and cumbrous, they are so old an establishment and answer so fairly the important purposes of men of war cruising in fleets, that they have become universally adopted by all maritime nations, and nearly all merchant ships leave their ports with a complete set of signal flags on board. But signalling in the daytime by merchant ships is extremely rare, and is almost confined to the display of the combination of flags representing the ship's number.

Flag signals, however, inefficient as they are, do undoubtedly give the power of sending any message which may be desired in daylight. But at night, in the merchant service communication is altogether cut off by signal, whilst in every navy in the world it is restricted to a few arbitrary messages, very limited in character and number, and displayed by means so liable to mistake, that practically there was no such thing as night signalling. Various means have been tried from time to time to obviate this great defect, and to give ships the means of communicating any intelligence that might be necessary by signal at night. In all cases these plans required a large number of lanterns, and most of them involved the use of coloured lights. It was found, however, that when coloured lights were used at any but the shortest distances in the clearest weather, it was impossible to distinguish one colour from another. The range of the coloured lights was also found to be very small in comparison with the white lights used in combination with them. So that, after short and limited trials, the plans proved unavailable for general use.

Commander Colomb having for several years studied the various systems of day and night signals brought forward in England and in foreign countries, became satisfied that the adoption of something altogether differing in principle from colour would alone solve the question. He therefore, in the year 1860, devoted his attention exclusively to the study of communicating intelligence to a distance by the appearance and disappearance of a single object. After long-continued experiment he completed the system, which will be found fully described and illustrated in another column of our present number. This system depends for its action on the alternate appearance and disappearance of a light, and in this the most unerring certainty and precision are attained by mechanical means. The signals are delivered by an alphabet of long and short flashes, on the Morse principle. The great characteristics of the apparatus are simplicity and complete adaptation to all circumstances. Whether in ships, boats, or on land, whether in darkness or daylight, whether at small or great distances, the flashing system equally meets all requirements. It is now decided upon as the night signal system of Her Majesty's Navy, and is in use in those of Russia, France, Italy, Austria, &c. It is at work at the naval and military gunnery establishments, and saves considerable labour in those experiments by conveying immediately to the officers in charge the effect of each shot as it falls. In the series of experiments which took place by command of the Lords of the Admiralty and the Secretary of State for War, the results showed most conclusively the value of the invention. It was found that the most rapid communication by signal could be carried on at the enormous distance of thirty miles at night, with proper apparatus, between a ship and the shore, whilst in the daytime the range was always found to be twice that of flags, and the speed of communication often more than six times as great. For short distances the apparatus is well adapted, being so simple and portable that a man may carry and work a complete apparatus for day and night, just as a sportsman carries his gun across the country. In the daytime, with clear weather and under ordinary circumstances, it is found that such messages as are not of very great importance

may be conveniently transmitted by means of a disc arrangement worked by manual labour, but under circumstances of excitement on the part of those transmitting the message, such a course would evidently be very undesirable, as there can be no reliable means of regulating the flashes, nor the intervals between them, otherwise than by the employment of mechanism.

For distant signals in the daytime from fixed positions, the following arrangement is used:—A set of shutters are placed on pivots, something after the manner of a Venetian blind. In their normal state they lie horizontally, so that their edges only are presented to observers, and, at a slight distance, will therefore not be seen at all. A very small motion, it is evident, will produce a very great change in such an apparatus, and the flashes are, therefore, capable of being worked by a somewhat larger description of barrel, its lever causing the shutters to appear perpendicularly to represent flashes, and to return to their horizontal position to represent intervals. Any amount of surface may thus be exposed or withdrawn by a motion comparatively small. For the use of the army, or, in fact, in any cases of fixed positions, where the signals address but a single point at a time, the barrel is made very small, and the lamp, with proper lenses and reflectors, is fixed on its top. An important adjunct to Commander Colomb's apparatus has been furnished by Captain Bolton, of the 12th Regiment, who has adapted the lime light to the flashing system. Captain Bolton, however, proposes the use of a finger-key arrangement for giving the flash by hand, instead of by Colomb's self-acting apparatus. The argument is that the finger-key quickens the operation of signalling, but it certainly appears to us to be a retrograde movement to substitute manual work for such a reliable mechanical arrangement as Commander Colomb has produced.

LAVOISIER.

THIS honoured name has once more appeared before the public in connection with science. Though he who owned it has long since passed away, the lustre of his reputation dims not, but the rather beams more radiantly. Though dead, he yet lives among us in his works—works in which his far forthlooking mind stepped beyond his day—works, too, some of which have only now revealed results reached by him, which have been but recently attained by followers in his footsteps. Only last week the French Academy of Sciences received, at the hands of M. Dumas, the third volume of his edition of Lavoisier's works. Undoubtedly this Father of modern Chemistry and one of the most illustrious victims of the Revolution of 1793, foresaw many of the great facts since discovered by modern science, although he could command but few of the many resources we now possess. This third volume of his works is composed chiefly of those among his papers which remained unpublished. It contains a hitherto unedited paper on fermentation, of which it is said with truth that Lavoisier gave the first rational explanation. He determined the amounts of carbonic acid and alcohol produced in the fermentation of sugar. Lavoisier appears to have bestowed very great attention upon this subject, and from his analyses he seems to have drawn the conclusion that sugar must be regarded as a compound of carbon and water. This idea was subsequently published by Gay-Lussac and Thénard, who were not aware that Lavoisier had previously discovered it. It further appears that Lavoisier must be regarded as the father of organic analysis. He burnt sugar by means of oxide of mercury, and collected the carbonic acid in a weighed flask of potash. Another paper, the first he ever wrote on a matter of public interest, obtained a prize from the Academy of Sciences. The subject, which was proposed by M. de Sartines, Lieutenant de Police, is, the best method of lighting towns. At that time Paris

was lighted in a very different manner to that adopted in the present day; its thirty thousand gas-burners were then represented by six thousand six hundred candles. But, notwithstanding all our modern improvements, it cannot be denied that Lavoisier laid down the true principles of street lighting eighty years ago when he proposed numerous reflectors at low elevations. Lighthouses also formed a subject of investigation with Lavoisier, and to him we are indebted for their true definition and the best rules for their construction. It is a singular fact, too, that it occurred to the same mind to propose a plan for dispensing with chandeliers in theatres, which were to be illuminated by causing the light to pass through a glass roof. This plan has only recently been carried into effect in some theatres.

Nor was the genius of Lavoisier fettered within the bounds of physical science. It could rove far beyond them and yet not lose its way; it could depart widely from them and yet hold its own. So we find him at home on questions of social science, writing highly valuable papers and reports on prisons. He, too, recognised and insisted upon the removal of slaughterhouses from the centre of Paris, and he called attention to the selection of a new site for the Hôtel Dieu. In an elaborate report on Mesmer's animal magnetism he condemned the whole system. At his instigation, and under his advice, the Academy appointed a commission to examine into the question of Montgolfières and Charlières—a question we have but recently discussed. The results of the labours of this commission were, in the first place, the adoption of means whereby the material of which balloons were constructed was made airtight, as in the present day, and, in the next place, the proposition to use the gas extracted from pit-coal as the best. Its illuminating properties had not then been applied to any practical purpose. In 1776 an intense degree of cold was experienced, which afforded Lavoisier the opportunity of making important experiments with the thermometer, of which he availed himself. He invented a special thermometer for the sole purpose of ascertaining whether the temperature of the cellars of the Observatory of Paris was constant or not. This thermometer is still there, in the very place where Lavoisier with his own hands fixed it. It is a gigantic instrument, the object of which was to exhibit variations of temperature, however slight. Some idea of its size may be obtained from the fact that each degree is represented on the scale by a space of four inches. M. Le Verrier, the imperial astronomer, states that the indications of this instrument do not agree with those of others. He, therefore, proposes that another instrument should be constructed on the same scale, that the discrepancy may be corrected. This is one of a few practical remains of Lavoisier's labours. He was not only a chemist, but a worker in almost every branch of physical science, and this last volume shows more plainly than ever how much was lost to science when that great philosopher suffered on the scaffold—suffered for no crime of his own, but for the circumstance of his representing an obnoxious system during the Reign of Terror.

SCREW ENGINES.

SCREW propulsion has become almost universal as a medium of nautical transit. The engines adopted as prime movers are varied in design and arrangement, each maker preferring certain peculiarities. These varieties in the principal types of marine screw engines we now purpose noticing. Of the perpendicular class there are two kinds, inverted direct-acting, and annular. The arrangement of the former is as follows:—The cylinders are secured on the main frames; these are often hollow, and, in fact, are the condensers in most cases; in other examples the condenser is behind the frames. The slide valves are either between the cylinders or on the outside

of each, fore and aft. The latter position is undoubtedly the better both for erection and repair, owing to the better means of access, to say nothing in relation to that required for the valve gear and eccentrics. The air-pumps are worked either from the steam pistons direct or by levers receiving motion from the piston-rod crosshead. The former arrangement deserves notice for its simplicity, and the latter for accessibility to all the working parts, valves, &c. It is obvious that when the air-pumps are under the cylinders, or rather between the cylinders and the crank-shaft, the space allowed for repair must be inconveniently small in comparison with that obtained when the air-pump is beyond the frames or at the side of the engines. It must be admitted that simplicity of action is worthy of every consideration, but when the desideratum is obtained at the cost of reduction of repairing facilities the gain may be truthfully said to be counteracted by the attendant evil. The best arrangement in actual practice is the lever system, and this is due to the considerations to which we have alluded, which are that accessibility should never be sacrificed for reduction of space. Our next example is the annular vertical engine. This type of engine is perhaps the best arrangement yet introduced for vertical action, when applied for driving the screw propeller. This arrangement, however, has its imperfections. The cylinders are annular, or a cylinder within a cylinder. Now the greatest evil may be said to exist in the fact of increased friction due to the internal and external rings of the piston, also two piston rods in the place of one. In the present case the air-pumps are worked from the piston-rod crossheads, levers and the connections being arranged in the ordinary manner. The condenser is at the side of the engines, forming portions of the air-pumps. The slide valves are outside the cylinders, or fore and aft. The great advantage in this arrangement is, that the cylinders are lower in the hull than in the ordinary vertical engines, a fact of some value with large engines. We may add that, in both of the examples described, the feed and bilge pumps are worked from the crossheads of the air-pumps. The relative value of the two engines will be understood from our observations without further comment.

The types we next propose for comparison are those of the horizontal class. Of these the following examples may be deemed most universal:—Single piston rod direct-acting, double piston rods return connecting rod, single and double trunks, and antifrictional trunks. The first of these examples is generally arranged thus. The cylinders are side by side; the condensers are oppositely arranged; the slide valves are at the sides of the cylinders, fore and aft. The guide for the piston rod is as important a portion as any, and we propose alluding to it in detail. In the latest and best examples, the guide channel is under the piston rod, of a double bracket-like shape in section. The guide block is generally in halves, and in some cases the back part is solid with the top and bottom, while between the bolts in front the portion is separate. Now we prefer this latter on account of its simplicity in construction and durability while in action. This flange at the bottom is strengthened by a shoe-piece, the connection of which forms an angle with the under side of the flange, adjustment being attained by studs at the front end of the block. The connecting rod is of the forked-end type and connected to the block by a single pin. The double piston rod type is the favourite amongst the many productions. This arrangement of engine at first met with a cold reception; it was deemed complicated. This may be said to be due to the arrangements of the guides of the piston rods. In the examples at present used the cylinders are placed side by side, the condensers being suitably arranged opposite, but in one example with which we are acquainted the condenser commences between the cylinders.

This plan, however, may be deemed of a special character. The positions of the slide valves are various; some makers prefer one to each cylinder; others deem it expedient to introduce two. When the former arrangement is adopted the valve is either at the side or top of the cylinder; in the case of two valves their positions are angular on the upper portion of the cylinders. The former mode can be said to be the better, due to the lesser number of detail, &c. The piston rod guide blocks in most cases are similar to those for single piston rod engines, while in other examples the blocks are double ribbed, each rib securing the crosshead, single and connecting rods being adopted. A third arrangement consists of guides similar to horizontal high-pressure engines. The relative values of the two arrangements, *i.e.*, single and double piston rod engines, are difficult to define; in this case, as in many others, each design possesses peculiar advantages in itself. The single piston rod type is the most simple in its connection from the cylinder to the crank, and has also the facility of admitting a well-arranged condenser. These remarks, of course, apply to direct-acting engines. Now, in the case of double piston return connecting rod types, there is the gain in space transversely of the hull of the vessel, while for the single piston rod class, this distance is much increased with the same length of connecting rod. This increase is of course due to the fact that the connecting rod, cranks, guide, and block, must be within the precincts of the front end of the cylinder and the crank shaft. With reference to the double rod type the guides, block, and connecting rod are beyond the crank shaft, or opposite the cylinders. It can be readily understood that in the present case the condenser is out up, so to speak, by the rods, guides, &c.; hence, a great disadvantage in arrangement, which the single rod type escapes. By this the relative values of both arrangements are clearly seen, but as space is of importance when all the machinery must be below the water-line, it is almost needless to add that the double rod example is the most universal. It will doubtless have been noticed that allusion has been made to two cylinders in the arrangements. Latterly, however, an eminent firm has introduced three cylinders in order to maintain a uniform motion, or rather action, of the pistons, the remainder of the arrangement being much the same as those already described. Now, the object in introducing varied arrangements is to test the best type, or rather that suitable for a given purpose.

The next class of engine is the trunk direct-acting. These engines are of two types—single and double trunks; the former are not as universal as the latter, owing, perhaps, to the inequality of the areas on each side of the piston. This, however, is partially counteracted by the cylinders being on each side of the crank shaft, and thus contrary in position and action. Thus, while the larger area of one cylinder is acted on, the smaller area is in action on the opposite side; hence, an equality of pressure or power may be said to be maintained. The condensers are arranged opposite each other on each side of the hull and secured fore and aft of each cylinder. The air-pumps are plunger action, or trunks with closed ends, single action. The feed and bilge pumps receive their motion from the crosshead secured on the air-pump trunk. It may be added that the steam piston and air-pump connecting rods are attached to the same crank. This arrangement is compact, but not perfect in disposition of detail. For example, suppose one engine to be disabled—say, the slide valve out of order; the opposite engine has an inequality of power or pressure on the piston due to the diverse areas; consequently there is an unequal strain on the crank shaft. Condensers separately arranged may not be practically incorrect with reference to the action of condensation; but when they are oppositely located, the necessary details for the discharge must be increased or doubled. The

double trunk engine may be said to be the most simple of all direct-acting engines; there is, however, an occasional outcry about the friction and the cooling surfaces of the trunks. Now, if the packing of the stuffing-boxes were evenly compressed, the former evil might be greatly reduced, while the latter fault could be mitigated by the use of high-pressure steam and expansion. We do not advocate the adoption of trunk engines in preference to any other type, but we point out the defective portions in each arrangement, and, when possible, suggest remedies. The arrangements of trunk engines are as follows:—The cylinders are laid side by side, the condensers being on the opposite side of the crank shaft—in fact, located as for single piston-rod engines. The merits of the trunk engine are—the great length of connecting rod, and the position of the same within a given space; these are matters of the highest importance, to say nothing of the absence of guides, blocks, and connections.

The next example for comparison is the anti-friction trunk engine, and, on further investigation, we find room for improvement as in the other types. In the present case the cylinders and condensers are arranged as for single piston-rod engines, the vital portion in this example being the trunk arrangement, which is as follows:—The front cover of the cylinder has cast on or secured to it a trunk, in length equivalent to the stroke of the engine plus the guide block; the piston and back end cover have a similar addition, clearance in each case being considered. The piston is further burdened with two piston rods, which transmit motion to a T head guide, the end of which is located in the smaller or front cover trunk. The connecting rod is attached to a pin, which vibrates in the brasses of the T guide. Each trunk is free from contact; consequently, no area is lost, as in the ordinary engines of this class. Now, this description may seem to portray a complicated arrangement and at the same time profusion of detail; but in practice this arrangement has been found equal to any we are acquainted with. The great faults existing in the present type are the heated surfaces for the guides and the necessary plurality of piston rods, with their attendant evils.

The systems of condensation as at present adopted for marine engines are of two kinds—*injection* and *surface*. When the former is used the air-pumps are generally double-acting, in order to reduce the space occupied, and at the same time maintain a good vacuum. There are many arrangements of condenser and pumps, each claiming a certain peculiarity of sufficient value to warrant their introduction. Surface condensers are simply tubes which the steam either surrounds or passes through. The circulating or cooling water is forced either by horizontal pumps worked direct from the steam pistons, or by a centrifugal pump driven by a separate engine. It is almost needless to add that, as with all portions of mechanism, surface condensers are subject in arrangement to the caprices of the makers. The position of the starting gear for marine screw engines is generally on the top of the condensers; but in some instances the wheel is at the side of the condenser, a locality to be preferred in vessels of war, to say nothing of the simplicity of the arrangement for raising and lowering the link. For economical reasons, expansion gear has lately been much in vogue in marine engineering, and in some instances with success. As with all the other details of the marine engine, plurality of arrangement exists in expansion gear, each type of valve being designed to accomplish a given result. We think more attention should be given to the prime mover of the valve rather than to the arrangement of the gear. In order to attain a correct action, inequality of motion must be imperative; also the neutrality of the steam on the valve must be preserved. The present systems of condensation and expansion, the latter especially, undoubtedly offer suggestions for improvement.

LONGITUDINAL STRENGTH OF SHIPS.

A GREAT deal has been written and many interesting experiments have been made upon the strengthening of ships of war longitudinally, but hitherto with very indifferent success, and we strongly advise our naval architects and mechanical men generally to turn their serious attention to this subject. It is unquestionably a matter of the greatest importance, more especially as ships have of late years been increased so much in length without any adequate provision being made as regards strength in the same direction. In another and kindred branch of mechanical science, viz., civil engineering, great attention has been paid to the question of obtaining the maximum strength with the minimum weight of material. Roofs and bridges are now made to any required span, and their lightness of construction, compared with their enormous resistance, approaches in some instances to the marvellous. Now, if we look at our ironclads, say, for instance, the "Warrior," the "Achilles," the "Bellerophon," and the "Agincourt," and note the enormous weight of iron of which they are composed as compared with their resisting qualities, and if we further proceed to compare them with the iron constructions of the civil engineer, we shall find the ships contrast very unfavourably as regards strength. In our impression of last week we gave the particulars of a patent taken out by Mr. John Hughes, of the Millwall Ironworks, for the strengthening of ships of war by the use of hollow stringers or girders running longitudinally or otherwise. Here we think the subject in question has been well met. The principle deserves careful attention, and we think other engineers would do well to follow in the inventor's steps. He has not only met the question of longitudinal strength, but has considered it in connection with the backing of the armour plates, and he appears to have accomplished this important point in a satisfactory manner. The principle also applies to the strengthening and backing of iron forts, cupolas, &c., and the object sought is the prevention of any serious damage to the ship or other structure from heavy projectiles, by the formation of a comparatively unyielding backing. It is certainly the very opposite of the wood backing, which adds nothing whatever to the strength whilst increasing the weight of the ship, and which, on being struck, yields to the blow, whereby a similar effect is produced to that of a cooper punching his hoop-iron on a block of wood.

NOTES ON NEW DISCOVERIES AND NEW APPLICATIONS OF SCIENCE.

Probable Introduction of Metallic Tungsten into Commerce—Matches without Phosphorus—Water-gas for the Lenoir Engine—Gun-cotton as a Motor of Machinery—Mineral Wealth of the Island of Sardinia—Californian Diamonds—The Quantity of Iron in Blood.

THERE seems some probability that metallic tungsten may shortly be introduced into commerce and the arts. This metal was first isolated in 1783, by two Spanish metallurgists, the brothers D'Elhujart. Two years previously Scheele had discovered in the Swedish mineral "tungsten" (so named on account of its density, "tung" meaning heavy and "sten" stone) a new acid, which Bergmann had immediately suspected to belong to a new metallic element. The brothers D'Elhujart found this same acid in the mineral "wolfram," and at length succeeded in separating the metal from it. Bergmann had suggested that the metal which he felt certain would be found in this acid should be called "tungsten," after the mineral in which the acid was first discovered; but the brothers D'Elhujart named it "wolfram," from the mineral from which they actually obtained it. It was subsequently proposed to

use for the new metal, instead of either of these names, that of Scheele, the distinguished chemist who had first detected the existence of tungstic acid, but "Berzelius set this suggestion aside, with the just remark that his countryman's immortality required no such artificial prop," and the names tungsten and wolfram are now both used, the metal being usually spoken of by the former name in England and France, and by the latter name in most other countries. The mineral which is called wolfram is a double tungstate of iron and manganese, and usually contains about seventy-five per cent. of tungstic acid. It is found in Cornwall, Devonshire, and Cumberland, in Bohemia, Saxony, and other parts of Germany, and also in France, Sweden, and South America, — England, Sweden, and Bohemia, being, however, the only countries, so far as is at present known, in which it occurs in any considerable quantity. Tungstic acid is reduced somewhat readily when heated in a current of hydrogen, but by this method the metal is obtained only as a dense dark-gray powder, exceedingly difficult of fusion. The brothers D'Elhujart did not succeed in fusing this powder, and there are upon record only two instances in which its fusion has been effected at all, and in those instances only very small quantities were fused. M. Riche fused a few grammes some years ago by means of a current from a battery of two hundred Bunsen-cells belonging to the Faculty of Sciences of Paris, and in the International Exhibition of 1862 was a very small button of tungsten which Mr. Frederick Versmann had obtained by subjecting about an ounce of the powder for three hours to the most intense heat he could obtain by means of a powerful gas furnace. He used for the purpose a crucible of freshly-burnt lime, having found that no graphite or Hessian crucible would stand the requisite heat. We now learn that a Swedish metallurgist has discovered a method of reducing tungsten by which he obtains it at once in a state of fusion, and that ingots of the pure metal weighing several pounds each are now on exhibition at Stockholm. We are informed, too, that the cost of obtaining tungsten by the new method does not exceed a few shillings per pound. If really obtainable thus cheaply, a metal which will bear exposure to so intense a heat without undergoing either fusion or oxidation must prove of incalculable value to certain of the arts, provided that the difficulties in the way of working it are not insuperable. With the exception of gold and platinum, tungsten is the heaviest metal yet known. Its specific gravity is about 18, that of gold being 19.36, and that of platinum 21.53.

We had occasion, some months ago, to draw attention to the terrible effect upon the health of the workmen engaged in the manufacture of the phosphorus which enters into the composition of the lucifer matches at present in use, and to mention that Dr. Hierpe, of Stockholm, was engaged in an earnest endeavour to discover some means of producing effective friction matches without the aid of a substance the whole of our supply of which ought to be devoted to the fertilisation of the soil, and which, when employed in the arts in the free state, is so frightfully injurious to those who are unfortunate enough to have to manipulate it. Dr. Hierpe has since patented, both in Sweden and some other continental countries, a composition for the tips of friction matches, consisting of a mixture of four to six parts of chlorate of potash with two parts of bicarbonate of potash, two parts of either peroxide of iron, protoxide of lead, or deutoxide of manganese, and three parts of glue or other cement. Matches tipped with this composition will only ignite when rubbed upon a surface specially prepared. For this igniting surface Dr. Hierpe uses a mixture of twenty parts of sulphide of antimony with two to four parts of bicarbonate of potash, four to six parts of either oxide of iron or oxide of lead, and from two to three parts of glue. The new matches are no more costly than the

old ones, and, besides having the advantage of their manufacture being innocuous, and not involving the consumption of any substance which ought not to be spared from other purposes, are immensely safer than our ordinary matches, since they will not ignite except when rubbed upon a composition prepared expressly for the purpose.

According to the Paris correspondent of the "Chemical News," M. Arbos, of that city, has made "a very ingenious addition to the Lenoir engine. That engine would often be extremely useful where gas could not be procured, and where to make coal-gas would be impracticable. In a very simple apparatus M. Arbos vaporises water, and passes the vapour over red hot charcoal dust. The mixture of carbonic acid, carbonic oxide, and hydrogen which is thus produced, is then passed through milk of lime to remove the first-mentioned of the three ingredients of the mixture, and the other two gases pass on to be mixed with air and exploded in the cylinder." Is not this a somewhat roundabout way of accomplishing the object in view? The gas-engine is very convenient, for purposes not requiring much power, in localities where coal-gas is laid on,—we notice that it is beginning to be used, for the propulsion of Mr. Camp's patented apparatus, by the enterprising *coiffeurs* who brush one's hair "by machinery,"—but where gas to work it can only be got by decomposing steam, the most economical plan would surely be to employ the steam as in the ordinary steam engine, instead of using it in the indirect manner suggested by M. Arbos.

A "gun-cotton engine," invented by M. Jules Gros, is favourably reported upon by "Les Mondes." No particulars of its construction are given, but we gather that it applies the force generated by the combustion of gun-cotton to the compression of atmospheric air, and then employs the air thus compressed to work a piston. Its principle is thus the same as that of a gunpowder engine devised by the writer of these "Notes" some five years ago.

The Italian journals are much occupied just now with some most important mineralogical discoveries which have lately been made in the Island of Sardinia. That island seems to be very rich in iron, lead, copper, and antimony. It also contains large beds of anthracite, of excellent quality, and a good deal of lignite capable of being turned to useful account. Of the valuable minerals thus abounding in the island, some of its lead ores are the only ones which have yet been worked.

"Californian diamonds" is a phrase with which our jewellers have been familiar for the last dozen years, but the stones so designated hitherto have not been really diamonds. Now, however, real diamonds are being found, in considerable quantity, in the beds of some of the Californian streams.

M. Pelouze has been making investigations respecting the quantity of iron contained in the blood of various animals. He finds that the blood of birds contains, per ten thousand parts by weight, from three to four parts of iron, and that the blood of man, and that of mammiferous animals generally, contains from five to six parts of iron per ten thousand parts of blood.

PROCESSES OF DISINFECTION.

"FOREWARNED is forearmed," says the old adage, and as we are now fully warned of the approach of pestilence, let it, if it does come with the terrible energy anticipated, at any rate find us armed. To promote this view we think it well to assist in giving publicity to the following memoranda on disinfection which have just been issued by the Privy Council.

1. For purposes of artificial disinfection, the agents which most commonly prove useful are—chloride of lime, quicklime, and Condy's manganic compounds. Metallic salts—especially perchloride of iron, sulphate of iron, and chloride of zinc, are, under some circumstances, applicable. In certain cases chlorine gas or sulphurous acid gas may advantageously be used; and, in

certain other cases, powdered charcoal or fresh earth.

3. If perchloride of iron or chloride of zinc be used the common concentrated solution may be diluted with eight or ten times its bulk of water. Sulphate of iron or chloride of lime may be used in the proportion of a pound to a gallon of water, taking care that the water completely dissolves the sulphate of iron, or has the chloride of lime thoroughly mixed with it. Cond's stronger fluid (red) may be diluted with fifty times its bulk of water; his weaker fluid (green) with thirty times its bulk of water. Where the matters requiring to be disinfected are matters having an offensive smell the disinfectant should be used till this smell has entirely ceased.

3. In the ordinary emptying of privies or cess-pools, use may be made of perchloride of iron or chloride of zinc, or of sulphate of iron. But where disease is present, it is best to use chloride of lime or Cond's fluid. Where it is desirable to disinfect, before throwing away, the evacuations from the bowels of persons suffering from certain diseases, the disinfectant should be put into the night-stool or bed-pan when about to be used by the patient.

4. Heaps of manure or of other filth, if it be impossible or inexpedient to remove them, should be covered to the depth of two or three inches with a layer of freshly-burnt vegetable charcoal in powder. Freshly-burnt lime may be used in the same way, but is less effectual than charcoal. If neither charcoal nor lime be at hand, the filth should be covered with a layer some inches thick of clean dry earth.

5. Earth, near dwellings, if it has become offensive or foul by the soaking of decaying animal or vegetable matter, should be treated on the same plan.

6. Drains and ditches are best treated with chloride of lime, or with Cond's fluid, or with perchloride of iron. A pound of good chloride of lime will generally well suffice to disinfect 1,000 gallons of running sewage; but, of course, the quantity of disinfectant required will depend upon the amount of filth in the fluid to be disinfected.

7. Linen and washing apparel requiring to be disinfected should without delay be set to soak in water containing per gallon about an ounce either of chloride of lime or of Cond's red fluid. The latter, as not being corrosive, is preferable. Or the articles in question may be plunged at once into boiling water, and afterwards when at wash be actually boiled in the washing water.

8. Woollens, bedding, or clothing, which cannot be washed, may be disinfected by exposure for two or more hours in chambers constructed for the purpose to a temperature of 210 deg. to 520 deg. Fahr.

9. For the disinfection of interiors of houses, the ceilings and walls should be washed with quick-lime water. The woodwork should be well cleansed with soap and water, and subsequently washed with a solution of chloride of lime, about two ounces to the gallon.

10. A room, no longer occupied, may be disinfected by sulphurous acid gas, or chlorine gas—the first by burning in the room an ounce or two of flowers of sulphur in a pipkin; the second, by setting in the room a dish containing a quarter of a pound of finely-powdered black oxide of manganese, over which is poured half a pint of muriatic acid, previously mixed with a quarter of a pint of water. In either case the doors, chimney, and windows of the room must be kept carefully closed during the process, which lasts for several hours.

DUBLIN WATERWORKS.

An excursion was made by the members of the Institution of Mechanical Engineers, which has held its annual meeting at Dublin, to the Vartny Waterworks. At Stillorgan Station two distributing reservoirs are nearly completed. The water area of these is 18 acres, their average depth 20ft., and they will contain about 90,000,000 gallons of water. The surface levels above the datum fixed for the city are 274ft. and 271ft. respectively. The principal feature of the embankments of these reservoirs, and of the larger one at Roundwood, is the puddle wall, by which the problem of providing an impervious barrier for the retention of an immense pressure of water is solved. This puddle wall forms a sort of central cone, against which the rest of

the embankment is heaped up. It is made of earth of a particular description, wrought up, while in a moist state, to a fine consistency, and then trodden or hardened down. Adjacent to the Stillorgan reservoirs is a large stone chamber, in which the water will be filtered through copper screens. The arrangement of the mains and valves will be such that the water may be introduced into this chamber, and thence to the mains leading to the city, either from the adjacent reservoirs or direct from the Vartny main. In the latter case the water, being less exposed, would be delivered colder and purer. From these reservoirs to the city there is a double line of 33-inch mains. By the use of "regulating valves," a violent rush of water arising from the bursting of pipes or any other accident between that point and the city is guarded against. The surface level of the lowest Stillorgan reservoir is 271ft. above the Ordnance datum. The level of the bottom of the Vartny river, which will be the bottom of the storage reservoir at Roundwood, is 632ft. above Ordnance datum, or 520ft. above the highest part of Dublin. If the water were brought direct to the city from that elevation, the pressure would be far too great. In order to reduce it a series of relieving tanks are in process of construction, by which a succession of levels are obtained, each lower than the other. The great reservoir at Roundwood has been formed by stretching an embankment 2,000ft. long across the extremity of a valley, through which the little rivulet called the Vartny flows down from the mountains to the sea at Wicklow harbour. The embankment is 28ft. wide at the top, and 320ft. at the base. It is now almost complete. Its greatest height is 66ft., and the greatest depth of the reservoir which it will form will be 60ft. The great outlet pipes of this reservoir are built into a tunnel of stone and brick, by which the embankment will be effectually protected from any such injury as that which occurred at the Sheffield reservoir. One of these pipes is 48in. in diameter, and will be chiefly used as a sluice for lowering water, whenever it may be in excess in the reservoir. The other, 33in. in diameter, is that through which the supply to the city will pass. The latter leads into a tower built within the precincts of the reservoir, and opening into the tower from without are pipes at different lengths to enable the supply to be taken at different levels, the exterior of the tower being submerged up to a certain height. By means of these pipes at different heights the slime of the lower water on the upper heated water will be avoided. The 33-inch pipe leads from the tower to a system of filtering beds and tanks on the other side of the embankment. The other larger pipe is connected with a by-wash, which will be used to let off any excess of water from the reservoir.

WORKING HEAVY GUNS.

THE shipment of the 12-ton 300-pounder gun on board the iron-cased frigate "Bellerophon," at Chatham Dockyard, was effected yesterday week, and it was got into position on the port side of the gun battery, where the machinery for working the gun has been erected. The arrangements having been completed, the first of the experimental trials took place on Saturday. The invention of the machinery is due to Mr. Reed, the Chief Constructor of the Navy, and its importance becomes apparent when it is stated that each of the 300-pounder guns which the "Bellerophon" will carry in her battery weighs, with its slides, carriages, &c., no less than 17 tons. To cast loose, manoeuvre, and train guns of this class while the vessel is pitching and rolling in a beam sea, by the ordinary appliances of manual labour, would be simply impossible. The machinery promises to effect a complete revolution in the system hitherto adopted of handling and training guns on board ships of war, the trials made proving that by the adoption of the machinery proposed some three or four men will be sufficient for working guns of the largest size possible to be placed on board our iron-clad vessels.

The machinery fitted on board the "Bellerophon" is exceedingly simple. On the gun-deck nothing is visible except an ordinary double wheel of metal, between four and five feet in diameter, formed like a steering wheel, and supported on a hollow standard containing the gearing-wheels that give motion to the machinery below. Even this wheel may be dispensed with, for a similar wheel is fitted on the lower deck underneath the battery, so that the whole of the machinery for working the gun can be placed

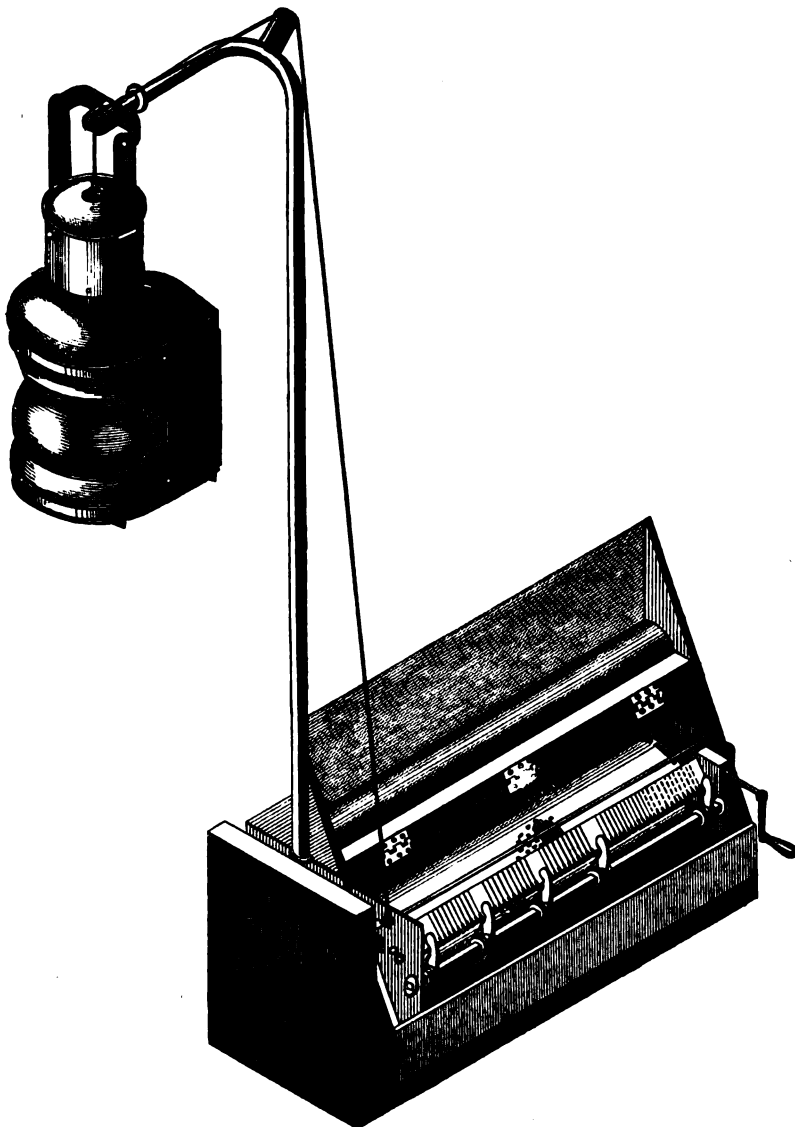
entirely away and out of the reach of injury, while the orders of those in charge of the gun could be transmitted by means of an ordinary voice tube. The guiding-wheels from one deck may ultimately be removed, or both may be retained, according as may seem desirable. Fitted below the beams of the gun-deck is a shaft turned by the above wheels, on which shaft is a powerful worm, or screw-thread, gearing into a worm-wheel. The latter is keyed on a short vertical shaft, which passes up through the floors of the main deck, and is furnished with a strong flat lever lying along the deck and underneath the slide. The lever is firmly connected with the slide by means of a very strong connecting pin, or bolt, working in a slot. This completes the machinery, which contains but few parts, and those of the simplest kind. The trials showed the advantage of mounting a slide on rollers on both sides, as in order to train it it was only necessary to turn the wheel placed on either deck, when the gun and carriage moved with the utmost readiness and precision. The instant the wheel was stopped the gun was brought to a standstill, just as in the case of guns mounted in a revolving turret, so that the nicest accuracy of aim may be obtained. On the whole being released, the gun is locked by the worm and worm-wheel, the pitch of which is so nicely adjusted that, while the slightest motion of the machinery will move the gun, no amount of rolling about can cause the gun to "fetch away," and set the machinery in motion. In a seaway only can mechanism of this nature be put to a satisfactory test, but judging from the obvious strength of the machinery employed in the "Bellerophon," there can be but little doubt that it will be perfectly practicable by this system to train even a much heavier gun than one of 12 tons at a broadside port with complete security at sea. It is scarcely possible for the discharge of the gun to affect the training machinery—as the play of the slide upon the bolt of the training lever is perfectly free. The trials were perfectly successful, and demonstrated the practicability of the invention. With four men at the wheel the gun was manoeuvred and trained with the utmost freedom and facility, a period of exactly one minute being all that was required to bring the gun over to a complete arc of a circle.

ARTIFICIAL STONE.

AN invention for certain improvements in the manufacture of artificial stone has been patented by Peter Armand Le Comte de Fontaine Moreau, of 4, South-street, Finsbury, London, which invention was communicated to him from abroad by Charles Pasquin, of Verdun, France. The invention consists in manufacturing artificial stones, either solid or hollow, with blocks or fragments of baked earth, or with a compound of cement and sand, or of plaster, or of any other like substances capable of being amalgamated and hardening as stone after being dried. To carry out the invention, on iron rods are fitted small hollow balls of the materials with which are to be produced the artificial stones, and of a sufficient resistance to support the pressure of the article to be moulded; these balls can also be made with canvas covered with tar and sprinkled with sand, cement, or plaster, or again made with any other substance capable of resisting the pressure of the stone to be moulded. These balls are separated one from the other at a convenient distance, in order to produce as many solid as hollow parts, and to obtain, by the balls crossing each other, a perfect regularity. The baked earth or composition to form the stone is then run into the moulds, and when the mass is sufficiently dried the rods are withdrawn from the balls composing the blocks. When the rods are taken off the blocks the cavities or holes through which they were passing are closed up with cement or with any other suitable substance. These artificial stones can be made of any form and dimensions, and receive any kind of ornament; and for this purpose, before they are dried, on one or more of their faces grooves or channels of a given section are prepared which are wider on their inside than on their outside surface. In these grooves or channels are set thin slabs or plates of stone, marble, stucco, or other ornaments resembling stone, marble, &c. The blocks made as herein described can be joined together if required with keypieces inserted in dovetail cuts, and afterwards cemented together. Sections of all kinds of forms and dimensions are thus united.

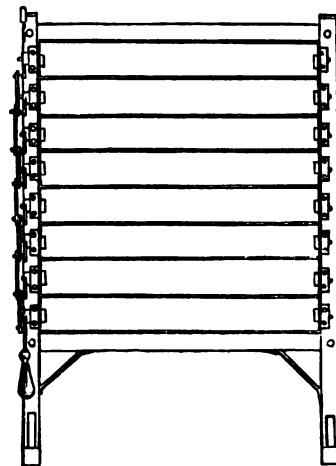
COLOMB'S PATENT FLASHING SIGNALS.

FIG. 1.



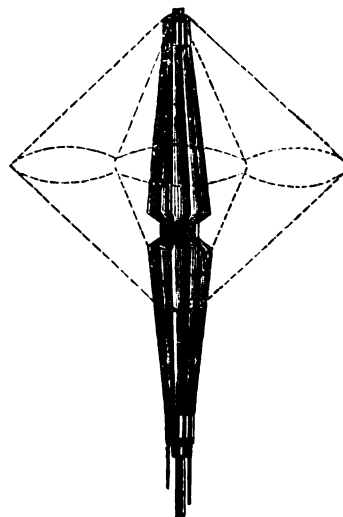
required; the smallest power is sufficient to render signals visible to the naked eye as far as the present royal naval night signals can be seen with an ordinary telescope. In the accompanying engraving fig. 1 is the apparatus complete

FIG. 4.



as employed for night signalling in the navy; fig. 2, apparatus employed for signalling by night in the army and boats; fig. 3, collapsible cone to be substituted for lamp when signalling by day with the apparatus shown in fig. 1; fig. 4, shutter apparatus as used for land service at

FIG. 5.



Shoeburyness; fig. 5, umbrella cone apparatus for day boat service; fig. 6, man with portable land service disc apparatus as used at Shoeburyness, and which consists of a simple disc, its flat representing a flash, and its edge an interval. The engraving shows the disc edgewise, repre-

FIG. 6.

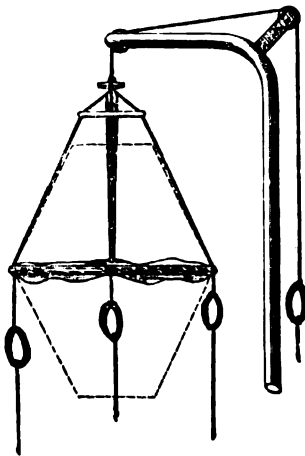
COLOMB'S PATENT FLASHING SIGNALS.

This system of night signals, the result of a large number of carefully-conducted experiments, appears to supply all that can be desired as an efficient, simple, and thoroughly practical solution of the problem so long sought by all maritime nations. It requires less skill and less knowledge than the ordinary flag signals in the daytime, and is also more rapid, and less liable to error. As one white light only is used, all questions relative to colour which have hitherto retarded progress in this direction are eliminated, and the full power of whatever light is

of the three or four composing a signal requires to be separately answered before the rest of the series can be proceeded with; in this system it is not so, as no answer is required before the purport of the signs telegraphed has been taken out of the signal book.

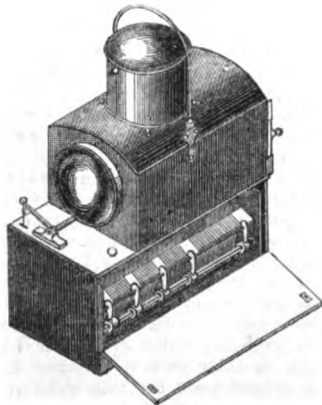
Owing to this peculiarity, the system is so closely assimilated to those in use with flags, that, as a general rule, whatever is the usage in signalling by day, may be also the usage in signalling by night. The apparatus complete for ships' use consists of—a fitted lamp, a signal box,

FIG. 3.



a gibbet for suspending the lamp, and six sockets, which are secured to the ship's side or hammock-rail, inboard, one on each bow, one on each beam, and one on each quarter. Lamps of different powers are used, according to the range

FIG. 2.



used is undiminished for range. The signals are made by means of flashes of light with intervals of darkness, and are so arranged that any signal, in any signal book, may be displayed, requiring no preparatory signal, and only one answer. In most other systems of night signals, each figure

sent 'an interval, the dotted position representing a flash. In clear weather, under

favourable circumstances, signals may by this means be transmitted to a distance of about five miles at the rate of one signal per minute.

TABLE OF FLASHES FOR ALL SIGNAL BOOKS.

1	6	
2	7	
3	8	
4	9	
5	0	
Preparative		&c.
Finish or Stop		&c.
General Answer		&c.

NOTE.—Two descriptions of flashes are used, the short and the long, the former being about half a second in duration, and the latter about a second and a half.

NAVAL SIGNAL BOOKS.	FLASHES.	MARRYATT'S.
Compass.....		
Pendants ...		
Numeral ...		Numeral.
Geographical		Rendezvous.
Horary		1 Dist. Pendt.
Interrogative		Telegraph.
Negative ...		2 Dist. Pendt.
List of Navy		Union Jack.
Alphabet ...		3 Dist. Pendt.

ALPHABET.

A 5	B 6	C 7	D 8	E 9	F 10	G 11
H 12	I 13	J 14	K 15	L 16	M 17	N 18
O 19	P 20	Q 21	R 22	S 23	T 24	U 25
V 26	W 27	X 28	Y 29	Z 30		

The mode in which signals are produced and transmitted is as follows:—In the interior of the lamp there is a semicylindrical shade, which falls by its own weight and completely covers the light; when raised it fully exposes it, and thus produces flashes of longer or shorter duration. This shade is connected with a lever in the signal box by means of the line. The signal box contains an instrument closely resembling a barrel organ, which is turned by means of the handle. The surface of the barrel is occupied by four series of pins and bars, each series representing the numeral flashes given in the preceding table. They are so arranged that after the first series has passed any point, a slight interval elapses before the next commences, and so on. Between the end of the fourth series and commencement of the first, there is an interval amounting to a fourth of the circumference of the barrel. The object of these intervals is to separate the figures from one another, and, as every signal is continuously repeated till answered, the long interval is required to distinguish the beginning and end of the series transmitted. Parallel to the barrel is an iron bar, upon which five keys travel horizontally; and above the bar there is a flat brass plate termed the director, on which four series of figures, from 1 to 0, are engraved, and slots placed opposite each figure for the reception of the keys. The revolution of the barrel causes the pins on its surface to operate on the keys, which transmit their motion to a lever and through the line to the lamp shade. It is, therefore, only necessary to place the keys in the slots corresponding to any required series of figures, and then to turn the handle continuously, to produce a revolving series of flashes, corresponding to the setting of the instrument, with unfailing accuracy, and with a legibility which surprises everyone who witnesses the operation.

It is evident that, as every signal is thus repeated three or four times per minute continuously, the accidental interruptions to signalling at sea, such as passing vessels, ropes, smoke, or sails, do not render the progress of night signals more uncertain than the same interruptions would in the daytime with flags. The advantages of the system are the following:—Great simplicity. Independence of individual skill. The use of but one light. The use of white light only, and consequently increased range. The use of the same signal books for day and night. Great power of combination and expansion, and great certainty. The system has successfully undergone long-continued trial in the Mediterranean and Channel squadrons, and has been most favourably reported on by large numbers of officers, who have thoroughly tested it under all circumstances. Her Majesty's ships are now supplied with the apparatus, including every ship in the Channel Squadron, in which command, for upwards of a year, the

old system of night signals has been entirely superseded by Commander Colomb's, with the most satisfactory results.

This system has been successfully used with the magneto-electric light, when rapid signalling at thirty miles has been carried on. With the lime light twenty-three miles, and with the oil lights now supplied to the Channel fleet, six miles has been obtained. The system possesses also the greatest range, and is the most rapid system known for daylight signals, for which purpose apparatus is provided, as shown in the engraving. It is also a perfect system in fog, and this is another important feature connected with this invention. For this purpose it is only required that the apparatus should be attached to a steamship's whistle, and it is then worked with the same result. For vessels not having steam power, the fog-horn takes the place of the steam-whistle. The weight of the whole apparatus is about 80lb. Each lamp supplied with the apparatus will be fitted to burn either candles or oil, both of which are manufactured on purpose for this system of night signals. Mr. W. Nunn, of 179, St. George-street East, London, is the sole agent and manufacturer for these signals, the invention of which is calculated to be of the greatest value, not only to our own, but to all other maritime nations.

THE CHEMISTRY OF WOOL.

By PROFESSOR ANDERSON.

At the opening of the Highland Agricultural Society's show at Inverness last week, Professor Anderson delivered a lecture on the chemistry of wool, and its management. The lecturer introduced the subject by alluding to the material influence exercised on the quality of the wool by the nature of the food supplied to the animal, and the influence of an abundant supply of food, and proceeded to remark that the chemical composition of the wool was extremely complex. As removed from the animal, it consists of two parts, the wool proper, that is, the fibre which is used by the manufacturer, and the "yolk," a peculiar substance, secreted by the glands of the skin by which the fibre is maintained and protected. In the process of scouring the wool, which is the first step in its manufacture, the greater part of the yolk is removed by means of water and other agents, and the fibre obtained in a more or less pure state. By careful treatment, the scientific chemist removes them entirely, and thus obtains the pure fibre, which then differs but little from the hair of other animals. The pure wool is itself a very complex substance. It contains a small quantity of fixed or mineral matters, which are left behind as an ash when it is burnt, and this contains a comparatively large quantity of silica, a substance found in extremely limited quantity in the animal body. Setting aside these substances the wool contains:—

Carbon	50.65
Hydrogen	7.03
Nitrogen	17.71
Sulphur	2.31
Oxygen	22.31
	100.00

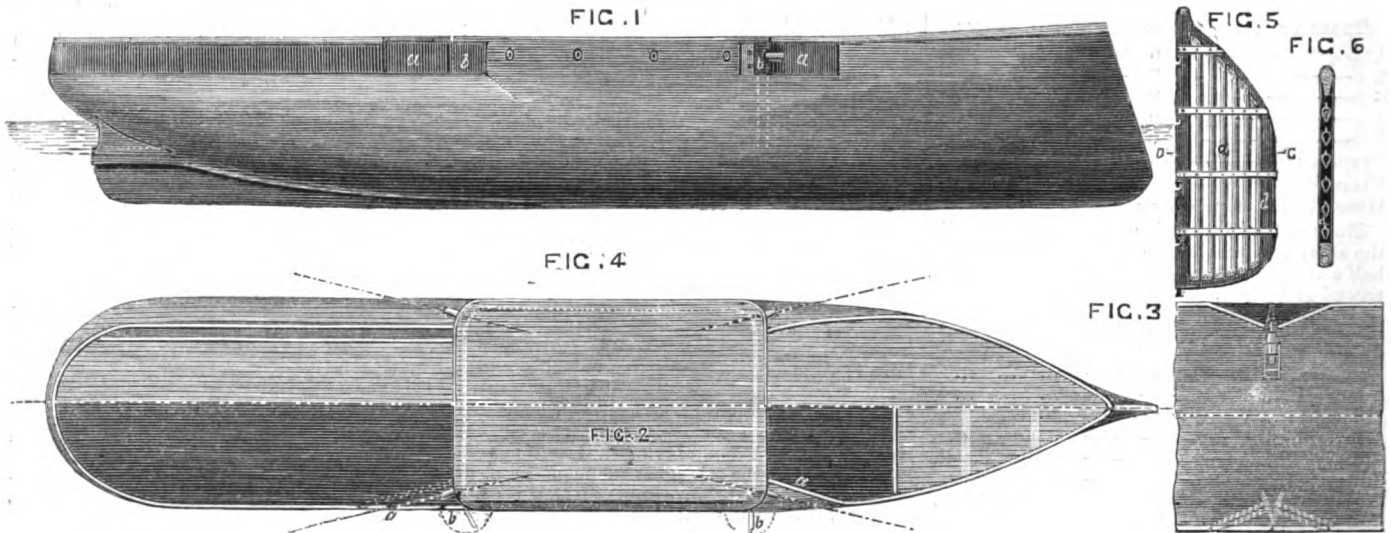
In composition, therefore, it does not materially differ from the nitrogenous constituents of other parts of the animal body. It is as rich in nitrogen as the gelatine of the bones, and surpasses every other animal substance in the proportion of sulphur it contains. The state in which the sulphur exists in it is peculiar. A very distinguished French chemist, M. Chevreul, supposed that it might be removed from it without injuring the quality of the fibre, but more recent experiments have disproved this view, but they show that a portion can be easily extracted, although the remainder resists all agents except those which completely destroy the fibre. So feebly is part of the sulphur retained that it is actually expelled when the wool is boiled with water, and even slowly escapes at ordinary temperatures; and this is why metallic, especially silver articles, become black on the surface when left for a long time in contact with it. A portion of the sulphur can be easily removed by alkalies, but a part resists their action, and from this difference in the condition in which it is present it is not improbable that the fibre of wool is composed of two different compounds; but chemists have not yet succeeded in devising a method by which they can be separated. This opinion derives support from the fact that the quantity of sulphur varies in different samples of wool, and appears to depend in some way on its quality. It has been found to vary from 3.4 per cent. down to 1.89, and one avows having found as little as 0.80, although this result appears to be doubtful. The largest proportion (3.4 per cent.) was found on the wool of a particular breed which feeds in moorlands in Germany, and which is extremely coarse and inferior in quality, while the lowest was from a particularly

fine wool. The quantity in ordinary wools is about 2.5 per cent., and from that to 2 per cent., as found in several samples of English wool, though the experimenter unfortunately omits to specify the breeds.

The "yolk," as it is called, which is mixed with the wool proper in the fleece, is still more complicated in its composition, and is a mixture of a variety of substances secreted by the oil and sweat glands of the skin. The proportion found in the fleece varies very greatly, sometimes amounting to nearly half the entire weight of the fleece, though in general it does not exceed 28 per cent. It appears that the yolk is largest in the finer varieties of wool, but on this point there appears to be room for further inquiry. The chemical nature of the yolk was first examined in the end of the last century by Vauquelin. Before his time, it had usually been thought to be of a fatty nature, but he showed that it was principally composed of a soap containing potash at its base, some carbonate of potash, small quantities of some other salts of potash, and an animal matter. More recently examined, the yolk was found to contain, in addition to those substances, two peculiar substances of a fatty nature, but differing from ordinary fats in being incapable of forming soaps with the alkalies. When wool is immersed in water a portion of the yolk, consisting of the matters excreted by the glands, rapidly dissolves, and the matter so taken up is rich in potash, and has to some extent the qualities of soap. As this accumulates in the water, it acquires a powerful detergent property, and causes the fatty matters of the wool, which are themselves insoluble in water, to enter into solution. In this way Chevreul found that 32 per cent. of the wool entered into solution, but it retained 8½ per cent. of fat, which could only be extracted from it by spirits of wine or by alkalies. These substances are removed from the wool in the process of scouring, first by the use of water, and afterwards by means of ammoniacal solution. Formerly urine, allowed to putrify until ammonia was produced in it, was employed for this purpose, but the facility of procuring the pure alkali has led to its being substituted, and in some cases soap is also used. The nature of the soluble matters of wool has undergone a further examination within the last few years by two Frenchmen, named Pnaumee and Eogelate, who have founded upon it an interesting branch of manufacture, peculiarly worthy the attention of the farmer, because it gives him some indication of what sheep are removing from the soil. According to their observations, average wool, when washed with water, yields to it 15 per cent. of its weight of yolk composed of a particular animal matter, and in union with potash, of which it contains about 33 per cent. According to the calculation a fleece weighing 6lb. must contain about 5oz. of potash, which are for ever removed from the soil, and have hitherto been entirely lost.

After some further remarks on this part of the subject, Professor Anderson proceeded:—Although the yolk must be considered as a refuse matter, its presence has an important influence on the quality of the fleece. When it is deficient the wool becomes harsh, more or less brittle, and unfit for the manufacture of the finer fabrics. A proper supply of it must therefore be of much importance, and can only be maintained by attending to the health of the animal, but unfortunately it is liable to be removed, and it is necessary to protect the animal as much as possible against the loss or to produce some substitute for it. In those localities where much rain falls, the yolk from its solubility is liable to be washed out of the fleece, and the quality of the wool is thereby affected. In these districts it is customary to resort to the practice of smearing the sheep with various mixtures. This process is usually stated to be employed for the purpose of protecting the sheep from the effects of cold and wet. For the former of these purposes, I think it must be admitted that it can bear no efficacy, for it seems impossible to conceive that the application of a small quantity of a greasy mixture to the skin can be of any use to an animal so well protected from cold. The next use of the smear is to destroy the tick and other parasites which infest the sheep, and by its oily nature to keep the wool in a soft condition. The mode of application of the regular old-fashioned smear was of the kind least suited to fulfil this object. The substance, always a greasy mixture, was rubbed into the skin instead of being applied to the wool. In practice, no doubt, what is applied to the skin gradually spreads itself through the wool, but in the meantime the thick oily coating is far from favourable to the proper performance of the functions of the skin, stopping up the pores and preventing exhalation from them, while the substances mixed with the grease occasionally produce irritation of the skin. In fact, the application of such substances to the skin appears to be a violation of the laws of physiology, although their application to the wool itself might possibly be defended on the principle of keeping it in a soft and elastic condition, and preventing it acquiring a harsh and coarse texture—in fact, acting as an artificial yolk when that is washed away by the rains. Of course, this opinion goes on the assumption

CONSTRUCTION OF SHIPS.



tion that the yolk really is washed out, but whether this happens, and to what extent, is a matter in regard to which there is no very definite information. I am inclined to think that the extent to which it occurs is overrated, for it must be remembered that the wool in its natural condition repels moisture, and it is probable that water can penetrate it in sufficient quantity to affect the yolk only under exceptional circumstances. That this must be the case I think derives confirmation from the fact that the process of smearing is gradually disappearing, and is being more and more supplanted by that of dipping, the object of which is merely to destroy the parasites.

Professor Anderson concluded by referring generally to the composition of the various smears and dips in use in different districts. These were either made up by the farmer from receipts which have been long in use and are well known, or they were manufactured by persons who make it their business. The oldest kinds of smear were mixtures of grease, butter, palm-oil, and other fatty matter, with wood, tar, or brown spirits-of-tar, and sometimes a little sulphur, rosin, or soap. To these, poisons were afterwards added to destroy the tick, those in most common use being arsenic, corrosive sublimate, and white hellebore. These materials were melted together and applied by separating the wool and rubbing the mixture well into the skin. Dips are mixtures of a similar kind, but generally containing a large quantity of soap in order to enable them to be mixed with water. They consist in many cases of soft soap, tallow, and oil, soda and tar, which are well mixed together, with the addition of some water, so as to give the whole a proper consistence, and the poisonous substance is stirred in while they are hot, or sometimes is added to the water in the first instance. Of course there are endless varieties in the nature of the mixture and the mode in which the materials are combined, each of which claims some superiority. In general the mixtures made by persons themselves were of a simple character, but he (Professor Anderson) had seen receipts given for their use in which almost all the materials enumerated were employed together.

CONSTRUCTION OF SHIPS.

In constructing ships and vessels of war, where more or less of the central portion of the body of a ship or vessel is formed with a battery carrying more or less guns on either side, it has in some vessels been the practice to form the forward and after ends of the battery by transverse bulkheads, in each of which, near the sides of the ship or vessel, but somewhat inboard, two ports or openings have been formed, in order that two guns may be fired through such ports or openings, and in such cases parts of the bulwarks have been hinged in such manner as to be moved inwards at the ends next the bulkheads. This invention, which has been patented by Captain Thomas Edward Symonds, of No. 10, Adam-street, Adelphi, consists in causing the forward and after transverse bulkheads at the ends of a ship's battery to be formed with curved or rounded parts where the bulkheads are connected to the sides of the ship or vessel, and in forming a port-hole or opening through each of such curved or rounded portions, by which and by rounding the sides of the ship or vessel beyond where the transverse bulkheads are connected to the sides of the ship or vessel, the guns may be fired through such port-holes or openings in lines parallel with the keel, and also through the same

port-holes at a considerable angle, approaching a right angle to the keel, whilst at the same time the guns may be depressed to a greater extent than guns similarly placed when firing through transverse bulkheads and over the deck, as heretofore constructed.

In single-deck ships, with or without a spar or light upper deck, or on the upper deck of frigates or other ships, this invention admits of two methods of constructing the bulwarks either fixed or movable, as shown in the engraving, so as to enable guns to be fired in the manner described at or nearly in a line with the keel. When movable bulwarks are employed, they are constructed in two or more parts, one portion being hinged from forward and the other from aft. In figs. 1 and 2 of the accompanying engraving is shown in elevation and part plan a single-deck ship with movable bulwarks *a a* and *b b* hinged from forward and aft, which, when required to be open for the purpose of firing the guns (as shown forward), that portion of the movable bulwark *a* is swung inboard clear of the port and abuts against the rounded face of the bulkhead which prevents it flying further inboard. The shorter portion of the bulwark *b*, also hinged, opens outwards against the ship's side, which in some cases may be recessed to receive it. At the after part of the vessel these hinged portions *a a* and *b b* are shown as closed and flush with the fixed bulwarks, and secured together and retained in their position by vertical and horizontal stanchions in the deck and the face of the bulkhead, or in any other convenient manner. In a flush-deck vessel this arrangement would admit of a top-gallant fore-castle, which may be either carried as far as the hinge of the foremost bulwark, or, if preferred, to the face of the armour-plated bulkhead, without interfering with the working of the gun.

In fig. 3 another method of fitting hinged bulwarks is shown applicable to gunboats, express boats, and other flush-deck vessels having central or pivot guns without armour, by which means the bulwarks may be opened inwards at a sufficient angle to form embrasures for the guns to be fired through at sea, and secured when there by drop bolts or other means; thus protection would be afforded to the gun's crew from grape or musketry, and the sea kept from washing over the deck. The hinged or movable bulwarks may be composed of iron or wood of convenient form, fitted with hinges formed of bolts and eyes, or in any other suitable manner, and with rollers or slides for traversing to and fro. Fig. 4 is a half plan of a vessel of the same class as that shown in figs. 1 and 2, exhibiting Captain Symonds' method of fitting ports in the rounded bulkheads with fixed bulwarks, a plan which he considers preferable to the foregoing, inasmuch as the gun will be always ready for action and the structure will be stronger. In this case a light upper or spar deck would be fitted forward and aft, which would afford increased accommodation without adding materially to the weight, and make the ship more generally seaworthy. The bulwark is brought to the inner side of the port at a suitable angle and curve, leaving sufficient space for the gun to be fired from the ports in the curved bulkhead, the side of the ship being rounded upwards and inwards externally as shown, so as to admit of the gun being fired at any suitable

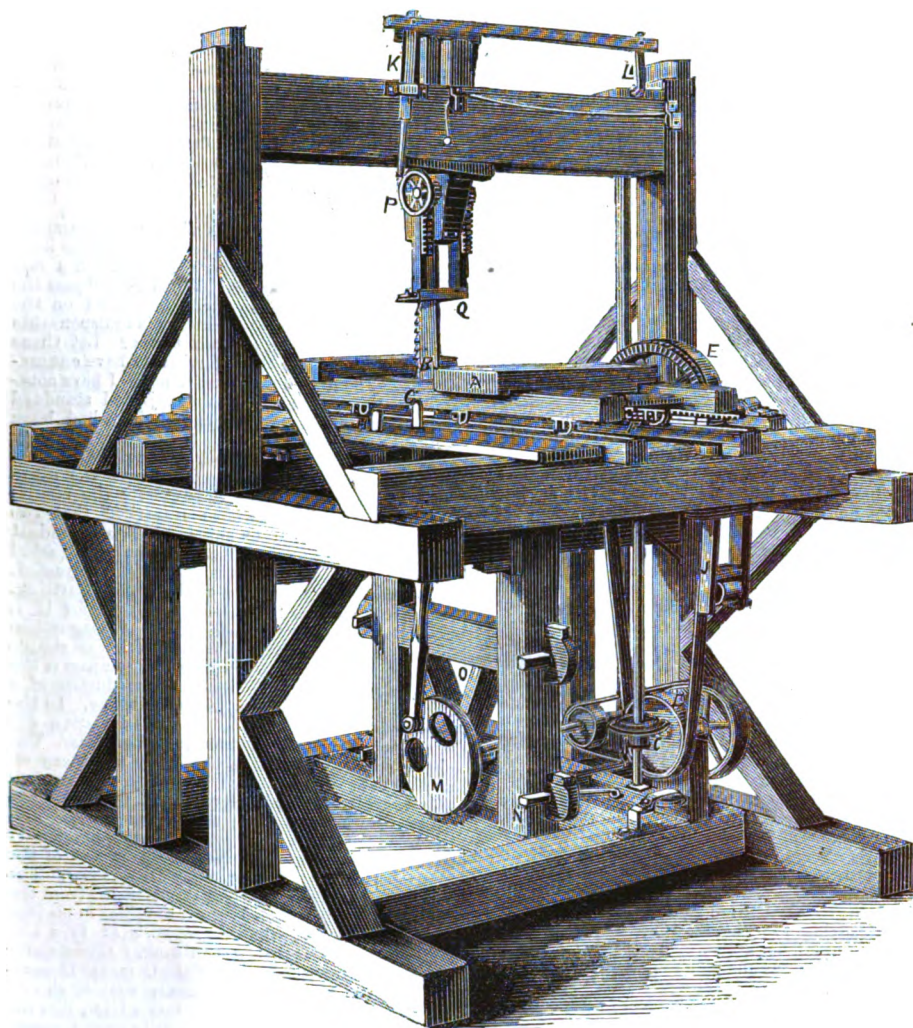
angle of depression when the ship is heeling over under canvas or at the top of the rolling motion when under sail or steam. The after ports in both these plans may be constructed in similar manner, the sides of the vessel being more or less rounded inwards abaft the bulkhead, the vertical bulwarks being placed at sufficient distance inboard clear of the port to allow the guns to be fired at or nearly in a line with the keel.

In the construction of frigates and ships of a larger class having guns on the main deck, instead of carrying the athwartship armour-plated bulkheads at right angles with the side, as is the ordinary practice, they are curved in a similar manner, and for the same purpose as previously described, the frames of the ship commencing next to the junction of the armour plating, with the side both forward and aft being curved inwards and upwards, or the frames may be varied to suit the particular purpose or form of vessel required, leaving a sufficient recess to admit of oval, circular, or other embrasures being pierced on either side of the bow and stern, so as to admit of the guns being fired in lines parallel with the keel at any required angle of depression. Captain Symonds further carries the armour-plated bulkhead in a similar manner to the upper deck, and extends it at a sufficient distance forward and aft in either case to protect the guns from flank fire, having a topgallant fore-castle and poop. By these means four protected guns may be fired at either end in a line with the keel, or even to cross their fire at about one hundred yards ahead or astern of the ship without altering the normal construction of the ship or vessel, except at the extremities in the manner indicated, at about ten feet above the water-line, which does not interfere with any existing arrangement, or impair efficiency, accommodation, or sea-going qualities. That part known as the head, which in ordinary ships is fitted externally, and therefore exposed, or when internally is an obstruction and nuisance, on the upper deck is arranged under the topgallant fore-castle, before the armour-plated bulkhead. The men are thus protected from the weather, out of sight, and being external to the bulkhead the nuisance is abated; the ducts for the urinals, &c., being led in the most convenient manner to facilitate their discharge. The ports or embrasures in both these methods may be of a form now adopted in the turret ships, or of other convenient form, they being intended for bow and stern attack, and not requiring a large arc for training.

In constructing the lower part of the body of a ship or vessel where longitudinal and other framing is introduced to form cells between the ribs or vertical frames, in place of the plates being of perforated or unperforated sheet iron, Captain Symonds constructs them of trellis or lattice bars, by which a greater relative longitudinal strength may be produced, as well as a lighter and more economical form of construction. This method is likewise employed in mortar vessels and gunboats that may be intended to carry the contemplated increased weight of ordnance in any way that may be most conducive to the required purpose.

Fig. 5 represents an improved plan of constructing rudders for ships and other vessels, by which less mechanical effort will be required to get them over to any desired angle, with a ma-

IMPROVED SAW MILL.



terial reduction of strain on the sternposts, rudder-head, and pintles. A series of vertical hollow bars *a* are shown framed together at the top and bottom in such manner that they are parallel to each other, and at a suitable distance apart. The bars *a* are shown as being vertical in position, but the arrangement may be somewhat varied. Fig. 6 is an enlarged section of fig. 5 taken on the line *CD*, the bars *a* being shown as formed in two parts and convex in section, but they may be otherwise formed, and be of concave or other suitable section, having angles more or less acute, and with two or more sides. In the example shown the angle formed by the two forward sides of each bar comes opposite to the angle formed by the two after sides of the bar next before it, so that a rudder thus constructed when "put over" the forward inclined surfaces of the bars will be more readily brought in a line at right angles with the keel than the central plane of the rudder, whilst the water acting on the inclined surfaces of the bars will be led through or escape between the openings *d*, and thus prevent any void or vacuity taking place on the side of the rudder opposite to that which for the time is put over. The bars *a* may be formed in manner described, either solid or hollow, of iron, wood, or other material.

IMPROVED SAW MILL.

VERY great advantages have ensued from dispensing with the heavy and cumbrous sash or slide formerly used in saw mills, and substituting therefor light but rigid guides, which answer the same purpose, but do not require a tithe of the power to stop and start them from a state of rest that the sash did. This saw mill, which was invented by Mr. D. C. Gibbs, of Fleetville, Pa., is exceedingly well designed in its several parts, and, at the same time, it is as simple and free from complexity in its details as such machinery can be. By examining the engraving it will be seen that it is substantial and conveniently arranged for access; every detail can be inspected or adjusted as required, with little trouble or waste of time. The details of the mill as given by the *Scientific American* are as follow:—The

timber to be cut is placed on the carriage *A*, which receives a regular and gradual feed or advancing motion toward the saw *B*, by means of gearing. This gearing consists of a friction wheel *C* below the frame and the driver *D*; the friction-wheel shaft has a small pinion on it, which is hidden by the frame. This pinion gears into the belt wheel *E* by the teeth on its edge, and thus (through the agency of another pinion *F*) advances the carriage in the manner previously described. After the saw has finished one cut the carriage is "gigged" back by throwing the friction wheel out of gear with its driver. This is done by moving the lever *G*, which releases a catch *H*, that held the pinion on the friction shaft in gear with the large wheel, and throws the pinion clear of the teeth in it. By grasping the cord *I*, the idler pulley *J* is thrown into contact with the belt, forcing it to hug the wheel *E*, and thus return the carriage rapidly in the contrary direction from that in which the feed gear moved it.

The amount of feed is varied by moving the friction wheel up on its shaft, so as to be nearer to, or farther from, the centre of the driver. This movement is accomplished by the rods *K* and *L*. This latter rigging is always within reach of the sawyer, and can be adjusted instantly. The black edge on the friction wheel in the engraving indicates a band of rubber, which is confined by discs of metal, thus obtaining a friction wheel which is certain to adhere under all ordinary circumstances. The crank shaft, or wheel *M*, can be adjusted laterally and vertically by keys *N*, in the timbers on which the bearings are placed, and the main bearing is further strongly braced by the timber *O*, above it. The crosshead is guided at the bottom by bars, which are not shown, and at the upper end by other guides—the back of which only appears. Both of these crossheads are simply constructed to avoid excessive friction and weight on the guides under the rapid motion they are subjected to. The gearing *P* on the upper part of the frame serves to adjust the foot *Q*, by which the timber is held down when being cut. These several parts thus arranged are well adapted for their work, and are free from the objections which attach to complex saw mills.

THE "DUNDERBERG."

CONSIDERABLE excitement has been caused on the other side of the Atlantic by the launch of the "Dunderberg," an armour-plated vessel which the American journals describe as the largest and most formidable vessel of war ever floated. We will endeavour to divest the accounts which reach us of their sensational character, and, reducing them to matter-of-fact proportions, to give a plain description of this big ship. The "Dunderberg" has been built at, and on the 22nd ult. was launched from, the yard of Mr. W. H. Webb, a builder of high repute in America. The ship has been built under the general superintendence of Rear-Admiral F. H. Gregory, U.S.N. Her dimensions, and the dimensions of her engines, boilers, and fittings of various kinds, are as follow:—Extreme length, 380ft. 4in.; extreme beam, 72ft. 10in.; depth of main hold, 22ft. 7in.; height of casemate, 7ft. 9in.; length of ram, 50ft.; draught when ready for sea, 21ft.; displacement, 7,000 tons; tonnage, 5,090 tons; weight of iron armour, 1,000 tons; cylinders (two), each 100in.; stroke of pistons, 45in. Boilers:—Six main and two donkey; depth of boilers, 13ft.; height of boilers, 17ft. 6in.; front of boilers, 21ft. 5in.; weight of boilers, 450 tons; boiler surface, 30,000 ft.; grate surface, 1,200ft.; condenser surface, 12,000 square feet; diameter of propeller, 21ft.; pitch of propeller, 27ft. to 30ft.; weight of propeller, 34,580lb.; capacity of coal bunkers, 1,000 tons; actual horse power, 5,000 horse; nominal horse power, 1,500 horse.

The builder has taken care to render the vessel safe in a sea-way, and safe against an enemy. For the latter purpose the advantages of an angular surface have been increased by a mass of timber and the protective powers of 4½-inch solid armour plating. The ship will resemble, when afloat, a huge fort embowered for a score of the heaviest ordnance. The bottom of the vessel is flat, the sides angular, extremely sharp, and surmounted by a casemate, in which are to be placed sixteen guns, although it is pierced for twenty-one. The hull is built in layers of square logs, securely bolted together, leaving no openings between them, and is caulked inside as well as out. This massive structure is strongly trussed with diagonal braces of iron, fastened on the inside of the solid frame, strengthening her in such a manner that it seems almost impossible that she could be damaged by any ordinary disaster. The bulkheads are so placed as in effect to make the "Dunderberg" a double vessel, as they run not only transversely but longitudinally, inclosing the engines. The ram is a portion of the ship itself, and is not bolted on or secured, as is usual in most vessels intended for ramming purposes. It is the bow of the vessel fashioned into a huge beak. To form this ram the vessel is a solid mass of timber from her stem, extending back fifty feet, rendering it impossible for any shock to break it off and thus endanger the vessel. This ram is armoured with a wrought-iron jacket or frontpiece, to protect it not only from shot but from abrasion.

The side armour consists of plates from 12ft. to 15ft. in length, by 3ft. in width, and 3½in. thick; they are screw-bolted to the armour cushion by 1½in. bolts. The plates are placed vertically, and not horizontally, as is the case with the iron-clad vessels of Europe. The casemate is covered with armour 4½in. in thickness, also placed vertically on the sloping sides, and screw-bolted with 1½in. bolts, which enter the woodwork to the depth of 18in. None of these fastenings pass through the sides; so that there will be no nuts or bolts flying about the deck in action. The plates are 38in. in width, and are over 8ft. long. The casemate is constructed of square logs, each 1ft. in thickness, built up to the height of 7ft., and covered over with a bomb-proof deck, on which it was originally intended to place two turrets similar to those used on board of the monitors. The casemate will contain twelve to fourteen 11-inch Dahlgren, and four 15-inch Rodman smooth-bore guns; making the heaviest armament, for the number of guns, ever placed on the deck of any vessel. The "Dunderberg" contract price was 1,400,000 dol.—the same as the "Dictator," which carries only two 15-inch guns. The "Dunderberg" has double the number of 15-inch guns, and twelve or fourteen (as the case may be) more 11-inch guns than the great ocean ram of the monitor style. She will be propelled by two horizontal back-acting condensing engines of 5,000 actual horse power, built by Messrs. John Roach and Son, of New York.

THE PEACE JUBILEE.

We gave last week an outline of the progress and objects of the Anglo-French Exhibition of skilled labour in the Crystal Palace. We have now to record the opening, which took place on Monday last with due ceremony, the chair being occupied by Mr. Herbert Maule. Mr. Coningsby, the secretary, said that the Exhibition was as much as anything an experiment; and that next year he hoped not only that the scheme as it at present stood would be enlarged, but that it might extend itself to an Anglo-French-American Exhibition. One of the French secretaries, M. Edmond Potonie, editor of *L'Association*, observed that he hoped an Englishman would soon be talking to a French audience on the same subject; and that a world-wide extension of their idea might set many nations talking to one another. He bore testimony to the heartiness with which the proposal of this Exhibition had been received by the workmen of Paris, although time had not permitted them to combine so powerfully, for a practical demonstration, as could have been wished. Conquerors, M. Potonie remarked, have always supposed, and have acted on the supposition, that progress is to be checked by force; but working men are now telling the world that progress is to be accomplished by persuasion.

The display occupies one of the galleries of the nave, approached by the stairs on the north of the Handel Orchestra. It is not yet complete, several important contributions being expected from Paris, and a second and enlarged edition of the catalogue being promised. On looking a little closer into the matter we do not find that the Exhibition has been carried out with that exclusiveness as regards working men which the programme led us to infer would be observed. For instance, there are at present fifty-three French exhibitors, thirty-five of whom are Parisian, and not all of these belonging to the artisan class. A countless exhibits an improved method of winding silk from cocoons; and a count sends capital photographs from Bordeaux. But whatever may be the merits or shortcomings of this Exhibition, the class identified with the enterprise are, on the whole, undoubtedly entitled to great credit for independence, energy, and unanimity of action, and deserve that every success should attend their interesting collection.

COMPASSES AND ADJUSTING MAGNETS.*

From the day that the Astronomer Royal first solved the difficult problem of rendering the compasses of iron ships manageable in a constant magnetic latitude, the subject has had no improvement. No dwarf has stood on the giant's shoulders to contribute his mite to it, although many have attempted it. If, however, there are certain subjects in all sciences which do not bear improvement, this, perhaps, is one. Iron shipbuilding at its commencement, like many other wonderful innovations of modern times, was at first looked on with mistrust. It seemed to be a toy which for a season would engage the minds of scientific men, and probably lighten the pockets of the speculative, before it passed away for a future generation to revive as something new. The most sanguine supporters of the art could not at that time have looked forward to such a wonderful development of their favourite theory as the last few years have produced in this and other European countries. It is no brief period since our large fleet of magnificent merchant steamers have been built wholly of iron, and the new paddle boats of the great mail companies are now being formed of the same material. Even the beautifully-formed yachts of this country are being invaded by it, and the once familiar Indiaman of British oak will soon be looked on as a novelty. Nature has indeed been liberal to us in solving a problem which had caused anxiety to more than one generation of statesmen, when dwelling on the means which we could command to uphold our maritime superiority, so rudely threatened, by the vast consumption of oak in this kingdom and that of the teak forests of India. The new material for the ship has no doubt been provided; but the compass which is to guide her has been forgotten. Perhaps the apathy regarding this indispensable monitor in iron ships may be attributed to two causes, viz., the influence of a few talented men, who, having mastered the subject to their own satisfaction, therefore think that nothing else remains to be done; and, again, to the ignorant multitude which infer that when once properly adjusted the compasses of an iron ship are as reliable as those in one of wood. Of the two parties, the first named are greatly to be blamed for treating so important a subject too lightly.

After many years of practical experience I have come to the conclusion that the compasses of an iron ship in thick weather, at the end of a long voyage, on nearing land, in the absence of recent observations, are always a source of uneasiness. Furthermore, I am always more doubtful of the compensated than of the non-compensated. Mr. Towson, in his interesting work, differs from this and says, "It remains yet to be proved that in a single instance on board an iron ship any magnet has lost more of its magnetic force than the ship." He quotes the dipping needle of the Liverpool Compass Committee in support of this argument; but, apart from all other causes, there is a vast difference between an instrument on which neither skill nor money was spared and the magnets supplied by contract to the merchant service. I do not so much challenge the theory as it might be, but as it is. In another page, however, he warns seamen not to steer within a point in running for the land,—an impossibility in many parts of the globe, especially in the China sea or any archipelago. The following anecdote will show the strange views entertained with regard to compasses by men who ought to know better than to put such an important instrument on board by competitive contract. "Would you believe it?" remarked a gentleman who had superintended the building of a steamship which had cost sixty thousand pounds, "that I got the compasses put on board for eight pounds less than Mr. ——— asked!" mentioning the head of a well-known firm. Either the compasses or the captain were out shortly afterwards, for the ship was hove to at all night in a channel through which a good navigator provided with proper instruments would have taken any steamer with her compasses in hand. The balance of the eight pounds was sadly reduced when daylight dawned. A short time since I did meet with a remarkable change of direction in an adjusted compass, and I am certain it arose from the loss of power in the adjusting magnet, and not from a change in the ship's magnetism. Had the latter been the case the remaining compasses would have been affected in some degree; but, although one was only a few feet distant, no change was perceptible. The following is the history of this change. Returning from an Atlantic voyage in the end of November, I found the weather more than ordinarily obscure, even for that dark season of the year. For six days I had not been able to take either azimuth or amplitude, and, when passing the Tuskar, in a heavy S.W. gale, with the usual accompaniments of rain and fog, I felt rather anxious about the correctness of the compasses. Ascertaining, however, that the steering and standard were alike (that on the bridge differing a point), I steered by the former, and made the South Stack Light in a sudden clear about eight miles on the starboard bow. The run showed a small westerly deviation for both compasses. My next homeward passage was in March, with easterly winds and unusually bright and clear weather. When steaming along the southern coast of Ireland one fine evening at sunset, the ship's head was put on the N.E. by E. point (the course from the Tuskar to the South Stack), and an excellent amplitude taken. On working out the result I was surprised to find that, in lieu of the trifling westerly deviation of the preceding voyage, it now amounted to fifteen degrees easterly. I thought it possible that I might have made an error somewhere, but at sunrise next morning a second observation confirmed the first. The compasses, which were all supposed to be correct, then stood as follows, viz.,—steering N.E. & N., standard N.E. by E., bridge E.N.E. The two former were alike only three months before. Had the weather been thick the position would have been embarrassing. Three compasses on board and each differing seriously from the others! Who can be surprised at men being sometimes "hopelessly puzzled" by such a combination of doubts. No reasoning could make me believe that it was the ship's magnetism which had been affected on this occasion. It is true that the compass was only twelve feet from the stern, and might probably be in some measure altered by the vertical iron frames there, but never to the alarming amount of seventeen degrees. In all iron ships the combination of iron masts and bulkheads will always in some degree be difficult to guard against, especially as the spot is not selected by experiment whereon the compass is to be placed, as the adjuster feels certain of being able to "lick it into shape." But he does not change hemispheres in the vessel: that is the captain's affair, not his. Similar changes to mine may happen in any ship. The result is that numbers are annually wrecked, and others have fearfully narrow escapes. In my opinion, it is this loss of power in the magnet which leads so many vessels on the iron-bound coast of France, and the more dreaded Arklow and Blackwater Banks, in the Irish Channel. But no such terrible warnings appear to be sufficiently powerful to provoke a searching inquiry into the cause. In the majority of cases neglect of the lead is the reason assigned. I am not one to undervalue the services of such a monitor, but in the present scientific age seamen have a right to expect that their instruments shall be such as not to require constant resort to what is, in many parts of the world, an indifferent guide. Even when aided

by the splendid Admiralty charts of the Irish Sea, so neatly sounded off in squares, there is a difficulty in finding a ship's position if the compass has misled, not so much from the similarity of the soundings as from the utter impossibility, on a dark and stormy winter's night, of obtaining an accurate cast in a ship hove to under canvas. A well-conditioned man-of-war, with her numerous and highly-trained crew, finds it no easy task to do so; how much more difficult is it, then, for the indifferently-manned merchant ship, whose crew, in working up or down Channel, are taxed to the utmost limit of their strength?

Again, there are thousands of merchant seamen who have but an indifferent knowledge of the lead. One good leadman in a watch is considered a fair allowance in most steamers. When such "pass the line along," what reliance can be placed on the result, especially as great accuracy is indispensable to fix a ship's position at such times? Let those who think lightly of the difficulties I have enumerated test them by actual experience. I have commanded two steamships with unadjusted standard compasses, and after their magnetic lines had been well shaken down by a little rough weather, they gave me no trouble. Indeed, it was highly interesting to remark, when steaming over the same track voyage after voyage, how closely the results approximated. I have also remarked that the changes of deviation on shifting the geographical position were more uniform in the unadjusted compass than in those which were adjusted. Indeed some of the latter at times were startling. In my opinion theory will confirm this, for it is natural to suppose that the action of magnetism will be guided by different laws in acting on simple and compound bodies. The adjusted compass is the latter, and its magnet, like the introduction of a third body in gravitation, alters the law. In the standards referred to, the greatest deviation did not equal the change in the adjusted compass. The binnacles were placed on the spots which experiments had shown to be comparatively neutral points, with the cards elevated five feet above the decks. Both ships were stiff under canvas, and the trifling list they sometimes had never practically affected the deviation. Nearly the whole of the binnacles of the merchant navy are too low. The cards are seldom more than thirty inches from the deck beams. Now this is much too close in an iron ship, considering what a network of ties and stringers there is below the deck. Commander Evans, the Superintendent of the Compass Department of the Navy, says distinctly that it should not be less than five feet; but this advice, like the silent offer of the correct Admiralty charts, passes unheeded by the many, because interested men have an object in keeping the shipowner and shipmaster in ignorance on these important points, or, like Othello, their occupation is gone. But it is quite time that both were brought more rigidly under official scrutiny. A writer in the *Times* recently showed that a private publisher's chart of the North Atlantic for 1863 was twelve degrees in error. We punish shopkeepers for selling adulterated articles of food, as being prejudicial to health, but openly permit the vending of false charts, on which the lives of thousands are annually staked. I presume that the Nautical Assessors of the Board of Trade are the people under whose cognisance this should fall. But these gentlemen appear to rest satisfied with punishing the unfortunate skippers who are brought before their tribunal, without making any suggestions as to the means of avoiding accidents. All laws should tend to this end, or they are not beneficial to the public weal.

As the editor of the "*Nautical Magazine*" remarks, ships must still be navigated, as of old, by the aid of the "sun, moon, and stars." Unceasing attention to this simple yet sensible advice can alone make the navigator in an iron ship feel satisfied with the compasses. The means are within the grasp of the most uneducated, if they choose to give their attention to the subject. Let it be given, and, apart from the satisfaction it always renders to the observer, it will, should he get into difficulty, be a consolation under his trouble, by assuring him that all the skill and prudence he possessed were unequal to ward off a disaster which occurred from circumstances beyond his control or judgment. There are now various methods published for shortening the calculations of azimuths and amplitudes. I admit their utility: still a good observation always repays the trouble of working it. The difficulty lies in the means of taking, not working it. I never rely on an azimuth when an amplitude is to be had. It is well known that the errors of observation in the former are often considerable, owing to the inclination of the card. An inventor in any form deserves well of his kind, for he lessens in some degree the toils of his fellow man, or adds to his happiness and wealth. When such invention (a lifeboat, for instance) increases his safety, it is of more than ordinary value, and should be appreciated accordingly; but even the most gifted among men are apt at times to fall into error when speaking of the child of their genius.

* "*Mercator*" in the "*Nautical Magazine*" for August, 1865.

This pardonable fault leads to disappointment, and causes many an important invention to be discarded as useless, because its merits were not equal to the expectations formed by a perusal of the advertisement. To read the many which are now blazoned forth on books, instruments, and diagrams, an amateur would imagine that none save a fool could possibly fall into error, with so many guides to assist him (forgetting that there are Holloways in every profession); but, from causes which I have mentioned, the wisest and most careful will be at times misled. A man-of-war does not run so much risk as a merchant ship: in thick weather her head is coolly put off shore, and no questions are asked. The other can only in extreme cases afford to comply with this precaution. The ship is a link in a certain chain which cannot well be spared. Disaster sometimes follows, but those who are inclined to judge such actions hardly should remember that it is this feeling of anxious and determined energy which has made England the greatest maritime nation of the world. Were every risk carefully weighed, many of our peaceful triumphs on the ocean would cease. A Cunard steamer could not often run from New York to Cork in eight days, for example; she must be hove to in fog, and allowed on dark nights. In these days of competition and free trade, when all the people of the earth who possess a seaboard are launching forth to meet us on the great highway of commerce, we should rather try to foster and encourage the skill of our seamen by giving them the best instruments which this scientific age can produce, than to damp it by punishment for ordinary accidents. The first and most important among these is the compass. A chronometer is as dust in the balance, in comparison,—because, in most cases, its results are only relied on when danger is not apprehended. Further, its errors are so easily checked by anyone tolerably familiar with its use that we rarely hear of an accident from this cause.

A NEW EXPLOSIVE SUBSTANCE.

GLYCERINE, as we all know, is the sweet principle of oil, and is extensively used for purposes of the toilet, but it has now received an application of rather an unexpected nature. *Galignani* states that in 1847, a pupil of M. Pelouze's, M. Sobrero, discovered that glycerine, when treated with nitric acid, was converted into a highly explosive substance, which he called nitro-glycerine. It is oily, heavier than water, soluble in alcohol and ether, and acts so powerfully on the nervous system that a single drop placed on the tip of the tongue will cause a violent headache that will last for several hours. This liquid seems to have been almost forgotten by chemists, and it is only now that Mr. Nobel, a Swedish engineer, has succeeded in applying it to a very important branch of his art, viz., blasting. From a paper addressed by him to the Academy of Sciences, we learn that the chief advantage which this substance, composed of one part of glycerine and three of nitric acid, possesses, is that it requires a much smaller hole or chamber than gunpowder does, the strength of the latter being scarcely one-tenth of the former. Hence the miner's work, which, according to the hardness of the rock, represents from 5 to 20 times the price of the gunpowder used, is so short that the cost of blasting is often reduced by 50 per cent. The process is very easy. If the chamber of the mine present fissures it must first be lined with clay to make it watertight; this done, the nitro-glycerine is poured in and water after it, which, being the lighter liquid, remains at the top. A slow match, with a well-charged percussion cap at one end, is then introduced into the nitro-glycerine. The mine may then be sprung by lighting the match, there being no need of tamping. On 7th June last three experiments were made with this new compound in the open part of the tin mines of Altenburg, in Saxony. In one of these a chamber 34 millimetres in diameter was made perpendicularly in a dolomitic rock 60ft. in length, and at a distance of 14ft. from its extremity, which was nearly vertical. At a depth of 8ft. a vault filled with clay was found, in consequence of which the bottom of the hole was tamped, leaving a depth of 7ft. One litre and a half of nitro-glycerine was then poured in, it occupied 5ft.; a match and stopper were then applied as stated, and the mine sprung. The effect was so enormous as to produce a fissure 50ft. in length and another of 20ft.; the total effect has not yet been ascertained, because it will require several small blasts to break the blocks that have been partially detached by this.

Correspondence.

SYMONDS v. FOXWELL.

TO THE EDITOR OF THE "MECHANICS' MAGAZINE." SIR,—My attention has been called to an article which appeared in your paper of the 7th ult., commenting upon the case of Symonds v. Foxwell, tried in the Court of Queen's Bench on the 3rd ult. As the article contains many inaccurate statements, upon which you found remarks calculated to do me

an injury, I must request you to insert in a prominent part of your next number a correction of them. The facts of the case were shortly these:—Mr. Roberts for a year before being applied to on behalf of Mr. Foxwell, had resided in Wales for the benefit of his health, and had broken up his establishment in London, and only assisted in the business by advising upon such matters as I submitted to him. When Mr. Foxwell's agent called upon me to ask Mr. Roberts's assistance, I fully explained this to him, and he was made well aware that if Mr. Roberts came up to town it would be solely for Mr. Foxwell's benefit, and that he would expect his full remuneration. Unfortunately, I omitted to make a special contract that Mr. Roberts's expenses should be paid, in addition to his usual fees; but his opinion was considered of the utmost importance, and it was understood at the time that he would be handsomely remunerated if he would come to town.

After Mr. Roberts's death I made out the account from his own memoranda and from accounts he had rendered on similar occasions, and I believe, for a gentleman in Mr. Roberts's position in the profession, the charges were all strictly moderate. The Lord Chief Justice was of opinion that, in the absence of any special contract, the charge for the expenses to London and residence in town could not be enforced, Mr. Roberts having an office in London, and, therefore, professedly carrying on business here. This was merely a technical point, and of course, if I had been aware of it, I should have taken the precaution of binding Mr. Foxwell to make the payment, which he would then readily have done. I will now point out the errors in your article of which I complain, adding my remarks in explanation:—

STATEMENT IN ARTICLE.

The action related to the charges to which a professional man was entitled when called upon to give evidence in a court of law.

The amount claimed was £124; the sum paid into court was £50; the jury gave a verdict for £68 6s.

The original demand was therefore excessive, and knowing what we do of the late Mr. Roberts's character, we believe he would not have been a party to the unjust demand which was made in his name.

Take, for instance, the first item in the bill of charges,—

"To receiving instructions on the case, and reading of specifications and other documents relating thereto, £15 15s."

Take another item,—

"To letter from Mr. Wickens, enclosing copy of the Lord Chancellor's opinion on the above case, and reading same, £10 10s."

Every honest man must say that these charges are not only unjust, but absurd, and we think that a slight has been cast on the bright reputation of Mr. Roberts by such demands being made in the name of his surviving partner.

REMARKS IN EXPLANATION.

The action was for services as a consulting engineer, and for loss of time in court.

Mr. Roberts was very unwell at the time, and he left his home and came to town solely for Mr. Foxwell's case.

He was put to an expense of about £30 for travelling, hotel bills, and lodgings, whilst his services were required, and deducting this and the extra costs from the £68 15s. given by the jury, his services will be miserably paid for.

He was in town for seven weeks when his death took place, and the excitement and fatigue which he underwent materially hastened his end.

The bill was made out from Mr. Roberts's own memoranda and from his charges on similar occasions; and as regards the items you quote, you will see by reference to the enclosed, which is an exact copy of the account rendered, and of the particulars of demand in the action, that you have greatly misstated them.

The first item should be,—To receiving instructions in the case, and reading seven specifications and other documents relating thereto, £15 15s.

This occupied Mr. Roberts for three days, the case being a very complicated one, and it is usual to charge £2 2s. for reading a specification.—Mr. Roberts invariably did so.

In the next item, instead of £10 10s. being charged, no charge whatever is made. The £10 10s. being charged against the following item; your remarks, therefore, on this point entirely fail.

It does not always follow, when in a court of law less is recovered than the amount claimed, that therefore the original demand was unreasonable or unjust. In this case it was clearly shown by the evidence of several of the most eminent men in the profession that the charges were fair and reasonable, and such as are usually made; and had Mr. Roberts been alive, he would, I am sure, have been the first to resist any attempt to depreciate the value of professional services. I may add, in conclusion, that the action was brought solely for the benefit of the daughter of the late Mr. Roberts, who is left unprovided for, and not for my benefit in any way. I am, Sir,

Your obedient servant,
THOS. EDW. SYMONDS.

10, Adam-street, Adelphi.
8th August.

[Captain Symonds should have written to the daily papers immediately after the trial. Our remarks were based on the report in the *Times*. The statements we made with regard to charges were taken *verbatim* from that paper, and given by us in inverted commas. We cannot be held responsible for the accuracy of law reports in the morning journals.—Ed. M. M.]

ATLANTIC TELEGRAPH CABLE.

SIR,—If it is true, as one is led to infer from some accounts, that the method of braking out the Atlantic Telegraph cable is such that the strain on the cable is regulated by a friction contrivance, when the necessary pressure is due to the action of a weight resulting from the law of gravity, one can see a very serious evil existing which might easily be eliminated. When a weight enforces the pressure necessary to friction at sea, where the constant motion of the vessel would be continually increasing or diminishing the downward pressure, the friction would be continually varying in amount with every heave or roll of the vessel. This source of disaster might be reduced to a great extent by giving the friction by pressure of steam, compressed air, or by hydrostatic pressure. The method of application might vary. It must be remembered, too, that any part of the paying-out machinery of considerable weight, on the friction due to motion of which the strain on the cable is contingent, will cause a variation of strain on the cable at every up or down movement of the vessel. The machinery should be designed with due consideration to this.

In paying out, the greatest strain on the cable is perhaps close to the brake, and if a breakage occur it will be situated there. Such breakage may occur either in taking up or in hauling in the cable again. As it is most desirable that on occurrence of such disaster, the end of the cable should, if possible, be prevented from escaping, and being thus irretrievably lost, I would suggest the following contrivance for preventing that occurrence. As far astern in the ship as possible place a cylinder of sufficient diameter to allow the cable to pass through quite freely, and also to allow a wedge or block to remain unmoved in the sternmost end of the cylinder. To this block let a rope be attached, and so arranged that on the breaking of the cable a weighty arm which it supports falls on this rope and draws the block in the cylinder, which is wider at the sternmost extremity, from that end to the other and narrower end of the cylinder, thus jamming together the cable, cylinder, and block, and retaining the escaping end of the cable by means of the rope which goes out with sufficient friction to retain the contrivance and cable jammed together. By means of the rope the end of the cable is retained until the ship goes astern over it and it is hauled on board. With regard to the necessity of obviating as far as possible the danger arising from variation of strain on the cable when being hauled on board, which strain is due to the motion of the vessel, it may perhaps be found that this would best be done by assisting such strain on the cable by means of friction-bound wheels, which could only give a safe amount of force without slip.

Your obedient servant,
F. DENBY.

August 7.

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

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

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

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

RECEIVED.—Messrs. E. and D.—E. B. W.—R. M.—R. T.—Messrs. H. and W.—M. P.—J. H.—W. N.—A. S. Y.—S. G. B.—G. H. P.—W. W.—J. H.—R. P. E.—M. A. C.

A. WILSON.—The locomotive boiler to which you allude as being 20in. long, 5in. diameter, and made of 3-16th-inch plate, could be worked safely at a pressure of 300lb. to the square inch. The pressure required to burst it would be about 1,680lb. per square inch. The latter portion of your letter involves a communication. Please send your address.

Miscellaneous.

The bronze manufacturers of Paris, who enjoy a world-wide reputation, have resolved to give prizes for which their workmen may compete. They propose to give £32 for a sculptured work of art; a similar sum for a sculptured ornament; £64 for the best chiselled work; £20 for the best drawing; £24 to the founder who shall turn out the best work; £16 to the best turner; and £12 to the best fitter. There are likewise medals to be given and "honourable mention" to be made of those who may distinguish themselves. Those who wish to compete must send in their works between the 10th and 16th of November next.

The student in English history will find a great help to his labours in the very useful historical and archaeological map of England which Messrs. Bacon have just republished. A most convenient method of colouring is adopted by which at a glance are seen the Anglo-Saxon and Danish kingdoms, represented in the large divisions, whilst in the smaller the counties are shown. In the same way the greater divisions in Wales show the three kingdoms founded by Roderick, the smaller representing the division into counties by Edward I. and Henry VIII. Another important feature is the placing of the medieval over the modern names, by which the Anglo-Saxon, Norman, and subsequent changes of names and places are shown down to the Revolution. Messrs. Bacon are also the publishers of Malcolm's genealogical tree of the Royal Family of Great Britain, from the first king of England, the first king of Scotland, and the first duke of Normandy.

It is well known that ink is a precipitate of gallate of iron mixed up and kept in suspension in gum and water. As the water evaporates the ink thickens, and, moreover, becomes mouldy owing to a small proportion of organic matter proceeding from the gallnut. M. Mathieu Plessy has got rid of these inconveniences by making a new kind of ink with pyrogallol acid and the colouring matter derived from Brazil wood and other sorts of wood used in dyeing. This ink flows well and never turns yellow on paper.

Mr. J. J. Danvers, the Government director of the Indian railway companies, has to state in his annual report just issued, that the present system of guaranteed railways comprises a length of 4,917 miles, of which 3,186 are now open for traffic. The nett profits in the year ending the 30th of June, 1864, on 2,161 miles of railway, amounted to £690,834, and to £915,077 in the year ending the 30th of June, 1864, on 2,489 miles. The number of passengers conveyed in the latter year was 11,781,683, compared with 9,242,540 in the former.

The Senate of the University of London have agreed upon the immediate institution of a new degree, that of "Doctor of Literature," and the scheme has been approved of by Her Majesty's Government.

At the Dublin Exhibition some watch oils are exhibited which consist of olein from olive oil, very neutral, and when subjected to the continuous action of a freeing mixture remain perfectly limpid, although at the same time they become viscous.

A correspondent in an American exchange referring to the difficulty of procuring good main-springs for watches, suggests that if the spring was made slightly convex on the outer and concave on the inner side, so that when coiled in the drum the convexity of one coil might fit into the concavity of the next, the object would be accomplished. This would give the spring much additional strength, so it might be made thinner, and consequently longer—all being desirable qualities. But the principal advantage which such a spring would possess over the common flat spring, would perhaps exist in its less liability to break. For the greatest tension of its metal would be at the centre of the convex surface where a flaw would be less likely to occur, and a rupture more difficult to start, than at the edge, where, he observes, fracture invariably commences.

The Geographical Society of Geneva, through their President, M. Beaumont, have invited those members of the Geographical Society of London and the Alpine Club who may be visiting Geneva to go to the Athenæum, in that city, for the purpose of seeing a topographical map of Switzerland. We understand that the work is well worthy of the inspection of savants. It extends over 25 folios, and is the result of the labour and industry of upwards of 30 years.

At the inquest on the twenty-six bodies killed by the late colliery explosion at Tredgar, Mr. Lionel Brough, the Government inspector of mines for the district, said a natural law with which physicians were familiar, but, unfortunately, not so well known to the generality of colliery managers, occasionally played an important part in explosions. The law of diffusion of gases, to which he referred, was not a chemical combination, but simply a mechanical mixture of two or more aeriform fluids. In the undisturbed quietude of the night, and consequent freedom from motion, there was more than usual opportunity for this propensity to exercise itself, and it was remarkable that the air that human beings breathed, and the fire damp that was permitted to stagnate under ground, possessed the very attributes of diffusion, and that in a high degree, on account of the great difference in their specific gravities, the law of the speed with which gases commingled being just in proportion to that very difference in their weights. Such diffusion made the mouths of levels, headings, crosses, &c., where gas had accumulated, excessively dangerous to be approached by naked lights. This is a strong comment upon the value of Mr. Ansell's gas detector, to which we have recently called attention.

The quantity of lead ore raised in the whole of Europe and North America is estimated at about 190,000 tons per annum. Great Britain gives 90,000 tons, of which 2,500 tons is raised in Ireland, or about 1·8 per cent. of the whole raised in the world. Ireland yields about 14,000oz., or 2·4 per cent. of the whole of the silver raised in the world; its value may be estimated at about £3,850 per annum.

There have been lately received at Fortress Monroe, one hundred and eighty iron guns, late the property of the Rebels, and mounted on the approaches of Petersburg and Richmond. These guns are all of large calibre, ranging from seven to ten-inch. The ten-inch guns are nearly new, and are excellent specimens of serviceable ordnance. They bear a strong resemblance to the Armstrong gun, being reinforced at the breech by concentric bands. There have also been received eighty-five brass guns, of every conceivable shape and pattern; many of them being of United States manufacture, and lost in battle. Then there are rude and cumbersome brass pieces of Southern make; quaint old French guns, which were stored away in Government arsenals before the war, and dragged forth to service by the hard-pressed rebels.

A new rifle is about to be adopted in the French army. It is a breech-loader, and is said to be superior in every respect to the Prussian rifle.

A fluid for rendering paper waterproof may be made by dissolving 1½oz. of pure tallow soap in water, then adding a solution of alum in quantity sufficient for the complete decomposition of the soap. This fluid ought to be mixed with the paper pulp, which may be worked up in the usual manner, but needs no glueing.

The violent thunderstorm which burst over Chatham last week had a remarkable effect on the telegraph wires connecting Chatham Dockyard and the Admiralty. For some time before the storm set in it was with difficulty that the messages passing backward and forward could be understood, so violently were the indicating instruments affected. During the evening the electric current traversed some portion of the wires, which it ultimately melted, severing the communication. On the same day the lightning interfered to an unusual extent with the telegraph wires on the lower portion of the Strathclyde or Banffshire Railway. The electric fluid entered the railway station at Tillynaught, running along the wires and penetrating the box of the telegraph instrument, setting the place on fire. It was discovered on examination that the wires leading to the telegraph instrument, and connected with the battery, were completely destroyed—the gutta-serena reduced to a cinder, and some of the wire itself quite melted and running on the floor.

Labels may be made to adhere to articles of tin-ware with common paste, if the tin be first washed with a whitewash of lime. When dry it should be wiped and the label pasted on in the ordinary way. It is also said that labels will adhere with common paste if the tin be washed first with strong vinegar.

The French Emperor has informed the King of Portugal that experiments will be made at the camp of Chalons on his Portuguese Majesty's newly invented cannon, and has invited him to be present.

A specification has recently been filed at the Patent Office for improvements in boiling eggs. This was shortly afterwards followed by a patent for a machine for removing the tops from eggs previous to eating them. We hope next week to be able to announce that a patent has been secured by somebody's grandmother for sucking the above delicacies.

Alexandria advices of the 15th July state that the *Isthme de Suez*, the special organ of the Suez Canal Company, announces that the continuous navigable way from the Mediterranean to the Red Sea would be opened on that day.

The perpetual motion clock to which we recently called attention appears to be a comparatively old invention. Mr. A. Z. Boon writes to the *Scientific American* to say that his father, Colonel S. Boon, in the year 1842, invented and constructed a clock operating upon similar principles, viz., the expansion of fluids made upon the same principle as a thermometer. A large sphere was the receiver, into which was placed a metallic cylinder; a piston was placed in the cylinder; upon the crosshead of the piston rod was attached a double rack with suitable guides to keep the piston rod straight with the cylinder. Upon the crosshead were also placed weights of 25lb. each. He filled the ball or sphere with oil, which kept everything lubricated, and obtained the power necessary to wind the clock by the contraction and expansion of the fluid. The weights carried down the piston rod and the expansion carried it up—winding the clock both by expansion and gravitation, by means of racks and ratchet wheels. The clock wound from the centre of the spring, on the same principle that American watches are now made. It was on exhibition at the American Institute, in New York city, in 1843.

The latest aerial intelligence from America states that a New Jerseyman has patented an aëron, or flying ship, and that a company is to be formed and will be known as the "Aërial Navigation Company." The principle of the aëron, or air-ship, is simple. As a balloon is round, and as the air presses evenly in all directions on its surface, it rises perpendicularly into the air, where it is swayed almost by the currents. The aëron differs from the balloon in being composed of three cylindroids fastened together, which contain the gas, and to which the car is attached. From this shape the aëron is intended to rise obliquely, and at an angle dependent on the position of the car. On rising, say ten miles in the oblique direction, a little gas is to be let out, when the aëron descends. The throwing out of a bag of sand will give it additional impulse, and it will ascend ten miles more in the oblique line. The inventor claims that a wonderful rate of speed may be attained in the manner described.

The "Dagmar," a cutter yacht, recently completed for His Royal Highness the Prince of Wales by Messrs. Harvey, of Wyvenhoe, near Colchester, is of 36 tons burden. Her dimensions are:—Length on decks 50ft. 6in., main breadth 13ft. 7in., depth 8ft. 4in., draught of water 8ft. 6in. The saloon is fitted with Spanish mahogany, walnut tree, and bird's eye maple. The ladies' cabin is superbly fitted with mirrors, couches, and spring cushions, covered with crimson silk, &c. From the saloon forward on the starboard side is a commodious cabin for the captain, and on the opposite side is the pantry. The yacht, which will cost about £1,500, has been built in ten weeks.

The "cigar ship," which has so long been on the stocks at Mr. Hepworth's yard, in the Isle of Dogs, is now nearly ready for launching. It is stated that upwards of £100,000 has been expended in her construction, and it is anticipated that she will attain the speed of twenty-five miles an hour.

Since the return of the "Aretusa," 35, screw steam frigate, 500-horse power, to her moorings, it has been discovered that the cause of the deficiency of vacuum on the trial trip was a large accumulation of grease which had become hard on the copper condenser tubes, and prevented the proper vacuum from being obtained. The reason that the vessel still remains at Sheerness, instead of joining the experimental squadron, is that these copper tubes have been all removed to the steam factory in Sheerness yard. They were carefully cleaned, and are now being replaced on board the ship. The performance of these operations necessarily requires a considerable period, as the tubing measures upwards of six miles in length.

Mr. Howard, of Plaistow, has issued a paper which contains some information upon the manufacture of plate glass. It appears that this manufacture amounted, in 1836, to only about 7,000ft. per week in consequence of the enormous excise duty which was imposed upon it, which amounted at that time to no less than 60s. per cwt. In 1845 the duty was abolished, and at the same time other materials of a much less costly description began to be used. Sand, the base of the manufactured articles, is 3s. 6d. per ton, against the former price of 18s.; labour, formerly 1s. 6d. per superficial foot, is now 5d.; and coal, formerly 1s. 10d. per foot, is now about 2d. The cost is thus reduced to about that of the common window glass of thirty years ago, and in consequence the manufacture has increased from 7,000 superficial feet per week, sold at from 20s. to 25s. per foot, to 140,000ft., sold at 2s. and upwards, according to quality. The finest qualities are imported from France and Belgium, at the rate of 16,000ft. per week; but the export of the English commoner make has increased tenfold since 1849. From the opening up of the China and Japan trade, even this enormous increase is by no means the limit which may be attained. The material is, moreover, applied to a variety of purposes, such as flooring and the sheathing of iron ships, so that there appears, practically, no limit to the development of which the manufacture is susceptible.

Large numbers of West India beetles are now imported into France for the Parisian beetle jewellers. East India beetles are also in request. In Edinburgh and Birmingham there is a great quantity of beetle jewellery manufactured. Sir Emerson Tennent has presented Mr. Thomas, a Southampton beetle jeweller, who is going to exhibit in the Paris exhibition, with some specimens of the coleopters of Ceylon, described in Sir Emerson's work on that island. The elytra of these are like burnished emeralds, and the thorax like shining plate armour. Mr. Thomas is exhibiting brooches adorned with gold casts of the ancient fossil trilobite. The regularly articulated frame of these creatures, and the curious attitudes in which they perished, adapt them for the goldsmith's art. The trilobite existed through many geologic ages. It is found in the Cambrian, and is traced up to the carboniferous periods. Its existing analogue is the woodlouse. Primeval lice and modern beetles now furnish ornaments for dress.

The last half-yearly meeting of the proprietors of the London and County Banking Company was held on Thursday, the 3rd inst., when it was announced that, after payment of all charges, and after ample provision had been made for bad and doubtful debts, the nett profits amounted to £106,821 3s. 1d., which, added to £18,629 12s. 3d., brought forward from the last account, made a total of £125,450 15s. 4d. for appropriation. A dividend of 6 per cent. was accordingly declared, with a bonus of 9 per cent., making together 15 per cent. for the half year, which amounts to £111,790 8s. 4d. and leaves £13,660 7s. to be carried forward.

Aéronauts will have to be careful where they descend in future, as balloons appear obnoxious to some members of the community, as the following incident plainly shows. On Saturday evening last, Captain Adams ascended from the Pomona Gardens, Manchester. After remaining up for about forty minutes he descended in a brick croft, near Great Ancoats-street. A crowd soon surrounded the balloon, and an Irishman, whose fanaticism and religious fervour were excited, it is believed, by the name of the balloon, the "Garibaldi," struck at it with a stick, and made a rent in it. On the man being taken into custody, a fight ensued, the police officers were surrounded, and the man reasoned. The balloon was again attacked, and torn in three or four more places and Captain Adams had to escape for his life, the balloon being conveyed away with some difficulty, and in a very tattered condition.

The report of the Royal Insurance Company for the year 1864, was presented at the annual meeting held at the Company's offices in Liverpool, on the 2nd inst. This report testifies to the run which has been upon the fire department of this company, in common with others, in consequence of the serious fires which have taken place during the past year. To this is due the unfavorable aspect presented by the accounts, which we much regret to observe. It is, however, a striking comment upon the system of insurance which ought to convince the public of its utility. The profit and loss account is diminished by £4,968 9s. 7d., but the reserve fund is increased by £7,355, which compensates for the decrease under the other head. Fortunately, the premiums have increased over those of 1864 by £44,736, upon which fact we congratulate the proprietors. In the Life branch remarkable success has attended all the transactions, and the directors announce that £35,000 can be appropriated as shareholder's profits on the past five years' transactions.

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.—173
BUILDINGS AND BUILDING MATERIALS.—None
CHEMISTRY AND PHOTOGRAPHY.—None
CULTIVATION OF THE SOIL. including agricultural implements and machines, —140, 200
ELECTRICAL APPARATUS.—166
FABRICS. including machinery for treating fibres, pulp, paper, &c., —133, 146, 153, 158, 162, 176, 178, 191
FOOD AND BEVERAGES. including apparatus for preparing food for men and animals, —150, 174
FURNITURE AND APPAREL. including household utensils, time-keepers, jewellery, musical instruments, &c., —141, 149, 167, 168, 170, 175, 185, 189, 190, 193, 195, 197, 199
GENERAL MACHINERY.—134, 135, 143, 145, 144, 172, 180, 181, 186, 198
LIGHTING, HEATING, AND VENTILATING.—142, 181, 201
METALS. including apparatus for their manufacture, —160, 165, 192
MISCELLANEOUS.—194
ROADS AND VEHICLES. including railway plant and carriages, saddlery, and harness, &c., —147, 164, 164, 169, 177, 179, 182, 184, 187
SHIPS AND BOATS. including their fittings, —137, 146, 161
STEAM ENGINES. &c., —155, 159, 166, 167, 183
WAPFARE.—136, 138, 139, 152, 171, 188

133 W. ROWBORTH. *Improvements in mules for spinning and doubling.* Dated January 16, 1865.

The objects of this invention are to wind the yarn firmly on the spindle on the nose of the cap, and to dispense with the stud at the end of the radial arm, commonly called the "nosing peg," which, in mules of the ordinary construction, acts upon the winding-on chain when the carriage is going up, and is within a few inches of the drawing rollers. Now this invention consists in giving the requisite additional motion to the winding-on barrel by a self acting apparatus, independent of the radial arm, winding bar, or winding-on chain. *Patent abandoned.*

134 J. MARSHALL. *Improvements in presses for the expression of fluids from substances containing the same.* Dated January 16, 1865.

The patents claim constructing presses for the expression of fluids from substances containing the same with a main hydraulic cylinder and ram combined with an auxiliary hydraulic cylinder and ram, carrying a straining

apparatus in a close-sided vessel, all formed and acting substantially as described. *Patent completed.*

135 R. A. BROOMAN. *Improvements in driving rolls, and in apparatus employed therein.* (A communication.) Dated January 16, 1865.

This invention consists in driving or working rolls for rolling metals by means of hydraulic pressure. The inventor compresses by an ordinary pump water into a receiver at very high pressure. He afterwards introduces this water by a pipe into a distributing box. Then, by means of a lever acting on two pistons or valves in the distributing box, he admits the compressed water into one or other of two cylinders at the right and left of the rolls, according to the side required to be worked, or direction in which the rolls are to be driven. The water acting on pistons in these cylinders gives the pistons to-and-fro motion more or less prolonged according to the distribution given by the lever which actuates the valves in the distributing box. These pistons are connected to each other by a rack, which, as it receives to-and-fro motion from the pistons, works a pinion on the roll shaft. Pressure is exerted on the bearings of the upper roll by a piston acted on by water led by a pipe from the receiver before mentioned, and is regulated by an escape cock fitted to the cylinder of the piston last mentioned. *Patent abandoned.*

136 J. B. COTTER. *Improvements in the construction of shells, and in the explosive powder to be used therewith, and for other purposes.* Dated January 16, 1865.

This invention relates to certain improvements in the construction of shells, and in the explosive powder for charging the same, such powder being applicable generally as a substitute for gunpowder for mining and blasting, or for the discharge of projectiles from ordnance and small arms. The inventor proposes to form the shell of a spherico-conoidal shape, having the pointed end or head made solid to form a shot sufficiently heavy for penetrating ships or batteries; at the rear of the head is formed a hollow chamber for the reception of the bursting charge. The rear end of the shell is of a rounded or spherical form, and between this and the bursting charge is a division in which a plug is inserted for holding the fuse, so as to prevent it from being driven into the charge by the explosion. By this form of shot the weight of the head ensures perfect accuracy in the flight of the projectile, besides affording a certainty of penetration through armour plate. The walls of the hollow chamber being only of such thickness as to offer strength to the whole, and yet permit of their destruction by the explosion of the bursting charge, it forms a combined shot and shell, and may be made of any size to be used with ordnance of rifled or smooth bores. The explosive powder is composed of chlorate of potash and realgar; about equal parts will form a powder of very great strength, and a much less quantity will be required than of ordinary gunpowder. *Patent abandoned.*

137 J. BETTELEY. *Improvements in shipbuilding.* Dated January 16, 1865.

Heretofore in constructing what are commonly called or known as "composite ships," or ships built with an iron frame and planked with wood, iron beams have been used. Now, according to one part of this invention, the beams, instead of being of iron, are to be of wood, and to be connected to the iron framing by means of metal gusset plates riveted or bolted to such framing; and according to another part of the invention the lower parts of the vertical iron framing are to be connected with the tubular flooring of such ships by means of metal gusset plates riveted or bolted to the iron framing. *Patent completed.*

138 G. T. BOVEFIELD. *Improvements in breech-loading fire-arms.* (A communication.) Dated January 16, 1865.

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

139 J. S. EGGS. *Improvements in breech-loading fire-arms.* Dated January 16, 1865.

The patents claims—firstly, the arrangement or combination of the parts described for fastening down the barrels of the said fire-arms for discharge and releasing them for reloading; that is to say, by means of a hooked arm or lever on either side the stock being made to bear upon a projection on either side the barrel or double barrel; secondly, the arrangement or combination of the parts described for preventing longitudinal motion of the barrel or barrels from the break-off on discharge; that is to say, by means of projections on either side the barrel or double barrel engaging with forked side pieces on the body and near the break-off, the engagement of the said projections with the said forked side pieces being effected by a slight wedging action, so as to force the breech ends of the barrels into close contact with the face of the break-off. *Patent completed.*

140 R. A. BROOMAN. *Improvements in treating phosphates of lime and salts of potash and soda in order to fit them for agricultural uses.* (A communication.) Dated January 17, 1865.

This invention consists, first, in the employment in agriculture of phosphate, pyrophosphate, and metaphosphate of potash; and second, in a particular method of treating these salts, which treatment is as applicable to native and artificial phosphates as to the various salts of potash found in nature or extracted from the mother waters of salt marshes. Phosphates, in the state found in nature, coprolites nodules, apatite, and even bones and animal black are often difficult of assimilation by vegetable bodies. In like manner the salts of potash in the state of chloride and sulphate do not act, or not but little on vegetation. Now, the object of this invention is to impart to these substances the forms most favourable to vegetation by their reciprocal action. Preparation of the new products.—The inventor treats hot in leaden or wooden boilers or vessels the phosphates of lime, apatite, coprolite, nodules, and by sulphuric acid diluted with thirty times its volume of water; he stirs the mass and heats it up to from about 120 deg. to 140 deg. Fahrenheit by a naked fire or by a steam jet. The matter is left to itself when the sulphate of lime is deposited; he decants the liquid when clear. It is a solution of acid phosphate of lime. He concentrates this solution to half its volume, and pours therein sufficient sulphate of potash, or simply anhydrous sulphuric acid, to precipitate the lime. He leaves it again to deposit the sulphate of lime, and the phosphoric acid remaining may be used to form phosphate of potash by the aid of chloride of potassium or sulphate of potash or other salt of potash, as carbonate or nitrate. He commences the reaction in a leaden boiler or vessel, and terminates it in a reverberatory furnace or a cast-iron cylinder. He obtains thus pyrophosphate of potash, which he pulverises and employs in that form, or after having mixed it with the sulphate of lime arising from the first

treatment. This sulphate of lime contains a third of the initial phosphate of lime in a very advanced state of disintegration. By this process he gives to the phosphate, which is little or not at all capable of assimilation at the commencement, a form which is most capable of assimilation, and to the salts of potash, which are of doubtful action or incapable of action, a state in which they possess a great and powerful influence on vegetation. *Patent completed.*

141 F. H. LARKIN. *Certain improvements in the manufacture and construction of pianofortes or similar stringed instruments.* Dated January 17, 1865.

This invention relates to a novel method of and means for tightening and slackening the strings, wires, or cords of pianofortes or similar stringed instruments, and is designed—first, for the purpose of effecting the more ready and accurate tuning of the instrument; secondly, for enabling stronger and thicker strings to be used than heretofore, whereby great fulness of tone is obtained; thirdly, for enabling the "keyboard" to be extended beyond the usual compass. The improvements consist in the novel application and use of short bell-crank levers, having a fulcrum at about the corner or angle thereof; one end of the levers is slightly hooked, and over which one end of the string is looped, the opposite and longer end of the lever being flat and acted upon by screws, which raise or depress the end of the lever to tighten or loosen the string attached, the opposite end of the string being secured to a pin as usual. The screws pass through nuts in a metallic plate extending on the framework or bracings at right angles to the strings, and the levers are held in position or divided and supported laterally by a metallic comb; also fixed to the bracings. Thus, by turning the screw, the "pitch" of the string may be raised or lowered by the use and arrangement of such mechanism, instead of the ordinary screwed pins, space is economised, and stronger strings than usual may be used. By the novel application and use of the bell-crank levers, acted upon by the screws or other equivalents, and the general arrangement exhibited, the patents are enabled to employ stronger and thicker strings or wires, and also to use strings of a greater length between the "bridges." *Patent completed.*

142 S. J. BEAR AND J. J. HOLDEN. *Improvements in apparatus for charging and drawing gas retorts, and for other purposes.* Dated January 17, 1865.

This invention has for its objects—first, the construction of machinery formed as described, and intended to be substituted for hand labour in charging gas retorts with coal and withdrawing the cokes and carbon therefrom; secondly, the application of similar machinery for other similar purposes, such as charging or drawing boiler and other furnaces, charcoal ovens, and the like; thirdly, an apparatus to be used in combination with parts of the said machinery for supplying the same with the coal, cannel, or other fuel. By the first above-mentioned improvement, one, two, or any other number of retorts placed in an oven or furnace in the usual way could be charged or drawn simultaneously, and by the last above-mentioned improvement, one, two, or more charging scoops could be supplied with the required quantity or weight of fuel respectively, also simultaneously. Another improvement comprised in the invention consists in mounting the whole of the covers of a set of retorts in one oven or furnace in a frame, or in connecting the same together and suspending the whole by means of chains or rods from a bearing bar, and balancing the same so that the whole could be raised from and open the mouths of the retorts at once, and be again lowered so as to close the whole of the retorts instantaneously. The invention cannot be fully described without reference to the drawings. *Patent completed.*

143 J. ROBINSON AND J. SMITH. *Improvements in machinery or apparatus for planing and moulding or otherwise shaping wood.* Dated January 17, 1865.

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

144 C. T. JUDKINS. *Improvements in sewing machines.* Dated January 17, 1865.

Sewing machines constructed according to this invention have two horizontal revolving shafts supported in suitable framework and bearings—one shaft is above and the other below the bed plate, and each shaft is attached at its back end to a toothed wheel gearing into a fixed or carrying wheel, through which motion is imparted to the machine by manual or other power; at the front end of the upper shaft is an eccentric or cam or disc carrying a pin working into a groove or slot in or attached to the needle slide, to move the needle slide or carrier down and up so as to pass the needle carrying the thread through the fabric the required distance, and then to raise the needle again to give slack enough in the thread to form a loop or bow in the thread, and when that is done a small hook, worked by means of a cam or other suitable device attached to the front end of the lower revolving shaft, enters the loop and holds the thread until the vertical needle with the thread has been drawn through the fabric upwards and descended again and entered the loop and withdrawn it from the hook, and so on from stitch to stitch. The fabric is fed by means of an oblique shaped ring with a leg and foot or presser operated by a cam or other equivalent movement from the upper shaft to move the fabric forward for the purpose of the next stitch. The above combination and arrangement forms a single thread machine, but two threads may be used by having an eye in the hook near to the point thereof to carry another thread from a second spool. *Patent completed.*

145 W. J. CUNNINGHAM. *Improvements in apparatus for transmitting and converting reciprocating motion into rotary motion applicable to various useful purposes.* Dated January 17, 1865.

This apparatus comprises a cylinder placed on a shaft, to which the inventor desires to transmit rotary motion; on this cylinder he cuts a double incline or cam groove, the one part of the groove encircling the cylinder the one half of its circumference, and the other in like manner encircling it the other half; they meet in a sharp angle as either extremity, and, in fact, form a continuation of the same groove. He applies a pin with or without a trunk roller in this groove, such pin and roller being mounted on a lever or other part having a reciprocating motion, the moving of which to and fro causes the traverse of the roller in the cam groove, and the rotation of the cylinder, the movement in the one direction taking place in the groove on one side of the cylinder, and the reverse movement on the opposite side, the incline of the cam being in the opposite direction; thus a continuous rotary movement in one direction is imparted to the shaft, which may be transmitted to other shafts, if desired, as well understood, and