A NEW TORPEDO BOAT.

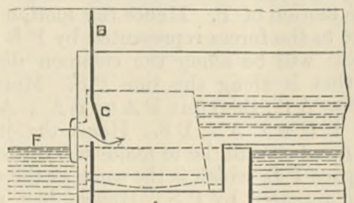
On Wednesday Admiral Brandreth, Controller of the Navy, Messrs. Morgan, Butler, and Allington, of the Admiralty, and several naval *attaches* of European Powers, visited a torpedo boat brought up to Westminster Pier for the purpose by Mr. Yarrow, of Poplar. This craft may be regarded as the latest example of torpedo boat construction, and thus deserves more than a passing comment.

Messrs. Yarrow and Co., of Poplar, are well known all over the world as builders of torpedo boats on the most improved system. The experience acquired by Mr. Yarrow during years of successful construction of this type of vessel he has utilised continually, with the result of making his designs more and more perfect. The boat of which we are now speaking has been built for the Italian Government, and is of the largest size, being 100ft. long. She is of what is known as the Batoum class, and is very similar to many sent by Messrs. Yarrow to the Mediterranean, which have reached their destination in safety. She is propelled by a pair of compound engines capable of indicating about 500-horse power, steam being supplied by a boiler of the locomotive type. She has a two-bladed screw, the results of the experiments carried out by Messrs. Yarrow, and reported in our columns, showing that the two-bladed screw is better for high speeds than either the three or four-bladed propeller. This boat has attained the highest velocity ever reached by any vessel fully equipped and ready for action. Her measured mile speed is the highest ever officially recorded, namely, 22·46 knots, or very nearly 26 miles per hour. We believe, however, that in a private trial even this performance was slightly beaten. She is fitted with a bow rudder, by the aid of which she can be turned round almost in her own length; and the screw has been so designed as to give great backing power. This is regarded by all naval Powers as a most important qualification, because in consequence of the extended use of machine guns, it is of the utmost importance to present as small a mark as possible to the enemy, and this can only be done by keeping bows on to the ship attacked. Immediately after the torpedo is discharged the boat goes ashore as quickly as possible out of gun shot. The new boat is fitted with two tubes in the bows for discharging Whitehead torpedoes, so that she is a much more dangerous foe than the ordinary spar torpedo boats. She is steered from a point near the bows, the steersman being in a bullet-proof conning room; while the sloping deck forward is made of steel plates which would probably resist any but very heavy Nordenfelt or Gatling projectiles, so that the men engaged in getting the fish torpedoes ready for launching would be tolerably safe. The enormous velocity of the boat gives her a great advantage. It may be taken for granted that at a distance of one mile from a ship to be attacked she would be safe, and she need not approach nearer than 300 yards to discharge her projectile. Thus she would certainly have to remain under fire only while she was attacking. If she did not succeed, she would of course still be exposed to risk, but the chances are that she would succeed, when of course little more attention would be paid to her. But steaming at 22 knots an hour, she would be only in imminent danger for about 2½ minutes, during which time her range would be continually altering, and it would not be by any means easy to hit her.

We have said that she is the fastest craft afloat, and it might be supposed that this result is due in some measure to her comparatively large dimensions. It is ordinarily assumed that, other things being equal, the larger a ship is the more easily will she be propelled; that is to say, that the resistance of a steamship does not increase so rapidly as her dimensions. This law holds good with torpedo boats up to about 15 knots; and Mr. Yarrow has found that at that speed a boat 100ft. long and displacing about 25 tons can be propelled with absolutely—not comparatively—less power than a boat displacing 15 tons. But after 15 knots have been reached a new law appears to come into operation, and the resistance of the 25-ton boat is just the same proportionately, or nearly the same, as that of a boat of 15 tons. This is another of the anomalous results obtained at exceptionally high velocities

The most noteworthy novelty in the new boat is an arrangement extremely simple but none the less ingenious, for preventing the fire being put out should the stokehole be drowned. In all torpedo boats previously built, if shot entered the stokehole, and made anything like a large aperture, the furnace would be quickly submerged, and the boat would be left a helpless log on the water. For those who are not well acquainted with the internal arrangements of torpedo boats, it is proper to explain that they are divided into water-tight compartments, in which are enclosed the engines, the boiler, and the stokehole, in which the coal is carried in sacks. The stokehole is shut down by air-tight lids, and a fan forces air into it to maintain the draught, which is very intense. The end of the boiler is, so to speak, fixed in a bulkhead, and in this are made two flap doors. The pressure of air in the stokehole forces open these doors, and the air then enters the compartment in which the boiler is fixed, and gets into the fire through the ash-pit and bars. It will be understood that there is no communication whatever with the ash-pan from the stokehole. If a boiler tube burst while the fire-door was shut, the smoke-box doors might be blown open; but the rush of steam and water would be confined to the compartment in which the boiler is, and the firemen could not be hurt, because the flap doors before alluded to would close, and shut off the stokehole from the boiler room. The last improvement introduced by Mr. Yarrow consists in carrying up the sides of the ash-pan as in the sketch, which is not to scale. Here A is the ash-pan, B bulkhead reaching to deck above, C is the flap-door to admit air to the boiler room. The ash-pan, it will be seen, is carried up above the bottom of the boat E for about 3ft. 9in. The utmost depth to which the water can rise in the stokehole is 3ft. 3in., representing about 11 tons, which sinks the boat some 7in. F is the water level, when the stokehole is drowned. It will be seen that the water rises some way up on the fire-door; but this door is made of the cupped form, and the edges are a good fit against the plate. The result is that but little water gets past it into the fire-box, and what does is immediately evaporated, and gives no trouble. Thus, in case of accident, the stokers would have time to withdraw from the stokehole, leaving the fire-door shut. The fire-box readily holds half a ton of coal, and this will keep up steam for forty miles at a speed of ten knots.

As torpedo boats are not intended to go far from a harbour, it is clear that an ample margin of power is thus provided to give the boat an excellent chance of escape. In the absence of this appliance, should water in quantity find its way into the stokehole, the fire would be extinguished, and the boat left to float like a helpless log, a ready prey to the most insignificant adversary. On Wednesday, as the boat lay beside Westminster Steamboat Pier, the stokehole was drowned several times without in



any way affecting the fire. Indeed, the steam pressure kept rising, although much steam was needed for pumping the stokehole out, and the draught was of course not on, the hatch to the stokehole being open. This we regard as one of the most important improvements recently effected in torpedo boats.

We may add in conclusion that, as the little vessel is intended for service at sea, she has a neatly-fitted cabin, with sofas, which will accommodate four officers, while forward as many as eight men can be berthed with tolerable comfort. It would be quite possible for such a vessel to remain at sea for a week; and it is worth notice that she can carry coal enough to steam about 1000 miles at a moderate speed. She will probably go to the Mediterranean under steam.

THE FOUNDATIONS OF MECHANICS.

By Walter R. Browne, M.A.

No. V.

66. *Accelerating Forces.*—The laws of motion, with our definitions, enable us to lay down at once the fundamental propositions as to the action between two centres of force, or between two bodies each of which may be supposed to be concentrated in a single centre. Practical examples of such cases are the attractions of the sun and earth, neglecting the disturbing forces of the planets, or the fall of a body to the earth, neglecting the resistance of the air. In such cases the ideas involved become greatly simplified. In the first place, since all motion is relative to some point assumed to be fixed, we shall naturally assume as our fixed point one of the two centres of force concerned, and thus investigate the motion of the other in reference to it. Thus, in the case of the earth and sun, we assume the centre of the sun as fixed; and in the case of a falling body, we assume the centre of the earth as fixed. Secondly, if the body assumed to be in motion be a single centre of force, it is an absolute unit of mass; and if it be a group of centres, yet they will all move as one, and therefore the idea of mass need not be included, at least as long as the two bodies are still at a considerable distance from each other. Thirdly, as no other forces are acting, the whole of the action will take place in the straight line joining the centres, and the question of the combination of forces, which has not yet been settled, does not enter.

67. Let us consider two bodies, A and B, and investigate the motion of A with regard to B, taken as fixed. The problem will be stated mathematically thus:—*Given the distance* l *between* A *and* B, *at the instant when* A *begins to move, and the accelerating force* f *with which* B *acts on* A; *to find the velocity of* A *(referred to* B*) at* t *seconds after that instant, and also the space* s *which it has passed over from its original position towards* B.

68. Let us, in the first place, assume that the force with which B acts on A is constant. This is, of course, against our definition of matter, and is never exactly true in nature. But it may be assumed as true—according to the ordinary principles of mathematical reasoning—when either the interval of space or the interval of time is relatively exceedingly small. The former of these suppositions holds practically in the case of falling bodies, where the variation of gravity due to the approach towards the centre of the earth may always be neglected. The latter will enable us to calculate the effect of a varying force by the ordinary methods of the integral calculus.

69. Let us then begin by assuming that the force f is constant. It will therefore be measured by the velocity generated in one second (Art. 57). Moreover, by the second law of motion, this velocity will in no way affect the action of the force, which in the next second will generate exactly the same velocity f. At the same time, by the first law, the velocity f, generated in the first second, will remain unaltered. The velocity at the end of the second second will therefore be $f + f$, or $2f$. In the third second a third velocity f will have been added, making the velocity $3f$. By similar reasoning the velocity at the end of t seconds will be tf; or, if V be the velocity of A at the end of t seconds, we have

$$V = ft \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1).$$

Next, to find the space s described in the time t. With the aid of the integral calculus, this is easily accomplished, as follows:—We have already seen (Art. 53) that velocity is measured by the limiting value of the ratio of space to time; or, if v be the velocity at any instant—

$$v = \frac{ds}{dt}.$$

But from above $v = ft$. Hence—

$$s = \int v\,dt = \int s\,ft\,dt = \frac{ft^2}{2} \quad . \quad . \quad (2).$$

No constant is added, because $s = 0$ at the beginning of the motion, or when $t = 0$. Combining the two, we have,

$$V^2 = f^2 t^2 = 2fs \quad . \quad . \quad . \quad . \quad . \quad . \quad (3).$$

70. To extend this to the case of varying forces, such as alone exist in nature, we may assume the above equations to hold for indefinitely small intervals of time, during which all the conditions are constant. Hence we may put

$$dv = f\,dt \quad . \quad . \quad . \quad . \quad . \quad . \quad (4)$$

$$v = \frac{ds}{dt} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (5);$$

whence

$$v = \int_o^t f\,dt;$$

or

$$\frac{ds}{dt} = \int_o^t f\,dt,$$

whence, differentiating,

$$\frac{d^2s}{dt^2} = \quad . \quad . \quad . \quad . \quad . \quad . \quad (6).$$

These are the ordinary equations of analytical dynamics, which must then be dealt with as described in any of the text-books on that subject.

71. The following proof of equation (2) above may be given for the benefit of those who are not acquainted with the integral calculus. Suppose the time t to be divided into a very large number n of very small equal intervals w. Then we may suppose that during each of these intervals the velocity remains constant at the value it has at the beginning of the interval; and the smaller the intervals, and therefore the larger their number, the nearer will this supposition be to the actual truth. But if the velocity be constant, the space described in each interval will be simply the velocity × the interval. Now, by equation (1), the velocities at the successive intervals, 1 to n, are o, $f \times w, f \times 2\,w, f \times 3\,w, \ldots . f \times (n-1)\,w$. Hence the spaces described in the successive intervals are $o, f \times w^2, 2\,f \times w^2, 3\,f \times w^2, \ldots . (n-1)f \times w^2$. But the total space must be the sum of the spaces described in the intervals, and it is therefore equal to $f\,w^2\,[1 + 2 + \ldots + (n-1)]$, or to $f\,w^2 \times \frac{(n-1)\,n}{2}$. But $n\,w = t$; hence this may be written

$$\frac{ft^2}{2} - \frac{ft^2}{2\,n}.$$

The larger n is, the nearer will this expression be to the truth; but the larger n is, the smaller does the second term of the expression become. Hence in the limit this second term will vanish, and the true value of the space described in the time t is $\frac{ft^2}{2}$.

72. *Composition of Forces and Motions.*—We have next to consider the effect of two or more forces, acting simultaneously on the same centre. This cannot be done by the aid of the three laws of motion alone, since the second law, or rather Newton's explanation of it, only decides the question where the two forces are in the same straight line. In that case the velocity of the centre, at the time t, will be the algebraical sum of the velocities generated by each force in that time; it being obvious that velocities, being measured in units of length, may be taken as positive or negative, added or subtracted, exactly as lengths are treated in analytical geometry. But suppose two forces to act on the same centre obliquely to each other; then the second law states that the effects are to be compounded together, but in what manner does not appear. To solve this question some additional principle is necessary. The principle generally used for this purpose is that a force may be supposed to act at any point in its line of action, provided that point may be treated as rigidly connected with the body in question. This principle, though of course true, is by no means self-evident; it involves conceptions, such as rigid connection, which are quite unfamiliar to a student when commencing mechanics; it introduces the vague and clumsy conception of a body, in place of the simple and accurate conception of a centre of force; and, lastly, it is a principle which is never used or heard of on any other occasion, and is no whit wider than the proposition it is adduced to prove. For these reasons another and more satisfactory principle seems desirable, and such a principle, open to none of the objections alleged, may be found in the principle of Symmetry.

73. This principle, in its general form, may perhaps be stated thus:—When a cause, or set of causes, is so related to two opposite effects that there is no reason whatever why one of those effects should take place rather than the other, then neither of the effects will be produced by the cause, or causes; and this relation is said to be a relation of symmetry.

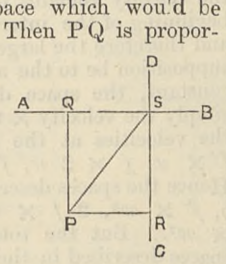
74. Of this principle, as of others, it may be true that when thus stated in its general form it is not easy at once to grasp its bearings. An illustration or two will make it clearer. We put a rein or a curb on each side of a horse's mouth, and then by pulling on both together we know that we shall not cause him to turn to either side, because there is as much reason to turn to the one as to the other. In Euclid, the unexpressed axiom that figures which coincide are equal to each other, really rests on this principle, since there is no reason why one of two such figures should measure more than the other, or why it should measure less. In ordinary mechanical practice we admit at once that two equal weights suspended over a pulley by a weightless string will remain at rest, because there is no reason why either should either rise or fall; and for the same reason that two equal weights suspended from the ends of an equal-armed horizontal lever will also remain

at rest. This last fact has indeed been made the basis of a complete system of statics—see Goodwin's "Course of Mathematics," p. 225—which would thus rest directly on the principle of symmetry. Looked at in the light of these illustrations, it may perhaps be thought that the principle should be regarded as a corollary from the great principle of causation; the cause, being as likely to produce one effect as the opposite, is really not a cause tending to produce either; and without a cause there will be no effect. I do not care to question this way of looking at the principle; but I believe it is at least equally good philosophy to regard the principle of causation as itself a deduction from a great number of observed facts, of which those of symmetry are some of the most important.

75. Original or derived, the principle of symmetry is one which nobody has ever cared to deny, and we may, therefore, accept it as an unquestioned truth, and apply it at once to the simplest case of compounding forces, which is the case of forces at right angles.

76. *Problem:—A point or centre is acted on by two forces whose directions are at right angles; to find the resulting motion of the centre.*

77. Suppose the two forces to begin to act on the centre at rest, and to act upon it for an indefinitely small time $d\,t$, and then to cease. If we assume for the moment that only one force has acted, it will have generated in that second a certain velocity $f\,d\,t$, where f is the measure of the force, being the velocity which would be generated if the force continued constant for one second. Since the time considered is indefinitely short, we may consider the force as constant during that time. This velocity $f\,d\,t$ will cause the centre to describe, in the next element of time, a certain indefinitely small space $d\,s$, proportional to the velocity. Hence $d\,s$ is proportional to f. Let P be the position of the centre at the end of the first interval $d\,t$, and let P Q be the element of space which wou'd be described in the second interval. Then P Q is proportional to f. Let P R be the element of space which would be described in the second interval, supposing the other force f^1 to be the only one acting. Then by similar reasoning P R is proportional to f^1, and by hypothesis P R is at right angles to P Q. We have now to find the space actually described by P under the joint action of the two forces.



78. By the second law—Art. 63—f will still produce its full effect, and will therefore actually cause P to describe the space P Q, except in so far as that space is increased or diminished—in other words, in so far as P is accelerated or retarded—by the action of f^1. But since the direction of f is at right angles to P Q, it has no more tendency to produce an acceleration of P along P Q than to produce a retardation, and *vice versâ*—in other words, f^1 is symmetrical with respect to motion along P Q, and, therefore, by the principle of symmetry, it will produce no effect either in accelerating or retarding. Therefore P will still travel the full distance P Q in that direction. But by exactly similar reasoning, it will also travel the full distance P R in that direction; for by the same principle of symmetry, the fact that it is also moving in the direction P Q will have no effect on its motion in the direction P R. This amounts to saying that, at the end of the time $d\,t$, P will be found somewhere on the line A Q B, which is drawn through Q at right angles to P Q; and also somewhere on the line C R D, which is drawn through R at right angles to P R. Hence its actual position must be the point S in which these two lines meet. And since the elements of space here considered are indefinitely small, the path of the centre will not differ from a straight line joining its extreme positions; in other words, from the straight line P S. But P S is the diagonal of a rectangle, the sides of which are proportional to f and f^1. Hence, P S is similarly proportional to $\sqrt{f^2 + f^{1\,2}}$; and, therefore, the path of the particle is exactly the same as if it had been acted on during the first interval $d\,t$ by a force $\sqrt{f^2 + f^{1\,2}}$, whose direction coincided with P S. Hence, we have this result:—*When a centre is acted upon by two forces at right angles to each other, the effect is exactly the same as if it were acted upon by a single force, which is represented in magnitude and direction by the diagonal of any rectangle, whose sides represent in magnitude and direction the two forces acting.*

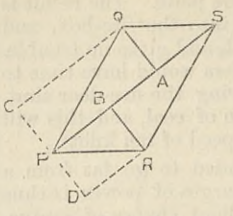
79. In the foregoing proof we have supposed for simplicity that the forces cease to act during the second interval; but by the second law the action of the forces during that interval will not alter the effect due to the action of the forces during the first interval, but must simply be added to or subtracted from it. But, by similar reasoning, this action in the second interval will be the same as if the diagonal force $\sqrt{f^2 + f^{1\,2}}$ continued to act during that interval; and therefore the result which we have arrived at will hold also for the second interval, and also for the third, fourth, fifth, &c., and is generally true for any time during which the two forces continue to act on the centre.

80. The above proof gives the principle of the combining, or, as it is usually called, the compounding of two forces, at right angles to each other, which act together on any centre. Conversely, if a centre is acted on by a single force, P S, we may in thought regard it as under the action of two forces in any two directions, P Q, P R, at right angles to each other, provided we consider the values of these forces to be represented by P Q, P R, the sides of the rectangle of which P S is the diagonal. On this supposition we are said to resolve the single force into two component forces at right angles to each other.

81. We have now to extend the proposition to cases where the forces are not at right angles.

82. *Parallelogram of Forces.—Problem:—A centre is acted on by two forces whose directions are at any angle with each other; to find the resulting motion of the centre.*

83. Precisely as in the last proposition, we may represent the effect of the two forces f and f^1, considered singly, by two straight lines P Q, P R, drawn from the position of the centre at the end of the first interval dt. Complete the parallelogram P Q S R, and join P S. Draw Q A, R B, perpendicular to P S, and complete the parallelograms C Q A P, D R B P. Then, by article 80, we may consider the force P Q as resolved into the two forces P C, P A, at right angles to each other, and the force P R as resolved into the two forces P B, P D, at right angles to each other. But by geometry it is evident that A Q = B R, and therefore P C = P D; hence the force represented by P C is equal in magnitude and opposite in direction to the force represented by P D; and therefore by the principle of symmetry they will cancel each other, and will have no effect upon the motion of P. Hence the motion of P will be entirely due to the forces represented by P B and P A, and therefore it will be along the common direction of those forces, that is along the line P S. Moreover, by geometry, P B = A S; therefore P A = B A + A S = B S, and therefore P B + P A = P S. Hence the joint effect of the forces f and f^1 will be to make the centre P move through the space P S, which is the same as the effect of a single force represented by P S. Hence, just as before, we establish the general proposition:—*If a centre is acted upon by two forces at once, whose directions make any angles with each other, the effect will be the same as if it was acted on by a single force, which is represented in magnitude and direction by the diagonal of the parallelogram, whose sides represent in magnitude and direction the two forces acting.*



84. We have thus established the proposition of the Parallelogram of Forces, which forms the foundation of statics; and that branch of mechanics can thenceforward be studied in the ordinary manner, without the introduction of any new principles. It should be observed that the forces, in the proof of the parallelogram of forces, have been represented by the velocities generated by them, as in dynamics, and not by the pounds weight they will balance, as in statics; but it is clear that a proposition which is true of things when measured in one way cannot become false when they are measured in another way, and therefore the proposition may be at once assumed to be true for the science of statics as well as for that of dynamics.

CALCULATIONS FOR HOISTING ENGINES.

THOSE interested, says the *United States Engineering and Mining Journal*, and in charge of our mining operations, rarely design their machinery for hoisting themselves. In the great majority of cases, it is far more profitable to order it from firms who make the manufacture of winding engines a speciality. Still engineers and managers are frequently placed in a position to calculate, approximately, what plant will be necessary to do given work; and with a view to facilitating this, we present, in the absence of such data in works generally available, the following outline, which may serve as a guide:—

Assuming the simplest case for vertical shafts, the points given, as a rule, are the depth of the shaft and the quantity of mineral to be hoisted in a given time. The latter will depended largely upon the nature of the arrangements for facilitating and removing the load below and above ground, and upon the dimensions and equipment of the shaft. If the former arrangements are good, little time will be lost during pauses in hoisting, while the latter affect the speed with which the hoisting can be done. When the mine cars are run directly on and off a cage, it takes only from fifteen seconds to one minute to load and unload. When the ore is filled in sacks, kept in readiness, or in filled buckets which are directly attached to the rope, one to three minutes are required; and when the bucket must be filled and dumped during a stoppage of the hoisting, from three to six minutes are necessary. The speed of hoisting depends chiefly upon the way in which the load is carried, and upon the manner in which the shaft is equipped. When hoisting is done in buckets, and there is no bratticing in the shaft, the speed should not run higher than 2ft. a second. In a bratticed shaft it may be increased to 4ft.; and when there are girders besides, 10ft. The usual speed for cages is 10ft. to 20ft., 35ft. per second being considered by many practically the maximum. The time for hoisting one load will therefore be found, in seconds, by the following formula, in which D, given in feet, is the depth of the shaft; v, the velocity of hoisting given in feet per second; and t is the time for loading and unloading:—

$$\frac{D}{v} + t$$

The number of times n in which the load is hoisted during a given period T is therefore:

$$n = \frac{T}{\frac{D}{v} + t}$$

The load q may be found in the following way, M being the quantity to be raised to the surface in the time T:

$$q = \frac{M}{n} = \frac{M}{T}\left(\frac{D}{v} + t\right)$$

As an example, let it be assumed that 120 tons (M) are to be hoisted from a depth of 300ft. (D) in ten hours (T) at a speed of 3ft. per second (v) and allowing six minutes (t) for loading and dumping. Then the quantity which must be hoisted every time will be found as follows:

$$q = \frac{120 \times 2000}{10 \times 60 \times 60}\left(\frac{300}{3} + 6\right) = 707 \text{ lb.}$$

By introducing different values for depth, speed, and time for loading, it will be readily seen how much the speed affects the output of deep shafts, and how little comparatively the time used for loading enters into the calculations for great depths and slow hoisting. It will be noted, on the other hand, that in shallow shafts and with high speed, the time thus lost is very important. As a rule, the weight of the load is given, and the question is to ascertain how much can be hoisted in a certain time. For that purpose the following formula will be used:

$$M = \frac{q \times T}{\frac{D}{v} +}$$

Assuming in the above example that the load is 1000 lb., and that otherwise the same conditions as above prevailed, we would have for the capacity per ten hours:

$$M = \frac{1000 \times 10 \times 60 \times 60}{\frac{300}{3} + 6} = 170 \text{ tons}$$

By doubling the speed, the output could be made 321 tons per ten hours, which shows that the loss due to frequency of stoppages is 19 tons.

For a steam hoist in which the drum is driven through the agency of gearing, and the weight of the descending bucket or cage counterbalances that of the one ascending, the calculation of the power requisite to do given work would be done as follows:—The engine must do its maximum amount of work in starting, when it must lift the load and bucket or cage, which constitute the dead weight, and the weight of a length of rope equal to the depth of the shaft, and must overcome some friction and resistance in the engine. The latter may be assumed to be proportional to the total strain on the ropes, and with well-designed engines may be placed at about 4 per cent. If we call q the load of ore or mineral, R the weight of the rope, and B the weight of bucket or cage and car, we shall have for the total resistance Q to be overcome in starting:

$$Q = q + R + \frac{4}{100}(q + R + 2B)$$

$$Q = \frac{104}{100}(q + R + 0{\cdot}077\,B)$$

This formula well illustrates how little importance the weight of the bucket or cage and car is, so far as moving it is concerned. It has, however, of course considerable influence in determining the size of the rope, and this, in turn, is a very important matter, especially, of course, for greater depths; and we may briefly give the data to show how its weight is arrived at. Let the number of wires in a rope be n, the diameter of the iron be d in inches, and the weight of iron per cubic inch 0·2812 lb. for iron and 0·2838 lb. for steel, then the weight per running foot is:

$$w\,12 = \times\ 0{\cdot}2812 \times n \times d^2 \times \frac{3{\cdot}1416}{4} \times \frac{125}{100}$$

The last fraction of the formula is introduced to allow for the fact that the single wires in a foot of cable are really longer than a foot, and that tar and hemp generally make it heavier. The formula per running foot is therefore:

$w = 3{\cdot}31 \times n \times d^2$ for iron.
$w = 3{\cdot}34 \times n \times d^2$ for steel.

Rziha gives the following formula for calculating the diameter of a rope D from the diameter of the wire:

$$D = 1{\cdot}5\,d\,\sqrt{n}.$$

Reuleaux calculates the diameter of the wire of the rope from their number and the load by the following formula:

$$d = \frac{1}{100}\sqrt{\frac{P}{n}}.$$

Introducing the value found by making P equal to load and weight of cage or bucket, the diameter of the wire is found, and from it that of the rope may be ascertained. Taking again our former example of 1000 lb. load with a weight of cage and car of 1500 lb., we have:

$$= \frac{1}{100}\sqrt{\frac{2500}{36}}$$
$$= 0{\cdot}0833 \text{ inch}$$
$$D = 1{\cdot}5 \times 0{\cdot}0833 \times \sqrt{36}$$
$$= 0{\cdot}75 \text{ inch.}$$

The weight of the rope per running foot would be:

$$w = 3{\cdot}31 \times 36 \times 0{\cdot}0833 \times 0{\cdot}0833 = 0{\cdot}834 \text{ lb.}$$

The weight of 300ft. of rope would therefore be 250 lb. Using the formula above given, the total resistance to be overcome in lifting the load would be:

$$Q = \frac{104}{100}\left(1000 + 250 + 0{\cdot}77 \times 1500\right) = 1420 \text{ lb.}$$

With these data we can calculate the horse-power H required to do the work, v being the speed of hoisting and Q the load:

$$H = \frac{Q \times v}{33{,}000}$$

Before entering into the details concerning the engine, we may mention, as the case frequently presents itself in our Western mines, that the value of Q is somewhat different when the rock is taken to the surface only in one bucket. Then the load will simply be the weight of rope, bucket, and rock, to which 4 per cent. of the whole is added, thus:

$$Q = \frac{104}{100}\left(q + R + B\right)$$

In designing a hoisting engine, the following points must be taken into consideration. High steam pressure is desirable in increasing efficiency and lowering the expenditure of fuel; but on the other hand, enhanced cost of boilers and greater loss of steam limit it. The use of condensers reduces the consumption of steam, but increases the first cost of the machinery, and requires considerable quantities of water. They are profitable when fuel is high and the cost of machinery is low. Cut-off engines are expensive, and the fact that the power required to carry the load to the bank varies makes it desirable to use the automatic cut-off.

The work of the pressure of steam behind the piston is returned by the back pressure, by friction and minor resistance. All these forces may be assumed to be equal to an effective pressure p, in pounds per square inch, acting upon the piston during the whole stroke. Let S, in square inches, be the piston surface; s, in feet, be the average piston speed, and H will be conceded to be equal to the following:

$$H = \frac{S \times p \times s}{33{,}000}$$

Or with D the diameter of the piston in inches, and s given in feet per second,

$$H = \frac{3{\cdot}1416}{4} \times D^2 \times \frac{60 \times s \times p}{33{,}000} \text{ or}$$

$$H = \frac{47{\cdot}124}{33{,}000} \times D^2 \times s \times p, \text{ or}$$

$$D = \sqrt{\frac{H \times 33{,}000}{s \times p \times 47{\cdot}124}}$$

Engines working without any cut-off may be assumed to be running during the entire stroke with 97·5 per cent. of full effective pressure, which would be equal to cutting off at nine-tenths of the stroke, and that value must be introduced. Allowance must also be made for the fact that the piston-rod takes away some of the effective piston surface, being greater for small engines. It may be placed at about 5 per cent. The effective pressure at the beginning of the stroke is not equal to the boiler pressure, being only about 80 per cent. of it. With these modifications, the formula for the diameter of the cylinder will be, p now being the boiler pressure,

$$D = 30\sqrt{\frac{H}{s \times p}}$$

The boiler pressure is generally given, or at least approximately known, the average being from 40 lb. to 60 lb. For engines of 8 to 300-horse power, the piston speed s ranges between 3ft. and 5ft. a second. If it is made large, the dimensions of the cylinder are naturally decreased, and the loss of steam by imperfect packing of the piston and by condensation is lessened. On the other hand, there is greater danger of breakage, and the back pressure of the exhaust steam is run up. The number of revolutions, too, is increased, whereby the proportion of the gearing may become unfavourable, though the weight of the fly-wheel may be lessened. The length of the stroke, of course, affects the number of revolutions, and it is generally chosen at 1·5 to three times the diameter of the cylinder.

Following out our example, which we may take this occasion to state is not intended to represent a model case, but is given merely as an illustration in the use of the formula, we may assume the piston speed to be 4ft. a second, and the boiler pressure 50 lb. per square inch.

$$H = \frac{1420 \times 3 \times 60}{30{,}000} = 7{\cdot}7\text{-horse power.}$$

$$D = 33\sqrt{\frac{7{\cdot}7}{4 \times 50}} = 5{\cdot}9\text{in.}$$

It would take us beyond the limits of the present article to go into a calculation of cut-off engines, nor can we enter into any details concerning the dimensions of the various parts of an engine, or a discussion of various styles. The data given may serve as a guide in shaping an opinion as to the capacity required for given work or to calculate approximately, for instance, to what additional depth a shaft may be sunk without calling for additional machinery to maintain a given output. We need hardly add that, in ordering a hoisting engine, ordinary prudence and foresight require that its capacity be chosen considerably in excess of immediate necessity. It is an error too often made to practice false economy in this respect. Engines that have grown weak in rough service are crowded beyond their capacity. In the natural course. the increasing depth of a mine causes its hoisting apparatus to be taxed in an increasing measure, while it is steadily becoming more unfit by wear. Unreasonable managers then lay the blame of frequent breakdowns and constant costly repairs upon the builders, who are generally held responsible for evils which are the outgrowth of such short-sighted economy.

SHAFT SINKING UNDER DIFFICULTIES AT DORCHESTER BAY TUNNEL, BOSTON, MASS.*

By D. McN. Stauffer, Member A.S.C.E.

The body of this paper will be devoted to a detail of actual experience in shaft building under difficult circumstances, but that the existing local conditions may be better understood, we will commence by a short general sketch of the work with which these shafts are immediately connected. The system of improved sewerage, now being carried out by the city of Boston, is too extensive and complex in its ramifications to be treated of in this paper; we will therefore begin at the pumping station on the Old Harbour Point, the terminus of the low-grade intercepting sewers. The sewage, in passing from the pumping station to the point of final delivery on Moon Island, must cross under Dorchester Bay, a navigable arm of Boston Harbour, about two miles wide from shore to shore, and to this end an inverted syphon or submarine tunnel becomes necessary. After an examination into the geological formation of this region, it was determined to locate the horizontal portion of the syphon at a sufficient depth below the surface of the water to be entirely contained within the rock which was found to underlie the bay. This determination fixed the average invert grade of the finished tunnel about 142ft. below mean low tide, or Boston City datum. The ship channel is only 18ft. deep at low water, but the material overlying the rock was mud, clay, sand, and gravel, so irregular in its deposit, and so unreliable in its general character, that tunnelling through it was an impossibility with the Atlantic ocean practically overhead. The rock to be passed through belongs to the clay-slates, with, so far, infrequent strata of very hard conglomerates. But at some remote period this ancient sea floor, in taking its present trough-like shape, has been subjected to enormous pressures, much disturbing the original stratification, breaking the beds in many places and leaving them tilted at high angles to the horizon. The numerous faults consequent on this action have been generally well filled again by injected material, but crevices, fortunately slight in extent, are frequent, which communicate more or less directly with a water-bearing stratum of sand, gravel, and boulders, which seems to be continuous over the surface of the rock. Wherever cut by the tunnel section these seams allow a greater or less percolation of sea-water into the workings below, amounting at this date—July, 1881—to $1\frac{1}{2}$ millions of gallons daily, which can, of course, only be removed by constant pumping, the length of tunnel now excavated being 4600ft. Fig. 1 is a general profile of the tunnel, and shows the rock dipping rapidly from east to west. To meet this rock at as high an elevation as possible, the western, or inlet shaft, was pushed out about 1400ft. from the Boston shore of the bay, and connection made between it and the pumping station by a high-grade tank sewer, founded upon on embankment, and protected by rip-rap and a sea wall. Four pumps, of a capacity of 25 million gallons each daily, will raise the sewage a height of about 43ft., and deliver it into this tank sewer, the invert grade of which is $15\frac{5}{10}$ft. above city datum. This tank is double, each section being 8ft. wide by 16ft. high, and the interior is provided with a series of dams, which will intercept any heavy material that may pass through the screens provided at the entrance to the pump well. Either compartment of the tank can be shut off by gates, and cleaned, and by means of stop planks, the velocity head can be greatly increased, and the tank sewer used to flush out the tunnel, sea water being pumped into the tank for this purpose. At the inlet shaft, the bottom of which is 142ft. below datum, the tunnel commences, and runs in a south-easterly direction for a distance of 6090ft. to the centre of the East Shaft, the bottom of which is 144ft. below datum; at this latter point the tunnel grade commences to rise at the rate of 1ft. vertical in 6ft. horizontal, and continues at this grade for a further horizontal distance of 903ft., until the tunnel pierces the surface of the ground on Squantum Head, which forms the eastern side of Dorchester Bay. At the eastern terminus of the tunnel the invert grade is 14·4ft. above datum, and from this point the sewer is continued in an open cut across Squantum Head, and then on an embankment over the shoal water lying between the Head and Moon Island, to the collecting basin on the island, from which basin the sewage is emptied into the bay at each ebb tide by an appropriate system of gates and outfall chambers. The point of discharge is $4\frac{1}{2}$ miles in a direct line from the State House in Boston.

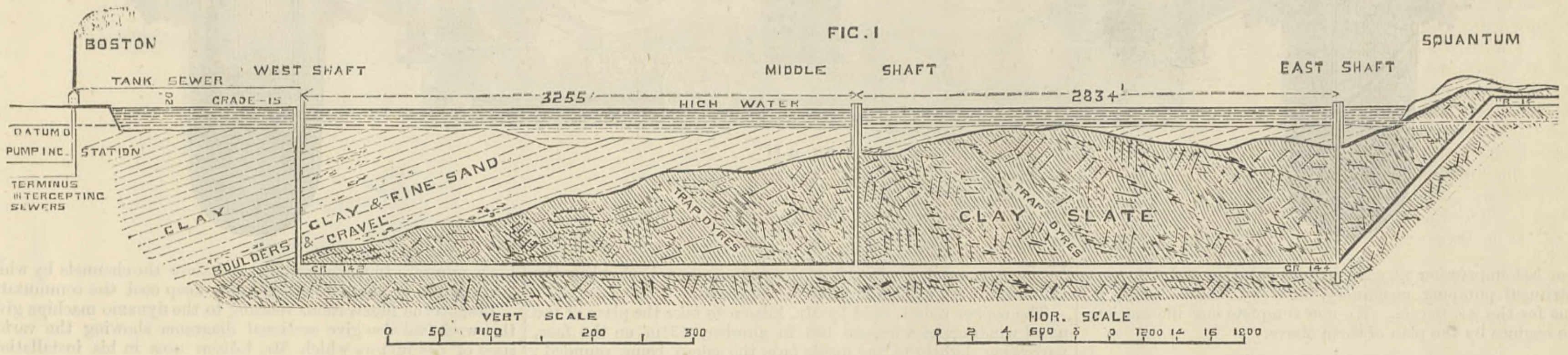
Dimension of Tunnel and Shafts.—The tunnel and the shafts are circular in section, with a finished inside diameter of 7ft. 6in. The tunnel and shaft excavation, as at first taken out, is as near as may be 9ft. 6in. in diameter, provision being thus made for a final lining of brickwork throughout, 12in. thick, for the purpose of reducing friction. This brickwork is intended to be water-tight, and at the inlet shaft gates and an outfall sewer will be built, leading from the tank sewer, so that the sewage can be discharged directly into the bay at this point, and the tunnel pumped out, examined, and cleansed when such a proceeding may be deemed necessary. To intercept any solid matter that may pass into the tunnel, a sump, 6ft. deep, is provided at the bottom of the East Shaft, and consequently at the foot of the incline, from which sump the material may be removed by dredging through the shaft. The middle shaft, shown on the profile, is simply for working purposes, and may be finally filled up.

Bulkheads about Shafts.—As all the shafts are located in water, from 3ft. to 15ft. in depth, depending upon the state of the tide, bulkheads were necessary, from which to commence operations, and to protect the mouth of the shaft from damage by storm, ice, passing vessels, &c. As shown at Figs. 2 and 3, these bulkheads consisted substantially of a box 20ft. square inside, formed of oak piles driven $2\frac{1}{2}$ft. apart from centres, and capped by 12in. by 12in. hard pine sticks, framed at the corners, and drift-bolted to the head of each pile. These caps were further secured at the corners by 12in. by 12in. angle braces, dovetailed into them. The box was lined inside by 4in. tongued and grooved sheet-piling, driven to hard bottom, and well spiked to four lines of 4in. by 10in. inside wale pieces. Outside of the piles were two sets of 12in. by 12in. hard pine timbers, spaced 4ft. apart vertically, and bolted to the piles by $1\frac{1}{4}$in. bolts, and tied at the corners of each set by 2in. diagonal rods. The top of this bulkhead was 18ft. above mean low tide, the average rise and fall of tide being 10ft. After the iron cylinder had been started within this box, the space surrounding the cylinder was compactly filled with puddle clay.

The Iron Cylinders.—To quote from the specifications, "iron cylinders were to be sunk to a depth sufficient to give them a firm bearing, to ensure the exclusion of tide-water, and to pass through ground otherwise difficult to excavate." These cylinders are 9ft. 6in. inside diameter, $1\frac{3}{8}$in. thick, and cast in solid sections 5ft. long. The flanges are $5\frac{3}{8}$in. wide over all, 2in. thick, and faced true for a width of $4\frac{3}{8}$in. in from the exterior edge. A groove, $\frac{1}{2}$in. wide and $1\frac{3}{8}$in. deep, was left between any two abutting cylinders, on the inside, to be caulked with lead if found necessary. The sections were connected by thirty turned bolts, $1\frac{1}{4}$in. diameter, in each joint, and the bottom section in each shaft was provided with a cutting edge 12in. deep. The weight of each section was five tons, or one ton to the lineal foot of iron cylinder. The joints were made water-tight by first painting them with thick red lead, and then passing four turns of cotton wicking dipped in the paint around the outside line of the bolt holes; grummets of the same wicking, dipped in paint, were put under the heads and nuts of all the connecting bolts. These joints proved perfectly water-tight.

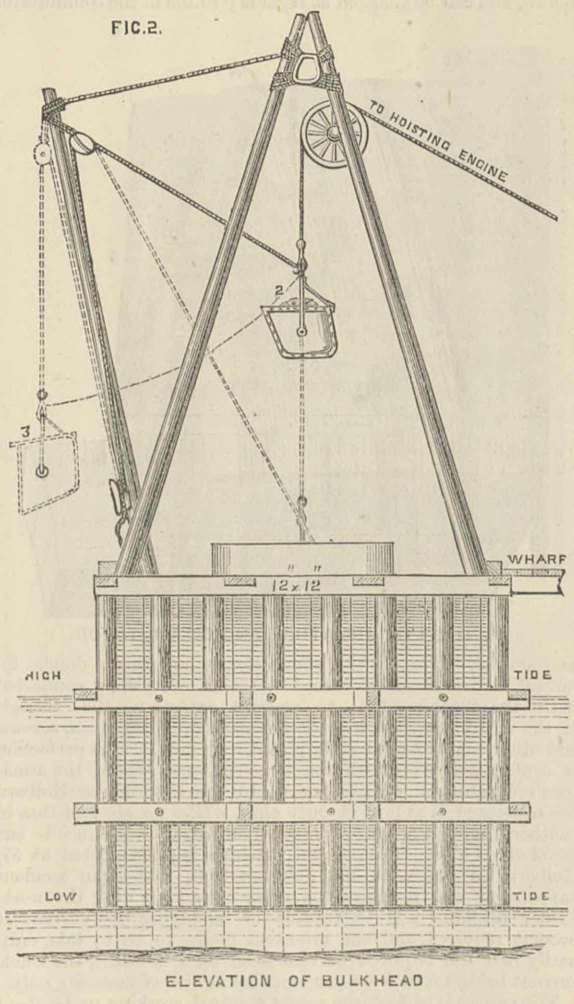
Sinking the Cylinders.—After the bulkheads were completed, pile wharves had to be built adjoining them, upon which to place the hoisting engines, boilers, coal-bins, fresh water tanks, &c. To handle the 5-ton cylinder sections, four stout shear-poles were erected, resting on the corners of the bulkhead, and meeting at the top over the centre of the proposed shaft, where the ends were secured by rope lashing—Fig. 2. A hoisting tackle of two triple-sheaved "masting blocks," and 4in. Manilla rope, was suspended from the apex of these shears. Owing to delay in obtaining the proper kind of clay filling, and to avoid the increased friction as well, the first five cylinder sections in each shaft were put in place by means of friction clamps, shown at Fig. 3. These clamps were made of two compound beams of hard pine timber, thrown across the bulkhead, one each side of the cylinder. Each beam was composed of three 12in. by 20in. sticks, the inner one of each beam being carefully fitted to the outside of the cylinder; to increase the friction, four vertical timbers, 12in. by 12in. and 4ft. long, were bolted to the inside of the beams, as shown on the plan. The clamps were drawn together and made to hold any object between them by tightening up the nuts on two $2\frac{1}{4}$in. iron rods that passed through the beams one each side of the cylinder section. We should here remark that, owing to its resinous nature, hard pine is not well adapted for use in that part of the beam touching the cylinder, white pine is much better, but in our case could not be obtained in time of the required dimensions. The method of operating these friction clamps was as follows:—No. 1 section was first lowered down between the beams, and clamped fast. No. 2 section was next lowered down upon No. 1, the joint made, and the connecting bolts put in and screwed up; with the hoisting tackle still attached to the last section as a "preventer," the two sections were allowed to slip down between the clamp beams in a series of short jumps, by carefully slackening and then tightening the nuts on the clamp rods with a long wrench. A little practice enabled the workmen to keep the mass under perfect control. When No. 2 section occupied the place in the clamps previously held by No. 1, the nuts were screwed up tight, the tackle cast off, and the third section bolted on, and lowered in like manner. This process was repeated until the cutting edge on the first section had reached hard bottom, when the clamps were loosened, and thereafter utilised as guides.

Handling the Material Excavated.—Before the permanent hoisting cages were put in place, the material excavated in sinking the shafts, and in driving a considerable portion of the tunnel as well, was handled by an arrangement shown at Fig. 2. This was simply an out-haul, working through a single block lashed to the head of a mast planted in the bulkhead; this mast leaned outward at the top—over the side of the bulkhead. In using this arrangement, the bucket is hoisted a distance above the shaft, fixed by experiment—the out-haul being hooked on to the bucket just as it reaches the mouth of the shaft—and the slack hauled in as the bucket ascends, when the bucket stops, the end of the out-haul is made fast to a cleat on the mast, and the bucket in descending will pass through a curve regulated by the length of the out-haul, until it hangs vertically from the top of the mast, and over the sides of the bulkhead, where it can be dumped. A reversal of thi process will bring the bucket again to the top of the shaft, where the out-haul is unhooked, and the bucket lowered to the bott for refilling. (*To be continued.*)



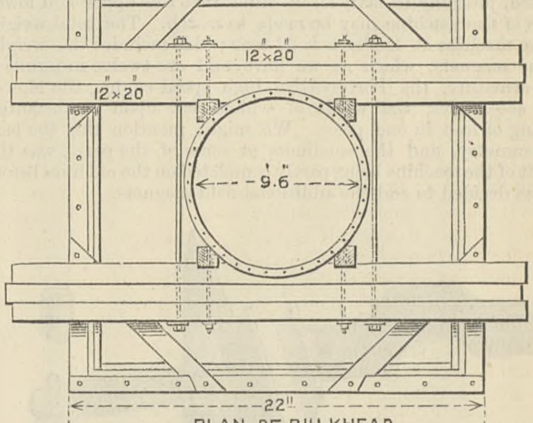
DORCHESTER BAY TUNNEL

FIG. 2.



ELEVATION OF BULKHEAD

FIG. 3.



PLAN OF BULKHEAD

* Read September 21st, 1881, before the American Society of Civil Engineers.

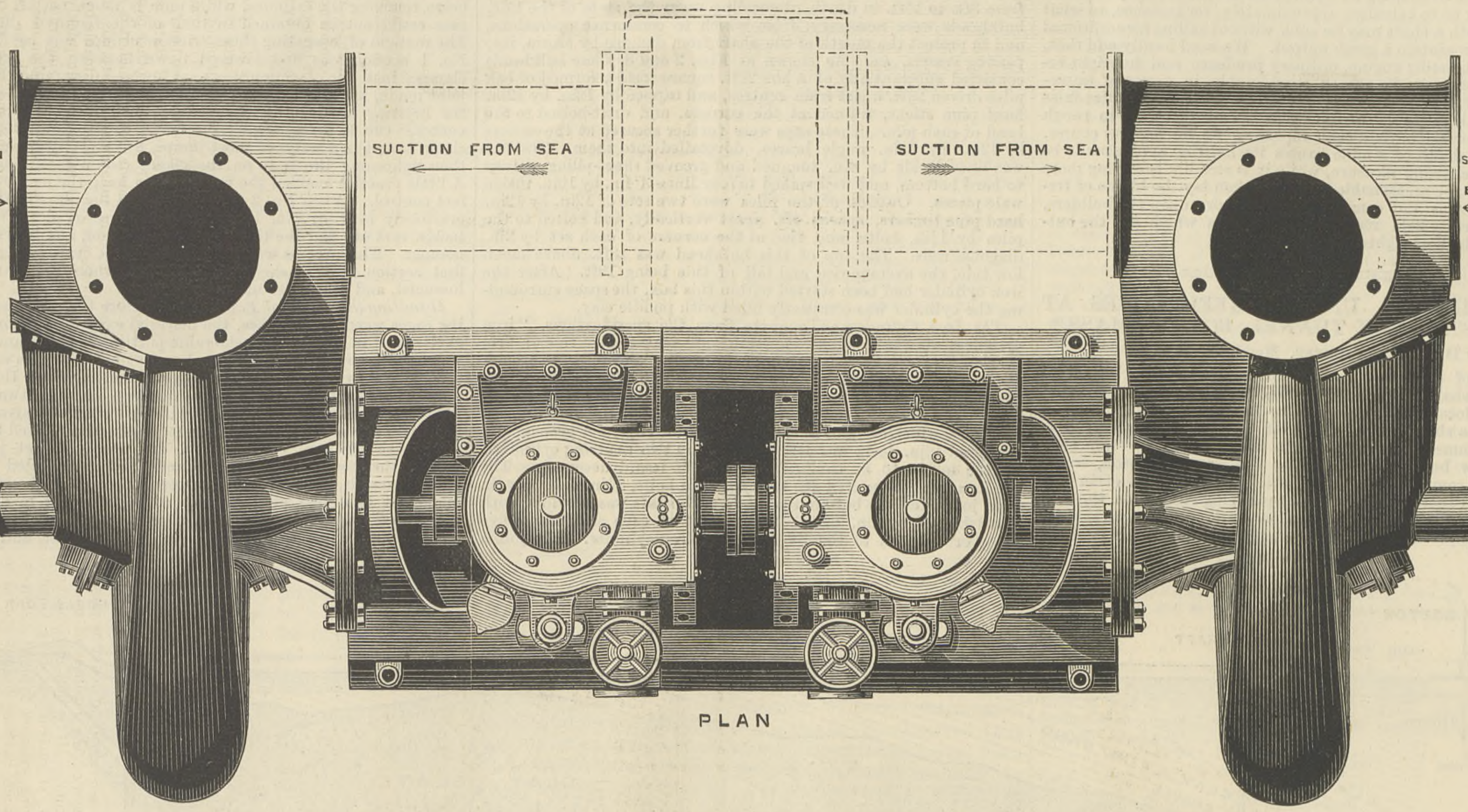
HIGH PRODUCTION OF AMERICAN STEEL WORKS.

According to the *Bulletin*, of the American Iron Trades Association, the Bethlehem Iron Company, in October, made 14,646 gross tons of Bessemer steel ingots. Its best week's work was 3857 tons, and best twenty-four hours' work was 654 tons. The Bethlehem Iron Company has four converters, but it has at present sufficient blowing apparatus for only two of them. One of the two new converters, however, is occasionally used in place of one of the two old ones. The best work by the Bethlehem Iron Company's blooming mill and steel rail mills was as follows:—Best twenty-four hours, 679 gross tons 220 lb. of blooms and 458 tons 2016 lb. of rails; best week, 3589 tons of blooms and 2875 tons of rails; best month, 14,663 tons 1568 lb. of blooms and 11,336 tons of rails. In the same month for which the rail production is here given, the billet mill rolled 1214 tons of steel billets. In the week ending October 29th, 1881, the two converters of the Albany and Rensselaer Iron and Steel Company made 2906 tons 896 lb. of Bessemer steel ingots; the blooming mill rolled all of these ingots. In this week, the best eight hours' work was 210 tons 1120 lb. of ingots; the best twenty-four hours' work was 544 tons 1568 lb. of ingots. The rail mill rolled 2230 tons 1120 lb. of steel rails in the same week. In the month of October, 1881, the Albany and Rensselaer Iron and Steel Company, with two converters made 11,629 tons 1792 lb. of Bessemer steel ingots; the blooming mill rolled all of these ingots, and the rail mill rolled 8748 tons 448 lb. of steel rails. The merchant mill also rolled 3145 tons 880 lb. of steel billets and bars, which, added to the rail product, makes the total finished product 11,893 tons 1328 lb. During the same month the Albany Ironworks department of the same company produced 3401 tons of merchant iron, exclusive of railroad spikes, bridge and boiler rivets, bolts and nuts, crow bars, and car axles. The Bessemer steel works of the Vulcan Steel Company record for October shows that good work may hereafter be expected of them. The record is as follows: Ingots, 8977 tons 1650 lb.; blooms, 7778 tons 1020 lb.; rails, 6403 tons 620 lb. They have but two converters.

Patent Law.—A meeting of the Civil and Mechanical Engineer's Society will be held on Thursday next, the 26th inst., at 7 o'clock p.m., when a paper "On Certain Proposals as to the Amendment of the Patent Laws," by Mr. W. Lloyd Wise, will be read. In order to have a free and open discussion any persons interested are invited to be present—without ticket—and in the discussion

CENTRIFUGAL PUMPING ENGINES, S.S. SERVIA.

MESSRS. J. AND H. GWYNNE, HAMMERSMITH, ENGINEERS.

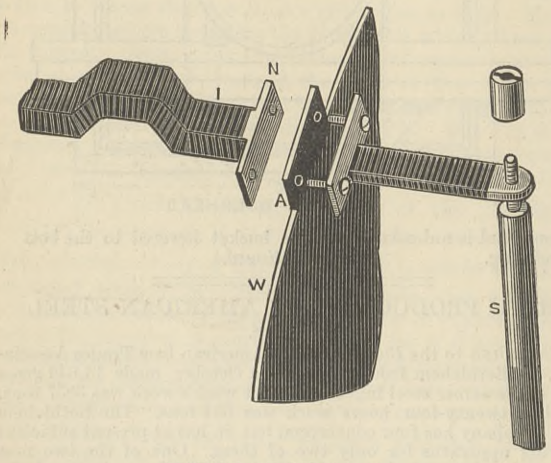


PLAN

IN our last impression we gave a front elevation and side view of centrifugal pumping machinery, made by Messrs. J. and H. Gwynne for the s.s. Servia. We now complete our illustrations of these engines by the plan of them above.

THE EDISON LIGHT.

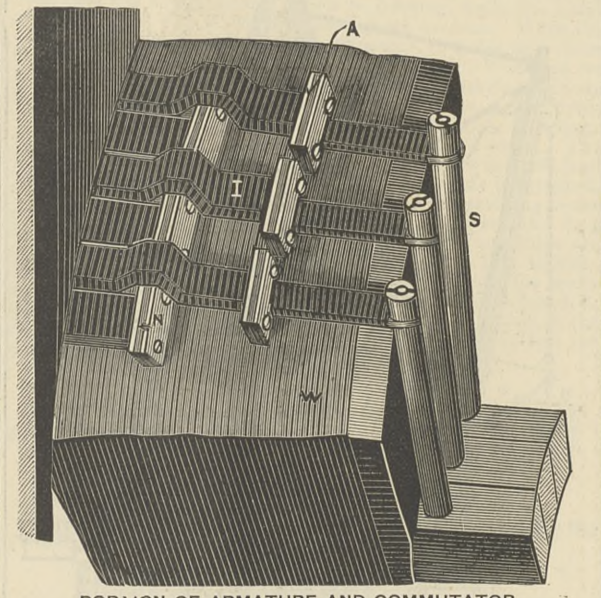
ACCORDING to our promise of last week, we give on another page a perspective view of the Edison machine as it stands at 57, Holborn. This machine differs somewhat from those shown in the plans given at pp. 5 and 28, inasmuch as it is larger. The dynamo machines shown in the illustrations referred to have six field magnets, whilst the machine at Holborn has twelve. The smaller machines are more symmetrical, but less effective, and in future the number of field magnets will be still further increased, probably to sixteen, in order that the upper and lower parts of the machine may be made to match. The total weight of the machine at Holborn is 22 tons; this includes the weight of the magnets, which as we have said are twelve in number, the armature, the Porter-Allen high speed engine, the blower and accessories, the whole of which rest upon a substantial casting of iron in one piece. We might mention that the lack of symmetry, and the smallness ot some of the parts, was the result of the machine being partly completed on the old lines before it was decided to add the additional field magnets.



DETAILS OF ARMATURE.

The dynamo machine proper consists of the cast iron field magnets, the resistance of which varies from 1·95 to 2·13 ohms each. These magnets are connected in series of six, the series respectively having a resistance of 12·23 and 12·22 ohms. The two series are connected in multiple arc, the aggregate resistance of the field magnets being thus reduced to 6·11 ohms. The magnets are wound with No. 10 wire—Brown and Sharpe's gauge. The poles are massive pieces of cast iron. These enormous magnets have excited considerable attention from time to time, and a good deal of adverse criticism has been made upon them, but Mr. Edison strongly maintains the wisdom of a large investment in iron which is cheap, and which allows him a large dividend in the utilisation of energy. The armature consists in the first place of a steel shaft 6in. in diameter, over which is fitted a wooden cylinder 12·5in. external diameter. On the central portion of this compound cylinder a large number of thin discs of sheet iron are slipped, the discs being separated from each other by sheets of tissue paper of similar diameter. There, are, however, eight intermittent iron discs of ½in. thickness to give the necessary strength, and the whole is bolted together by eight bolts, each 1in. diameter and 44$\frac{9}{16}$in. in length. These iron discs form the core of the armature. Copper discs of a somewhat larger diameter than the iron discs are placed at each end of the built-up core. There are fifty-three of these discs each 26⅝in. diameter ·102 B and S gauge, with alternate discs of prepared paper for insulation ·015in. thick. These copper discs have each two lugs on their circumference, to which the armature rods are connected. In the details shown in our drawings W indicates the copper disc, A the lug, I the armature rod, S the connection to the commutator. We show the arrangement both when the connections are made and when disconnected.

The copper rods I, used by Mr. Edison to take the place of the usual windings of wire, are 106 in number, ·634in. on the face, narrowing slightly to the inside face, the edges being rounded; they are ½in. thick and average in length 52in. These rods are wrapped by machinery with prepared paper, the layers of paper being each coated with a special insulating material. The rods are separated from each other at every foot of their length by peices of vulcanite fibre encased in mica, and also by an air space of ·38in. Every alternate rod is connected through a radial copper rod with the commutator. The blocks of the commutator are fifty-three in number, and taper in a similar manner to the armature bars, are bevelled at the ends and separated by strips of mica. The diameter of the commutator K is 12⅞in. At the back of the radial bars, and acting as a facing to the copper discs, is a mahogany disc ½in. thick. The complete armature is wound with steel wire, with double mica insulation underneath; this wire is intended to counteract any centrifugal action. The bar upon which the brush holders are fastened is shown at H, the brushes are connected with the main conductors C through levers as shown, and can be changed as regards position in the commutator



PORTION OF ARMATURE AND COMMUTATOR.

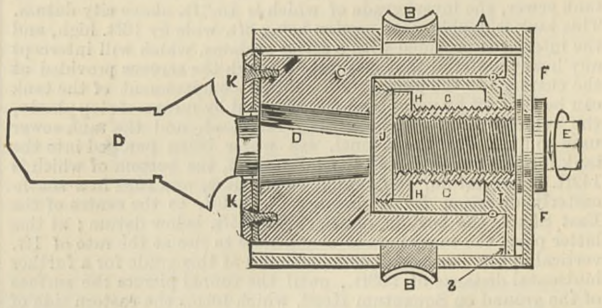
as required. The drawing shows clearly how this is done. So careful has the inventor been to consider everything connected with the machine, that to prevent oxidation the threads of the radial bars, the lugs on the armature, bars, discs, screws, and other contacts are lightly plated with gold. This perfection of contacts, together with the large sectional area of the armature rods, ensures low resistance. In the machine at Holborn the resistance is as low as ·0049 ohm, whilst we are told that in another machine, now *en route* for London, the resistance is but ·0032 of an ohm. This second machine is to be erected at 57, Holborn, in order, as Mr. Johnson says, that if an accident happens to one machine the other may take over the work. Either machine will be capable of supplying the current at present required, and the intention seems to be to take ordinarily half the required current from each machine, the whole current being taken from one machine in case of necessity only.

The engine is of 40-horse power nominal, working up to about 125-horse power indicated. The cylinders are 11in. diameter, with 16in. stroke, the cut-off taking place at about half stroke. The engine is connected direct to the shaft of the armature, which revolves at the rate of 350 revolutions per minute. This machine is intended to supply the current for 1000 Edison lamps of 16-candle power each, and is the largest machine hitherto erected. The new machine has been tried with 1360 lamps, running for fifteen hours per day for several consecutive days. Taking the figures as above given, the Holborn machine with an expenditure of 125-horse power, gives 16,000 candles, or 128 candles per horse-power. In the engraving, A A show the channels by which air is driven to circulate around and keep cool the commutator.

Besides the illustrations relating to the dynamo machine given this week, we also give sectional diagrams showing the various sizes of conductors which Mr. Edison uses in his installations. The conductors used of course vary with the current to be carried. We would particularly call attention again to the street and house connections illustrated last week. It is easy to calculate the diameter, &c., of the wire of a given metal that will carry a given current without fusing. As a safety appliance Mr. Edison uses a piece of fusible conductor of such a size that it will conveniently carry the current ordinarily required, but should at any time a greater current attempt to pass per unit of time, the conductor fuses and is broken, offering an infinite resistance to the passage of the current, and obviating danger of fire by over-heating the wires. On Wednesday last the dynamo machine and lamps at Holborn were shown in action to a number of gentlemen, as was also a fusible conductor. A hundred lamps had been arranged in circuit with a fusible conductor calculated to carry current sufficient for fifty lamps only. The experiment was successful—the metal was fused—and the lamps, and we may suppose the woodwork, saved from the effects of a too large current. We may also state here that on Tuesday evening the concert-room at the Crystal Palace was lighted up by the Edison light, in the presence of the honorary council and other gentlemen specially invited.

A SMALL DRILLING APPARATUS.

THE following description of a small machine for drilling the holes in the cheeks of the locomotive frames in the Altoona Works of the Pennsylvania Railway Company, we take from the American *Mechanical Engineer*:—The size—about 1⅝in.—and the position of these holes make them very awkward to get at The machine designed by Mr. S. M. Vanclair will, however, drill a hole in five minutes. Its feed mechanism is constructed to give a length of feed equal to twice the length of the feed screw. Its construction is shown in Fig. 1, in which A A represents a cylindrical bearing, which has means whereby it may be fixed between and to the pedestal jaws, and affording a bearing to the sleeve C which is driven by the worm wheel B, having the feather *d*, which fits in a spline in C. The drilling and countersinking tool D has an ordinary taper stem

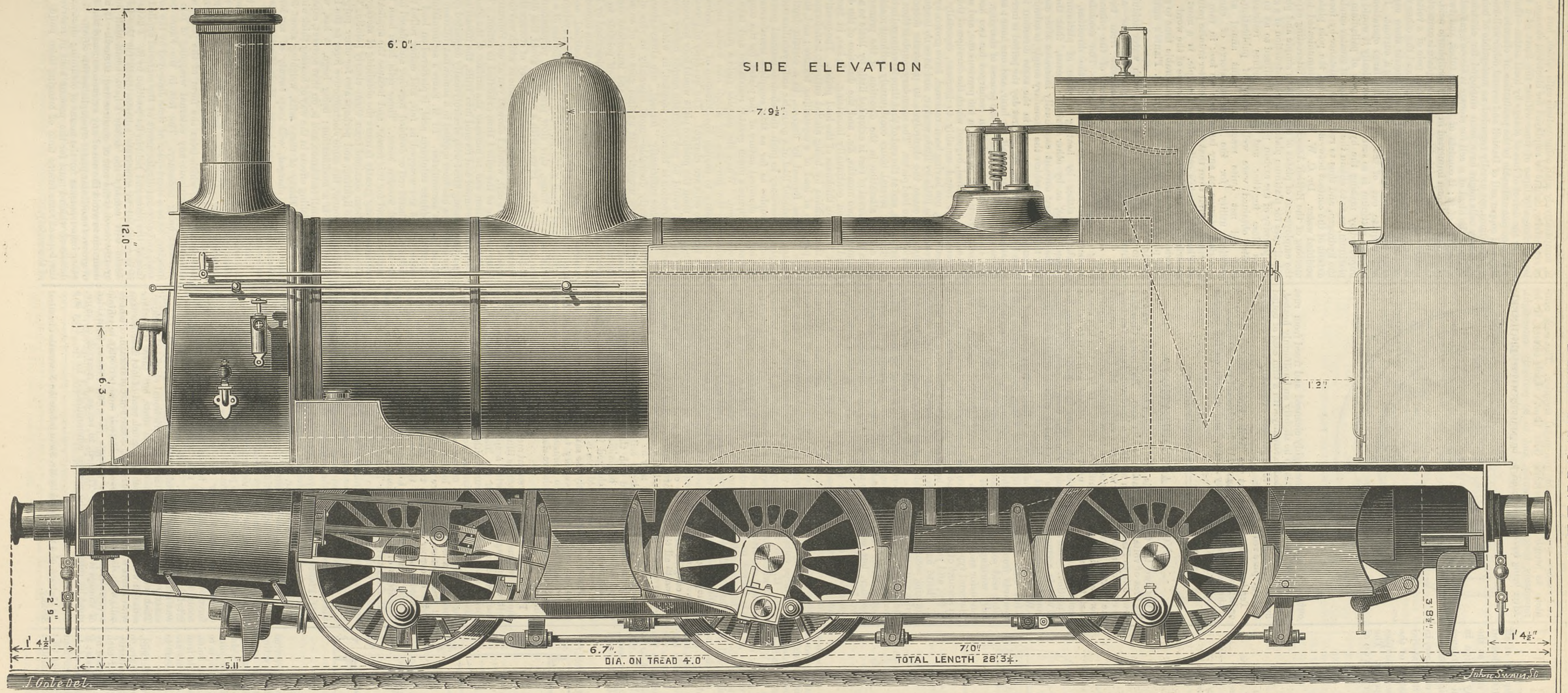


fitting into C. F is a feed screw threaded into a sleeve G, which is also threaded into the sleeve I at one end; F F is a collar made in two halves, screwed to A, and affording journal bearings to E.

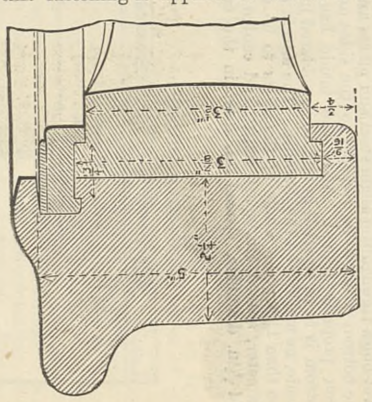
The piece I has a feather at *i* which projects into a spline in A, so that I cannot rotate. Suppose that B is rotated by the worm—not shown—then C and D will be rotated, while E F G I and J will remain stationary. But if E be operated by a wrench then G will rotate with it—by reason of the friction between the two—and I, acting as a nut, will move endways within A and feed C, and therefore D to the cut. This action will continue until I has moved sufficient to cause the inside radial face of I to meet radial face H H of G, whereupon it will hold G stationary by reason of the friction of these radial surfaces; and E, on being operated, will cause G to act as a nut, and the feeding of C within D will continue. Thus the length of the feed is that due to the length of E within G, added to the distance between the radial face H and the inside radial face of I. K K is a collar put on in two halves, and holding a disc of leather to C to exclude dirt and chips from the bore of A.

SIX COUPLED TANK ENGINE, KIOTO-OTSU SECTION, JAPANESE RAILWAY.

MR. B. WRIGHT, M.I.M.E., LOCOMOTIVE SUPERINTENDENT, ENGINEER.



WE illustrate above a tank locomotive designed for the Japanese railways by Mr. B. Wright, locomotive superintendent of the line. The drawing practically explains itself. The principal dimensions are as follows:—Diameter of cylinders, 15in.; stroke, 22in.; wheel base, 13ft. 7in.; leading to driving wheels, 6ft. 7in.; driving to trailing wheels, 7ft.; heating surface, fire-box, 70 square feet; ditto tubes, 757 square feet; total, 827 square feet; fire-grate area, 11·5 square feet; number of tubes, 160; thickness B.W.G., 12 and 14; pressure, 150 lb.; diameter of wheels, 4ft.; tank capacity, 500 gallons; ditto of bunkers, 30 cwt. The boiler is fed by one No. 9 Friedman's injector, one No. 8 ditto, made in Kobe Works, both placed under the foot-plate, with delivery pipes, clack boxes, and stop valves on the front of the fire-box. The weight of the engine loaded is 32 tons 11 cwt., of which the leading wheels carry 10 tons 5 cwt., the drivers 11 tons 2 cwt., and the trailing wheels 11 tons 4 cwt. The tires are secured on the system patented by Mr. Carlton, of 63, Queen Victoria-street, and Mr. Stroudley, of Brighton. The arrangement is illustrated in the accompanying engraving. The method usually adopted when rings are employed as a medium for fastening and securing tires upon iron wheels, is simply to form a groove between the wheel and an overlapping portion of the tire into which the ring is fitted, so as to prevent the tire moving outwards across the wheel; but such arrangement possesses little or no power to retain the tire in its place when it is broken into several pieces. The mode in which this fastening is applied to wheels is as follows:—The



iron wheel is prepared to receive the tire by first having shoulders formed on its two side surfaces, which extend the transverse thickness of its periphery; the tire is then formed so as to embrace and fit this shoulder or rim on one side, and leave an opening or groove clear and overhanging the other side; then a ring is rolled of iron or steel to a section fitting the shoulder or bevelled recess formed in the tire and the square shoulder of the wheel. The ring is then sprung into the tire so as to clip the shoulders of the tire and wheel, and secured by means of a ring of a slightly bevelled section, which is forced in behind the clip ring, which position makes it impossible for the clip ring or the tire to escape from the wheel, even if broken into short pieces.

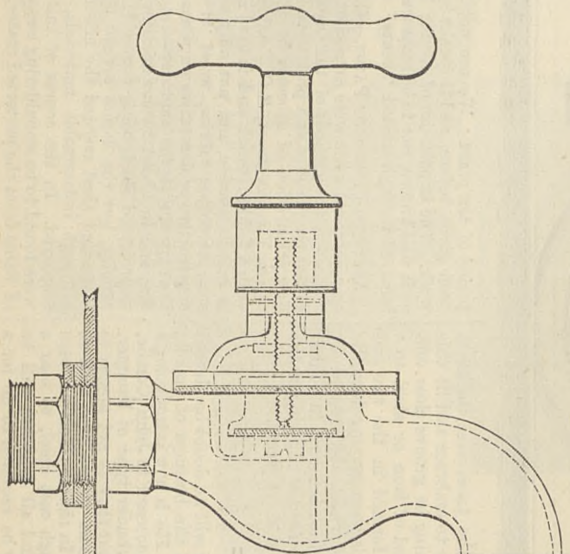
A NEW STEAM HAMMER.—Many of our readers will no doubt be pleased to hear that Mr. Allan C. Wylie has resumed the business of making steam hammers which he gave up for a time. He is now introducing a hammer in many respects new. Mr. Wylie, as successor to John Condie, has always been identified with the moving cylinder type of hammer. Great objections were raised to it at one time, but they do not appear to have much force; at all events there are hammers of the kind still in use after more than twenty years' hard service. In the new hammer each cylinder and cover will be made of mild, tough cast steel, to bear a tensile strain of 34 tons to the square inch, and all cylinders will be guaranteed to stand the hardest work they may be required to do for a period of ten years. We are not aware that such a guarantee has ever been given before, and it speaks highly for Mr. Wylie's confidence in his work. The importance of having hammers which will not break down is, as is well known, not to be measured by the cost of repairs, but by the loss incurred through wasted "heats" and men standing idle.

ASBESTOS FIREPROOF PAINT.—On the 15th inst. a series of experiments on a practical scale were carried out in the presence of a large number of visitors in the grounds of the Crystal Palace with asbestos paint, in order to test its qualities as a protective covering against fire. This paint is a new preparation of asbestos by the United Asbestos Company, of 161, Queen Victoria-street, E.C. Asbestos in a finely divided state is mixed with a fluid material, and is used in a similar manner to other paints. It is uninflammable, and not only so, but substances to which it is applied, such as cotton fabrics, wood, or other inflammable materials used for constructive or decorative purposes are rendered uninflammable by it. In the experiments the unprotected stage which had been built quickly caught fire, and in about twelve minutes it was a heap of blazing ruins. The unprotected shed, being open-sided, did not take fire so soon nor burn so rapidly, but the flames eventually got hold of it. Both the protected stage and shed resisted the effects of fire to the end most successfully, although inflammable materials, including naphtha, were occasionally employed. In the course of half an hour some portions of the fittings were found to be smouldering away, but at no time was there any outburst of flame from the protected materials.

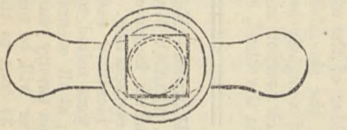
CONTRACTS OPEN.

100-GALLON STEEL OIL CISTERNS.

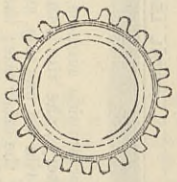
THE work included in this specification is the finding of all materials and labour in the construction of 104 100-gallon oil cisterns, as hereinafter described, and delivering the same at the Trinity Buoy Wharf, Blackwall, or at any railway station in London as may be directed. The work to be made in accordance with the terms and conditions, the details of this specification, and the drawing number 4456. The work to be executed complete, in a proper workshop, on the contractor's premises, and the material and workmanship are to be to the entire satisfaction of the Engineer-in-Chief to the Corporation of Trinity House. Samples of all materials to be supplied by the contractor for approval. The gun-metal is to be in the proportion of 14 oz. of copper to 1 oz. of



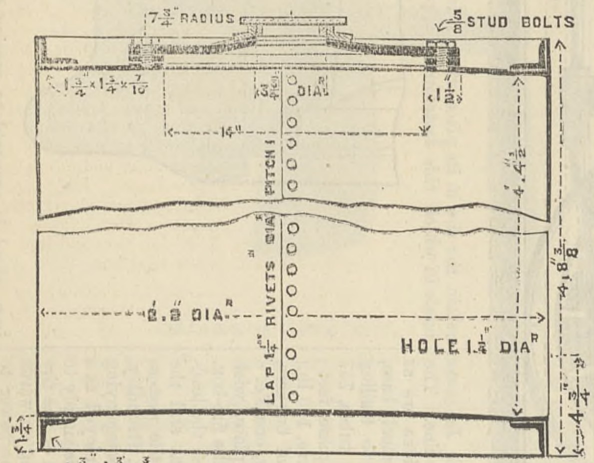
ELEVATION OF COCK



INVERTED PLAN OF KEY



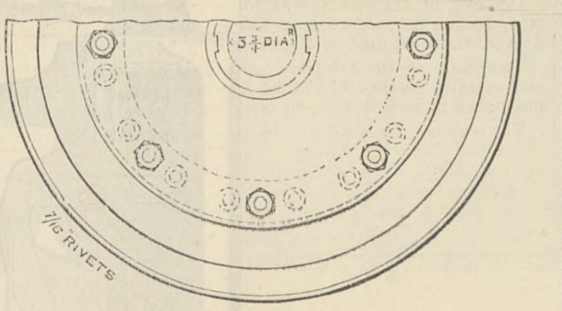
tin and 1 oz. of zinc, the copper, tin, and zinc to be of the best pure and approved quality. The iron and gun-metal castings to be run solid, free from sand, air-holes, and other defects and blemishes and to be neat, clean, smooth, and true. The steel to be "Siemens-Landore Steel," or of equal and approved quality; the threads of the screws and of the screw-bolts are to be cut true to "Whitworth's Standard," and the screw-bolts provided with proper nuts and washers. The cisterns to be 4ft. 8⅜in. long outside and 2ft. 2in. inside diameter. The side and end plates to be No. 8 Birmingham wire gauge. One end and one side-plate will be selected by the engineer for test. The bottom to be attached to the sides by a 1¾in. by 1¾in. by 7/16in. angle steel welded ring. The rivet-holes through the angle steel and plates are to be drilled, but the bottom is not to be rivetted to the sides until the inside has been properly tinned. After the inside has been tinned, the bottom is to be rivetted in and to be soldered in the angle on the inside, as marked on the drawing. The laps in all cases not to be less than 1¼in.; the whole of the rivets to be of steel, to be ⅜in. diameter, spaced 1in. apart centre and centre in the side seam, and 7/16in. diameter, spaced 1in. apart in the ends. The top and



VERTICAL SECTION

bottom to be of the same thickness as the sides, and to be rivetted to a welded angle steel ring, 1¾in. by 1¾in. by 7/16in., the rivetting to be as specified. A circular opening, 14in. diameter, is to be formed in the top, and to be stiffened round the edge by a welded ring 1½in. by 5/16in.; the ring to be rivetted to the top with 7/16in. rivets, countersunk on the outside to form a flush face for the joint of the cover. A circular cover, 17½in. diameter by ⅜in. thick, is to be provided, and to be secured to the cover by eight ⅝in. stud bolts, and nuts at shown. The cover is to be fitted with a malleable iron collar, with a malleable iron cover screwed into it. The covers are to be interchangeable. A specimen spout and cover will be lent to the contractor for his guidance.

The whole of the interior surface of each cistern, *i.e.*, the bottom, sides, and tops, including the malleable iron collar and cover, are to be thoroughly coated with the best pure refined tin. As the purity of this coating is of great importance, one cistern out of each delivery on the premises of the Trinity House will be selected by the Engineer-in-Chief, and the coating subjected to analysis; if found to contain over one per cent. of inferior metals, the whole of the delivery will be rejected. Each cistern is to be provided with one well-finished gun-metal cock, as shown, for drawing off; the cock is to be the patent cock manufactured by Messrs. Lambert and Son, Short-street, Lambeth, fitted with gutta-percha diaphragm and washers and a removable gun-metal spanner. The cock complete to weigh not less than 3 lb. 13 oz. Each cistern to be separately tested with water, and to be perfectly water-tight. After being tested and found to be perfectly water-tight through-



HALF PLAN OF TOP

out, each cistern is to be thoroughly cleansed and freed from rust externally. In this state it is to be slightly and uniformly heated, and, while warm, to be coated externally with a thin coat of boiled linseed oil, and, when dry, to be painted externally with two good coats of pure red lead paint.

Tenders to be delivered at the Trinity House, London, E.C., on or before Monday, 23rd January, 1882, addressed to the "Secretary of the Corporation of Trinity House," and marked on the outside "Tender for Oil Cisterns."

VOLTAIC ACCUMULATION.*

WE owe the term voltaic accumulation to M. Planté; we owe the idea of voltaic accumulation to him also. But more than this—we owe to Planté the rich results of a life devoted almost entirely to researches in connection with this subject. M. Planté employs the phrase voltaic accumulation in a double sense—to signify storage, and to signify cumulative effect. It is in this last sense that the term is generally used by M. Planté, and it is to voltaic accumulation in this sense that M. Planté has chiefly directed his attention. One of his principal aims has been to produce by means of voltaic accumulation the high tension effects usually obtained from the frictional electrical machine.

When the platinum terminals of a voltaic battery composed of a few cells are made to dip in acid water, gas in torrents pours upwards from them. If the same platinum poles, dipping in the same acid solution, be disconnected from the quietly but powerfully working battery, and put in connection with the prime conductor and the cushion of a large electrical machine of the frictional type, you may turn the handle by the hour and produce an amount of electricity that would maintain a continuous stream of fire, and yet not a single bubble of gas will rise from the poles. M. Planté makes a few cells—two are sufficient—do the work of charging secondary cells, which, after being charged, are joined in series and made to develope high tension effects. This is chiefly the kind of accumulation performed by M. Planté by means of his secondary cell, namely, the accumulation of tension or electromotive force. The Planté cell consists of two plates of lead rolled together, but separated by narrow strips of gutta-percha. These two lead plates being, to begin with, in the same condition, generate no current when immersed in dilute acid and united through the wire of a galvanometer. But if the couple be for a time connected, the one plate with the anode and the other with the cathode of a voltaic cell, or any other form of electrical generator capable of developing an electromotive force of not less than three volts, the anode plate becomes coated with peroxide of lead. If, then, the secondary cell be detached from the primary cells it will be found to be capable of generating a powerful current of about one-fifth to one electromotive force than Grove's cell. When it is desired to obtain cumulative effects from a series of Planté's cells a mechanical arrangement is made whereby the plates of the different cells are so connected together that they are in effect one couple; that is to say, all the inner plates are connected together as one plate, and all the other plates are connected together as one plate. Arranged in this manner, if one of the poles of two Grove cells, coupled in series, be connected with the terminal which is common to all the inner plates, and the other pole be connected to the terminal common to all the outer plates, the same change takes place in the 100 or it may be the 1000 cells as that which takes place in charging a single cell. That is to say, if all the outer plates were connected with the positive pole of the Grove cell, all these plates would be oxidised, and in this condition all the cells may be said to be charged just as a Grove cell is charged when one puts the nitric acid into it; for the highly oxidised lead of a Planté cell plays exactly the same part as the nitric acid of a Grove cell, and it is also necessary to alter the connection of one cell with another, so as to connect them in series, in order to obtain from them the cumulative electromotive effect due to their number.

Planté has devised a convenient method of making this change in the connections. This apparatus illustrates the arrangement. The cells are arranged in line with a spring projecting upwards from each plate on each side of the line; between these two lines of springs an axle of ebonite runs, with metal bands so inlaid upon it, that when it is in one position all the springs on one side are pressing against a long strip of copper on that side, and all the other springs on a corresponding long strip of copper on the other side. In this position the cells are arranged for charging, the two long strips of copper being the two poles. When charging has been effected it suffices to turn the ebonite bar on its axis through a quarter of a circle in order to disconnect the springs from the two long strips of metal mentioned, and to bring them into contact with short strips of copper inlaid and insulated in the bar and crossing it obliquely so as to put the oxidised or positive plate of one cell in metallic communication with the non-oxidised plate of the next cell throughout the entire series. The change of connections is the work of a moment and the result is a multiplication of the electromotive force by the number of the cells.

M. Planté went a step beyond this. He charged a large series of plates of mica, partly coated on each side with tin-foil, on the principle of the Leyden jar. These were connected in charging and in discharging in the same manner as the secondary battery, that is, all the coatings of tin-foil turned one way were connected together, and all the coatings turned the other way were connected together. When, by the momentary joining of these two groups of plate coatings to the two poles of 800 secondary cells, the plates became charged, the connections were then changed from quantity to tension. By this contrivance the electromotive force of the four volts, due to the two primary Grove cells, was accumulated first to 1800 volts and this again was increased fiftyfold by the mica plates. I can bear witness to the fact that it was sufficient to produce flashing discharges some inches in length, exactly resembling the discharges of a frictional electrical machine. That is electrical accumulation in one sense, but there is another sense in which the phrase has been much used of late in connection with Faure's accumulator, namely, in the sense of storage. Planté's cell, with slight modifications, lends itself most perfectly to voltaic accumulation in the sense of storage. The very essence of the idea of storage is retentivity. The cell, to act as a reservoir or store, must be retentive of the charge communicated to it. This is a quality possessed in an eminent degree by the Planté cell. There is, comparatively with other voltaic cells which, but for the want of retentivity, might be employed for electrical storage, very little loss of charge by lapse of time within the limit of a few hours. But for the defect of loss of charge by local action—that is, chemical action not utilisable in the production of electric currents, the zinc and copper cell of Daniell and several other well-known voltaic combinations not usually regarded as susceptible of being used as secondary cells might have been employed for electrical storage. Perhaps the ideal of a cell for storage is Grove's gas cell. Here is a specimen of it; it consists of two gas tubes, and two plates of platinised platinum immersed in dilute sulphuric acid. If, while the tubes are filled with dilute acid, one plate is connected with the positive and the other with the negative pole of a voltaic battery, the one tube becomes filled with oxygen and the other with hydrogen, and when so filled the cell is an electric store capable, even after the lapse of a long time, of yielding a current. But Grove's cell is quite out of the question for large operations, if only because platinum is so scarce. Theoretically it would perhaps be improved by making the hydrogen pole of palladium instead of platinum, so as to obtain the advantage of greater condensation of the hydrogen, and thus to reduce the resistance by increasing the extent of the contact between the gases, the pole plates, and the acidified water. Dr. C. W. Siemens communicated to the York meeting of the British Association some interesting experiments in the employment of plates of carbon, both simple and platinised, as substitutes for platinum plates in the construction of a gas battery. The porosity of the carbon plates was utilised so as to bring the poles close together and greatly reduce resistance. The results obtained were well worthy of publication, although they did not quite reach the point aimed at, namely, practical utility for the electrical storge of energy. For electrical storage on any large scale we look in vain to discover a better material than that fixed upon after infinite painstaking by M. Planté. Planté's cell, pure and simple, is a most admirable electrical accumulator in the storage sense of the word. It has one drawback, however, it requires a considerable time to give to the lead plates a large storage capacity. M. Planté's method of preparing his cell is as follows:—

The secondary cell is first filled with water acidulated with sulphuric acid—1 quart acid to 10 quarts of water—and on the first day it is charged by the current from two Bunsen cells six or eight times, the direction of the primary current being changed at each new charge. The secondary cell is discharged between each reversal of the direction, and it is ascertained either by heating a piece of platinum wire to incandescence, or by other suitable means, that the duration of the secondary current continually increases after each charge. The time during which the secondary couple is submitted to the action of the primary current in the same direction is increased little by little. Thus, on the first day the period is increased from a quarter of an hour to half an hour, and one hour; and, finally, the battery is left over-night in the process of charging. The next day it is discharged, and then recharged for two hours in the opposite direction, then again in the previous one, and so on. But soon a limit is reached, beyond which the duration of the secondary current is not found sensibly to increase, especially when the primary cells, not having been removed, have grown by these successive actions little by little weaker, and have no longer sufficient intensity to cause the electrolysis to penetrate deeper into the interior of the lead plates. The secondary couple is then left at rest for eight days, and at the end of that time is recharged in the opposite direction for several hours continuously, without making on that day a fresh alteration in the direction of the primary current. Then the interval of rest is extended little by little to a fortnight, one month, two months, &c., and the duration of the discharge is found to go on continually increasing. It has, in fact, no other limit than the thickness of the lead plates. The positive plate, if it is thin, finishes by being almost entirely transformed by time into peroxide of lead of a crystalline texture; and the negative plate becomes formed by degrees, to a certain depth below its surface, of reduced lead of a granular and crystalline nature. It is not always necessary to push the electro-chemical preparations of secondary couples as far as this complete transformation of the physical and chemical nature of the plates, for the couples would ultimately acquire a much greater resistance and take more time to charge them. When the couples yield a current of sufficient duration for the purposes for which one wants them, it is no longer necessary to change the direction of the primary current each time the cells are charged. The quantity of peroxide of lead accumulated upon the positive plate would take too long to reduce, and no result would be got from the couple before several hours. A definite direction is therefore adopted, in which the secondary cells, when once sufficiently "formed," are always charged.

It is evidently desirable—more especially in view of the want more and more urgently felt as time goes on, of an accumulator which will be available for the large and important uses to which electricity will in future time be put—if possible to avoid this tedious process of preparation so minutely described by M. Planté. No doubt it answers the purpose quite well when industrial applications are not in question, but for electrical accumulators such as must be used in connection with a central system of electric lighting, and which would probably involve the use of a set of large cells in every house, this slow process of preparation would be hardly applicable. It was with a desire to avoid this disadvantage and give to Planté's cells a greater capacity of storage that I made the experiments last winter, the outcome of which was the modification of Planté's cell, which I showed you at our February meeting. Here are some of the cells I then exhibited in action. The idea of this modification was to increase the surface of the lead by means of lead foil, crimped and formed into frills, the interstices between the frillings being filled with electrolytically deposited spongy lead. The same idea has been applied in a somewhat different way by M. Faure in his accumulator. In M. Faure's accumulator red lead, mixed with dilute sulphuric acid, is plastered on lead plates, the coated plates are wrapped in felt, and either rolled up like the plates of a Planté cell or doubled together and placed in rectangular lead-lined wooden boxes. These cells have been made on a large scale, and for this reason, and because the application of the red lead coating greatly favours the obtaining of storage capacity, effects have been obtained from them clearly pointing to practical use in electric lighting, and perhaps also for other purposes. The cell has, of course, the same electromotive force as the Planté cell, of which it is a modification; being large, it has, when fully charged, a small resistance, and is, on that account, capable of producing astonishing effects in the way of heating thick wire. [Heats some wire.] Thirty of these cells, weighing about 50 lb. each, when properly charged, will keep twenty of my lamps up to 20-candle power for several hours. M. de Meritens has also made an accumulator on the Planté lines.

I have recently introduced into the construction of the Planté cell some modifications which, I anticipate, will increase its utility when applied on a large scale for the practical work of storage for electric lighting. One of my innovations consists in making the lead plates corrugated or cellular, the cells or grooves being filled with spongy lead, which from the form of the plate will remain attached to it without any external wrapping of felt or similar material being necessary. The felt in the Faure cell must, I imagine, be in a short space of time destroyed by the action of the acid, and occasion displacement of the material applied to the surface of the plate and held in its position by it. I have heard that it is proposed to substitute asbestos cloth for the felt; this no doubt will remedy the defect I have mentioned, but it must greatly increase the cost of constructing the cell. It is obviously desirable to avoid the use of any extraneous material, and the use of grooves or cellular plates accomplishes this object. I have made other improvements for the means of obtaining electrical storage, details of which I must for the present hold in reserve, but with the hope at some future time of bringing them under the notice of the society.

*Abstract of a paper read by Mr. Swan before the Newcastle Chemical Society.

RAILWAY MATTERS.

THE St. Lawrence, Upper Mississippi, and Missouri rivers are closed by the ice. Three hundred feet of the railway bridge at Sioux city, Iowa, have been destroyed by ice, generally interfering with the river navigation.

THE Great Western Railway Company commenced yesterday to run a train from Paddington to Milford Haven in seven hours. This train is supposed to be for the convenience of passengers who will go to New York *viâ* Milford Haven and the promised new steamships, by which from eighteen to twenty-four hours at the least are to be saved between here and America, if not a good deal more.

THERE seems to be every chance of the long pending question of the junction with the Turkish railways being at last settled. "The objection made so long against the junction with the Salonica Railway is now, the *Times* correspondent says, believed to be really withdrawn, so that only the point of junction has to be settled; and in this respect every consideration will, no doubt, be given to the strategic scruples of Turkey against one or another point of junction. As regards Bosnia it appears that it has not even been mentioned."

AT a conference of railway managers held last week at Brussels, for the organisation of the Continental international service during the present year, the opening of the St. Gothard line throughout its entire length was provisionally fixed for July 1st, and arrangements were made accordingly. The opening of the great tunnel has already increased the traffic between the valleys of the Reuss and the Tessin more than fourfold. Although in former years the traffic at this season was little more than nominal, every train is now filled with passengers.

WE learn from the *Annales Industrielles* that it appears that the French Government has definitely abandoned the Achard brake, and has decided to adopt the comparatively new automatic vacuum brake due to Mr. Wenger. Our contemporary thinks it very curious that the State should recommend the air pressure brake and adopt the vacuum. Inasmuch as several thousands of engines and vehicles have been, and are being fitted, with the Westinghouse brake, it does seem curious, that is, if our contemporary has learned his story aright, which does not seem probable.

A VERY bad accident occurred on the Hudson River Railway at seven o'clock on Saturday evening last. An express train, containing many members of the New York Legislature and other prominent persons, was stopped at a point about eight miles from the city. Six minutes later another train crashed into it, "telescoping" the two rear Wagner palace cars, throwing both from the line. In the fire which as usual ensued, eight persons were burned to death, including Senator Wagner, the inventor of the Wagner Palace Car, in which he was burned. Nineteen other persons were injured.

A CORRESPONDENT writes that the much-talked-of Exeter Tramways are being laid at last, to the gauge mentioned in this column some three years ago or so, when the matter was first brought before us—viz., 3ft. 6in. They will connect Exeter with its suburb, Heavitree, and eventually the three railway stations will be accessible thereby, and they will be worked, at least for a time by one-horse cars. The cars are being built by the Bristol Wagon Works Company, and are to be fitted with "road-and-rail" wheels, to save stable sidings, and enable their use where prohibited by the Board of Trade as tram-cars.

THREE important public works have been sanctioned by the South Australian Parliament, viz., a railway from Nairne to Strathallyn (20 miles), and thence to Milan (8 miles); a railway from Farina Town to Goolong Springs (29 miles); and a large bridge at Morffett-street, Adelaide, where the increased railway traffic has made ordinary traffic on the level exceedingly dangerous. The Farina extension is to be a link in the chain of transcontinental railway communication, and, according to the *Colonies and India*, assumes importance only in that light. A line from Orooroo to Port Augusta, South Australia, is in course of construction. When completed, this line will bring that colony into connection with the projected great northern or transcontinental line. The extension from Terowie to Orooroo has been completed.

JUDGMENT has been given by the Anglesea Court of Quarter Sessions in a rating appeal which occupied four days in hearing. The London and North-Western Railway Company, appealed against the assessment of its 11 miles of railway in the Holyhead Union, and also of the new station and hotel at Holyhead, which were opened last year. Under the new assessment the rating of the line per mile had been raised from £400 to £900. When the case had been partly heard, an agreement was come to under which the rating of the line was fixed at £525 per mile. The railway hotel was rated at £800, and the station, graving dock, and buildings assessed at £15,674. The court assessed the ratable value of the hotel at £700, and the station premises at £9666, as against the £6728 given by the company's valuers, and ordered each party to pay its own costs of the appeal. On behalf of the railway company it was pointed out that as it already paid two-thirds of the rates in Holyhead parish, it would be condemned, in addition to its own costs, to pay two-thirds of those incurred by the assessment committee. The court, however, declined to reconsider their decision. Holyhead practically belongs to the North-Western Company, and it is not a cheap possession.

THE Birmingham Town Council on Tuesday empowered the Public Works Committee to take such steps as they might deem advisable respecting the London and North-Western, the Midland, and Birmingham and Cannock Chase Railway Bills. The London and North-Western Railway, seek powers principally to carry out the agreement entered into with the Town Council last year. The company would have, our Birmingham correspondent writes, to provide a new street, which was to take the place ofthe thoroughfare of Great Queen-street. Powers are also asked to make a small branch from the Liverpool and Birmingham line, to to run into the Saltley gasworks. That line was to be constructed entirely at the request of the Gas Committee, and they expect to derive considerable advantage if they could get through that means their coals from North Staffordshire and Lancashire, instead of being confined as at present entirely to the Derbyshire district. The Midland Railway Company in addition to seeking for powers to carry out an agreement, also seek for powers to enlarge their proposed goods station on the Worcester wharf. The Cannock Chase Railway Company seeks for powers to come into Birmingham in the Handsworth district. It is proposed to open two small lines and a coal depôt and goods station.

TRAVELLING on the New Zealand railways is not, according to a writer in the *Colonies and India*, all pleasure. He says:—"The speed seldom exceeds fifteen miles an hour, and so many of the lines are over steep hills, and are laid out with such an evident fondness for curves, that a high or even average speed is out of the question. Experience in this colony is hardly in favour of Government lines of railroad. There is only too much truth in the common remark that the lines are laid off with far more consideration for the convenience and property of influential landowners than regard for the levels of the land or the convenience of the majority. The grinding of the wheels upon the rails as curve after curve is described by the train is continually suggestive, not only of danger and rapid wear and tear, but of the question why, with plenty of level land about, the train turns sharp corners and mounts steep hills. Only one answer is given, viz., that a Government railroad means a political railroad. Only two classes of passengers are carried—first and second—the former paying 3d. and the latter 2d. per mile. The New Zealand railroads are now beginning to pay interest upon their cost, as well as working expenses. Notwithstanding all the blundering and extravagance in their construction, I believe that it would pay an English company well to take over these railways at their cost, and work them upon commercial principles, though I fear there is little likelihood of a colonial Government giving up so convenient an instrument of influence and power."

NOTES AND MEMORANDA.

THE barometric pressure has been greater during this week than for forty years; it has reached 30·01in.

INSTEAD of the emery commonly used with soft metal discs laps, points, &c., for chasing, lining, and drilling glass, diamond dust is said to be used with greater rapidity of work.

THE value of the telegraph apparatus and wire exported from this country reached £1,974,266 last year; which is over £600,000 more than in 1880, but nearly that amount less than in 1879.

THE saline springs of Cheltenham, according to Professor Hull, rise along planes or fissures in the Lower Lias, like the water in artesian borings, and are probably derived from water percolating through salt-bearing Keuper, which out-crops at higher elevations, as explained by Sir Roderick Murchison.

THE following statement of furnaces in blast we take from *Ryland's Iron Trade Circular*:—November 13th, 1879, 457; March 31st, 1880, 597; June 30th, 1880, 559; September 30th, 1880, 555; December 31st, 1880, 590; March 31st, 1881, 575; June 30th, 1881, 542; September 30th, 1881, 548; December 31st, 1881, 552.

THE iron and steel exports from Great Britain amounted last year to 3,818,338 tons. In 1880 it was 3,787,271 tons. The imports of iron, iron ore, steel, and tin in the same years were 2,587,981 tons in 1881, and 2,779,958 tons in 1880. The value of exported iron, steel, machinery, hardware, &c., was £42,381,662 in 1880, and £43,353,021 in 1881.

THE deep-seated springs in the chalk formation of the river Thames Basin maintain the dry-weather flow of the river, the minimum of which amounts to 350,000,000 gals. per diem, of which London water companies have parliamentary powers to draw 110,000,000 gals., or nearly one-third. The water companies, however, do not take the maximum quantity to which they are entitled, but are rather increasing their supply by sinking wells to the coalk—says Mr. De Rance, in his new work on the "Water Supply of England and Wales"—and obtaining water free from organic impurity.

DURING the past year the number of applications for letters patent has been 5751, being an increase of 234 upon those of the year 1880. The records of the office show a steady and tolerably regular increase in the number of applications from the year 1852, when the Patent Law Amendment Act came into operation, down to the present time. In that year the number was only 1211, but that was for a portion of the year only, the following year showing an advance to over 3000, which, however, subsequently fell off; but by 1862 the number had risen to 3490. During the following decade the progress was not quite so marked, the number for 1872 being 3970. In 1876 the number was 5069, the highest then reached; but there was a falling off of 120 in the succeeding year, since which time the numbers have risen to the figures first given as being the return for 1881.

BREWERS are sometimes advised to render their brewing liquor permanently hard by the addition of a small quantity of sulphuric acid prior to mashing. The quantity of sulphuric acid thus to be added must not—the *Brewers' Guardian* says—be greater than is required to neutralise the carbonates of calcium and magnesium present in the water, and as this quantity can only be determined by the aid of some very exact tests, we cannot recommend this system of hardening waters, unless it is carried out under the supervision of an experienced chemist. If by any chance a slight excess of acid were to be added, the results must be very disastrous; independent of the flavour imparted by an acid and its corrosive action on metals, it must be borne in mind that very small quantities of free sulphuric acid interfere with the action of diastase, and thus malt mashed with such an acidified water will yield considerably less extract. The objections to the use of sulphuric acid for artificially hardening water so greatly exceed its advantages that we certainly advise our readers not to adopt this system.

THE final returns of the census of the Colony of Victoria, taken on April 3rd last, have been published, and show an excess of 3764 over the approximate totals at first issued. The total population of the Colony is now stated to be 862,846—viz., 452,583 males and 401,263 females, or a proportion of 90·75 females to every 100 males. The number of persons to the square mile is 9·812; the number of inhabited dwellings is 170,086, giving 1·935 to the square mile, and 5·07 persons to each dwelling. Compared with the returns of the previous census in 1871, the general results are an increase of 130,818 in the population, or 17·88 per cent., and of 19,458, or 12·92 per cent., in the number of inhabited buildings. Some of the counties show a falling off in population during the ten years, the largest diminution being 16,799 in Talbot, 16,758 in Grenville, 7655 in Grant, 5096 in Dalhousie, and 2800 in Bogong. The falling off in Grant county is no doubt due to the influence which Melbourne has had in attracting the trade which used to go to Geelong, while in the other counties mentioned the falling off is due to the fluctuations in the populations on the gold-fields.

HERR P. VOLKMANN has in the *Annalen fur Physik und Chemie* compiled the results of experiments by Hagen, Matthiessen, Perre, Kopp, and Jolly, on the expansion of water, and has obtained the following mean results for the volume and density of water at various temperatures:—

Temp.	Volume.	Density.	Temp.	Volume.
0 deg. C. ..	1·000122	0·999878	15 deg. C.	1·000847
1 ,, ..	1·000067	0·999933	20 ,, ...	1·001731
2 ,, ..	1·000028	0·999972	25 ,, ...	1·002868
3 ,, ..	1·000007	0·999993	30 ,, ...	1·004250
4 ,, ..	1·000000	1·000000	40 ,, ...	1·007700
5 ,, ..	1·000008	0·999992	50 ,, ...	1·011970
6 ,, ..	1·000031	0·999969	60 ,, ...	1·016940
7 ,, ..	1·000067	0·999933	70 ,, ...	1·022610
8 ,, ..	1·000118	0·999882	80 ,, ...	1·028910
9 ,, ..	1·000181	0·999819	90 ,, ...	1·035740
10 ,, ..	1·000261	0·999739	100 ,, ...	1·043230

The increase in the volume per degree of increase of temperature from the point of greatest density, 4 deg., is thus very rapid. For a rise of 1 deg. from this, the volume increases by 0·000008, while from 99 deg. to 100 deg. the increase is about 0·000721.

WHAT would be the relation between the velocities of clouds of smoke and gusty wind by which they were impelled? The value of the following, which was sent by a correspondent to *Nature*, somewhat depends on this question. He reports the following observations on the velocity of the wind in the south-west gale on the 21st and 22nd of November last, at Edinburgh: "The observations were made about 9 o'clock on the morning of the 22nd, when the wind had somewhat moderated: Mean velocity, 62·3 miles per hour; during a squall, 71·6. These observations he calculated from the velocity of clouds of smoke issuing from a chimney of the Caledonian Distillery, and travelling for a distance of 2100ft., and are thus free from instrumental errors. The chimney is 225ft. high, and its base is about 200ft. above the sea-level." During the gales on the 14th the recording anemometer at the Greenwich Observatory registered a wind pressure of 56 lb. per square foot, the highest ever recorded there. Professor Robert Grant, F.R.S., who occupies the chair of Practical Astronomy in the University of Glasgow, reported that during the violent storm which passed over that city on the night of November 21st and the following morning, during several hours after the special observations commenced, the hourly velocity of the wind ranged from 16 miles to 17 miles, but at 11 p.m. it had risen to 30 miles, and it went on increasing till 2 o'clock next morning, when the register indicated a velocity of 54 miles an hour, and the reading at 6 o'clock was 57 miles an hour. Just a few minutes before 11 o'clock there was a tremendous gust of wind, which, measured by Osler's anemometer, was equivalent to a wind pressure, as already mentioned, of 48 lb. on the square foot. This was confirmed by the indications of Robinson's velocity anemometer, which showed that for a few minutes the wind was travelling at the rate of nearly 80 miles an hour.

MISCELLANEA.

A BUILDING is in course of erection near the Leadenhall Market for the purpose of and to be styled the Metal Market and Exchange. The entrances are from Leadenhall-street, Gracechurch-street, and the Leadenhall Market. Mr. E. Harradine is the secretary.

THE death is announced of Mr. John Trevor Barkley, C.E., for many years a foremost representative of British enterprise in developing the resources of Turkey and the Danubian Principalities. Mr. Barkley was fifty-six years of age, and was for many years a valued contributor to the *Times*.

THERE is an old adage about going abroad to hear news of home. An American contemporary says, "A pair of compound engines have been made by Messrs. Ahrberker and Son, London, which develop 30-horse power and weigh only 168 lb. all told. The boiler weighs 142 lb. These engines are intended for use in aerial propulsion."

ON the 7th inst. a large steel sailing ship was launched from Messrs. Harland and Wolff's building yard, Belfast. She is named the Garfield, and is said to be the largest sailing vessel ever constructed of steel. The Garfield, which is of 2220 tons register, is 292ft. in length, 24ft. 9in. depth, and 41ft. breadth. She has been built for Messrs. Ismay, Imrie, and Co., of the White Star line, and is intended for the Australian and Californian trades.

A RICH deposit of quicksilver has been discovered near Maltrata, Mexico, and a company is being formed for the purpose of working it. A valuable silver lode has also, the *Times* says, been struck near Zacualtipam. A dockyard is to be established at Campeachy, and an American engineer is engaged in selecting the site and drawing plans for the work. An ancient cemetery has been discovered about twelve miles from Yurecuaro, in which thirty bodies have been found, which are supposed to have belonged to some Tarasca tribe long anterior to the Spanish conquest.

ALTHOUGH the long voyages to Australia, China, and West Coast of America, continue to encourage steam tonnage, and the trades which were thought by their distance would be reserved to the sailing ships are readily supplied with the speedier mode of transit; nevertheless there has been, according to White's "Steamship Circular," a very active demand during the past year for sailing ships, more especially iron vessels, which have commanded very good prices, and many been laid down, one yard alone having eight vessels of from 700 to 1700 tons register building.

MR. DRUMMOND HAY, British Consul at Stockholm, calls attention to the remarkable development in the export trade in Swedish matches. Nearly 23 million skalpunds—about 19 million pounds avoirdupois—were shipped during 1880. One "tandsticker" fabric alone, which is said to be fast gaining a world-wide celebrity for the quality combined with the cheapness of its products, employs 872 hands, of which 339 are women. This factory was originally started on a very small scale in 1845. The precautions adopted against fire are said to be so efficient that the buildings are insured for comparatively low premiums. The little boxes in which the matches are packed—now so familiar throughout the world—are made by prisoners in the gaols of Stockholm.

SINCE the Ring Theatre disaster an American has proposed a kind of big fire-escape to be kept in readiness at every theatre. His escape consists mainly of a movable floor, suspended by chains from near the ceiling of the entrances, halls, and vestibules, or by hinges on the side walls, and lowered in case of fire, to be supported on projecting rests of the side walls, at suitable height above the floor. Sliding extensions and swinging stairs and rear sections connect with the ground outside of the door, and with the staircases of the gallery, so as to form separate exits above the regular entrances. In case of fire the floor would be lowered, the swinging sections and stairs swung down, and thereby a second passage formed, which is mainly designed for the people in the galleries, so that they may pass out simultaneously, and without interfering with the people from the boxes and dress circle.

THE old scheme of shortening the time between New York and Europe by using a port on the extremity of Long Island is again brough' t the front. Mr. Jacob Lorillard, who has a project for a new; umboat line "to be purely American," and which will crossth Atlantic in six days, has secured the co-operation of Mr. Austin( ) in, who will extend the Long Island Railway to Fort Pond Bay, near Montauk Point. Great docks will be built here, and the steamships of the new line will enter here instead of at New York. The latest information in regard to the project, however, robs it of its "purely American" character. According to the *Railway News*, it is said that Mr. William Pearce, of the Glasgow firm of John Elder and Co., who has just returned from New York, has expressed his intention of joining the undertaking with capital secured on this side of the Atlantic, and promises to build vessels faster than any hitherto launched for the new service.

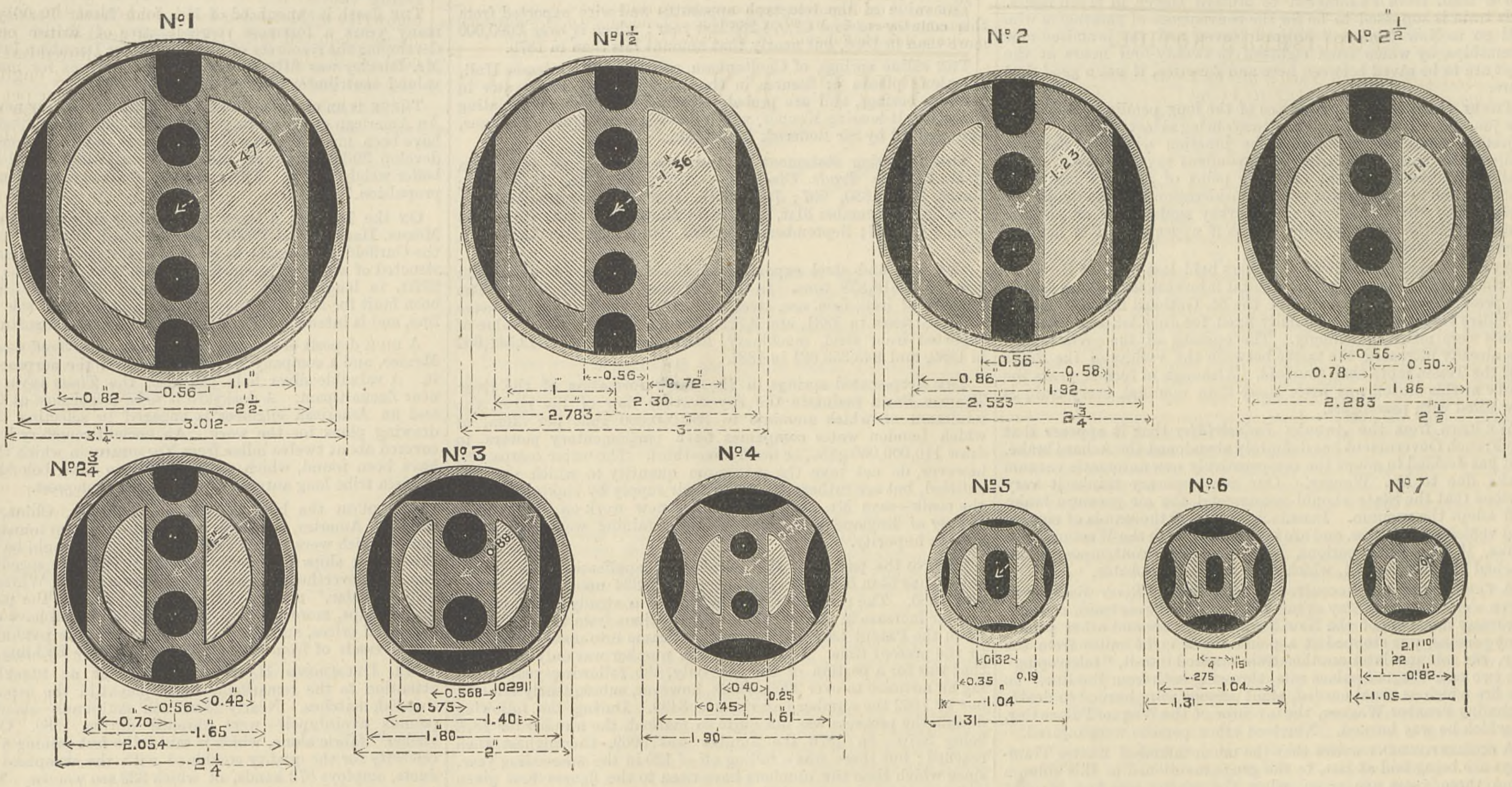
THE s.s. Jacob Christensen, which has been built by Messrs Raylton, Dixon, and Co., Middlesbrough, to the order of Hans Konow and Co., of Copenhagen, has proceeded on her trial trip. She is a handsome iron screw steamer, 269ft. long, 34ft. 9in. beam, 24ft. 3in. depth of hold, which gives her a carrying capacity of 2500 tons on 22ft. draught. She is built as a three decked steamer, having main deck of iron and upper of wood. Her water ballast is contained in a large chamber in the main hold forward of engine-room, which is also available for storage of cargo. She is fitted with a short poop aft, in which are commodious cabins for captain, officers, and two or three passengers. Higginson's steam quarter master steers her from the bridge, and she is fitted with steam winches and self-reefing topsails. Her engines, of 150 horse-power nominal, are by Messrs. T. Richardson and Son, of Hartlepool, and gave every satisfaction on her trial trip.

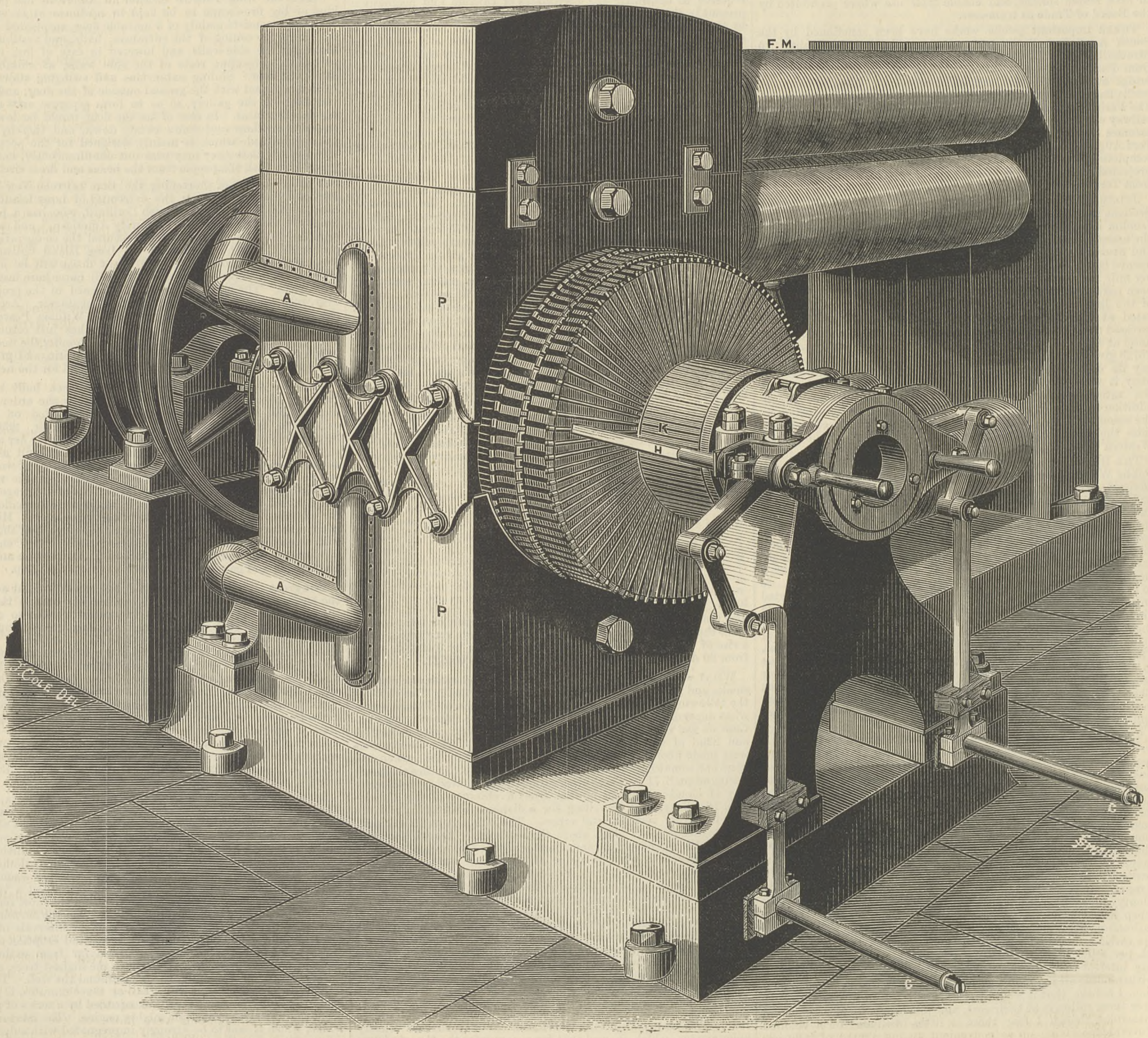
THE great activity in shipbuilding has caused similar activity in the anchor and chain trades, all the leading makers throughout the country being full of orders for several months to come. A good share has gone to the North of England, among them a number of orders for Mr. Wasteneys Smith's "shockless" anchors. These include orders from her Majesty's Government for anchors up to 5 tons each: for H.M.S. Agamemnon, Amphion, Albacore, Mistletoe, and Watchful; for the Union Steamship Company's new ships Spartan, Moor, Athenian, Mexican, and Tartar; the Cunard steamship Company's Cephalonia, Aurania, Catalonia, &c., and a large one of 6 tons for the same company's moorings in the Mersey, making the fifth—from 3½ tons and upwards—supplied them for this purpose. There is also a very large number of anchors on order for various owners of vessels building on the Clyde, &c., so that work in this department will be full for some months.

PETROLEUM has been found in large quantities in Sarnia, Ontario. About three and a-half miles south-east of the town of Sarnia, the usual indications of oil were found at one of the borings at a depth of 600ft. from the surface. Suddenly operations were suspended by the bursting forth of a powerful jet of gas, which became ignited by a torch held by one of the workmen standing at a distance of 20ft. or 30ft. from the well. The gas seemed to be forced out with extraordinary power till it formed a volume of vivid silvery flame fully 30ft. high. "But the most remarkable feature of this very remarkable exhibition," says the *Sarnia Observer* in describing the phenomenon, "is that at intervals of exactly fifteen minutes by the watch, there is a grand eruption of water, which mingles with the flames, and, so far from extinguishing them, drives them in sheets far above the highest trees, and falls in showers for a considerable distance around the well. This eruption of water, which lasts about two or three minutes, is preceded by a gradually-increasing roar, accompanied by a series of powerful gasps like the strokes of some mighty engine. The mixture of the water, which is said to be strongly impregnated with sulphur, produces effects in colour which are dazzling in their brilliancy and beauty, various shades of yellow and purple predominating."

THE EDISON ELECTRIC LIGHT IN NEW YORK AND HOLBORN.

(*For description see page 42.*)





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TO CORRESPONDENTS.

*** *In order to avoid trouble and confusion, we find it necessary to inform correspondents that letters of inquiry addressed to the public, and intended for insertion in this column, must, in all cases, be accompanied by a large envelope legibly directed by the writer to himself, and bearing a* 1d. *postage stamp, in order that answers received by us may be forwarded to their destination. No notice will be taken of communications which do not comply with these instructions.*

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*** *All letters intended for insertion in* THE ENGINEER, *or containing questions, must be accompanied by the name and address of the writer, not necessarily for publication, but as a proof of good faith. No notice whatever will be taken of anonymous communications.*

R. P.—*Try tannate of soda. It often proves useful in preventing and removing incrustation.*

H. W.—*Goodeve "On the Steam Engine," Rigg "On the Steam Engine." They can be obtained through any bookseller.*

CHINA GRASS.

(*To the Editor of The Engineer.*)

SIR,—Could any of your correspondents inform me who is the maker of a machine for peeling China grass? It is the first operation which this fibre undergoes after reaping, and prior to its importation into this country.

J. McM.

Manchester, January 14th.

UTILISATION OF SLATE REFUSE.

(*To the Editor of The Engineer.*)

SIR,—There is a modern invention for the utilisation of slate refuse, and the use of the refuse of slate quarries, in the formation of solid blocks. I shall be very much obliged if any of your readers can inform me where I can find any description of the process.

J. W.

London, January 16th.

GUN-METAL CASTINGS.

(*To the Editor of The Engineer.*)

SIR,—I was somewhat surprised on reading your last, at "Royal Arsenal's" reply to "Pneumatic's" inquiry on the above subject. I take it that he wishes to make the casting in the same position as he describes for some reason or other he does not explain. As there is no difficulty in making it either one way or the other, it need not be entertained. The point upon which he requires information I take is what is the cause of the mould scabbing at the place marked A B C in his drawing. My answer to that is, having decided first which way a mould has to be constructed, the next question is what will take place during casting under those conditions. It is absolutely necessary for the mould—whether it be a sand or a loam mould—to be made of some material that will bear the intense heat that it is subjected to, whether the metal be gun-metal, cast iron, or steel that is run into it, that will not melt during casting. The next thing is to get rid of the gas that is generated. I do not think that in this case the sand has melted, from the position in which it is described as being defective, but that the defect entirely arises from the following cause:—From the moment a mould is being filled with metal it begins to generate gas, and goes on increasing until the mould is filled and the metal becomes crystallised. Therefore it is quite plain that the greatest amount of gas will accumulate at the top part of the mould, and at the time when the metal is in the worst condition to battle with it. The remedy is to make a better exit for the gas to escape. Whatever number of rising heads are put on it will not cure the disorder. If the mould is bricked up in loam, I would advise him to lay on a course of brickbats or coke on the plate that covers A B C, and then get up with very rough loam to near size, then finish with a fine coat of thin loam; run the casting pretty sharply, and keep all runners and risers perfectly air-tight. The gas must pass through the outside of the mould, and not through the rising heads, as there is danger of its stripping off the skin of the mould. The only useful part that a riser plays is that it feeds the casting during crystallisation. If the above is attended to, all will be right. The same general remarks will apply if the mould be green sand.

SAML. KEIGHLEY.

Burnley, January 17th.

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MEETINGS NEXT WEEK.

THE INSTITUTION OF CIVIL ENGINEERS.—Tuesday, Jan. 24th, at 8 p.m. Paper to be read and discussed, "The Analysis of Potable Water; with Special Reference to the Determination of Previous Sewage Contamination," by Charles W. Folkard, Associate Royal School of Mines.

INSTITUTION OF MECHANICAL ENGINEERS.—Thursday and Friday, Jan. 26th and 27th, at 7.30 p.m.: The annual report of the Council will be presented to the meeting. The annual election of the president, vice-presidents, and members of Council, and the ordinary election of new members, associates, and graduates, will take place at the meeting. The following papers will be read and discussed:—"On Meters for Registering Small Flows of Water," by Mr. J. J. Tylor, of London. "On the Bazin System of Dredging," by Mr. A. A. Langley, of London. "On Hydraulic Lifts for Passengers and Goods," by Mr. Edward Bayzand Ellington, of London. "On Improved Appliances for Working under Water, or in Irrespirable Gases," by Mr. W. A. Gorman, of London. "On Power Hammers with a Movable Fulcrum," by Mr. Daniel Longworth, of London.

THE ENGINEER.

JANUARY 20, 1882.

NON-CONDENSING STEAM ENGINES.

IN THE ENGINEER for December 30th, 1881, will be found a report by Mr. Isherwood on the relative efficiency of two Corliss engines—one condensing, the other non-condensing. Such of our readers as have perused this report know that it contains some very remarkable statements, and for the benefit of those who have not particularly noticed the report we propose to say something concerning it here. The engines in question seem to have been of the ordinary Corliss type, and with unjacketted cylinders. The condensing engine had a cylinder 24in. in diameter, with a piston stroke of 4ft.; the non-condensing engine had a cylinder 16in. diameter, and a piston stroke of 4ft. The piston speed of the latter was greater than that of the former in the ratio of 60 to 49. These engines were tested for consumption of steam and coal in the usual way. At first sight it would appear that the condensing engine ought to have far excelled its rival in economy. It was a larger engine; it expanded steam of a total pressure of 71 lb. nearly 7·9 times, while the smaller non-condensing engine expanded 79 lb. steam but 4·36 times. The large engine condensed its steam; the small engine exhausted into the atmosphere. Everything pointed to the large engine as being the best calculated to get a good duty out of the coal burned; yet as a matter of fact the superiority of the large engine was so small as to be hardly worth much. In terms of the net horse-power the condensing engine used 28·58 lb., and the non-condensing engine 31·78 lb. of feed-water per horse per hour. The difference is but 3·2 lb., and even this difference may be said to disappear when it is remembered that the non-condensing engine can supply a boiler with feed water at 200 deg., while 120 deg. is about the maximum in the case of the condensing engine. Mr. Isherwood goes on to state that the results obtained at a certain flour mill in New York, after fitting engines with condensers, was that the consumption of fuel was increased, and as a consequence the condensers were discarded. A very similar experience was recently obtained at Birkenhead with one of Davy's differential engines of considerable dimensions. The condensing water available at first was full of mud and sand, and could not be used; after about six months a supply of good water was obtained. The condenser was started, but the engine, instead of working with less coal than before, actually required considerably more. We have reason to believe that many similar cases might be cited; and it is by no means clear that the condenser is always productive of economy. In an article on the "Value of a Vacuum," we have already written to the same effect; but the whole subject is just now attracting so much attention amongst continental engineers that we make no apology for referring to it.

Mr. Isherwood, in common with many other engineers, uses three different power denominations, namely, "total horse-power," "indicated horse-power," and "net horse-power." The first and the last appear to require explanation. The total horse-power represents the work done by the steam in overcoming all resistances. Now in the non-condensing engine these resistances are represented by engine friction, including that of all moving parts up to the end of the crank shaft, the pressure of the atmosphere, and lastly, the useful work done, in which is included the friction of all shafting, gearing, &c., beyond the end of the crank shaft. Of course, in one sense, overcoming this friction is not useful work, but it is useful work as regards the engine, because it must be overcome by some agent. The useful work is the net work. As regards the total work, it is evident that the indicator takes no account of it, although it can be calculated with approximate accuracy from an indicator card by putting on a zero line and constructing a parallelogram on it, the lowest line of the indicator diagram being the top line of the parallelogram. A good deal of confusion seems to exist in some minds as to the work done in overcoming the pressure of the atmosphere, and we have heard it argued that it was done already in some mysterious way in the boiler. The truth is that back pressure, whether due to the atmosphere or any other cause, simply represents a resistance to be overcome. It has just the same effect as putting extra load on the engine. We may be pardoned if we try to make this point quite clear. Let us suppose that the owner of a steam engine works with an average pressure of 45 lb., and that he lets off a portion of his power to his next door neighbour, a shaft passing through the party wall between the two houses. The owner finds that when none of his own machinery is running he can do his neighbour's work with an average pressure of 15 lb. per square inch in the cylinder; when he adds his own work he requires 45 lb. in the cylinder. The steam does not know what resistance it is overcoming; it matters nothing to it whether it is working for the engine owner or his neighbour, or both. Now, the atmosphere stands in the position of the neighbour; and when a condenser is added to an engine we only save the work which would otherwise have gone, so to speak, to the other side of the party wall. If he choose to do so, the engine owner can refer the whole of the fuel burned to the work done for himself, leaving that done for his neighbour out of consideration, and he can say that it costs so much; and this is what is usually done in dealing with steam engines—that is to say, the work done in overcoming back pressure is passed over in silence, and all calculations are based on the indicator cards. But it is obvious that if we want to get at the true result, we must include the work done for our neighbour, or, to drop metaphor, in overcoming back pressure. If we do this, we shall have, not the indicated, but the total horse-power to deal with. Doing this with the two Corliss engines about which he has written, Mr. Isherwood finds that the non-condensing engine required but 18·74 lb. of feed-water per horse per hour, while the condensing engine required but 23 lb. Putting this in another way, the condensing engine expended 25,569 units of heat per total horse-power per hour, while the non-condensing engine needed but 18,922 for the same purpose. It may be urged that it is with the net power we really have to do, and that it makes little matter how economically an engine works, including in its power that taken by a next-door neighbour, who will not pay sixpence for it, if the remaining or net horse-power is not had at a low price. The advantage gained by the condenser is, in other words, tantamount to the excision of the neighbour element. But we think this is an erroneous way to look at the question. It will, perhaps, be admitted that the neighbour's claim for gratis power might be bought up at too high a price. We believe it to be not impossible that the gain derived from a condenser is very much more frequently than is generally known altogether illusory; and it admits of being shown that it is possible to make a non-condensing engine which may be as economical as a condensing engine.

It will be seen that in the cases stated by Mr. Isherwood his figures show that for each net horse-power the non-condensing engine used 3·2 lb. more feed-water than its rival; but for each total horse-power it used 4·25 lb. less. Therefore it is clear that if the net horse-power could have been made a little higher than it was, the consumption of steam would have been identical in the two engines. The total power of the non-condensing engine was, in round numbers, 116 horses. The indicated power was 74·3 horses. Now 116 — 74·3 = 41·7, say 42-horse power. The total feed-water used was 31·78 lb. × 74·3 = 2361·25 lb. Dividing this by 28·58 we get 82·8. That is to say, if the total power of the engine remaining the same, we got 82·8 indicated horse-power instead of 74, other things being equal, the consumption of feed-water would be identical in the two engines. There are two ways in which this end can be reached—we can attain it either by simply diminishing the back pressure by working steam through a hot condenser, giving only, say, 6in. of vacuum, or what is better, we can get at the same result by augmenting the work got out of each pound of steam, in which case, although the consumption of feed-water and work done in overcoming back pressure remains unchanged the total, power will become 42 + 82·8 = 124·8-horse power instead of 116-horse power. This result ought to be easily attained by simply augmenting the ratio of expansion, with an increase in boiler pressure. The steam was actually expanded 4·36 times. The hyp. log. of this ratio is 1·4725. The average cylinder pressure ought to have been 42 lb. It was really, by indicator, nearly 40 lb., the loss being due to cylinder condensation. A simple rule-of-three sum shows us that, if the pressure had been 46 lb., the required power would have been more than obtained, with an initial cylinder pressure of 90 lb., corresponding to a 75 lb. safety-valve load, the steam being expanded a little over five times. There is every reason, indeed, to believe that the steam would be used to more advantage thus than it really was, and, consequently, it is more than probable that the non-condensing engine would beat the condensing engine in economy of fuel.

Mr. Isherwood has shown very clearly why the condensing engine was so wasteful. The want of economy is due to what was, many years ago, pointed out in THE ENGINEER—and for the first time in any English journal—namely, the frigorific influence of the condenser. Mr. Isherwood's remedy is jacketting; but we much doubt that the jacket would entirely cure the evil. There is even in the non-condensing engine a good deal of cylinder condensation going on, and no doubt the jacket would prove useful to it as well as to the condensing engine, so that the jacket would after all, perhaps, not materially affect the result; both engines would become more economical, and that is about all. The plan of working with a hot condenser is worth trying, and can very easily be done by any one whose boilers will carry as much more pressure as is required to give the necessary power. A most instructive experiment could be carried out in this way at very small expense, the only thing necessary being a tank to measure the feed-water, the engine being run with various back pressures until the best result was obtained. The engine ought in this case, however, to be credited with the saving effected by the use of hot feed. Many seagoing engineers assert that their engines give a better economical duty when the temperature of the condenser is from 130 deg. to 140 deg., corresponding to 25·5in. to 23·5in. of mercury, than when it is cool enough to keep the gauge at 26in. or 27in. With a temperature of 195 deg., or 21in. of mercury, the back pressure would be 10·38 lb., representing a gain of about 4·5 lb. per square inch, as compared with exhausting into the atmosphere. We have said enough to show that there is a large field for experimental inquiry yet unworked, and that there is reason to conclude that as a result of working it, information may be obtained which will tend to promote steam engine economy. It may seem absurd to suppose that working with a hot condenser can tend to save fuel. It would be absurd if steam were a permanent gas while in a cylinder; being what it is, a most unstable fluid, with nothing permanent about it, there is nothing absurd about the proposition.

THE BOARD OF TRADE AND AUTOMATIC BRAKES.

ON the 8th of August last year a collision took place in Blackburn station between two express passenger trains. Two passengers were killed on the spot, and four more have subsequently died of the injuries received, besides, sixty-four persons were more or less severely hurt. We have already commented on this collision, and the verdict of the coroner's jury will be found in our impression for Sept. 23rd, 1881. A Board of Trade inquiry was also set on foot, and Col. Yolland acted for the Government. His report was not sent in until the 6th of October, and it was not published until the 11th instant. This is a most unusual delay; but this is not the only remarkable circumstance about the report. On the outside it carries a memorandum from the President of the Board of Trade himself, and the memorandum goes as far as official courtesy permits to traverse Col. Yolland's conclusions. It is possible that Mr. Chamberlain may have had some doubt as to whether he would accept the report at all. It is at least certain that it has been shelved for many months; and it is now given to the world with a commentary which practically nullifies its author's utterances. The reason for all this is easily found. Col. Yolland virtually condemns automatic brakes, and as they have been specially—and properly—recommended for adoption by the Board of Trade, some difficulty was, no doubt, set up by a report which pretty flatly contradicts the Government. Mr. Chamberlain's minute terminates with the following words:—"Finally, the Board of Trade, as at present advised, after careful consideration of Col. Yolland's report, and after a reconsideration of the conditions which they have repeatedly laid down as being desirable in all continuous brakes, after consultation with their inspecting officers, and after consideration of the experience gained during the last few years, have come to the conclusion that while it is essential that the defects in the automatic brake to which Col. Yolland alludes should be provided against, and every precaution taken to insure the brake acting only when required, yet there is no reason to withdraw the opinions they have previously expressed as to the conditions which should be observed in providing brake power for passenger trains."

In order to render the circumstances which we have to consider quite intelligible, it is necessary that we should say something concerning the accident. The Liverpool and Todmorden express was standing in Blackburn station when an express train from Manchester ran into it. The driver stated that when he endeavoured to apply the Westinghouse brakes, with which the train was fitted, they would not act; and that this was the cause of the accident. It will be remembered that the coroner's jury refused to accept this excuse, and it was not pressed by the railway company. The jury laid the blame on the defective system of signalling adopted, and said nothing about brakes. It was not disputed that the brake worked properly from Manchester to Blackburn, and it was found after the collision in good order on such vehicles as were not smashed up. "The officers of the railway company," says Col. Yolland, "were of opinion that the hose-pipe had become disconnected between the first and second vehicles; but I was not furnished with any evidence to prove that it was so disconnected." Now it is well known that one of the special features of the automatic brake is, that if any part of it gets out of order the brake will at once apply itself; and it might be supposed that if a hose parted the brake would go on; and so it undoubtedly would if the parting took place anywhere but at the regular coupling, or even if that were pulled asunder instead of twisted. The coupling is so made, however, that when it is taken apart in the regular way, valves close the ends of the pipes and prevent the escape of air and the going on of the brakes. But the couplings are very secure, and are so fitted that the hose between the carriages must be lifted up before they can be united. The coupling is then effected, and the weight of the hose and couplings prevents them from coming apart. When, however, a pressure of 80 lb. or 100 lb. on the square inch comes on the hose, an action somewhat like that which takes place in the spring of a Bourdon gauge tube is set up. The hose tends to straighten itself, and to rotate on its axis, and *if* this took place sufficiently the coupling would be turned upside down and might fall apart. It was, as we have said, suggested to Col. Yolland that this twisting might have occurred, in which case the brake would have been practically cut off from the engine, although it might still have been applied by the guard. It is also proper to say that if a porter in coupling up a train puts himself to some trouble, he can, when the hose are very flexible, put the couplings together upside down, but they are certain to shake apart after a short time. As Col. Yolland, ignoring the driver's inexperience, was convinced that his explanation was conclusive, and that the brake really had failed to act, and as moreover it was found to be in excellent order after the accident, the suggestion about the hose coming uncoupled was extremely useful, and inquiries were made as to whether such an accident had ever before taken place, but only two cases could be found which bore on the point. The first occurred at Stanningley, when the couplings between the tender and the first coach came apart. The fireman of the engine, however, explains that the hose was not properly put on. "I got the monkey wrench," he says, "and went under and twisted the cast iron connection to the pipes until the couplings hung straight down. They did not come uncoupled again." We have no intimation of the nature of the second case of uncoupling, save that contained in Col. Yolland's words: "I had also heard of a somewhat similar case to that at Stanningley as having happened on the London, Chatham, and Dover Railway." We think under the circumstances we may assume that the uncoupling of the hose on the Manchester express, if it took place, was virtually the first instance of such uncoupling on record; for it is clear that in the Stanningley case the hose was put on with a twist to begin with, and there was no suggestion that the hose was improperly fitted to the Manchester train. The other example (!) may be dismissed altogether. Furthermore, it must not be forgotten that at the coroner's inquest three witnesses prove that the brake was applied. Thus, for example, Mr. Evans said—"I was a passenger in the express on the day in question. I was in about the fourth carriage. The whole journey was what I might call rather lumpy. *On reaching the West Cabin I felt the deep grinding bite of the brake on our carriage.* We came into the Blackburn station at as rapid or more rapid speed, I should say, than at any period of our journey between Manchester and Blackburn. Immediately after the collision, and after we had attended to the injured, I spoke to the driver of the train. I asked him, 'Why in the world did you bring that train into this station at such a rate?' He replied that he could not see the train standing in the station, nor could any other man, until he was coming into the station." It is true that the driver said he had forgotten using such words, and that if he did use them it was in his excitement.

Thus, then, it appears that the accident was caused either by the incompetence of an engine driver who had hardly any acquaintance with the Westinghouse brake—a fact which came out before the coroner's jury, though not before Col. Yolland, who was, however, present at the inquest—or by the occurrence of a unique accident. There is nothing whatever in Col. Yolland's report to substantiate the theory of uncoupling. A pair of hose pipes were fitted on trestles in a shed, and Col. Yolland was shown that it was possible to put them together wrong way up; but the chances are that had this been done in the case of the train, they would have become uncoupled before they had run a mile. If the hose ends were put together wrong way up by a negligent porter, it must have been done in Manchester, many miles from Blackburn. The brake was used and acted very well at Bolton, Over Darwen, and Springvale. This is tolerably conclusive evidence that the brake was not coupled up wrong; but we have still more. Thos. Brooke, a driver, was called, and stated that on one occasion the hose on his engine was improperly connected to the train at Leeds, but before starting the moment he turned on the air pressure it came apart. It is not disputed that the coupling *can* be made the wrong way, but it is, we contend, extremely improbable that it should be so made, and if it was it would, according to the Stanningley and Leeds evidence, fall apart almost at once. We may reject the improper coupling theory, we think, without further consideration. As to the other supposition that the hose itself twisted apart the couplings, it is simply a surmise, nor can we find a single fact which tends to support it, save that a collision took place which, in theory, should not have taken place if the brake had acted. "Col. Yolland concludes," writes Mr. Chamberlain, "from the evidence taken at the inquiry and from the experiments subsequently made, that some of the mechanism of the brake with which the train was fitted had become out of order, and that the brake consequently failed to act properly when required to prevent a collision, which was primarily caused by a failure of the permissive block system. This conclusion is not founded on such direct and positive evidence as to place it beyond doubt, but on inferences drawn from a variety of circumstances. On the other hand there is evidence that the brake was in order, and had acted properly on this journey at the preceding stations at which the train had stopped." The explanation that the driver, new to the brake—he admitted that he had only run with it five times before—did not put it on soon enough, is consistent and sufficient, and is supported by the fact that during some experiments made by Col. Yolland he failed to put the brake on at the proper time; according to Col. Yolland because he misunderstood an order. The truth appears to be that the man over-estimated the power of the brake, and under-estimated the speed at which he was running. If he had put on the brake ten seconds or so sooner than he did, there would have been no collision.

In so far as the Blackburn accident is concerned Col. Yolland's report can do no harm, but he is certainly not justified in building up on the feeble foundation of surmise what is neither more nor less than a sweeping condemnation of automatic action. "No one," he writes, "can question, I imagine, the desirability of the continuous brakes being made, 'in case of accident, self-acting,' if that can be accomplished without introducing any other element of danger. The self-action can probably do no harm in such cases, and in some may do good; but it is quite a different thing when any of these continuous automatic brakes become self-acting when there is no accident, and suddenly arrest the progress of a train when it is not required by the driver to be stopped; or, on the other hand, refuse to go on and act, from any cause whatever, when the driver desires to pull up his train in order to stop at a 'danger' signal, or at the proper spot at a station, or to avoid any obstruction whatever which he may suddenly come upon, such as cattle straying on the line. No great harm is done, so far as the public safety is concerned, by the brakes suddenly going on without any action on the part of the engine-driver, where the traffic is strictly worked on the absolute block system, and two trains are not permitted to be on the same section of the line between two signal-boxes at the same time, beyond the delay thus occasioned, which, however, is frequently a great nuisance to the passengers; but the case is altogether different where failures take place in the working of the absolute block system, or where it is replaced by the permissive system, as through Blackburn station, and two trains are allowed by the system of working adopted, or, by mistake on the part of one of the signalmen, to be on the same section at the same time, and collisions take place like that in the Bleamoor Tunnel, on the Midland Railway, on the 19th August, 1880, when three passengers were injured, and that at Bow-road station, on the Stepney and Stratford branch of the Great Eastern Railway, on the 3rd ultimo, when eleven passengers are returned as having been injured, and the driver and fireman of an engine of the following train sustained fatal injuries, and died on the spot, from the action of the brakes suddenly stopping the leading train where no stoppage was required, and where the engine-driver did all in his power to avoid the stoppage. It is quite true that, if the signalmen concerned in both these cases had done their duty in correctly working the block system, the collisions would not have occurred; neither would they have happened had not the trains been unnecessarily stopped by the action of the brakes."

Col. Yolland seems to be unable to see that the accident in this case was due, not to the brake, but to the defective signalling; and furthermore he has overlooked the fact that the brakes in neither case were to blame. If they had been in perfect order they could not have gone on, and it was because the Midland officials did not attend to their duties that the Bleamoor accident took place. When the wire of a properly made signal gives way, the semaphore arm flies to danger. A train may thus be stopped, and may be run into by another; but Col. Yolland would not we imagine argue from this that signals should not be made to fly to danger when wires break. Col. Yolland forgets that many accidents have either occurred, or only been averted by good luck—if we may use the words—as a consequence of the failure of non-automatic brakes—like Webb and Clark's chain and Smith's vacuum brake—to act when wanted. It is essential that notice should be given when a failure occurs; and Col. Yolland's own condemnation of the Westinghouse brake is, if he could but see it, based on the assumption that the brake was not automatic enough; in other words, if it had given notice when the coupling parted, no accident would have occurred. Mr. Chamberlain has done well to add his minute to the report. No one supposes that automatic brakes are absolutely perfect, or that they can instinctively stop a train to prevent a collision. It is no argument against their use not to say that they must be maintained in perfect order, and used with intelligence by competent men. If this is done they will not disappoint those who use them. But it is not a defect peculiar to brakes that they require to be looked after with care and well treated. Good servants deserve good masters.

THE EXPLOSION OF A LOCOMOTIVE ON THE NORTH-EASTERN RAILWAY.

MR. LAVINGTON FLETCHER, chief engineer to the Manchester Steam Users' Association, has reported to Mr. Settle, the coroner for North Stockton, on the cause of the explosion which took place on the 26th of December, 1881, near Stockton. It appears that the boiler which exploded was of the ordinary multitubular locomotive type, and had formed a portion of a six-wheeled coupled goods engine, made at the North-Eastern Railway Company's works, Darlington, in March, 1880, since which time it had run 48,843 miles. The pressure to which the safety valves of the boiler were loaded was 140 lb. per square inch. The explosion occurred just after the engine had been brought to a stand, with only three trucks and a van attached to it. The boiler did not give way in the barrel from grooving at the longitudinal seams, as boilers of this class so frequently do, but it gave way in the fire-box, which was of the ordinary square type. It was made of copper, and measured 4ft. 7in. in length, by 3ft. 4in. in width at the bottom, and 3ft. $7\frac{1}{2}$in. at the top, while the height was 5ft. 10in. The thickness of the tube plate was $\frac{7}{8}$in., of the ends and sides $\frac{1}{2}$in., and of the flat crown plate $\frac{1}{2}$in. The ends and sides were strengthened with stud stays $\frac{7}{8}$in. in diameter, and pitched as nearly as may be $4\frac{1}{4}$in. apart from centre to centre. The crown was strengthened with seven roofing bars, assisted by four suspension stays tying them to the top of the outer casing. These roofing bars measured 5in. in depth by $1\frac{3}{4}$in. in thickness, and were spaced 5in. apart from centre to centre, the bolts for tying the crown plate to the roofing bars being 1in. full in diameter, tapped into the plate, nutted on the fire side, and pitched at $4\frac{1}{2}$in., while the suspension stays measured 3in. by $1\frac{1}{2}$in. The roofing bars ran well over the ends of the fire-box, and were well bedded. The part of the fire-box which gave way was the flat crown plate. This had been driven down obliquely, hinging on the top of the tube plate at one end, and tearing away from the back of the fire-box, immediately over the fire-door, at the other. In consequence of this the boiler was lifted from the ground, torn from the framing of the engine, thrown forwards, and turned over on its back. Immediately in front of the engine another goods train was standing, and the boiler was shot over the brake van at the rear of this train and thrown on to the sixth truck from the end. On examining the crown of the fire-box to ascertain the cause of the rents, it was found that the plates were not at all wasted by wear and tear, but that there was clear evidence of their having been overheated. The nuts on the fire side of the plate at the ends of the stays uniting the plate to the roofing bars appeared to have been burnt. But far more convincing proof of overheating was afforded by the general appearance of the crown plate. This was severely distorted, a series of corrugations being formed right across from side to side. The hill and valley condition of the crown plate left no room to doubt that it had been overheated. The fire-box crown was fitted with a fusible plug, but this did not prove of any use. It was a common lead plug, $\frac{3}{8}$in. in diameter. This was screwed into a brass nut and rivetted at the top and bottom, the length of the lead plug being about $1\frac{1}{2}$in. from out to out. Such a construction does not appear to be sufficiently sensitive. The construction of the lever safety valves, as well as of its direct spring loaded valve, was such that neither could be by any means easily tampered with; and there is no reason to conclude that the explosion was in any way due to excessive pressure of steam, while this view is corroborated by the fact that the sides and ends of the fire-box were perfectly flat and true, the bulging being confined to the crown, which bore evident signs of overheating. Mr. Fletcher considers the explosion did not arise from excessive pressure of steam, nor from defective construction, or defective condition of the boiler, but that it arose from the weakening of the crown of the fire-box through overheating of the plate in consequence of shortness of water, that shortness of water, in all probability, being due to the misreading of the glass water-gauge by the engine-driver. Two inquests have been held, one at North Stockton, and the other at South Stockton. The jury for North Stockton accepted the view given in the report, and brought in the following verdict:—"The deaths of the two deceased persons were due to the effects of the explosion of the boiler of the engine No. 204, belonging to the North-Eastern Railway Company, and we attribute the explosion to the overheating of the fire-box top plate, caused by shortness of water, and we suggest that the railway company should strive to find a more reliable fusible plug, and we also recommend the adoption of double water gauges." The jury at South Stockton adjourned for another fortnight, and will probably call in further scientific evidence. A joint report was presented by Mr. Johnson, locomotive superintendent of the Midland Railway; Mr. Stirling, locomotive superintendent of the Great Northern Railway; and Mr. Jeffries, late manager of the Low Moor Ironworks. These three gentlemen gave evidence before both juries, and attributed the explosion to overheating of the fire-box crown, in consequence of shortness of water, and thus confirmed Mr. Fletcher's report. Notwithstanding this, however, the South Stockton jury were not convinced. We may add that the North-Eastern Railway Company submitted a twin locomotive to the one that burst to hydraulic test of 300 lb. per square inch at York on Saturday, the 7th inst. The fire-box stood it well, showing that there was no structural weakness to account for the explosion at the ordinary working pressure of 140 lb. Mr. Johnson, Mr. Stirling, and Mr. Jeffries witnessed the test and reported thereon to the jury.

LONDON FIRES.

Captain Shaw's annual report on London fires, presented at the meeting of the Metropolitan Board last Friday, shows that there were as many as 1991 fires in the metropolis during the past year, of which number 167 were serious. The total exceeds that of any previous year, but, allowing for the increase in population, the figure is not so unfavourable as in some of the years that are past. This will be seen if we take the number of fires per 100,000 of the population. The ratio for 1881 will be 51·9, a result which has been exceeded on three previous occasions. Thus in 1868 the ratio was 53·6 ; in 1870 it was 60·7 ; and in 1871 it was 56·6. There are, however, two untoward facts. First, the ratio is higher than in any other year since 1871, and the ratio has been rising annually from 1877 inclusive. Thus the ratios for the last five years are respectively 42·7, 45·8, 47·0, 49·8, and 51·9. Accordingly the rise, year by year, has been 3·1, 1·2, 2·8, and 2·1, while the ratio for 1881 is 9·2 in advance of that for 1877, the increase in the ratio during the last five years being 21 per cent. This is not satisfactory as concerns the amount of danger which besets the metropolis, and our chief satisfaction must be sought in the circumstance that the Fire Brigade has done its work so well as to keep down the number of "serious fires," these constituting only 8 per cent. of last year's total, as compared with 10 per cent. in 1877, 25 per cent. in 1866, and the tremendous figure of 34 per cent. in 1865. The operations of the Brigade commenced with the year 1866, in which year the serious fires were nearly double the number recorded last year. That fires altogether should be now so numerous is the curious feature, the rate per 100,000 of the population having been 50·5 in 1865, a lower figure than that which prevailed last year. The early statistics may have been defective, but that can hardly account in full for the broad result that the ratio for 1833 was as low as 26·8, while in no year did it reach 40 until after 1856. The growth of London thus appears to increase its inflammability, and consequently to demand a corresponding development in the strength of the Brigade. As to the "causes of fires" last year, we observe that candles are recorded in 149 instances, gas in 210, and lamps, whether fed with oil or spirit, together with spirit apart from lamps, in 149—the same as candles. In these last-named instances there are twenty-seven cases in which fire was caused by a spirit lamp "exploding," and seventy-nine in which the lamp was upset, besides thirteen instances in which the vapour of spirit came in contact with flame. "Light thrown down" was the cause of 181 fires, besides two instances in which the light was thrown down an area, and twelve in which it was thrown from the street. "Spark from fire" was the cause of disaster in 173 cases, and "smoking tobacco" is specified in forty, while lucifers account for twenty-three, in addition to forty-one instances where children were "playing with lucifers." In as many as 462 cases the cause of fire is returned as "unknown."

THE DOTEREL, THE TRIUMPH, AND THE DRIERS.

The news of the explosion on board the Triumph, off Coquimbo, sad as it is in itself, has revived the doubts as to the general management of the Navy which the loss of the Doterel and the subsequent official inquiry had given rise to. We do not remember whether the drier which boasts of the barbarous name of "xerotine siccative," which means "drier" twice over in Greek and in Latin, and to which the recent explosion is due, was mentioned in connection with the accident at Puntas Arenas. But in any case, there appears to be little doubt that the authorities saw cause for suspicion, and the drier which had already been analysed and pronounced harmless, was then analysed afresh, and pronounced to be of so doubtful a character that its use in the Royal Navy was to cease. Since the recent accident, directions have been forwarded to every station to the effect that it is to be regarded as a dangerous explosive, and should be got out of the way as quickly as possible. How many ships of the Royal Navy, it may be asked, are there cruising at a distance from stations which may go to pieces any day, thanks to this dangerous form of cargo? Again, it has been asked in one of the daily prints, what is the use of keeping laboratories at the public expense, if compounds, which turn out to be explosive, are issued for use with such careless examination that their properties are not discovered? Moreover, if the Admiralty had such doubts about its composition as to discontinue its use, why were not the orders which have now been telegraphed dispatched at once? As far as concerns the Doterel it is of course difficult to say that this "siccative" was the cause of the accident. But it will be remembered that the evidence showed the existence of dangerous communications with the magazine from various parts of the unfortunate ship. If the explosion which killed three men and injured half-a-dozen others on board the Triumph had communicated itself to the magazine, the entire ship would have gone to the bottom. The class of compounds to which the name of "siccative" is given are, it appears, varnishes which are added to oil paints to make them dry quickly. They are prepared by boiling linseed-oil with metallic oxides or salts. Formerly litharge, minium, umber, and gypsum were employed for the purpose, but more recently the oxides and salts of manganese have come into use; they produce rapidly drying siccatives, and when added to zinc-white do not introduce any substance that can be blackened by sulphuretted hydrogen. A mixture of equal parts of manganous sulphate and acetate with an equal quantity of zinc sulphate and ninety-seven parts zinc-white added in the proportion of one-half to one per cent. to the zinc oxide with which the oil colour is to be prepared, is said to effect the drying of the paint in twelve hours. A similar mixture is the *siccative zumatique de Barruel*, which, according to Bolley, is made by mixing from five to six parts of borous manganate with ninety-five parts of zinc-white, and adding to zinc-white colours in the proportion of about 2½ per cent. Acetates and manganates closely associated with boiled oils do not form the most stable compounds imaginable. It now appears from a letter which has been forwarded to the Admiralty by the commander-in-chief at Portsmouth, and written by three survivors of the Doterel explosion, including the carpenter, that they attribute the disaster in the Straits of Magellan to the ignition of xerotine siccative, and not to the explosion of gases generated in the coal bunkers, as had been found by the court-martial upon the evidence of Professor Abel. The explosion on board the Triumph, they state, directed their attention for the first time to the fact that xerotine siccative had explosive properties, and reminded them that within a very short time of the explosion, perhaps fifteen minutes, a leakage of xerotine siccative had been discovered in the paint store room, which is immediately adjacent to the fore magazine in which all powder stores, excepting small-arm ammunition, was placed. The presumption is that the escaped composition flowed under the wooden flat of the magazine, and that the inflammable vapour it gave off was ignited by the light carried by the man told off to clean the store room floor. What remained of xerotine siccative in the cask had been in the meantime thrown overboard by the seamen who are still alive. The dangerous character of the drier was, it appears, perfectly well known to the Admiralty.

GAS IN MIDDLESBROUGH.

We referred in The Engineer a few months ago to the question of the cost of the production of gas, and of the growth in its manufacture in some of the northern towns ; and it may be now interesting to notice the continuance of some of the features then noted. In the town of Middlesbrough, for instance, it seems that there is now being sold about 2,500,000 cubic feet more gas monthly than there was a year ago at a corresponding period. It is also worth notice that whilst a year ago the production of gas at Middlesbrough was on the average 13,200,000 cubic feet monthly, it has now been raised to for the past month over 21,100,000 cubic feet. Turning to the question of cost, it appears that coals cost 10·62d. per thousand cubic feet of gas sold ; wages, 6·60d., and other items bring up the gross cost to 23·32d. per thousand cubic feet, a rate slightly above that of the corresponding month of last year, owing mainly to a slight advance in the price of coals. Against this is to be set, chiefly for "waste products" tar, coke, ammoniacal liquor, &c.—rather over 10d. per thousand cubic feet of gas sold, so that the net cost of the gas sold has been 13·28d., or about 1s. 1¼d. The net receipts for the gas sold were nearly 2s. 8¼d., so that 1s. 7d. per thousand feet remain to pay interest on the capital and redemption. It is thus evident that with a production and sale that must be now approaching 170,000,000 cubic feet yearly, there is a very large profit returned by the Middlesbrough Gas Works to their owner—the Corporation. In the last year the yield of gas has been about 10,308 cubic feet for every ton of coal carbonised, and the tendency is towards increase. The leakage is rather less than it has been ; a year ago it was 12½ per cent., but in the month last reported on it was reduced to 10½ per cent., and there are other facts that point to the probability of a long and prosperous life for the gasworks in the great iron manufacturing town. In the north-east of England very little attention has as yet been devoted to the fostering of the use of gas as a fuel or for power-raising purposes ; but were this done, and with that increased value of the bye-products that seems now setting steadily in, it may be supposed that there would be a more than counterbalance for any loss in the consumption by the growing use as an illuminant of the electric light. What the gas companies have to do is to cheapen the price of gas, to improve its quality, and to prepare themselves to supply the alternative light, so that they may give to their consumers a cheap fuel, and either the light that we have been accustomed to or that that seems likely to take its place.

LITERATURE.

Tramways : their Construction and Working, with special reference to the Tramways of the United Kingdom. By D. Kinnear Clark, M.I.C.E. Supplementary volume. London : Crosby Lockwood and Co.

Those interested in tramway construction and working, and who therefore, as we suppose we may say, possess Mr. Clark's first volume on this subject, published in 1878, need only to be informed that this supplementary volume has been published, and that the character of the first is maintained in the second. To those who are not acquainted with the first volume, we need only say that all that has been done towards the perfection of tramway permanent way and rolling stock since it was sent to the press is fully described in the volume before us, which also contains a mass of that statistical information that is so difficult to obtain, but which is so necessary to those who desire to construct and work tramways economically, as well as to those who would examine for themselves, previous to investing money in them. Tramway accounts are not yet generally kept with the precision which marks railway accounts. The North Metropolitan Tramway Company has done this, and there are few if any more successful companies. The advantages of accounts which show plainly the cost of every detail of tramway working are such that it would have been thought that every company would have adopted the best method of doing this. Such is not, however, the case, neither is there any general uniformity in the methods adopted. Upon this subject Mr. Clark has a good deal to say, and he gives good reasons for his opinion that if the companies will not do this on their own behalf, it should be made compulsory as it has been with the railway companies.

Amongst the systems of tramway permanent way described in this volume is that of Mr. Edge, of Birmingham, which we noticed in our impression for the 8th November, 1878, and 30th January, 1880. This system was tried on a short experimental length in Birmingham, and upon inspecting it we expressed a favourable opinion of its merits. Since then it has been in successful operation in the city of Brunswick, and an inspection of its working there in 1880 confirmed our opinion. The rails are grooveless, and all the most salient objections to tramways as operating prejudicially to ordinary vehicles are thus removed. The rails are of inverted channel section, and are perforated with holes about 5in. apart, and short spuds or studs in the rim of the car wheels take into these and run as smoothly as flanged wheels in grooves. It should be pointed out that this system offers great advantages for lines to be worked by mechanical traction, as it removes the necessity for great weight in the motor, whether compressed air, electric, or steam. During the four years which have passed since Mr. Clark's first volume was published a great many systems of permanent way have fallen into desuetude and others have been tried, heavy rails of girder or joist section being now most favourably received, especially as the adoption of mechanical traction has also made great strides. Upon these questions Mr. Clark enters fully, and compares English with foreign practice and progress. The cost of horse haulage is very great, and probably more in London than elsewhere. In London about 26 per cent. of the horses are renewed annually, or in other words, the tramway life of a horse is only four years. Few businesses could afford to pay so much for horse-power, but in spite of this the cost of mechanical traction has not hitherto been sufficiently low to make tramway companies generally anxious to adopt it. Engines which do not cost fabulous sums in repairs are now, however, made, and no doubt the progress in the next four years will be even more rapid than in the past four dealt with in these pages. Mr. Clark states that the Merryweather steam engine moves one ton one mile with 0·69 lb. of coal, while the Mékarski engine consumes 1·75 lb., or more than two and a-half times the quantity used by steam. Coal, however, is far from being the principal cost at present ; the design of engine which shall reduce the cost of repairs may soon be produced.

To give a full account of the contents and character of Mr. Clark's book would occupy more space than can be spared, but as all interested in tramways should possess it we need say no more.

BOOKS RECEIVED.

The Gas Engineers' Diary and Text Book. 1882. Edited by G. E. Wright and W. S. Mason. Birmingham : J. Wright and Co.

An Elementary Treatise on the Differential Calculus Founded on the Methods of Rates or Fluxions. By J. Minot Rice and W. Woolsey Johnson. Abridged edition. New York : John Wiley and Sons. London : Trübner and Co. 1882.

Our Factories, Workshops, and Warehouses, their Sanitary and Fire-resisting Arrangements. By B. H. Thwaite, C.E. London : E. and F. N. Spon. 1882.

The Figure of the Earth, an Introduction to Geodesy. By Mansfield Merriman. New York : Wiley and Son. London : Trübner and Co. 1881.

A Practical Guide for Inspectors of Nuisances. By F. R. Wilson. London : Knight and Co. 1881.

Elementary Lessons on Electricity and Magnetism. By Silvanus P. Thompson, B.A. London : Macmillan and Co. 1881.

Sewage Disposal for the Guidance of Sanitary Authorities. By Henry Robinson, C.E., F.G.S. London : E. and F. N. Spon.

Steam Heating for Buildings ; or, Hints to Steam Fitters. By W. J. Baldwin. New York ; J. Wiley and Sons. London : Trübner and Co. 1881.

LETTERS TO THE EDITOR.

We do not hold ourselves responsible for the opinions of our correspondents.]

FAURE'S ACCUMULATOR.

Sir,—As the writer of the lines criticised by M. Faure, I may, perhaps, be allowed to say a few words in reply to his letter. In the first place I do not admit that the words quoted contradict one another. I said from my own knowledge Faure's battery was very good ; I then stated that compared with some other batteries shown to me it was nowhere, but I carefully stated that the Faure's battery used in these experiments was one made by the experimentalists, and although every attempt might be made to do Faure justice, it is possible, nay probable, that M. Faure would refuse to recognise such a battery. Lastly, from data obtained from experiments, and taking the data as published about Faure's battery, I said it was not the best. My arguments were based entirely on the public figures obtainable *re* Faure's battery, and not on any private results he or others may have obtained. I may state that I took these figures because they were slightly better that those obtained in my own experiments. With regard to the owners of the improvements with which I am acquainted, they are not the owners of the Faure patents ; but whether the owners of the Faure patents possess improvements equally good is a matter unknown to me.

As a matter of fact, I had no thought of the commercial aspect of the case when writing the lines in question. M. Faure's battery possesses certain defects better known to M. Faure than to myself; some of these defects other parties at any rate have overcome, and whilst they may have been obviated in M. Faure's private work, they at any rate exist in the cells that have been sold here. The experiments described by M. Faure are very interesting, and the figures show the battery to be worthy of a high position among secondary batteries—whether it is the best the future will show. I still hold that in the public mind M. Faure's battery will never regain its pristine position, a result entirely due to the methods pursued by the commercial element, and from which M. Faure must be exonerated.

In conclusion, may I express an opinion which I hold very strongly, viz., that inventions of a scientific character should be, in the first place, considered in the technical and not the political press ; in the latter case a false conception is generally gained by the reader because he is ignorant of the subject, and sees only just what is put before him ; in the former case some knowledge at any rate is soon brought to bear on the subject, and the matter is placed upon a fair footing before it is brought under the notice of the ordinary public.

γ. β.

London, January 19th.

COOPERS HILL ENGINEERS.

Sir,—I see a long letter in your paper from General Chesney, R.E., trying to persuade the profession and the public that at some happy date—some twenty or thirty years distant—the Indian Public Works Department will, by the aid of the engineers from Coopers Hill, be able to build a barrack that will not tumble down before it is occupied by the troops. An Indian barrack is not a very ornamental building ; its style of architecture is not recognised by any work on architecture, nor is the internal finishing more complicated than a coat of whitewash and the usual barrack bed. The outside appearance is something like a warehouse of Manchester goods with large windows. Pending this millennium how many millions are to be wasted on tumble-down buildings, railways of all sorts of fancy gauges that carry nothing, canals that nobody wants and that do more harm than good by making India more feverish than it naturally is?

To read General Chesney's letter one would imagine that the Royal Engineers were totally ignorant of mathematics and theoretical mechanics, and that the Stanley engineers were mere cram-fed youngsters. As a matter of fact the theoretical education at Woolwich is good, and most of the Stanley engineers had been educated at some college and were good mathematicians—all I ever met were. But suppose Coopers Hill is all that General Chesney imagines it to be, what is the good of it? Is it not perfectly well known that all the higher appointments in the Indian Public Works are the right of the Royal Engineers?

I will ask a few questions for General Chesney to answer. Who blundered all the accounts of capital and revenue in the Indian Public Works to such an extent that it took several years to get them put into something like order? The Royal Engineers, or who? Who invented the metre gauge railway? Who invented a system of canals, with all sorts of useless but very expensive masonry works, all of which works show a gross ignorance of geometry and mathematics? As the Duke of Argyll has already stated that the barracks are a blunder of the Royal Engineers, this question does not need to be put. General Chesney is quite correct in saying that an engineer in India ought to be a practical man. I believe this is the general opinion about an engineer either in India or elsewhere ; but it is in this practical sense that the Royal Engineers have turned out such expensive failures.

None of the Indian public works, either canals or railways, publish detailed accounts of their expenditure and revenue, showing capital distinct from annual expenditure. According to the Blue-books, which show roughly the general result, most of these works pay only 1 or 2 per cent. Some canals—as the Orissa Canal and the Madras Canal—Sir Arthur Cotton's great work—do not even pay working expenses.

A reform not mentioned by General Chesney is needed more than any other, viz., that the accounts of Indian canals and railways should be got up by a professional accountant, and put into a shape that can be understood, and will show separately capital and revenue. It is perhaps not known here that the chief engineer of each province in India is also secretary to himself, and gets up his own finance to show how clever he is. This opinion is not shared by the present or late Secretary of State for India, or anyone else. A. G. MURRAY.

141, George-street, Edinburgh, January 16th.

A PROBLEM IN ELECTRICITY.

SIR,—In reference to the letter of "Φ Π" in your last issue, it is certain that a current will traverse the coil at F, forming a portion of a closed circuit, whenever this coil approaches or recedes from A or B, on either side of the verticals. When F approaches either electro-magnet, the current induced in F is inverse, *i.e.*, in the contrary direction to that of the current in the electro-magnet. When F recedes from the electro-magnet the induced current is direct, *i.e.*, in the same direction as the current in the electro-magnet. The effect of these induced currents, it will be seen, is to diminish the effectiveness of A and B in maintaining the motion of the pendulum. When, in fact, the electro-magnets should attract F, the attraction is diminished by the effect of the inverse current; and, when they should release F, the direct induced current causes them to attract it. The energy which disappears from the pendulum system becomes developed in the circuit of F; but the proof of the proposition would be more than I could at present undertake. DESMOND G. FITZ-GERALD.

January 14th.

BRITISH EQUIVALENT OF A METRE.

SIR,—In your issue of the 11th November there appears a letter from Messrs. James Chesterman and Co. on "the length of the metre," about which I wish to make a few remarks. "The length of the metre" is an ambiguous expression, for in the abstract the metre is not a measurable substance, but length, or rather a unit of length, whose equivalent in terms of any other unit of length must be constant, and cannot be dependent on expansion or contraction, or any other law of nature, *i.e.*, so long as we are dealing with the "metre" and the "inch" their respective standards must be considered as mere lines, "length without breadth." But immediately we go to measure anything with, say, a material metre standard at a higher temperature than 32 deg. Fah. we must make a correction due to the elongation of that standard, together with that due to the coefficient of expansion of the substance to be measured, independent of the equivalent. The importance of such corrections, whether for scientific or commercial purposes, is only comparative.

I therefore consider the error of which Messrs. Chesterman speak as not likely to arise out of the use of the conversion table you have lately compiled and published, but from neglecting to make the necessary corrections due to temperature and coefficient of expansion when such units are applied to material bodies.

Should others have already noted this, and my communication be in consequence rather late in the field, I trust it will be none the less acceptable to you and some of your readers.

Demerara, 24th December, 1881. JAMES H. MAN.

PHOTOMETER TESTS OF ELECTRIC LAMPS.

SIR,—Notwithstanding the numerous comments in the various scientific journals on the obvious discrepancy in the results of the tests on electric lamps in the report by Professors Ayrton and Perry, which recently appeared in your pages, and seeing also that Professor Jamieson, on the same subject in your issue of the 6th inst., has fallen into similar errors, I venture, as no one else has done so, to point out the cause. Some of Messrs. Ayrton and Perry's observations are correct, but all of Mr. Jamieson's are wrong, from the simple fact that the resistance *hot* is not correctly got at.

As Mr. Jamieson has given his formulæ and a diagram of connections in his paper, I will deal more particularly with it. All the tests might be taken and worked out correctly as Mr. Jamieson proposes should an ordinary battery or a current from a fed dynamo be used; but when a current from a self-energising machine is employed, both the electro-motive force and the current are very materially altered by the varying resistances employed in the testing circuit altering the strength of the magnetic field.

There is no difficulty in getting at correct results whatever the source of the current is; but, as your space is valuable, I need hardly explain how—as any electrician would easily see, I think—now I have pointed out the cause of error. I may mention that the mean resistance hot of this company's lamps, as tested by Mr. Jamieson, should have been about 82 to 83 ohms, with a current of 1 ampère, as against 51 ohms, shown in his paper.

Should my explanations not be sufficiently explicit, I shall be happy to answer any further inquiries.

FRED. ORMISTON, Manager,
Incandescent Department, British Electric Light Company.
Heddon-street, Regent-street, London, W., January 18th.

THE QUESTION OF HEAVY GUNS IN AMERICA.

SIR,—While thanking you for your able and discriminating article upon the above subject, I should feel obliged if you would be good enough to allow me to offer the following remarks upon the bursting of a Spanish converted gun—the first gun of the kind out of several thousand that has ever burst, excepting under known excessive charges. In the first place, the gun was supposed to have fired a 13 lb. charge of powder with a projectile of, I believe, about 80 lb., and the powder was of about the same strength as English R.L.G.—rifle large grain—powder. Judging from the results of my own experiments, the Spanish gun must have been double-loaded. Had it been double-loaded with 13 lb. charges of pebble power, no harm whatever would have resulted; and had it been double-loaded with 6 lb. charges of R.L.G. powder, the cast iron casing would have cracked longitudinally in three or four places, and the coiled tube would have remained sound, although permanently bulged to the extent of about $\frac{1}{4}$in. measured along the diameter of the bore.

As I have already said, the gun must have been double-loaded, and the charges were each of 13 lb. weight. The result was that the cast iron was so badly cracked longitudinally that the staves, into which the body of the gun had been divided, were forced radially away from the breech of the gun. The coiled barrel has practically no longitudinal strength, and makes no pretence to any. The result was that the coils of the inner barrel drew out, and as the outer tube remained intact it acted like the bore of a gun to blow the detached cast iron breech away to the rear.

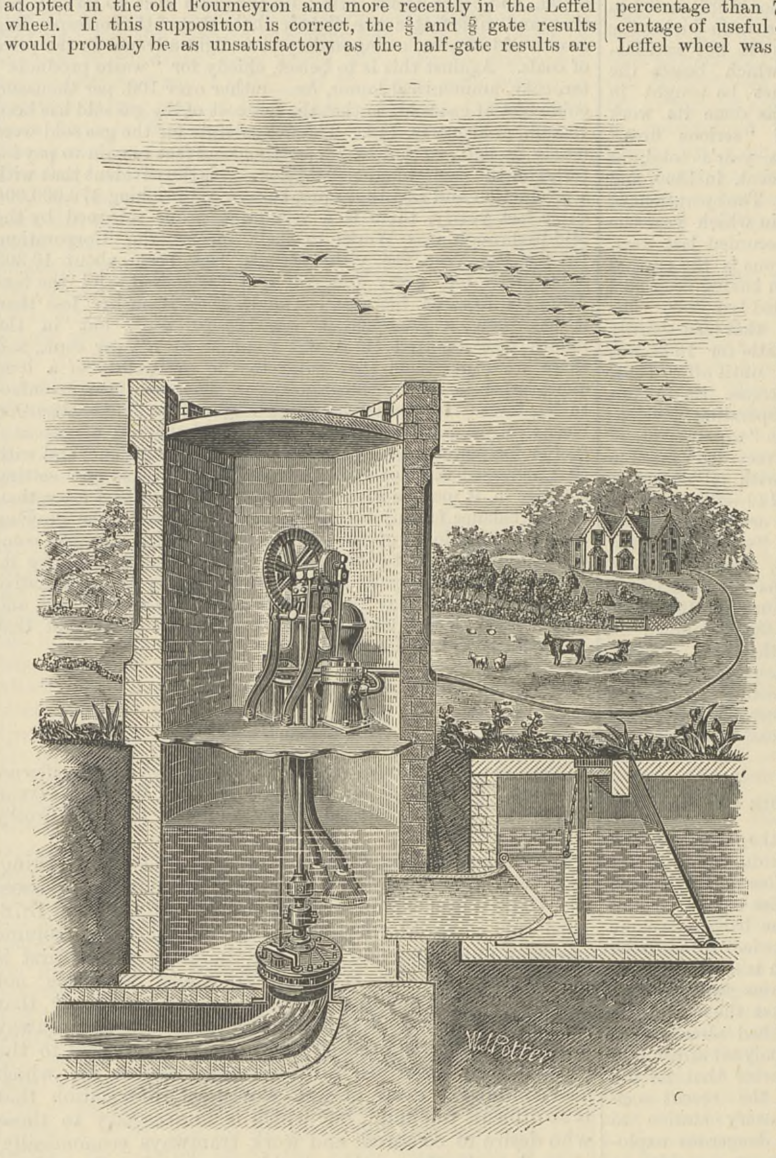
In introducing my guns into the service I was often tempted to abandon—under the heat of fierce competition with regard to cost—the outer tube round the breech end of the lining barrel. The object of thus dividing the breech end of the barrel into two concentric tubes was to break the continuity of fracture in the event of rupture commencing from the inside of the gun. I have been fully rewarded for my resistance to temptation by the result of this accident; for the outer tube held together to the last and prevented a lateral explosion from taking place. Had the barrel been formed of a single tube a terrible explosion would have occurred, and many brave soldiers would have been killed, whereas, owing to the existence of my "B" tube, only $1\frac{1}{2}$in. thick, no life has been lost. I may remark that if coiled wrought iron barrels would burst like steel instead of bulging, it would require about four times the pressure necessary to burst a converted gun laterally in order to blow the breech off.

21, Earl's-court-square, January 17th. W. PALLISER.

THE EFFICIENCY OF TURBINES.

SIR,—As this subject is at present one of great interest, I venture to offer a few remarks on the letters of Mr. J. Turnbull and Messrs. Gilbert Gilkes and Co. Mr. Turnbull gives 74 per cent. as the highest result obtained by Mr. Emerson when experimenting with a Leffel turbine. Yet Mr. Emerson's Turbine Reporter, 1877, gives a very much better result, viz., 79 per cent. as the highest duty which he obtained with this wheel.

Now with regard to the merits of the "Hercules" wheel, which Mr. Turnbull says he is introducing on this side of the Atlantic. The result quoted by him is excelled by the Risdon wheel, which gave an efficiency of 91 per cent. The half-gate result obtained with the "Hercules" 72 per cent. is very satisfactory, but it may probably be due to a central division in the buckets, such as was adopted in the old Fourneyron and more recently in the Leffel wheel. If this supposition is correct, the $\frac{3}{8}$ and $\frac{5}{8}$ gate results would probably be as unsatisfactory as the half-gate results are



good. It is to be regretted that Mr. Turnbull's drawing gives an outside view only of the "Hercules" wheel, as your readers can only form a surmise as to the shape of the gates, and there is nothing to indicate the peculiarities of the wheel itself.

Mr. Turnbull claims as an advantage that his turbine will do as much work as a larger one of an ordinary type; but as the decrease in diameter has to be compensated for by making the buckets unusually deep, this claim must be accepted with a good deal of qualification. A smaller wheel runs faster with a given head than a larger one, and this is frequently a great objection. In some cases I have reduced the width of my turbine disc and increased the diameter to keep down the speed, but have never found it desirable to reverse the process.

Turning to Messrs. Gilbert Gilkes and Co.'s letter. Thirty years ago the vortex wheel was introduced, and since then has remained practically the same. At that time it was a complete novelty; now in its original form it may be considered to be out of date; modern makers advancing with the times have introduced many improvements suggested by practice. The only published record of any experiments with the vortex wheel with which I am acquainted will be found in Donaldson's "Turbines." The wheels experimented on were employed for raising water, and gave a pumping efficiency varying from 22 per cent. to 33 per cent. Allowing excessively for the friction of the pumps and water therein at another 33 per cent. of the whole power, the efficiency of the turbine would only reach 66 per cent., which is very poor.

The advantage of a horizontal shaft is by no means peculiar to the vortex wheel, but is possessed by Schieles' turbines, and numbers of other modern examples. It is not, however, to be recommended except in special cases. I enclose sketch showing the setting of the Blackwell Mill turbines, a method which I have also adopted in other cases. CHARLES L. HETT.

Ancholme Ironworks, Brigg, January 3rd.

SIR,—In your issue for December 30th we are pleased to see that the turbine has been taken by other makers, &c., as being a proper prime mover for driving the machinery for the electric light. There cannot in our opinion be any doubt about this, and that the turbine will be very extensively used for that purpose where water is available. It is, therefore, desirable that the subject should be as far as possible well ventilated in your columns. Mr. J. Turnbull, of the Hercules Turbine Office, Glasgow, says that his turbine has several advantages over Leffel's—one in particular is named, the small size of the wheel. This will make it necessary to have a small draught tube, and as this draught tube in the illustration appears rather long, the discharge of the water after having done its work must in some degree be retarded by having to pass a long and narrow tube, as this wheel is only half the diameter of Leffel's to give the same power. We have not seen the internal construction of the wheel, so are unable to judge how the footstep is carried, but suppose there will be as in Leffel's a cross in the draught tube; this will tend also to block the water in the narrow discharge tube. It is perhaps questionable whether any gain can be derived by reducing the size of the wheel to the least possible diameter, excepting first cost. About the working parts we cannot say, not having seen the wheel, but shall be pleased to avail ourselves at the first opportunity of doing so.

The Canal Ironworks, Kendal, turbine is shown, with a horizontal shaft. This is a very good plan for driving any kind of machinery direct by a belt. It is not, however, peculiar to Professor Thompson's wheel. The same plan is extensively used by us in our mining case, as well as by other makers. Some of the advantages are—the wheel with case can be placed at any convenient height, not, of course, exceeding the usual height above the tail water level, the shaft passing out at each side of the case, having bearings on the outside which can be oiled, the whole being accessible and subject at any time to examination. The water is conveyed away from the wheel by a draught tube. In Mr. Hett's letter we see that we claim as high a percentage for our wheel at one-tenth gate as for full gate. In our letter it says "nearly." We know that the act of running a wheel capable of using, say, 1000 cubic feet of water per minute with only 100 cubic feet cannot give the same useful duty. We believe Mr. Hett has an English turbine, and in his advertisement cautions the public against his wheel being represented as an American invention. We presume that this wheel will be constructed on the basis of 75 per cent. useful effect. Yet we have in Mr. Hett's wheel list a much higher percentage than 75 per cent. claimed. With regard to the percentage of useful duty, a great difference of opinion exists. The Leffel wheel was tested by a brake some time since, by a Mr. Brown, who wrote a letter in THE ENGINEER stating the result of the test. This letter appeared about two years since, when a similar discussion took place in your columns. We do not remember the exact percentage the tested wheel gave, but believe it was much over 75 per cent. Perhaps Mr. Brown will give us his experience by taking part in this discussion.

THOS. MCKENZIE AND SONS, Limited,
16, Holborn Viaduct, London,
January 11th.

THE FORTH BRIDGE.

SIR,—I have examined the paragraph in my work on "The Britannia and Conway Tubular Bridges," referred to in your remarks on the Forth Bridge, November 11th, and I fail to discover any error in the result given. I would call your attention to the fact—see page 470—that we estimated the pressure of a hurricane in this country at 46 lb. per square foot, which though, as we believed, overrated, is a pressure of very little importance as regards the lateral strength of the combined tubes of the Britannia Bridge, which are not only continuous but are laterally united. We found, moreover, that these large exceptional pressures, both as regards wind and probably waves, are purely local, and never occur simultaneously over so large a surface as that of the whole side of one of these tubes; in fact, it is evident that if this were not the case a very large proportion of our domestic architecture, as well as of our sea defences, would have been long since swept away. During the great gales of February, 1850, the heaviest gale experienced in Wales during twenty years, one of the tubes, totally disconnected from the rest, was at its full height of 100ft., and was resting only on a pile of packed planks. It was so slightly affected that its lateral motion did not exceed $1\frac{1}{2}$in., while a gleam of sunshine caused a lateral deflection of 3in.

The blows from the gale were in the nature of impacts over limited local areas, and were never synchronous with the vibrations, and never produced the same amount of oscillation that we could obtain by the synchronous exertion of ten men—see p. 719. These vibrations all became inappreciable after the tubes were united together. I may add that the local impacts of *foci* of wind during a gale are evident on a lake or river where the approach of each gust is well marked and its limited area defined. The recent and exceptional disaster at the Dee Bridge has naturally for the moment given rise to much unfounded apprehension on this subject, which will in due time subside; but there are many difficulties to be overcome in the design of these large structures of a far more formidable character than the resistance to wind. EDWIN CLARK.

Marlow, January 14th.

STRAINS ON CRANE POSTS.

SIR,—I am much pleased to see the letter of Mr. W. H. Bidder in THE ENGINEER this week. I could hardly have desired a better illustration of my arguments than his Fig. 2. I have, however, a friendly criticism to make. In the fourth paragraph, speaking of the method I used to determine the position of the "neutral axis," Mr. Bidder says:—"How he arrives at these calculations I am at a loss to understand, *they really mean nothing as to the point in question.*" The italics are mine. Now I take it that the point in question is the determination of the stresses, and the position of what Mr. Bidder has called the neutral "line," which, by the way, is only the locus of what I have called the neutral "axis," the neutral axis being in fact an axis perpendicular to the plane of the paper, and defined by a point in the neutral line, as shown in Mr. Bidder's Fig. 2. As to the meaning of my calculations, I have simply to say that what they "really mean" is, that equations (8) and (9) in which their results are embodied, give respectively the stresses and the position of the neutral line. I have stated this several times already, and it is sufficient for my purpose that an eminent professor of applied mechanics and engineering construction, in one of the leading colleges of civil engineering in Europe, has assented to the method of calculation I have used. Equation (9) follows, as a matter of course, by simply making (8) equal zero and equating with respect to x, and the remarks in which I refer to Fig. 3 in my letter of December 30th are a demonstration of this extension of the use of equation (8). If Mr. Bidder can illustrate this part of the subject more clearly than I have done, I shall be the first person to admit a deficiency in my arguments, and I might possibly be able to see why it is that my calculations "really mean nothing," &c.

It appears to me that it would not be unreasonable if some of your readers were to ask how Mr. Bidder obtained the information shown in his Fig. 2. It is true he says the position of the dotted line can be ascertained from a knowledge of the stresses, but he does not say how those stresses are calculated. If Mr. Bidder's Fig. 2 should present itself in this light to any of your readers, let me tell them that the stresses represented by the shaded triangles in that figure are given by equation (8) in my letter of Dec. 16th, and that the position of the dotted line is ascertained by equation (9) in my letter of Dec. 30th, and that as a matter of fact there is absolutely nothing in Mr. Bidder's Fig. 2 which has not been explained either by Mr. Tozer, Mr. Fyson, "J. H. H.," or myself.

Mr. Bidder says I have "attempted" to discover the neutral line. I have said that in the post of Mr. Fyson's crane it is ·9in.—more accurately ·88in.—from the centre of gravity of the cross section, when that crane carries a load of 20 tons, and the weight of the crane itself is neglected. If I am correct, why call it an attempt; and if I am wrong, why not say how much I am wrong? Am I in round numbers 5 per cent. wrong? If not I cannot see the object of Mr. Bidder's accusations against me.

May I ask your readers, Sir, to compare the dotted line C D in Fig. 3 of my letter of Dec. 30th with the dotted line of Mr.

Bidder's Fig. 2, especially in that portion of the post below "quay level," and which is under a condition of stress similar to that of the cantilever in my Fig. 3. If my diagram, with the undoubted advantage of equations (8) and (9) which accompany it, is unintelligible, then is not Mr. Bidder's, which, as far as the values of stress are concerned, is left to speak for itself, *à fortiori* infinitely more so?

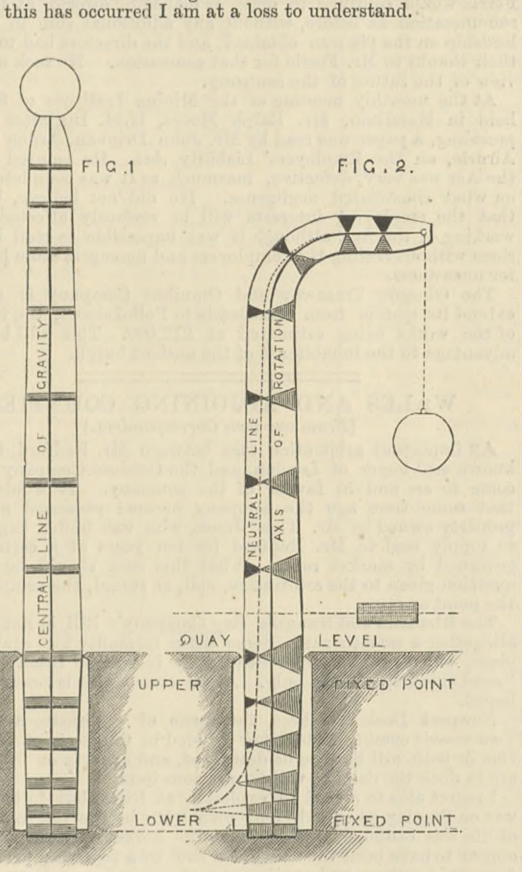
I fully concur, Sir, in your remarks on Mr. Ward's letter, and I can assure Mr. Ward that I should be quite willing to comply with his request, but for the fact that I have twice already practically done what he suggests, in making Mr. Fyson's crane a test on the question of stresses; but Mr. Major in his letter this week, with reference to my request that he should say what values he assigns to the stresses, says: "If he wishes to know what I should make them, my diagrams and letters printed December 9th and 23rd are at his service," &c. We know that Mr. Major thinks the stresses given by Mr. Fyson "improbable if not impossible;" it is therefore clear that Mr. Major would say the same of the stresses which I should give in a design for Mr. Ward's crane. I have only one remark to make with reference to Mr. Major's last letter, and that is that his method of ascertaining the modulus of elasticity below the elastic limit, from results obtained far above that limit, is a sufficient excuse for my not wishing to discuss the matter with him any longer.

I have read Mr. Frederico de Vasconcello's letter, and I may say that so far as the stresses in a crane post are concerned I see no reason why the expression $(b + z)$ should not retain the definition he gives of it. I am sorry to find that "Q. E. D." should still think my "accurately right" "voluminous effusions" are a source of danger to the science of mathematics. My greatest fault seems to be that I "hold the views of the best trained men of the day" in preference to those of "Q. E. D." I regret that I am unable to depart from my usual course of action in this respect.

"Que ceux qui vivent dans des maisons de verre
Se mefient du danger de jetter des pierres."

Fordingbridge, January 14th. W. B. COVENTRY.

SIR,—My diagrams which you were good enough to publish last week are rendered simply absurd and meaningless by the omissions and commissions made by your engraver, and I shall be glad if you will kindly republish them with the corrections. In the first place, in Fig. 1 the centre vertical dark line alluded to in my remarks is omitted entirely, and in Fig. 2 it is only partially shown, viz., down to the quay level and omitted below this; and the shaded rectangles in Fig. 1 are shown nearly all the same width vertically, and do not diminish as we ascend as stated in my letter, and in Fig. 2 the triangles showing the amount of tension are not shown shaded darker than the parts in compression as stated in my letter; and the third and fourth diagrams of compression starting from the bottom in Fig. 2 are considerably too large, and not at all in the proportions of those shown in my drawing sent to you; finally there is a heavy dark line shown on the right-hand side of each figure which was not shown on mine. How all this has occurred I am at a loss to understand.



Also in the letterpress in the tenth line you make me say "central" and not "neutral;" the word central makes the thing absurd. I should like to make one correction, and that is that the centre vertical dark line is only the axis of rotation, so far as the vertical and curved portions of the post are concerned; and at the top end of the curve it becomes simply the neutral axis of the horizontal part. Broadly stating, the shaded sections in Fig. 1 show the strains in a vertical column due to its own weight and an additional load at the top. Fig. 2 shows the alterations of strain produced by the column being bent as shown, and the additional load suspended from the end. W. H. BIDDER.

15, Great George-street, Westminster, S.W.

SIR,—Having neither the wish nor the time at my disposal to enter into a discussion either with Mr. Coventry or Mr. Major, I will content myself with making a few remarks bearing on their letters of last week's issue.

I should have stated perhaps in my previous letter that I used the term "neutral axis theory" in the sense in which Mr. Pendred used it in connection with the "eminent authority," and not in that made use of by Mr. Coventry, so that I had no intention of hurting his delicate susceptibilities on that score—in fact I quite agree with most of what he says on the subject.

It was with no little surprise, however, that I read in Mr. Major's letter that he has been contending from the first that Mr. Pendred's results were correct; to satisfy myself on the subject I therefore referred to my back numbers, with the following result which I hope will excuse my having mistaken his line of argument. In his first letter, October 21st, he distinctly says Mr. Pendred's "view of the case is wrong," and gives the "rocking shaft" example which clearly gives the strains in the back and breast as equal, which as I understand from his allowing my equation to stand as correct he is still prepared to maintain, and which certainly leads one to suppose that he agrees entirely with the "eminent authority." On November 11th he strengthens this impression by his example for Mr. Seguin's benefit, in which he produces the required strains in his post by a horizontal force. In his third letter, December 9th, he writes a lecture on the position of the neutral axis, but still no word as to change of ground, and it is only on December 23rd, his fourth letter, after Mr. Coventry has kindly called his attention to the absurdity, that he quietly, without calling attention to the fact, which quite escaped my notice, alters his statements, so that, to quote from his letter this week, where he refers to Mr. Coventry, this "shows either a great change in Mr. Major's views or an unfortunate vagueness of diction," if nothing worse. This I hope he will accept as the reason why I mistook his final dictum on the subject, occurring as it does towards the end of about half a dozen columns of letter-press.

One point I must confess I fail to see, and it is this: Why, if it does not make the slightest difference to the strains in the flanges, considering them only as the resisting powers, whether the neutral axis, if it were possible, is in the back, breast, or any intermediate point of the web—if, as I say, it does not vary the strains in the least—and neither Mr. Coventry nor Mr. Major, as I now understand them, contend that it does alter them—then why make all this storm in a butter-boat?

Mr. Major's own definition of the state of things necessary for equilibrium, regarding the neutral axis as axis of rotation, applies equally well, and with equal truth and more logically, to the valve theory; and if we do wish to regard the web as effective in doing work, it is quite easy to calculate the amount, still carrying out the valve theory; and I cannot understand why Mr. Major will assert that that theory necessitates the "elimination of the neutral axis," when, as a matter of fact, the neutral axis is the natural consequence of the forces acting as viewed from the valve theory standpoint, which ought to be apparent to any reasonable person.

The fact that Mr. Major has ideas in common with nine other of your correspondents is certainly encouraging, as the depressing conviction had forced itself on my mind, that according to his own opinion no one besides himself had yet properly stated the case.

Mr. Coventry accuses me of an attempt to obtain two unknown quantities from one equation; this, I submit, is not true, as the weight was known, and the distance, on the assumption of a central neutral axis, an assumption which he has before now himself indulged in, was known; the strain alone being unknown.

In compliance with Mr. Coventry's request I give the following details as to position of neutral axis in my model, hoping that I may not still further be exhausting my experimental energy:—Equal flange areas, 1in. × $\frac{1}{8}$in.; web, $1\frac{3}{8}$in. × $\frac{1}{8}$in.; distance, centre to centre of flanges, 2in. With a weight of 1 lb. hung 5in. from the breast, the neutral axis was $1\frac{1}{16}$in., as nearly as possible, from the centre of the breast flange. I leave Mr. Coventry to draw his own conclusions. W. STOKES.

Kensington, January 16th.

THE PATENT-OFFICE LIBRARY.

SIR,—While I fully agree with you that caution should be used in weeding a library, I cannot agree with you that much mischief is now being done at the Patent-office. If the library there is to be regarded as a general library, then the harm done may be great; but the Patent-office library is not a general but a special library, and as such it should be cleared of what is rubbish, in the sense that it is matter in the wrong place.

For example, one room contained until the other day a huge pile—quite a cartload—of United States parliamentary reports. For the purpose of those using the library these books were utterly worthless. In another place were to be found great piles of theological works, never taken out of the paper in which they were originally wrapped when purchased. Of the character of certain other old works the less said the better. They were not scientific, and assuredly not theological. Even though the report on Dollond's case is only to be found in the *Gentleman's Magazine*, I do not see any reason why hundreds of magazines should be retained.

If there was ample room, it would be all very well to retain such books; but there is not. Hundreds of new and valuable books have to be bought every year. Space must be found for them, and rubbish must be cleared away. The first consideration is the utility of the library. Luxury cannot be had under the existing illiberal administration of Patent-office funds. PATENTEE.

London, January 18th.

SNOW-HILL STATION ROOF.

SIR,—Your correspondent, Mr. Timmins, has given some rather startling and important facts regarding the above. By his diagram of strains he gives a possible load of no less than 17 tons per square inch of section at the top or central tie, under certain conditions which, in my opinion, are unfair, considering the small altitude of the roof and the way it is protected at the south end. I think the chief danger is in the lifting pressure on the underside at the north end, which is quite open. At any rate, taking the roof under the worst conditions, I fail to see how more than 10 tons per square inch can come on any part in tension. The arrangement of diagonals is undoubtedly bad, and it is not by any means a grand roof compared with others, but I think there are many worse. P. H. S.

Soho, January 17th.

THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS.

(*From our own Correspondent.*)

THE Ironmasters' Quarterly Meetings had not been over two days before the customers of the Earl of Dudley and of Messrs. Wm. Barrows and Sons received circulars which, though they did not announce a rise, yet indicated that future orders might have to be subjected to a rise.

Mr. Fisher-Smith, writing as to Round Oak Ironworks, said:—"In the present state of the iron market orders for the Earl of Dudley's finished iron can only be received upon special quotations, or at the price at Round Oak at the date of execution, and for approved quantities and specifications." Messrs. Barrows, writing from the Bloomfield Ironworks, state that they "are now only open to receive further orders subject to the price of our iron at time of execution of the same, and our approval of specifications, as regards quantities, sizes, &c."

The business which was done upon 'Change at the weekly meeting of the iron trade in Wolverhamton on Wednesday induced the conclusion that the effect of this action, combined with the advance of 10s. per ton by another firm announced last week, had been to make the users of marked iron somewhat less reluctant to buy. They especially objected to the giving out of orders with an uncertainty overhanging the transactions touching the terms upon which they were to be supplied. Of this hesitancy the makers of a good quality of medium bars reaped the advantage. Yet bars were not generally so strong in price either in Wolverhampton yesterday or in Birmingham to-day, as they were upon either Exchange last week. Indeed there were firms who last week asked £7, who this week have been prevailed upon to accept £6 17s. 6d. for common bars. Medium bars were to be bought at from £7 to £7 5s.

Reports from the firms who are well known for their brand of hoops showed that the orders for that description of iron are very unequally distributed. There were houses who reported themselves to be getting quiet in their hoop mills. They are busy upon tube and also lock-making strip, but upon baling strip and coopers' hoops the orders in hand are being worked down. Such firms would generally have accepted orders to-day and yesterday at £7 per ton. At the same time there were makers who were still quoting £7 10s. per ton. The markets were not bare of hoop orders, but they were at prices which could not be accepted. Liverpool merchants were ready to buy on account of the States' requirements, but they would not give even for a better quality any more than they are giving to makers whose proximity to the port enables them to quote within the Staffordshire rates.

The nail rod business has dropped to a low level lately. There is a slight improvement for the moment; but there is nothing like the extent of business being done which there was before the late protracted strike of operative nailers in the Bromsgrove district. That strife lasted over three months. While it was on customers who never before used cut nails, tried them, and ultimately found that they could be employed to supplant the forged article, for which a higher price would have to be paid. To-day slit rods were to be bought at £6 15s. per ton.

There was a demand for sheets not of the best sort for the making of braziery goods. The local demand was not, however, so brisk as it was three weeks ago. Buyers sought to purchase on account of the requirements of Lancashire and of the export trade. They were seeking to place their orders at £8 for sizes from 20 to 24 w.g. This price makers would not accept, though they were not indisposed to take £8 5s., and here and there such a figure as £8 2s. 6d. seemed possible.

Galvanising sheets were scarcely so strong as a week and fortnight back, and large buyers reported that they have this week done better than they had at the earlier time thought would be probable. Nevertheless, firms who have still plenty of work on hand quoted £8 15s. for singles, £10 for doubles, and £11 10s. for latens. Firms who are seeking orders quoted £8 10s. for singles, £9 15s. for doubles, and £11 5s., and occasionally £11, for latens. Business was done to-day, but not upon an extensive scale.

Stamping sheet orders continue to arrive upon export account, both colonial and foreign; but upon home account only little new business has been transacted at the advanced rates lately declared. Last week's rise in tin-plates is not yet being generally secured.

Boiler plates keep a few mills fairly on and a few others busy; but there is more being done in tank and girder plates, at prices made firmer by the recent advances in plates upon the Middlesbrough market.

Puddled bars are in demand in advance of the supply, the requirements of the sheet mills in particular being in excess of the capacities of the forges in more than a few instances.

Pig iron is dull of sale this week. Recent purchases by consumers have mostly satisfied their present requirements. Prices were to-day quoted without abatement, and there was more uniformity amongst the sellers of hematite qualities. Tredegar iron was realising the 75s. for which the makers have been holding out. All-mine pigs were quoted from £3 10s. to £3 12s. 6d. for hot-blast, and £4 10s. for cold-blast. Part-mine was £3, and £2 10s. was demanded for common iron. Derbyshire iron was difficult to buy under from 57s. 6d. to 62s. 6d.; and Northampton iron was almost as high. Wiltshire pigs are selling better in this district; and on Monday one Wiltshire firm again blew in a second furnace. Messrs. Groucutt, of Bilston, have blown in a second furnace for the supply of their own mills. By other firms preparations are nearly completed for the restarting of one blast furnace each at Tipton, Wednesbury, and Willenhall, and of two at Bilston.

Ironstone and ore and pottery-mine keep in large demand, and limestone was advanced from 4s. 11d. to 5s. 1d. and 5s. 2d. per ton.

Coke is to be had at the local gasworks at £10 per boatload, or about 15s. per ton. Derbyshire and Wigan coke is selling at 16s. 6d. to 17s., ordinary South Wales coke at 15s., and best South Wales at from 17s. to 18s. per ton all delivered.

Coal keeps dull of sale. Best furnace is 10s., and best forge 9s. per ton. Best household is 10s. per ton at the pits down to 6s. for inferior sorts.

The Brush Farm Ironworks, which had been for some time standing idle, have been taken by Messrs. Bright and Langham, who have just started the sheet mill.

Machine castings are in a little better request upon the week.

Amongst the miscellaneous requisites in demand as the result of the improved trade in metal goods in different parts of the kingdom, are drawing presses, lathes, and other machinery required by the wire-drawers and tin-plate workers.

Following the course taken by the Leeds firms, the cut nail makers of this district have advanced prices 6d. per cwt., making present prices 9s. 6d. per cwt. for 3in. and upwards. A similar rise has been declared in iron washers. Stamped, tinned, and japanned iron odd work has been put up from 10 to 20 per cent. on the net. Black and tinned and japanned forged odd work has been advanced from 5 to 10 per cent. on the net. Chest handles are dearer by $12\frac{1}{2}$ per cent. on the net price.

The improvements that are being carried out at the London and North-Western Railway station in Wolverhampton are progressing with vigour. This week the contractors began the widening of the down platform. The work is expected to occupy a fortnight, and during that time all trains will be started from the opposite side of the station. A new booking-office and waiting and refreshment-rooms have been opened on the south side.

Although the demand in the North Staffordshire iron trade is at the moment scarcely as active as recently, either on home or foreign account, yet prices keep firm at from £7 to £7 5s. as the general quotation for Crown bars, and common bars are selling at £6 15s. One firm is reported to have advanced their bar prices 10s. per ton. Notwithstanding the lull in the arrival of new orders, the mills and forges are fairly well off for work, and the orders on the books are generally sufficient to keep the mills running steadily for some weeks. Pigs are rather quiet at the moment at £3 per ton for mine qualities, and £2 7s. 6d. to £2 5s. for common sorts.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—In the iron trade of this district business has been rather quiet during the week, and for the present there seems to be somewhat of a lull. Consumers generally are tolerably well covered for the next month or two; consequently, but little iron is really wanted for present actual requirements, and where inquiries are made they are mostly for deferred deliveries. The weaker tone in the Scotch and Middlesbrough markets during the last few days has also had some influence upon buyers, who might otherwise have given out orders, but now prefer to wait. Makers, however, in this district are so well sold that they are very little influenced by the fluctuations of speculative markets, and not only are they very firm in their prices, but they show little or no disposition to enter into forward engagements at present rates. The actual condition of trade itself is healthy, nearly all the iron-using branches of industry being busily engaged, and there is prospect of a continued steady market, with at least present prices well maintained.

At Manchester on Tuesday there was only a limited amount of business doing, but prices were very firm, and in Lancashire pig iron there was even an advance of 1s. 6d. per ton, local makers who have good inquiries in hand putting up their list rates to 52s. 6d., less $2\frac{1}{2}$ per cent. for forge and foundry qualities delivered equal to Manchester. Second-hand lots of Lincolnshire forge iron are being offered at about 51s. 6d. per ton, less $2\frac{1}{2}$ per cent. delivered into this district; but makers want 1s. per ton more than this, and sales of Lincolnshire foundry have been made during the week at prices equal to 43s. and 44s., less $2\frac{1}{2}$ per cent. Derbyshire remains at late quotations, but Middlesbrough iron was quoted at 51s. 4d. net cash delivered equal to Manchester.

In the finished iron trade, although there is not the pressure of orders as a short time back, still there is a good steady demand coming in, with enlarging home requirements, and there are also considerable inquiries in the market for the ensuing spring shipments. In some cases, where local makers are as fully sold as they care for the present, £7 5s. is quoted for bars delivered into the Manchester district, but this is a figure which is only being obtained in exceptional instances, and the average selling prices may be given at £7 to £7 2s. 6d., at which makers are very firm.

The engineering branches of trade continue generally well employed, and boiler makers especially all through the district are full of work. American inquiries are also still coming into this district for various descriptions of tools, such as lathes, drills, &c., and notwithstanding the high tariffs, this branch of trade with the United States seems to be increasing.

There is a good deal of work in prospect for machinists, as in several districts the erection of new mills or the extension of existing ones is projected.

The safe lighting of mines, with special reference to the lamps now in use, is a question which continues to attract considerable attention in this district, and at a meeting held in Dukinfield on Monday for the purpose of addressing the colliers engaged at the pits in the district on some of the causes of explosions in mines. Mr. John Higson, a well-known mining engineer of Manchester, gave the matter special prominence in his remarks. It seemed to him that at the present day there was a struggle going on in mining matters between the great ventilating power we had now in our mines and the means we had of dealing with it as regarded the lighting of the mines, and it would almost appear that the improvements in lighting had not kept pace with the progress which had been made in ventilation. If they knew a lamp would only resist a velocity of 8ft. per second, and they had air travelling in their mines at much greater velocity than this, and that air became charged with gas, it was evident they had here the means of causing an explosion. It was just possible, therefore, that with some of the lamps now in use the increased currents of air passed through the mines were really rather a source of danger than of safety, and it would certainly appear that we had arrived at that point in the ventilation of our collieries when the ventilation had got ahead of our methods of dealing with it, so far as the lighting of the mines was concerned. The mining world was still in its infancy; we were sinking to depths of 1000 yards, vastly extending the underground workings, and every year a colliery became a more complicated undertaking. It was therefore essential that in mining matters they should have a thoroughly scientific as well as practical education, and it was also essentially urgent that with the present system of ventilation a thoroughly safe and reliable lamp should be introduced into their mines.

The coal trade continues depressed so far as the better classes of round coal are concerned, and the very limited requirements for house fire purposes cause the commoner sorts for ironmaking and steam purposes to be also abundant, notwithstanding a good demand for trade requirements generally. Prices also continue low, and during the past few days a rather weak tone has been noticeable here and there in round coals. Engine classes of fuel which move off without difficulty, so far as the better sorts are concerned, maintained late rates. The average pit prices are about as under:—Best coal, 9s. to 9s. 6d.; seconds, 7s. to 7s. 6d.; common coal, 5s. to 6s.; burgy, 3s. 6d. to 4s. and 4s. 3d. per ton.

Barrow.—As mentioned in my last report, makers of hematite pig iron have no reason to complain of the inquiries which are being made for all classes of metal. The demand shows a very steady increase, and makers are sending the whole of their large output into immediate consumption. The output at the furnaces in the district is very large, and makers are of course very busy; but at one or two ironworks in this district arrangements are being rapidly pushed forward for the re-lighting of two or three furnaces, and when this is done makers will be better able to meet the large demands which are being made upon them. The tonnage of metal which is already sold forward is, I know, very considerable, and any orders that are being booked now must necessarily be for forward delivery. The demand from America and the Continent shows a very appreciable increase, and the deliveries to these places during the year will be very heavy. I also hear that the colonial demand shows a very healthy state, and the increased demand which is being experienced from this quarter is an evidence of the increased prosperity which has set in all round. No. 1 Bessemer is quoted at 64s. 6d. per ton, and No. 3 forge at 62s. per ton at makers' works. These figures leave last week's prices practically unchanged, but, as I said in my last week's notes, they must not be taken as being correct evidence of the state of the hematite market, as several makers have secured orders at 67s. 6d. per ton.

Steel makers still maintain the activity which has characterised that branch of industry for some time, and further orders are being obtained. Shipbuilders are giving evidence of an increased activity, while engineers, ironfounders, and others are very fairly employed. Iron ore in good request. Shipping fairly employed. Pig iron is being sent by rail to the ironmasters in the Cleveland district who are doing business in the steel trade, from the Furness mines in large quantities.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

THERE is no change for the better in the South Yorkshire coal-field. The officials of the Yorkshire Miners' Association have had their interview with the Coalowners' Committee, when they were accompanied by delegates representing eleven large collieries in the South Yorkshire and West Yorkshire districts. The coalowners repeated their offer of the sliding scale for the regulation of wages. The officials and delegates required first that there should be an advance of 10 per cent. in wages, which they claimed as justified by the increased value of coal. If this demand were conceded, their constituents would be prepared to adopt the principle of the sliding scale. The coalowners distinctly denied that any increase had taken place in the selling price of coal sufficient to justify them in acceding to an advance of wages. The meeting terminated without any definite decision being arrived at, the delegates promising to report the result to their constituents. Though the miners, or rather their representatives, talk freely of "striking," I do not anticipate any serious disturbance in the South Yorkshire coal-field this season. During the last month I have been over a very large tract of country commonly known as "the coal district," and though the miners have got the idea that they ought to have an advance, I have not yet met with one who is prepared to strike work to obtain it.

Our engineering houses keep remarkably busy, working night and day on heavy orders for machinery and plant. There are orders on hand for which early delivery is pressed, and cases have come to my knowledge where considerable premiums have been offered for the speedy completion of contracts. The engine-builders in other towns must be exceptionally active. Over one hundred locomotives are on order from America, on account of the inability of American makers to complete them in time. It is questionable if they can be finished in this country within the time required. In Sheffield, unfortunately, railway engines are not built, the parts which are manufactured here being sent to Glasgow and other places to be put together.

Rails are so heavily ordered that several of our manufacturers are booked forward six months. I hear of several good contracts —for exceptional sections—having been taken at £7 10s.; but the average price is stated at £6 5s. The American demand is still very important, and tends to prove that the reliability of the Sheffield made rail has a distinct reputation with several of the leading railway companies of the United States. One firm in this district sent last year to the States at least 30,000 tons of steel rails. In the rail trade the most curious feature comes from Germany. In that empire the price of rails for home use is £14 per ton, yet Krupp, who gets £14 from the Government, can compete in Italy with English makers at about half that figure.

I am glad to learn that there is every prospect of a new trade being introduced into Sheffield within a month. Messrs. Howell and Co., Brook Steel Works, Brook Hill, have long enjoyed an excellent reputation in the manufacture of blister, shear, spring, and cast steel. In their special cast steel for turning, planing, and slotting tools, they claim that it enables the speed of the lathe to be increased from 25ft. to 70ft. per minute. They have also been favourably known for their "homogeneous metal" for boiler and fire-box plates, as well as their patent homogeneous metal and cast steel tubes for locomotives or other boilers. It is now the intention of the firm, I understand, to enter vigorously upon what has long been an important Birmingham speciality—the drawing of tubes for railway locomotives, &c. This trade, which is really one of the railway branches, is naturally connected with Sheffield; yet, singular to say, up to this time all the Sheffield houses have had their work done for them in Birmingham. Messrs. Howell and Co. have obtained the blast furnaces at Tinsley formerly occupied by Messrs. William Cooke and Co., Limited, Tinsley Steel and Ironworks, and are at present laying down the necessary machinery for carrying on the new enterprise, which is already exciting considerable interest in the trade circles of the district.

Our cutlery manufacturers are not a little interested in the rapid advances in the value of ivory. At the last Liverpool sale there were 40 tons on offer—an unusually large quantity; yet it was all promptly picked up at from £2 to £4 per cwt. advance. A very large quantity of ivory is returned to Africa in the form of "bangles," which are worn as wrist ornaments by the dusky belles. The fashion has rapidly extended of late, and formed no inconsiderable factor in the rise in the value of ivory.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

A SLIGHT reactionary feeling in a downward direction took possession of the Middlesbrough iron market on Tuesday last. Prices of pig iron were certainly 1s. per ton lower than the previous week. As usual under the circumstances sellers were more numerous and urgent, and buyers were scarce. The change seems to have been due to operations by speculating merchants in Glasgow, depressing that market and affecting all others; still the check must be regarded as merely a temporary one. The confidence in the future is unabated, both merchants and makers being willing to sell only for prompt or approximate delivery. No. 3 g.m.b. may now be considered worth 43s. per ton, or for delivery over the next three months 44s. per ton. No 4 forge is 1s. per ton less. The shipments have been remarkably good considering the time of year, the total shipped from Middlesbrough during January up to Monday night having amounted to 36,825 ton. Warrants are in moderate demand, 43s. 9d. being the present price, as against 44s. 6d. a week ago. There are now 176,114 tons in Connal's Middlesbrough store, being 23 tons less than the previous week.

The demand for manufactured iron keeps steady. No further advance in prices took place on Tuesday, but all the manufacturers have work to last them six or seven months, and the contracts recently booked still exceed the quantities run off. In the meantime considerably increased competition is likely to ensue. The West Hartlepool Ironworks will shortly be in full operation; and the Walker Rolling Mills Company has issued its prospectus, and is endeavouring to obtain the requisite capital for commencing operations. The Auckland Ironworks Company—late Edward Hutchinson—has also issued a prospectus, the leading promoters being the chief creditors of the liquidating firm. By the end of the year, if not before, the production of shipbuilding iron will be very largely increased; still, as far as present appearances go, the demand will be sufficient to take up the increase.

The great trouble which is looming in the future for iron manufacturers is the unsettlement of the labour market. Puddlers are becoming extremely scarce, and notwithstanding the Board of Arbitration and the sliding scale, employers are competing strongly with one another for the men. This competition has so far taken the form of allowing "prize money" and various extras, which practically raise the price paid for work done, but it is not reckoned within the ken of the Board of Arbitration. It is stated that at one large iron manufacturing works not very far from the city of Durham, puddlers have been offered £2 each and free house and fuel for six months, if only they will migrate to that somewhat outlandish district. At Stockton the prize money hitherto usual in the district has been increased, and the conditions under which it is earned have been made more favourable to puddlers at all the works. At each puddling furnace the two men working it now get 1s. per shift prize money, in addition to their ordinary tonnage rate, whether they are working on the level-hand or the under-hand system. In the case of level-hands, the men get in addition 1d. per man per heat, each shift being taken on its own merits. This altered arrangement gives every facility for men coming to work when they like, staying as long as they like, and going when they like, and it is certain they will not be slow to avail themselves of every opportunity to "play" as much as possible.

The notices which were put in by the puddlers on Saturday week, to give over Sunday fettling and to cease working on Mondays, have had a somewhat curious result. At two out of the five Stockton works the men refused to work on the first Monday affected; at one of the other three they came and fettled their furnaces out before six in the morning in consideration of a bonus of 2s. 6d. each promised them by the manager. At another works the firm fettled the furnaces themselves during the preceding Sunday at their own cost, and the men worked as usual on the Monday. At the remaining works it appears that the men went to work on the previous system, which they had given notice to terminate. It is clear, therefore, that there is the greatest want of unanimity and uniformity of practice amongst the men themselves; and it must not be forgotten that the whole thing is unrecognised by their union, and in defiance of the wishes of their executive. At Middlesbrough the puddlers are very uneasy, and are endeavouring to force their employers to grant them the same concessions as they have obtained at Stockton.

The annual dinner of the Cleveland Institution of Engineers takes place on Friday evening at the Erimus Club, Middlesbrough. In the course of the evening the president, Mr. E. W. Richards, will give an account of what he saw from a technical point of view during his recent journey to the United States of America.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

THE pig iron market has been very flat this week, and prices, which were declining towards the close of last week, have receded still further. Holders of warrants have in some cases been selling pretty heavily, and this fact, together with the absence of any immediate demand of consequence, has led to the present dulness in the market. There is a steady trade being done with the Continent in pig iron, and the American demand appears also to some extent improved; but the high rate of freights to New York militates against any great expansion of this department of the trade at present. The exports, as a whole, have been unsatisfactory, those despatched during the past week amounting to only 5767 tons, against 6677 in the same week of 1881, and to date the shipments show since Christmas a comparative decrease of 4322 tons, while the imports from Middlesbrough of Cleveland pig iron, on the other hand, have increased 3208 tons. Only a small quantity of pig iron is being sent into store, not more than a fourth of the amount that was weekly placed in the care of Messrs. Connal and Co. before the close of the year. The stocks amount now to about 630,000 tons, exclusive of the accumulation in makers' yards.

Business was done in the warrant market on Friday forenoon at from 51s. 10d. to 52s. 1½d. cash, and from 52s. to 52s. 3d. one month; the afternoon quotations being 52s. 3d. to 51s. 10½d. cash, and 52s. 3d. to 52s. one month. The market was very dull on Monday, when a decline of 5d. per ton took place, the forenoon quotations being from 52s. to 51s. 8½d. cash, and from 52s. 2d. to 51s. 11d. one month; and in the afternoon from 51s. 8d. to 51s. 6d. cash, and 51s. 11d. to 51s. 8½d. one month. The market was also very flat on Tuesday, with business at 51s. 4½d. to 51s. 2d. cash, and 51s. 7d. to 51s. 5d. one month. The market was irregular on Wednesday, with business between 51s. 2d. and 51s. 6d. cash, and 51s. 8½d. to 51s. 5d. one month. To-day—Thursday—the market was easier from 51s. 2d. to 50s. 10½d. cash, and 51s. 5d. to 51s. 1½d. one month.

In consequence of the dulness in the warrant market, makers' iron has declined in second hands to the extent of fully 6d. per ton since last report, the quotations being now as follows:—Gartsherrie, f.o.b. at Glasgow per ton, No. 1, 62s., No. 3, 54s. 6d.; Coltness, 63s. and 54s. 6d.; Langloan, 63s. and 56s.; Summerlee, 61s. 6d. and 53s.; Calder, 61s. 6d. and 54s.; Carnbroe, 56s. and 53s. 6d.; Clyde, 52s. 6d. and 51s.; Monkland, 52s. 6d. and 50s. 6d.; Quarter, 52s. 6d. and 50s. 6d.; Govan, at Bromieelaw, 52s. 6d. and 51s.; Shotts at Leith, 62s. 6d. and 55s.; Carron, at Grangemouth, 53s. 6d. (ditto specially selected, 56s.) and 52s. 6d.; Kinneil, at Bo'ness, 52s. and 50s. 6d.; Glengarnock, at Ardrossan, 55s. 6d. and 53s. 6d.; Eglinton, 53s. and 50s. 6d.; Dalmellington, 53s. and 51s. 6d.

The malleable iron trade continues very busy, all the works being full of orders and the prices are very good; were it not that a great quantity of the work on hand is for contract, sales would be higher. Malleable common bars are quoted at £6 5s. to £7, according to quality; angle iron, £8; plates, £8; rods, £7 per ton.

The different branches of the manufactured hardware trade are very actively engaged just now. Nail-makers and bolt and screw and rivet makers are especially active, some of them having orders on their books which they will not be able to undertake for some months to come. The nail-makers have this week intimated an advance of 10s. per ton on cut nails. Some of the finer qualities of the American steel machine-made horsenails are in good demand, but other kinds are not so much inquired after. Belgians are almost out of the market, and the Scotch makers are doing very well.

There is a fair business doing in the coal trade, which is showing more activity than it did a week ago. Notwithstanding the drawbacks experienced by shippers of coals in consequence of the damage done to the harbours by the recent storms, the shipments during the past week have been nearly 10,000 tons larger than they were in the corresponding week of last year. The inland demand for household consumption is very poor, owing to the mild weather, but manufacturers are taking a steadily increasing supply as trade continues to expand. Prices are nominally a little firmer this week, although quotations are not altered.

The first general meeting of the shareholders of the reconstructed Monkland Iron Company, Limited, was held a few days ago in Glasgow, Mr. Reid occupying the chair. The chairman stated that the capital of the company, 40,000 shares of £5 each, had been duly subscribed and allotted, and calls aggregating £4 per share had been made and well responded to, the unpaid arrears amounting to £1935. This it was expected would be paid ere long. He also stated that the property of the old company had been purchased on the following terms:—For the works, stocks, debts, cash, and property of every description, £157,688; for an annuity of £1000 payable to three lives aged respectively sixty-three, fifty-seven, and fifty-three, £14,000; in all £171,688. Towards this sum the new company had paid the liquidators £150,827, leaving £2086 and interest still to pay. The chairman also intimated that Mr. Ferrie would continue in office as managing director at the same remuneration as before, without any additional sum in name of lordship on the pig iron obtained, and the directors had to express their thanks to Mr. Ferrie for that concession. He took a hopeful view of the future of the company.

At the monthly meeting of the Mining Institute of Scotland, held in Hamilton, Mr. Ralph Moore, H.M. Inspector of Mines presiding, a paper was read by Mr. John Drinnan, Arden Colliery, Airdrie, on the Employers' Liability Act. He pointed out that the Act was very defective, inasmuch as it was completely silent on what constituted negligence. He did not believe, however, that the employing interests will be seriously affected by the working of the Act, although it was impossible to read its provisions without feeling that employers and managers alike had cause for uneasiness.

The Glasgow Tramway and Omnibus Company is about to extend its system from Shawlands to Pollokshaws, the total cost of the works being estimated at £12,000. This will be a great advantage to the inhabitants of the ancient burgh.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

AN important arbitration case between Mr. Radford, the well-known coal buyer of London, and the Coedcae Company has just come to an end in favour of the company. It would appear that some time ago the company became possessed of a coal property owned by Mr. Thos. Jones, who was under engagement to supply coal to Mr. Radford for ten years at a certain price governed by market rates. What this rate should be was the question given to the arbitrators, and, as stated, the company won the point at issue.

The Rhondda and Swansea Bay Company's Bill is not to have altogether a smooth run. Some little formality has again taken place, but I do not apprehend that it will be fatal. Possibly "send them up stairs" only. At all events this is sincerely to be hoped.

Newport Dock has been the scene of a disastrous accident. Two vessels coming in together collided in the neck of the dock. One or both will have to be destroyed, and as forty or fifty vessels are in dock the damage will be a serious item.

I regret also to record an explosion at Risca, but fortunately it was on Sunday when only four men were in the pit, and the loss of life was confined to these and the horses. The cause would appear to have been the firing of a shot by a repairing party. The damage is serious, and another cause is given for continued care in firing shots in collieries of the explosive character of the Risca seam.

The iron and coal trades continue to show a prosperity of a very firm and substantial aspect, one that has been caused by no spasmodic movement, but by equal and well-based advances.

In steel the year is opening out very well, orders are coming in freely, and advices from America in particular encourage very sanguine expectations.

The additions at Blaenavon will be fifty coke ovens and two boilers.

At Dowlais there is a good work being done. Mr. Menelaus has left for Denby.

At Pentyrch, Mr. Spence, Mr. Adley, and others visited the works a few days ago, and the extensive hematite workings. It is not at all improbable that considerable extensions of the works will be carried out by the new company which is to take possession in a short time. This may assume the form of additional furnaces. The works are so well placed for railway service that rates for Spanish ore to, and manufactured products from, the place are as low as if the works were built on the moors at Cardiff—the site, I imagine, of the steel works of the future.

The total coal shipments from the Welsh ports last week amounted to 156,315 tons, of which Cardiff sent 106,355 tons. Swansea retained its high place with 23,799, and Newport, Mon., a fair average with 26,170 tons.

Prices remain the same, but an advance in price is imminent, and I shall fully expect that the close of the month will show this. At present, best steam coal ranks at 11s. 6d. f.o.b. At the present day, when the depletion of the coal field is a matter of ordinary conversation, it may be interesting to know that large and valuable tracts will be opened by the projected new lines of railway to which I have referred of late. One of these is a tract of 300 acres of the fine No. 3 Rhondda coal.

A meeting of railway *employés*, consisting of representatives from various districts, met at Quakers'-yard this week, to form a union for the advocacy of the short hours system.

The Rhondda tramway is to be strongly opposed, first on technical grounds and for informalities, and secondly, by the Taff Vale Railway Company, which pleads that the formation of the line would interfere with their railway, and is not required, seeing that five trains are run daily.

The Raven Anthracite Colliery, near Llanelly, is to be sold by auction.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

*** *It has come to our notice that some applicants of the Patent-office Sales Department, for Patent Specifications, have caused much unnecessary trouble and annoyance, both to themselves and to the Patent-office officials, by giving the number of the page of* The Engineer *at which the Specification they require is referred to, instead of giving the proper number of the Specification. The mistake has been made by looking at* The Engineer *Index and giving the numbers there found, which only refer to the pages, in place of turning to those pages and finding the numbers of the Specification.*

Applications for Letters Patent.

*** When patents have been "communicated" the name and address of the communicating party are printed in italics.

10th January, 1882.

122. Shear, W. Smith, Sheffield.
123. Stillions, R. Moreland, jun., London.
124. Reproducing Engravings, L. Philippi, Germany.
125. Bottles, H. H. Fanshawe, East Dulwich, and A. J. L. Wild, Nunhead.
126. Moulding, A. Henderson.—(*C. G. Picard, Paris.*)
127. Hydraulic Motor, C. Burnett, Ladyston.
128. Army Trenching Tool, A. Storey, Wandsworth.
129. Electrically Lighting Trains, W. H. Preece, Wimbledon, and J. James, London.
130. Electric Currents, W. T. Henley, Plaistow.
131. Fixing Bronze, H. Dewhirst, Huddersfield.
132. Manure, E. Edwards.—(*Messrs. Galliet and Huet, Lille.*)
133. Converters, J. Johnson.—(*W. Henderson, U.S.*)
134. Treatment of Animal Refuse, J. H. Johnson.—(*A. J. Huet, Paris.*)
135. Firelighters, F. Holmes, New Cross.
136. Gas, J. A. Schlater and M. M. Brophy, London.
137. Tip-wagons, J. W. Glover, Warwick.
138. Section of Rail, W. Bean, Croydon, and E. Thompson, Nunhead.
139. Railway Signalling, A. H. Perry, Croydon, and B. J. Houghton, Peckham.
140 Preventing Heat of Axle-boxes, A. M. Clark.—(*H. Bouchard, U.S.*)
141. Bicycles, C. W. Francis, London.

11th January, 1882.

142. Iron Wire, G. and E. Woods, Warrington.
143. Locomotive, R. Brandon.—(*A. Cottrau, Naples.*)
144. Galvanic Batteries, H. J. Haddan.—(*Dr. E. Boettcher, Leipzig.*)
145. Umbrella Fastening, A. C. Henderson.—(*Messrs. J. Roy and J. Beuste, Paris.*)
146. Lithographic Machines, G. Newsum, Leeds.
147. Cranes, F. R. Ellis, Liverpool.
148. Increasing Power of Gas, J. Weston, London.
149. Umbrellas, J. Bayzand and G. Boyle, London.
150. Extinguishing Fire, W. Dennis, Brixton.
151. Cork Branding, C. J. Leclere, Paris.
152. Dyeing Yarn, &c., E. Boden, Manchester.
153. Shuttles, J. R. Richards, Kirkham.
154. Lubricating Spindles, G. Bodden, Oldham.
155. Buttons, S. Wilding.—(*R. Behrendt, Magdeburg.*)
156. Mineral Phosphates, D. Perry, Glasgow.
157. Electric Lighting, G. Hawkes, London.
158. Sewing Machines, W. R. Lake.—(*Messrs. E. Thimonnier, fils, and Vernay, Paris.*)

12th January, 1882.

159. Cardboard Boxes, S. Wood, Cleckheaton.
160. Stay Busk Fastenings, J. Salisbury, Sheffield.
161. Spinning, J. Roussel, fils, Roubaix, France.
162. Syphon Traps, A. T. Angell, London.
163. Skates. H. Haddan.—(*H. Wirths & Sohn, Germany.*)
164. Shuttle Boxes, F. Pim and T. Sands, Dublin.
165. Valves for Pumps, P. Reid, Glasgow.
166. Indicating Speed, L. Smith, London.
167. Dyeing Felt, J. Allan, Barnsbury.
168. Lubricant, T. G. Alcock, Manchester, and J. Johnson, Stretford.
169. Electro-motors, H. S. Raison, London.
170. Cabs, J. Abbot, Bideford.
171. Looms for Weaving, C. Turner, Colne.
172. Making Concrete, J. Jackson, London.
173. Producing Signals, C. B. Crisp, London.
174. Polishing Rods, A. Watt, Old Charlton.
175. Hoisting, T. King, Birmingham.
176. Bedsteads, A. M. Clark.—(*A. H. Oudry, Paris.*)
177. Steel, W. Whiteman.—(*C. Martin, Belgium.*)
178. Railway Signalling, C. Spagnoletti, London.
179. Pattens to Boots, C. Mayer, Cologne.
180. Gas Burners, F. Siemens, Dresden.

13th January, 1882.

181. Velocipedes, G. Moss, London.
182. Forging Horsenails, F. W. Wallner, Cologne.
183. Buttons, W. Willeringhaus, London.
184. Gas-burners, T. Richardson.—(*J. Smith, U.S.*)
185. Electric Accumulators, H. J. Haddan.—(*A. Morel, France.*)
186. Coke, H. J. Haddan.—(*G. Siebel, France.*)
187. Admixture of Liquids, E. J. Whitlock and S. Smale, London.
188. Warming Apparatus, J. Parrot, Wallington.
189. Ratchet Braces, C. T. Colebrook, London.
190. Gas Kilns, D. and W. H. Thompson, Leeds.
191. Pneumatic Brake, C. D. Abel.—(*G. Westinghouse, jun., Italy.*)
192. Ochre Pigments, J. M. Cameron, London.
193. Horseshoes, J. C. Worthington, Lowestoft.
194. Safes, D. R. Ratcliffe, London.
195. Working Cables, G. Cradock and L. Gooder, Wakefield.
196. Wine, E. G. Brewer.—(*A. and L. Q. Brin, Paris.*)
197. Transmission of Sound, W. C. Barney, London.
198. Electric Block Signals, J. Radcliffe, Retford.

14th January, 1882.

199. Stoves, J. F. Hoyne, London, and G. B. Lovedee, Birmingham.
200. Multiplying Copies, H. E. Tyler, Edmonton.
201. Skates, J. Yelloly and A. Elwes, Royal Navy.
202. Treating Solutions, A. McDougall, Penrith.
203. Distillation of Glycerine, G. Payne, Millwall.
204. Distilling, G. Vaughan.—(*F. Lürman, Germany.*)
205. Reducing Rock, J. Mewburn.—(*J. Tayler, U.S.*)
206. Wire Net, F. Wirth.—(*G. Pickhardt, Germany.*)
207. Perambulators, J. H. Miles, Birmingham.
208. Spring Mattresses, A. Clark.—(*E. Slayton, U.S.*)
209. Glazing Greenhouses, T. Shelley, Smethwick.
210. Velocipedes, W. Soper, Reading.

16th January, 1882.

211. Fire-proof Paints, C. Mountford, Birmingham.
212. Corking Bottles, K. F. C. Peterson, Hamburg.
213. Breech-loading Fire-arms, H. Thorn, London.
214. Steelyards, J. Spencer and J. Consterdine, Holingwood, and J. Greenwood, Salford.
215. Steam Boiler Furnaces, G. H. Watson, U.S.
216. Preventing Fouling of Anchor Chains, T. Cockshott, East Greenwich, and H. Goodman, Catford.
217. Horse Beds, B. W. Holt, London.
218. Coupling, H. E. Newton.—(*Société Anonyme des appareils automatiques pour accrocher les wagons de chemins de fer, Paris.*)
219. Corrugated Tubes, S. Fox, Leeds.
220. Artificial Ivory, F. W. Cottrell, London.
221. Weldless Corrugated Tubes, S. Fox and J. Whiteley, Leeds.
222. Table Fountain, C. H. and C. Kessell, London.
223. Pumping Liquids, A. M. Clark.—(*C. Cooper, U.S.*)
224. Electric Lighting, W. Lake.—(*J. Williams, U.S.*)
225. Lighting, W. R. Lake.—(*J. S. Williams, U.S.*)

Inventions Protected for Six Months on Deposit of Complete Specifications.

136. Gas or Gas and Air Cooking, J. A. Slater and M. M. Brophy, High Holborn, London.—*10th January*, 1882.
189. Ratchet Braces, C. T. Colebrook, Islington, London.—*13th January*, 1882.

Patents on which the Stamp Duty of £50 has been paid.

94. Distributing Types, J. Imray, London.—*8th January*, 1879.
97. Magazine Fire-arms, E. T. Hughes, London.—*9th January*, 1879.
116. Stays and Corsets, R. A. Young and R. Neilson, Bristol.—*10th January*, 1879.
495. Caloric Engines, M. P. W. Boulton, Tew Park.—*7th February*, 1879.
117. Uninflammable Composition, A. M. Clark, London.—*10th January*, 1879.
121. Hauling Vessels, T. Summers and A. J. Day, Southampton.—*11th January*, 1879.
142. Gas Purifier Grids, S. Cutler, Milwall.—*13th January*, 1879.
330. Filtering Liquids, E. Perret, London.—*27th January*, 1879.
138. Wire Ropes, J. Lang, Gateshead-on-Tyne.—*13th January*, 1879.
205. Cannons for Athletic Purposes, J. Holtum, Wareside.—*18th January*, 1879.
316. Steam Boilers, A. F. Yarrow, Poplar.—*25th January*, 1879.
666. Capsules for Bottles, C. Cheswright, London.—*19th February*, 1879.
175. Mixing Machines, P. H. Bracher, Wincanton.—*15th January*, 1879.
318. Glue and Gelatine, B. Cannon, Lincoln.—*25th January*, 1879.
151. Chair Backs, N. Harwood, U.S.—*14th January*, 1879.
168. Printing, G. Duncan and G. A. Wilson, Liverpool.—*15th January*, 1879.

Patents on which the Stamp Duty of £100 has been paid.

118. Centrifugal Apparatus, F. J. Britten and W. S. Barron, London.—*12th January*, 1875.
115. Knitting Hats, &c., A. M. Clark, London.—*12th January*, 1875.
138. Extinguishing Fires, J. H. Johnson, London.—*13th January*, 1875.
147. Sulphates, J. Hargreaves, Widnes.—*14th January*, 1875.
218. Furnaces for Heating, S. Perkins, Fairfield, and W. Smellie, Gorton.—*20th January*, 1875.
139. Punching Machines, G. H. Nussey and W. B. Leachman, Leeds.—*14th January*, 1875.
272. Ventilating Water-closets, J. C. Potts, Handsworth, & D. Darnell, Cargilfield.—*23rd January*, 1875.

Notices of Intention to Proceed with Applications.

Last day for filing opposition, 3rd February, 1882.

3878. Steam Engines, C. Bedford, Birstall.—*7th September*, 1881.
3882. Products of Distillation from Small-wood, R. Haldane and J. Telfer, Glasgow.—*7th September*, 1881.
3889. Safety Valves, T. Davis, Sheffield.—*8th September*, 1881.
3891. Steam Winches, T. Archer, jun., Dunston.—*8th September*, 1881
3909. Indicating Speed, J. L. Pottulo, North Shields.—*9th September*, 1881.
3915. Violins, E, Edwards, London.—A communication from F. von Zebrowski.—*9th November*, 1881.
3923. Explosive Compound, W. R. Lake, London.—A communication from P. Sandoz.—*9th September*, 1881.
3930. Albumen, W. P. Thompson, London.—A communication from U. Hillman.—*10th September*, 1881.
3933. Flower Pots, A. Booty, Harrogate.—*10th September*, 1881.
3940. Removing Impurities from Water, A. W. L. Reddie, London.—A communication from N. de Derschau.—*12th September*, 1881.
3950. Heels for Boots, W. Morgan-Brown, London.—A com. from J. W. Brooks.—*13th September*, 1881.
3956. Plates, Bars, &c., J. Larue, Paris.—*13th September*, 1881.
3957. Gas Regulators, W. T. Sugg, London.—*13th September*, 1881.
3962. Open Fabrics, T. Coltman, Leicester.—*14th September*, 1881.
4043. Cans, H. H. Lake, London.—A communication from F. Fleishmann.—*19th September*, 1881.
4052. Alarm Apparatus, H. H. Lake, London.—A com. from H. C. Roome.—*20th September*, 1881.
4055. Combination Furniture, F. Parker and W. Parker, London.—*20th September*, 1881.
4124. Switches, &c., H. J. Haddan, London.—A communication from H. Aron.—*24th September*, 1881.
4159. Bookbinding, W. Morgan-Brown, London.—A com. from E. S. Boynton.—*27th September*, 1881.
4216. Protection against Fire, E. Leonard, London.—*29th September*, 1881.
4356. Shelling Rice, A. G. Fraser, G. Smith, and L. W. Harvey, London.—*6th October*, 1881.
4432. Looms, J. Barbour, Belfast.—A communication from A. Coulter.—*11th October*, 1881.
4551. Water-closets, G. E. Waring, jun., London.—*18th October*, 1881.
4675. Grinding Mills, A. J. Boult, London.—A com. from W. N. Cosgrove & R. Morrell.—*25th October*, 1881.
4916. Breech-loading Fire-arms, J. Lang, London.—*9th November*, 1881.
5111. Water Fittings, J. R. Hargreaves, Haslingden.—*23rd November*, 1881.
5424. Gas Stoves, E. A. Rippingille, Aston-juxta-Birmingham.—*12th December*, 1881.
5441. Pumps, H. J. Haddan, London.—A communication from D. S. Chapin.—*13th December*, 1881.
5518. Torpedo Apparatus, C. A. McEvoy, London.—*16th December*, 1881.
5543. Brick-moulding Machines, C. F. Schlickeysen, Berlin.—*17th December*, 1881.

Last day for filing opposition 7th February, 1882.

3935. Spinning, I. Buckley and E. Crossley, Dukinfield.—*12th September*, 1881.
3938. Washing Machine Frames, A. Shaw, Lockwood.—*12th September*, 1881.
3972. Stoves, &c., S. C. Davidson, Belfast.—*14th September*, 1881.
3980. Mechanical Game, J. Maxfield, London.—*15th September*, 1881.
3981. Abdominal Belts, H. Willington, London.—*15th September*, 1881.
3986. Protectors for Watches, A. H. Turner, London.—*15th September*, 1881.
3992. Beetling Machines, C. Edmeston, Salford, and S. Smith, Manchester.—*16th September*, 1881.
4045. Light Rowing Boats, J. H. Clasper, Oxford.—*20th September*, 1881.
4056. Wet Spinning Frames, J. Erskine, Strabane.—*20th September*, 1881.
4057. Electric Currents, H. E. Newton, London.—A communication from the Société Universelle d'Electricté Tommasi.—*20th September*, 1881.
4065. Building Walls, W. White, Abergavenny.—*21st September*, 1881.
4085. Moulding Clay, C. H. Murray, Southwark.—*22nd September*, 1881.
4151. Fireplaces, W. P. Thompson, London.—A communication from J. M. Cook.—*27th September*, 1881.
4175. Grinding Mill, W. P. Savage, West Winch.—*27th September*, 1881.
4262. Trans-shipping Salt, R. Verdin, Northwich.—*1st October*, 1881.
4478. Electric Lamps, R. Harrison, Newcastle-upon-Tyne.—*14th October*, 1881.
4504. Electric Arc Lamps, J. Brockie, Brixton.—*15th October*, 1881.
4507. Drilling Rocks, J. McCulloch, J. H. Holman, and J. M. Holman, Camborne.—*19th October*, 1881.
4756. Drawing-off Bottled Liquids, S. Pitt, Sutton.—A com. from P. Hathaway.—*31st October*, 1881.
4761. Spirits, P. Jensen, London.—A communication from A. Deininger.—*31st October*, 1881.
5325. Steam Boilers, H. Sharp, Bolton.—*6th December*, 1881.
5343. Kilting, &c., G. Browning, Glasgow.—*7th December*, 1881.
5421. Truss Bars, S. Alley, Glasgow.—*12th December*, 1881.
5436. Machine Guns, J. G. Accles, London.—*13th December*, 1881.
5440. Warping, &c., Machines, J. C. Sewell, E. Hulton, and J. Bethel, Manchester.—*13th December*, 1881.
5442. Rowlocks, E. S. Martin, Ipswich.—*13th December*, 1881.
5467. Barrels, J. Campbell and J. T. Swainston, London.—*14th December*, 1881.
5478. Hand Stamps, E. M. Richford, London.—*14th December*, 1881.
5480. Embroidering Apparatus, W. R. Lake, London.—A com. from F. H. Chilton.—*14th December*, 1881.
5499. Measuring Electric Currents, J. W. Swan, Newcastle-upon-Tyne.—*16th December*, 1881.
5550. Spring Balances, R. Lamont, Kilmarnock.—*16th December*, 1881.
5524. Electric Lamps, R. Kennedy, Glasgow.—*17th December*, 1881.
5525. Dynamo-electric Machines, W. H. Akester, Glasgow.—*17th December*, 1881.
5561. Preventing Smoke, &c., E. Fair, San Francisco, U.S.—*19th December*, 1881.
5587. Barbed Fence Wire, E. G. Brewer, London.—A communication from T. H. Dodge and C. G. Washburn.—*21st December*, 1881.
5615. Cables, J. N. Culbertson, Antwerp, and J. W. Brown, London.—*22nd December*, 1881.
5665. Electric Light, S. A. Varley, Hatfield.—*24th December*, 1881.
5667. Electric Currents, S. A. Varley, Hatfield.—*24th December*, 1881.
24. Removing Flocculent Matter from Spent Acids, W. R. Lake, London.—A communication from M. C. Lefferts.—*3rd January*, 1882.
136. Gas Cooking Apparatus, J. A. Slater and M. A. Brophy.—*10th January*, 1882.
189. Ratchet Braces, C. T. Colebrook, London.—*13th January*, 1882.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the 13th January*, 1882.)

3080. Looms, J. Clayton and T. Richmond, Burnley.—*14th July*, 1881.
3089. Heating Water, J. H. Fraser and E. J. C. Welch, London.—*15th July*, 1881.
3090. Ladies' Saddles, W. F. D. Schreiber, Ipswich.—*15th July*, 1881.
3092. Drying Machines, F. Craven, Brighouse.—*15th July*, 1881.
3128. Looms for Weaving, T. Singleton, Darwen.—*18th July*, 1881.
3130. Evaporating Apparatus, W. R. Lake, London.—*18th July*, 1881.
3134. Moulding Glass, T. and J. Humphreys, Hulme.—*19th July*, 1881.
3148. Utilising Exhaust Steam, W. R. Lake, London.—*19th July*, 1881.
3159. Safety Shaving Apparatus, L. A. Groth, London.—*20th July*, 1881.
3179. Healing Wounds, G. Lowe, Barnet.—*21st July*, 1881.
3294. Electrical Musical Instruments, W. F. Schmoele and A. Mols, Antwerp.—*27th July*, 1881.
3296. Connectors, E. P. Alexander, London.—*28th July*, 1881.
3386. Electric Organ, W. F. Schmoele and A. Mols, Antwerp.—*4th August*, 1881.
3600. Printing Machines, H. T. L. Wilkinson, London.—*18th August*, 1881.
3858. Diffusing Light, J. Wetter, New Wandsworth.—*5th September*, 1881.
4197. Umbrellas, J. Minière, Paris.—*29th September*, 1881.
4212. Purifying Sewage, P. Spence, Manchester.—*29th September*, 1881.
4332. Mortise Locks, E. de Pass, London.—*5th October*, 1881.
4366. Pneumatic Brakes, G. Westinghouse, jun., London.—*7th October*, 1881.
4472. Electric Meters, C. V. Boys, Wing.—*13th October*, 1881.
4531. Colouring Matters, J. A. Dixon, Glasgow.—*18th October*, 1881.
4556. Self-lubricating Axle Bearings, P. M. Justice, London.—*18th October*, 1881.
4562. Sawing Rails, J. H. Kitson, Leeds.—*19th October*, 1881.
4578. Ventilating Stoves, W. A. Barlow, London.—*19th October*, 1881.
4616. Drying Agricultural Produce, M. E. G. Finch-Hatton and R. Thorpe, Lincoln.—*21st October*, 1881.
4676. Wire Ropes, J. Hodson, St. Helena.—*25th October*, 1881.
4686. Knitted Fabrics, J. Imray, London.—*26th October*, 1881.
4760. Removal of Yeast, P. Smith, Sevenoaks.—*31st October*, 1881.
4776. Cartridge Cases, G. Kynoch, Witton.—*1st November*, 1881.

(*List of Patent Letters which passed the Great Seal on the 17th January*, 1881.)

3116. Raising, &c., Blinds, G. Furness and J. Robertshaw, Manchester.—*18th July*, 1881.
3123. Ice, E. Edwards, Southampton-buildings, London.—*18th July*, 1881.
3147. Germinating Grain, A. J. and A. Q. Reynolds, London.—*19th July*, 1881.
3156. Open Fire-grates, T. E. Parker, London.—*20th July*, 1881.
3166. Electric Lamps, W. Morgan-Brown, London.—*20th July*, 1881.
3167. Perforating Cheques, R. Donkin, London.—*20th July*, 1881.
3169. Dynamo Machines, A. M. Clark, London.—*20th July*, 1881.
3170, Cooling Air, B. R. Gibbs, Liverpool.—*21st July*, 1881.
3186. Speed Governors, M. Havelock, Newcastle-upon-Tyne.—*21st July*, 1881.
3189. Electric Lamps, W. R. Lake, London.—*21st July*, 1881.
3192. Rolling Leather, E. Wilson, Exeter.—*22nd July*, 1881.
3193. Valve Gear, G. L. Lambert, Nottingham.—*22nd July*, 1881.
3200. Driving Mechanism, A. Burdess, Coventry.—*22nd July*, 1881.
3203. Springs, W. Buckley, Sheffield.—*22nd July*, 1881.
3204. Lawn Tennis Bats, C. W. Simons, Saintbury Rectory.—*22nd July*, 1881.
3210. Lighting Lamps, W. H. Stokes, Birmingham.—*22nd July*, 1881.
3214. Electric Lamps, A. M. Clark, London.—*22nd July*, 1881.
3219. Pulley Blocks, R. Priest, Cradley Heath.—*23rd July*, 1881.
3223. Camp Furniture, T. Barnby, Birmingham.—*23rd July*, 1881.
3227. Changeable Lasts, J. Fieldhouse, Keighley.—*23rd July*, 1881.
3255. Waterproof Sleeping Bed, B. Genn, Ely.—*26th July*, 1881.
3259. Funnels, C. D. Abel, Southampton-buildings, London.—*26th July*, 1881.
3298. Sewing Machine, D. Mills, London.—*28th July*, 1881.
3312. Treatment of Waste Sand, H. J. Haddan, London.—*29th July*, 1881.
3328. Coal Washing, H. H. Lake, London.—*30th July*, 1881.
3374. Winding Engines, H. J. Crawford and J. Lees, Belfast.—*4th August*, 1881.
3377. Fire Engines, H. J. Haddan, London.—*4th August*, 1881.
3395. Treatment of Fractures, J. C. Mewburn, London.—*5th August*, 1881.
3399. Intermittent Syphons, A. T. Bean, London.—*5th August*, 1881.
3508. Steadying Vessels, J. F. C. Farquhar, London.—*12th August*, 1881.
3541. Paper Hangings, W. Clark, London.—*15th August*, 1881.
3544. Disposal of Slag, E. F. Jones, Middlesbrough-on-Tees.—*10th August*, 1881.
3774. Sewing Machines, A. M. Clark, London.—*30th August*, 1881.
3926. Secondary Batteries, J. S. Sellon, London.—*10th September*, 1881.
3987. Secondary Batteries, J. S. Sellon, London.—*15th September*, 1881.
4011. Electric Lamps, B. Hunt, London.—*17th September*, 1881.
4202. Incandescent Electric Lamps, J. W. Swan, Newcastle-on-Tyne.—*29th September*, 1881.
4433. Street Railways, A. M. Clark, London.—*11th October*, 1881.
4439. Incandescent Electric Lamps, J. Jameson, Newcastle-on-Tyne.—*12th October*, 1881.
4466. Knitting Machines, W. Dexter, Nottingham.—*13th October*, 1881.
4526. Stoves, P. Everitt, Great Ryburgh, and A. Barnard, Norwich.—*17th October*, 1881.
4559. Utilising Electricity, F. M. Newton, Barton Grange, near Taunton.—*19th October*, 1881.
4586. Stop Valves, J. A. and J. Hopkinson, Huddersfield.—*20th October*, 1881.
4588. Fleece Dividers, C. Pieper, Berlin.—*20th October*, 1881.
4683. Railway Wagons, R. Hudson, Gildersome.—*26th October*, 1881.
4714. Spring Mattresses, W. R. Lake, London.—*27th October*, 1881.
4792. Switches, W. E. Hubble, London.—*2nd November*, 1881.
4920. Life-boats, J. T. Baharie and W. Adamson, jun., Sunderland.—*9th November*, 1881.
4922. Furnaces, A. M. Clark, London.—*9th November*, 1881.

List of Specifications published during the week ending January 14th, 1881.

4121, 2d.; 2097, 2d.; 2143, 2d.; 2197, 2d.; 2265, 2d.; 2327, 6d.; 2331, 2d.; 2336, 2d.; 2339, 2d.; 2358, 2d.; 2375, 6d.; 2388, 6d.; 2412, 6d.; 2421, 4d.; 2442, 8d.; 2444, 8d.; 2452, 6d.; 2459, 4d.; 2461, 6d.; 2463, 6d.; 2462, 6d.; 2472, 6d.; 2475, 2d.; 2483, 6d.; 2484, 2d.; 2487, 4d.; 2489, 6d.; 2490, 6d.; 2491, 6d.; 2498, 6d.; 2504, 8d.; 2505, 2d.; 2509, 6d.; 2511, 6d.; 2515, 1s. 2d.; 2516, 6d.; 2518, 2d.; 2519, 6d.; 2521, 10d.; 2522, 4d.; 2528, 1s.; 2530, 6d.; 2582, 6d.; 2533, 8d.; 2534, 6d.; 2539, 6d.; 2540, 8d.; 2541, 4d.; 2544, 6d.; 2550, 10d.; 2551, 6d.; 2552, 5d.; 2553, 6d.; 2554, 2d.; 2555, 6d.; 2556, 4d.; 2559, 4d.; 2562, 2d.; 2563, 6d.; 2564, 10d.; 2567, 6d.; 2568, 6d.; 2570, 2d.; 2571, 6d.; 2572, 6d.; 2574, 6d.; 2576, 2d.; 2579, 6d.: 2580, 4d.; 2583, 2d.; 2584, 2d.; 2588, 2d.; 2589, 4d.; 2591, 2d.; 2594, 2d.; 2596, 2d.; 2598, 2d.; 2599, 2d.; 2600, 6d.; 2601, 4d.; 2603, 6d.; 2605, 6d.; 2606, 2d.; 2607, 2d.; 2608, 2d.; 2609, 2d.; 2610, 6d.; 2612, 4d.; 2614, 2d.; 2615, 2d.; 2616, 4d.; 2617, 2d.; 2618, 2d.; 2621, 2d.; 2625, 2d.; 2626, 6d.; 2627, 2d.; 2628, 6d.; 2629, 6d.; 2631, 2d.; 2633, 2d.; 2634, 2d.; 2636, 6d.; 2637, 2d.; 2638, 6d.; 2640, 2d.; 2641, 2d.; 2644, 2d.; 2645, 6d.; 2648, 6d.; 2649, 2d.; 2651, 2d.; 2652, 2d.; 2655, 2d.; 2659, 2d.; 2671, 2d.; 2678, 2d.; 2679, 2d.; 2684, 6d.; 2699, 6d.; 2700, 8d.; 2701, 4d.; 2716, 1s. 6d.; 2796, 6d.; 2806, 6d., 2817, 6d.; 4420, 6d.; 4421, 10d.; 4445, 1s. 2d.; 4611, 2d.

*** Specifications will be forwarded by post from the Patent-office on receipt of the amount of price and postage. Sums exceeding 1s. must be remitted by Post-office order, made payable at the Post-office, 5, High Holborn, to Mr. H. Reader Lack, her Majesty's Patent-office, Southampton-buildings, Chancery-lane, London.

ABSTRACTS OF SPECIFICATIONS.

Prepared by ourselves expressly for The Engineer *at the office of Her Majesty's Commissioners of Patents.*

2097. Substitute for Coffee, *R. Hall, Lindley, York.*—*13th May*, 1881.—(*Provisional protection not allowed.*) *2d.*

The materials employed are lintels, the kernel and shell of English and foreign nuts, browned linseed, browned wheat, browned licorice, browned sugar, raw sugar, and treacle.

2143. Pocket Time-indicator, *E. Nayler, Dudley.*—*17th May*, 1881.—(*Provisional protection not allowed.*) *2d.*

This relates to a card or dial of such form and size as can be easily folded and carried in the pocket, and by the aid of which, when illuminated by the sun's rays, the correct time can be ascertained.

2197. Economising the Fuel Consumed in Working Steam Engines, *A. Boudeville, Rouen, France.*—*19th May*, 1881.—(*Provisional protection not allowed.*) *2d.*

This relates to the employment of a hollow pendulum in which is placed a heavy weight, and caused to oscillate by means of a driving wheel driven by steam.

2327. Apparatus to Facilitate Swimming, *J. Overton, Coventry.*—*27th May*, 1881. *6d.*

This consists of a pair of apparatus to be attached, one to each leg, which apparatus is caused to expand by pressure against the water, and contract when that pressure is withdrawn. A modification is shown for the hands.

2331. Hydraulic Telegraph, *Compte C. de Montblanc and L. Gaulard, Paris.*—*27th May*, 1881.—(*Not proceeded with.*) *2d.*

This telegraph is based on the combined employment of the constant pressure exerted by a column of water of determined height, and the velocity of flow in a pipe of the same liquid under a given pressure.

2335. Seats, *J. Hamlyn, Exeter.*—*27th May*, 1881.—(*Not proceeded with.*) *2d.*

This consists in fashioning the seat to fold and lie flat against a pillar or support piece, which is also hinged at the bottom, so that it and the seat can lie flat on the floor or against the counter or a wall, and so project very slightly.

2339. Ships' Water-closets, *W. Fraser, Liverpool.*—*27th May*, 1881.—(*Not proceeded with.*) *2d.*

This consists essentially in employing in combination a trough receptacle, common to two or more seats, or a series of pans emptying into a pipe common to the series, and an automatic water tumbling flusher.

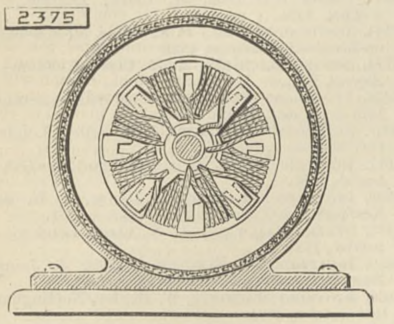
2358. Arranging the Orchestra of Theatres, &c., *H. J. Murcott, London.*—*28th May*, 1881.—(*Not proceeded with.*) *2d.*

This relates to the arrangement of the orchestra in combination with or in relation to the stage, stalls, auditorium, &c., so that the orchestra may be screened from the view of the audience.

2375. Improvements in Magneto-electric Machines, &c., *H. E. Newton.*—*31st May*, 1881.—(*A communication from C. A. Hussey and A. S. Dodd, New York.*) *6d.*

The improvements consist in the employment of a continuous permanent magnet of circular form, inside which an annular armature wound longitudinally with wire is made to rotate. The armature thus traverses not only the poles, but the whole length of the magnet. The permanent magnet is made of a number of ring-shaped sections placed side by side and enclosed in a brass case. In order to centre the sections in the case, plaster of Paris is introduced between them and the case. The core of the armature is composed of a number of plates arranged side by side, and having alternate inward and outward projections. Between the former are spaces for the circulation of air lengthwise throughout the armature, and between the latter the coils of insulated wire are wound. Each coil is independently wound The inner end of each coil is fastened to the outer end

2375



of an adjacent one, and the loops thus formed are connected by leading wires, one to each of the plates of the commutator. The invention also refers to the adaptation of a circular permanent magnet for telephone purposes, the projections of which, extending radially inward, are wound with insulated wire. The outer ends of the wire are united, and the inner ends fastened to binding screws, which may be connected to a telephone. The invention also relates to the method of magnetising the above description of permanent magnet. Our illustration gives a view of the magneto-electric machine.

2388. EVAPORATING APPARATUS, *W. R. Lake, London.—31st May, 1881.—(A communication from C. Lachaize and C. Têtevuide, Paris.)* 6d.

This consists essentially in collecting, by means of a special device or arrangement, the water of condensation which is deposited in the lower part of the discs, and in conducting the same to the level of a hollow shaft which passes through the apparatus where it is collected in helicoidal channels, the weight of the liquid combined with the rotation of the shaft ensuring the automatic discharge of the water of condensation from the apparatus.

2412. PRODUCTION OF ORNAMENTAL SURFACES UPON WOOD, &c., *J. Cowan and O. Stuart, Liverpool.—1st June, 1881.* 6d.

This consists in effecting the raising of patterns in relief on wood by the impression of designs or devices on dies into the said wood ; the after removing of the then projecting surface of the wood, and the application of a relaxing agent or agents.

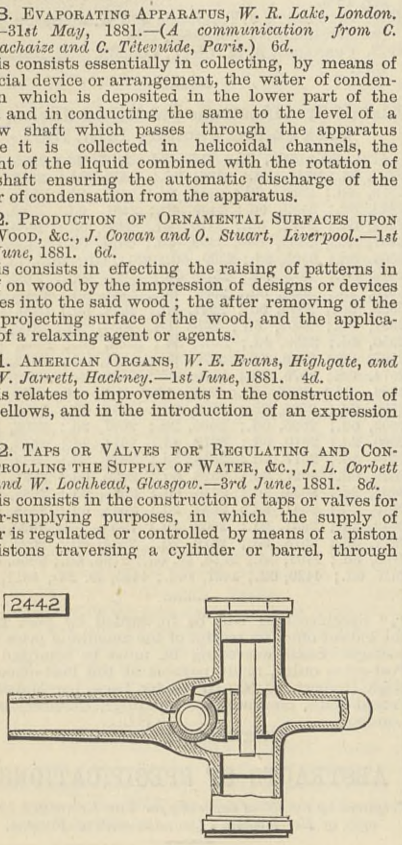
2421. AMERICAN ORGANS, *W. E. Evans, Highgate, and W. Jarrett, Hackney.—1st June, 1881.* 4d.

This relates to improvements in the construction of the bellows, and in the introduction of an expression stop.

2442. TAPS OR VALVES FOR REGULATING AND CONTROLLING THE SUPPLY OF WATER, &c., *J. L. Corbett and W. Lochhead, Glasgow.—3rd June, 1881.* 8d.

This consists in the construction of taps or valves for water-supplying purposes, in which the supply of water is regulated or controlled by means of a piston or pistons traversing a cylinder or barrel, through

2442

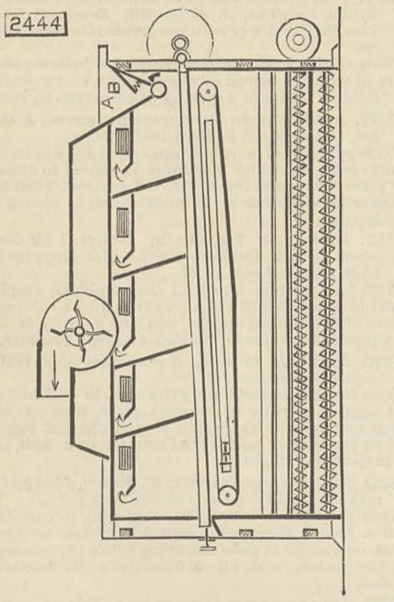


which the water passes, such pistons being caused to close against seats to cut off the supply by means of the water pressure acting behind. The drawing is a horizontal section of one modification.

2444. MIDDLINGS' PURIFIERS, &c., *W. H. Dickey, Jackson, Mich., U.S.A.—3rd June, 1881.—(Partly a communication from G. T. Smith, Jackson, Mich., U.S.A.)* 8d.

This relates, First, to a device by means of which the quantity of material fed into the purifier is automatically regulated by the hinged flap B in the hopper A. The second improvement consists of a device for tightening the silk coverings on the sieves.

2444



The third improvement consists in so constructing and combining a middlings purifier that it shall be adapted to properly treat the "meal" or "breaks" from rolls and other gradual reduction machines, containing, as it does, the coarsest as well as the finest middlings.

2452. MACHINERY FOR MECHANICALLY OPERATING FANS, *E. J. C. Tear, Redland, Somerset.—3rd June, 1881.* 6d.

This relates to improvements in machinery or apparatus for mechanically operating fans or punkahs by the addition to a clockwork or driving mechanism of governing, regulating, and operating parts.

2459. AXLE PULLEYS, *F. Ryland, West Bromwich.—4th June, 1881.* 4d.

This consists in casting the pulleys and frames together.

2461. APPARATUS FOR PERFORMING FINGER EXERCISES FOR MUSICAL PURPOSES, *F. H. F. Engel, Hamburg.—4th June, 1881.—(A communication from F. Moller, Hamburg.)* 6d.

The apparatus is constructed for exercises of the joints of the hand and fingers, and has to be used in such manner that each finger alone and several simultaneously may be exercised.

2463. DISINTEGRATING OR PULVERISING MACHINES, *C. E. Hall, Sheffield.—4th June, 1881.* 8d.

This consists, First, in the combination with known beaters of a surrounding revolving cage, and the means of driving and cleaning connected therewith; Secondly, in the construction of a feeding chain band, in links admitting of attachment of scrapers or buckets; Thirdly, in the combination with a disintegrating machine, of an iron separator composed of rotating electro-magnets.

2469. LOCK-STITCH SEWING MACHINES, *C. Pieper, Berlin.—7th April, 1881.—(A communication from E. Bruncker, Cologne.)* 6d.

This relates to double lock-stitch sewing machines, and the improvements consist, First, in placing the lower spool into a round shuttle, to which a continuous rotative motion is imparted, while the spool does not rotate; and Secondly, in providing for the upper thread a new kind of tension device.

2472. APPARATUS FOR INDICATING THE ARRIVAL AND DEPARTURE OF EMPLOYES, *W. M. Llewellin, Bristol.—7th June, 1881.* 6d.

This relates to apparatus for checking or indicating the periodical arrival and departure of workmen and women and *employés* generally at and from the place of their occupation.

2475. FASTENER FOR DRIVING BELTS AND BANDS, *F. Reddaway, Pendleton, Lancaster.—7th June, 1881.—(Void.)* 2d.

The fastener consists in its simplest form of a metallic saddle shaped frame composed of three cross bars or members, retained in their respective positions by end bars or pieces.

2483. SELF-ACTING FEEDING APPARATUS FOR THRASHING MACHINES, *A. C. Henderson, London.—8th June, 1881.—(A communication from J. A. Demoncy-Minelle, Chateau Thierry, France.)* 6d.

The apparatus attacks the sheaf previously loosened, divides it by intermittent movements into handfuls, which it regulates in its progressive movements, and afterwards spreads it out and finally distributes it to the thrashing machine. The sheaf, loosened and thrown on a flap slightly inclined, is divided by a

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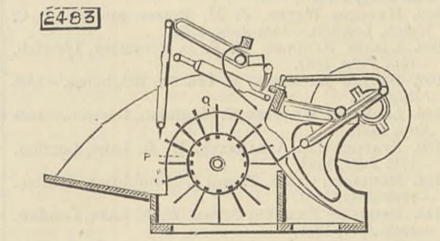

series of discs P, armed with long teeth mounted on the same shaft, and turning with an intermittent motion between iron sheets Q, all bent alike, which serve to support and direct the straw as it is drawn along. At the commencement an oscillating panel, provided with fingers acting on the straw only on its arrival, limits the quantity of admission, throwing back any excess on the flap.

2487. MOWING OR REAPING MACHINES, *J. A. Carlès Toulouse.—8th June, 1881.* 6d.

This relates to the apparatus for moving the sickle disc Z from the travelling wheels, such apparatus being composed of the internal toothed ring D, the

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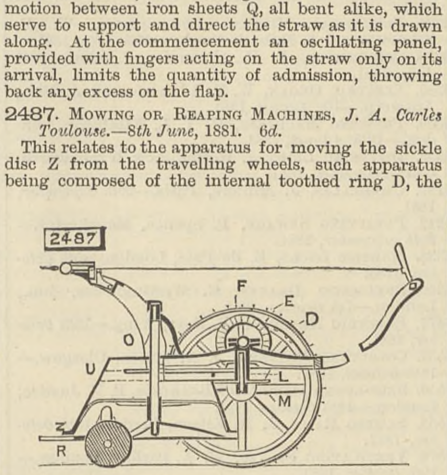

spur-wheel E, the horizontal shaft F, bevel-wheels, the vertically adjustable shaft L, the spur-wheels M and U, and the shaft O, which takes its bearings in the nave of the rake R and carries the sickle disc Z.

2489. FISHING NETS, *W. Laughrin, Polperro, Cornwall.—8th June, 1881.* 6d.

This consists in the employment of a net of the seine type, so constructed and arranged as to be capable of being closed up at the bottom or foot after a shoal of fish has been encompassed by the same.

2490. REMOVING STIFF OR COARSE HAIRS FROM SEAL SKINS, &c., *W. R. Lake, London.—8th June, 1881.—(A communication from D. Mueller, New York.)* 6d.

This relates to the method of plucking furs, which consists in first separating the soft wool from the hairs by means of an air blast, and then pulling out the hairs entirely from the skin.

2491. MANUFACTURE OF TIN-PLATE, &c., *W. Elmore, London.—8th June, 1881.* 6d.

This relates to the process for the manufacture, tinning, and surfacing of tin plates, and for tinning metal articles, consisting of the employment of the tin solutions, the tin anodes, and the electric current, and in combination with the cathode holder or dipping frame of the plating tank.

2492. IMPROVEMENTS IN ELECTRIC LAMPS, &c., *P. Jensen, London.—8th June, 1881.—(A communication from T. A. Edison, New Jersey, U.S.A.)* 8d.

This invention refers to a method of sealing the glass globes of incandescent electric lamps, so as to maintain a good vacuum, and is an improvement on patent No. 578, dated 10th February, 1880. The required glass having been blown into a bulb, this is broken away from the blowing rod at the tapered end sufficiently to leave room for introducing the carbons. Upon the semicircular end of the bulb a small opening is made and a tube formed thereon, by which to exhaust the lamp. A small piece of tubing is then taken, and an enlargement blown therein of a diameter about equal to the aperture above referred to in the taper end of the bulb. The leading-in wires are then laid in this tube. One end is brought to welding heat and clamped down on the wires, hermetically sealing them in the tube. The wires are in three sections, a central bit of platinum for sealing into the mass of the glass, with copper extremities, one leading from lamp, the other into it for supporting the carbon. The end of the latter portion is flattened and wrapped round the ends of the carbon, and this union may then be electro-plated. The carbon is then introduced into the globe, and the edge of the opening of the globe and the enlargement of the tube sealed at a welding heat. The globe is then exhausted through the upper tube, and when sufficiently exhausted, the latter is fused and welded near the body of the globe. The specification also describes methods for utilising defective carbons by arranging them so that the more perfect side is the negative portion; also for automatically transferring the current from one circuit to another in case of breakage, &c.

2498. MOTOR ENGINES FOR UTILISING THE FORCE OF HEATED AIR OR GAS, *W. R. Lake, London.—8th June, 1881.—(A communication from M. Arzberger, Vienna, and A. Oblasser, Trieste.)* 6d.

This consists essentially in a closed apparatus, in which compressed atmospheric or other gas is alternately heated and cooled, and thus caused alternately to be under a greater or less degree of tension or pressure, and to act with this difference of pressure upon the piston of a motor.

2504. GAS MOTORS AND PRODUCERS, *C. W. Siemens, Westminster.—9th June, 1881.* 8d.

This relates to improvements on patents No. 2074, A.D. 1860, and No. 2143, A.D. 1862, for the production of inflammable gas. The drawing is a front elevation partly in section, showing a pair of engines. The lower part A of each cylinder is cooled by water circulating through its casing; the upper part B is lined with refractory material. The trunk piston C is made hollow, and formed with a shield covered by refractory material, to protect the packing of the piston and the

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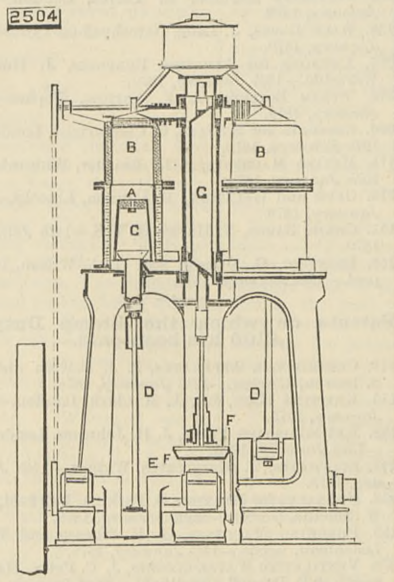

surface of the lower part of the cylinder from heat. The pistons of the two cylinders are connected by connecting rods D to opposite cranks on the shaft E. This shaft, by means of bevel gear F, works a revolving cylindrical valve G situated in a casing between the two cylinders. The lowest part of this casing is supplied with combustible gas and air in proportions, regulated by cocks and valves.

2505. APPARATUS FOR PROPELLING AND STEERING VESSELS, *H. A. Bonneville, London.—9th June, 1881.—(A communication from L. Planers, Paris.)—(Not proceeded with.)* 2d.

This relates to substituting for screw propellers or other propelling or steering apparatus, a double-acting compound apparatus fitted as the screw to the stern of the vessel, but at each side of the said stern, instead of in the middle, as is the case with the screw, each apparatus consisting of a wooden block covered with sheets of a suitable metal to give the block the density of the water, and having a semi-cubic shape, one face of which, provided laterally with blades running in slides fixed in the face of the stern, is attached to an iron rod or bar, to which from the engine of the vessel an up-and-down motion, and *vice versâ*, is imparted, the said motion being therefore transmitted to the semi-cubic block attached to the said iron rod or bar.

2509. ROSES OF WATERING CANS, &c., *J. Ludlow, Birmingham.—9th June, 1881.* 6d.

Combined with certain shaped roses are loose lids, covers, or fronts which divide the rose generally at or near its largest part or largest diameter.

2510. MACHINERY FOR FILLING BOTTLES *R. Bardsley, Manchester.—9th June, 1881.* 6d.

This consists in the mode of charging bottles with syrup, each bottle being charged with the desired quantity by one stroke of a pump with adjustable stroke, previously to the bottle being placed in the filling machine.

2511. HORSE-RAKES, *J. Huxtable, Brayford, Devon.—9th June, 1881.* 8d.

The chief object is to obtain any desired "pitch" of tooth, *i.e.*, the teeth can be set any distance apart for collecting different kinds of crops, or for any other desired purpose, and also for imparting to each of the said teeth a vertical and lateral tension.

2515. TAPS AND VALVES, *A. Pullan and J. J. Meihé, London.—9th June, 1881.* 1s. 2d.

This relates partly to the construction of a liner or seating, with or without grooves, on which the valves or loose pieces work by expansion, contraction, or pressure.

2516. JACQUARD MACHINE FOR PRODUCING ORNAMENTATION IN HOSIERY, &c., *J. Brentnall, Mansfield.—9th June, 1881.* 6d.

To an ordinary hosiery machine is fixed by suitable means a frame carrying points working freely when the machine is in action. The said points work between comb bars. The pin is connected or forms part with the bolt, to the front of which is the point. Around each pin is coiled a spring. To the back of the pin is fitted the perforated cylinder, over which the perforated cards for producing the pattern are worked by ordinary means, either by hand or steam.

2517. APPLIANCE FOR WINDING AND HOLDING TAPE, *J. Imray, London.—9th June, 1881.—(A communication from La Société les Fils de Cartier Bresson, Paris.)* 4d.

This consists in the use for winding and holding tape of a slip of card or other suitable material, cut so as to present at each end widened parts and horns, between which the tape is wound lengthwise, in combination with a sliding ring or sheath, which may bear marks of quantity or quality.

2518. CENTRIFUGAL PUMPS, *W. F. A. Beyerinck and M. G. C. Stuart, Amsterdam.—9th June, 1881.—(Not proceeded with.)* 2d.

In one modification the revolver or wheel is made with inlet eyes or openings at both sides, and with curved shells extending from the eyes to a comparatively narrow circumferential discharge opening.

2519. PACKAGES FOR CARRYING OR SHIPPING PAINT, LARD, &c., *R. R. Gray, Liverpool.—9th June, 1881.* 6d.

This consists partly in forming the lid of a plate turned over and curved round a wire bead or other projecting rim of the can, so as to hold tight without soldering.

2521. MANUFACTURE OF BOOTS AND SHOES, *J. Keats, Bagnal, Stafford.—9th June, 1881.* 10d.

This relates to mechanism for operating the cutting and burnishing tools used in finishing boot and shoe soles and heels, and in apparatus for presenting boots and shoes to such tools, which apparatus is applicable in other stages of the manufacture of boots and shoes. It also consists in novel means for securing the heels of boots and shoes in place by nails, the same being driven from within the boot in curved or inclined lines, to meet the peculiar contour of the heel.

2522. MANUFACTURE OF CHAINS, *J. Imray, London.—9th June, 1881.—(A communication from E. Oury, Cherbourg.)* 4d.

This consists in the manufacture of lengths of chain without welds by cutting and punching cruciform bars of iron or steel so as to form links engaged with one another, and forging to shape the links so produced.

2528. MANUFACTURE OF GAS, *J. Dixon, Richmond, Victoria.—10th June, 1881.* 1s.

This consists partly in generating illuminating gas from metals, earths, earthy bases, acids, carbon and hydrocarbon substances or liquids, or other chemicals, by subjecting such materials or some of them to a cherry-red heat in closed retorts, and intermittently injecting mixtures conveyed in solutions of kerosine or other equivalent as a vehicle.

2530. DRILLING, BORING, OR CUTTING ROCK, &c., *G. F. Wynne, Minera, Denbigh.—10th June, 1881.* 6d.

This consists in the construction and employment of a double-acting rock drill without any separate distributing valve other than the piston itself, in which a cylinder is moved over a fixed piston by the pressure

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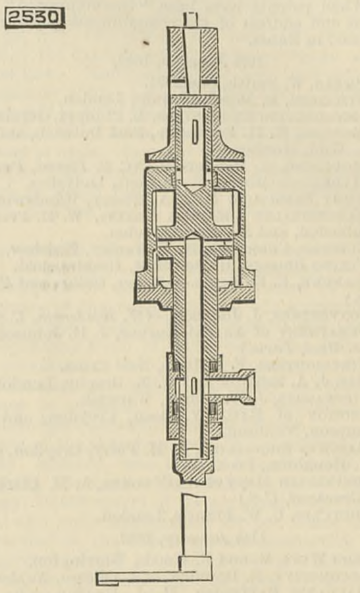

of the motive fluid, and forms the hammer for striking the blow, the force of which depends on the pressure of the motive fluid and the weight of the cylinder, by which means holes may be bored without the drill being brought to a stand.

2532. IMPROVEMENTS IN ELECTRIC CABLES, *G. E. Gouraud.—10th June, 1881.—(A communication from P. B. Delany and E. H. Johnson, New York.)* 6d.

To avoid as much as possible the effects of induction the inventors form their cable of a number of insulated wires wrapped in a leaden covering. The method of construction is to take a lead pipe, flatten it out, leaving room between its sides for insertion of the insulated wires. These are then inserted so as to fill the pipe, and the latter is then passed between rolls which force the metal between the wires and fill all interstices, holding the wire in place and forming a flat cable. The wires are so arranged that at stated intervals their relative positions will be changed. Thus in a cable of six wires the order in the first section will be 1, 2, 3, &c., in the second 3, 1, 5, &c., in the third 5, 3, 6, &c.

2533. MANUFACTURE OF LEATHER, *J. Hall, Leeds.—10th June, 1881.* 8d.

The roller is raised on the table, lowered so as to separate them a sufficient distance to enable the roller to clear the edge of the butt at each end of the stroke.

2534. MANUFACTURE OF SECTION KNIVES AND RAZORS FOR MICROSCOPIC PURPOSES, &c., *T. Heiffor, Sheffield.—10th June, 1881.* 6d.

This consists in forming a perfect and true edge on razor and other cutlery blades used for scientific and microscopical purposes by a hollow central grindstone, glazier, or lap fitted and revolving horizontally on a vertical shaft, the said stone, glazier, or lap being affixed to a disc by pitch as a cement.

2536. DRYING CERAMIC PRODUCTS AND BRICKS, *L. W. Beck, Duffel, Belgium.—10th June, 1881.—(Not proceeded with.)* 2d.

This consists in enclosing the article in some material of a porous or capillary nature before being placed in the kiln.

2539. CHIMNEY TOP OR COWL AND VENTILATOR, *M. Delmard, Plumstead Common.—10th June, 1881.* 6d.

This relates to the chimney top or cowl consisting of a vertical pipe whose upper end is enclosed within a perforated box or casing, and is provided with a flange and plate either with or without a cover or diaphragm, which flange and plate are so arranged that the direct upward or downward passage of air from or into the said pipe is prevented, while free space is left between the said flange and plate for the escape of the products of combustion or foul air.

2540. CRUSHING MACHINERY, *C. E. Hall, Sheffield.—10th June, 1881.* 8d.

This relates to such machines as effect the crushing, stamping, &c., of stone or other material by means of well-known toggle plates or motions, and is designed to prevent breakage or accident through undue strain by the introduction of elastic or safety connecting rods or clutch between the driving gear and the crushing or reducing jaws.

2541. NEW SPADE RIFLE, *J. F. Fuller, Dublin.—11th June, 1881.* 4d.

This relates to forming the stock of a rifle so as to be capable of containing a spade or trowel, or the stock itself may be suitably made so as to form a spade.

2542. IMPROVEMENTS IN ELECTRICAL INSULATED WIRES AND CONDUCTORS, AND IN THE MEANS OF INSULATION OF THE SAME, *S. J. Mackie, London.—11th June, 1881.* 4d.

This invention consists in covering the wires with a flat covering of jute, hemp, or other yarn, and saturating the same with insulating material, so that both jute and insulating material become combined, and form a practically homogeneous substance. The outer covering may be waterproofed by gelatine, combined with bichromate of potash or other means. The insulating material may be gutta-percha, Stockholm tar, and resin in equal weights, mixed with powdered glass to secure solidification.

2544. APPLYING ZINC FOR PREVENTING CORROSION IN STEAM BOILERS, *J. B. Hannay, Glasgow.—11th June, 1881.* 6d.

This relates to the mode of applying zinc for preventing corrosion in steam boilers in the forms of blocks or masses of a spherical, or spheroidal, or polyhedral, or cubical form, or other form having small difference of thickness in different directions.

2550. TYPE WRITING MACHINES, *A. D. Furse, Rome.—11th June, 1881.—(A communication from La Société Clairgraphique Maggi et Cie. Rome.)* 10d.

This machine is made in the form of a piano, and has been designed with the object of enabling anyone knowing how to manipulate the keyboard to simultaneously present several letters continuously in a manner as to reproduce them, properly united so as to form words as in ordinary printing, and with the speed at which a speech can be made.

2551. Straps or Bands for Saddle Girths, &c., *H. Studdy, Waddeton Court, Devon.—11th June, 1881.* 6d.

This consists in the combination with a band and strap attached thereto, and passing over rollers, of another band provided with buckles, through which the said straps pass, and by which they are secured.

2552. Manufacture of Wood Pulp, *F. Wirth, Frankfort.—11th June, 1881.—(A communication from the Society for the Manufacture of Wood Pulp, Grellingen, Switzerland.)* 6d.

This relates to improvements in machines for reducing wood to pulp by means of grindstones, the wood being pressed in an oblique direction against a vertical grindstone.

2553. Manufacture of Felt Hats, &c., *W. R. Lake, London.—11th June, 1881.—(A communication from C. P. Marin, Barcelona, Spain.)* 6d.

This relates to means for hardening or felting the hat body. The result is obtained by means of two endless aprons made of flannel, which, while travelling over rollers or cylinders carrying them, have imparted to them a to-and-fro or reciprocating motion, this double motion effecting the penetration or consolidation of the fibres to form the felt.

2554. Improvements in Apparatus for Receiving and Transmitting Audible Signals by Means of Electricity, *A. F. St. George.—13th June, 1881.—(Not proceeded with.)* 2d.

This invention consists in reproduction of audible signals by means of a vibrating disc, in connection with an electro-magnet surrounded by insulated wires. When undulating currents are sent through these wires corresponding vibrations of the disc produce audible signals.

2555. Water Taps or Valves, *A. Harvey, Glasgow.—13th June, 1881.* 6d.

This consists in the construction and arrangement of water taps and valves in which the supply or passage of water is controlled by means of a vulcanised rubber, or other similar elastic ball, fitting on a valve seat formed by the inlet or outlet, and opened or closed by the action of a moving spindle.

2556. Combing Machines, *J. Carroll, Bradford.—13th June, 1881.* 4d.

This consists in the employment of a circular rotating knife which assists the wool forward.

2559. Drilling, Boring, or Cutting Rock, &c., *G. F. Wynne, Minera, Denbigh.—13th June, 1881.—(Not proceeded with.)* 2d.

This relates to improvements in the construction of double-acting rock boring machines or drills, whereby the compressed air or steam is alternately admitted into opposite ends of the cylinder through ports in the piston of the machine instead of in the ordinary manner.

2562. Extinguishing Fires, *J. Braddock, Ashton, Lancaster.—13th June, 1881.—(Not proceeded with.)* 2d.

This consists in the employment and use of a revolving spray diffuser, which may be fixed or suspended in any convenient part of a room or building.

2564. Locomotive Engines for Tramways, Railways, &c., *J. R. Wigham, Dublin.—13th June, 1881.* 10d.

The drawing shows a plan of one arrangement for imparting motion to the road wheels from a motor engine.

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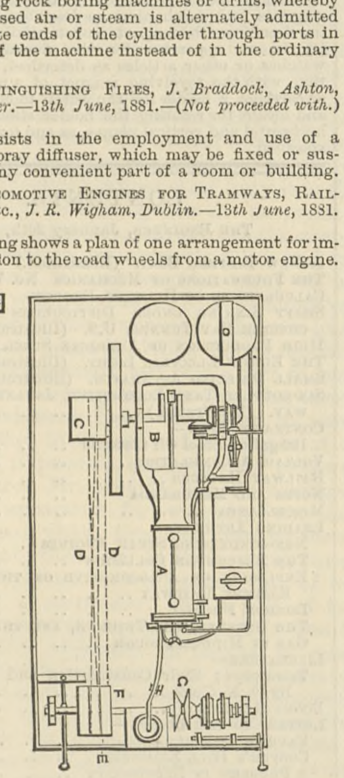

A is a gas motor engine, the shaft B of which has a broad drum C that imparts motion, either by an open strap D or a crossed strap D[1], to the pulley E on the shaft F, the "Blackburn" pulley G on which imparts motion to another "Blackburn" pulley on a countershaft, whose pinion gears with the wheel on the road axle.

2567. Regulating the Speed of Marine Engines, *E. P. Alexander, London.—13th June, 1881.—(A communication from C. J. A. Ziegler, Paris.)* 6d.

The speed regulating apparatus is characterised, First, by the direct action of the regulator on the apparatus for the admission of steam by means of a small steam cylinder or a balance valve, according to

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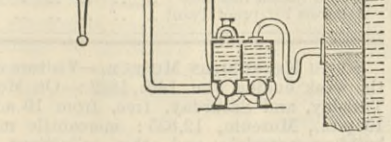

the dimensions of the engine to be regulated; Secondly, by the employment for the working of the said apparatus of two columns of water maintained in suspension by the pressure of air, the first varying with the level of the water at the stern of the ship, and the second being of a fixed height, acting in the reverse direction, and having for its chief object the complete annulling of the influence of rolling and pitching on the working of the apparatus.

2568. Regulating Patterns of Work in Braiding Machines, &c., *F. E. A. Büsche, Schwelm, Westphalia.—13th June, 1881.* 6d.

This consists partly in imparting a differential motion by means of a cam on a rotary shaft to a slide, which carries the lifter bars of a jacquard or pattern regulating apparatus, to be used in connection with a braiding or other like machine, whereby the said slide shall be caused to descend suddenly, to be lifted again immediately after, and to make a pause or dwell in its elevated position during the relatively longer period required for the completion of the revolution of the actuating cam.

2570. Distributing and Measuring Water for Gas Scrubbers, &c., *J. Dempster, Elland, York—14th June, 1881.—(Not proceeded with.)* 2d.

This consists in the use of a self-acting tippler or vessel capable of holding a certain quantity of water, which vessel when full discharges its contents into a receiver communicating with the distributing pipes, and then returns to a horizontal position.

2571. Looms, *J. Pickering, Batley, York.—14th June, 1881.—(A communication from G. Pickering, Berlin.)* 6d.

This consists in dispensing with the ordinary picking stitch and strap, and employing instead thereof a picking arm mounted on a rocking-shaft fixed to the lower part of the framework of the loom.

2572. Improvements in Electric Lamps, &c., *H. E. Newton, London.—14th June, 1881.—(A communication from C. A. Hussey and A. S. Dodd.)* 6d.

This invention consists of an incandescent lamp furnished with several carbons, the body of which can be rotated in such a manner that should one carbon fail, the rotation of the globe will cause the current to pass through another carbon, and so on

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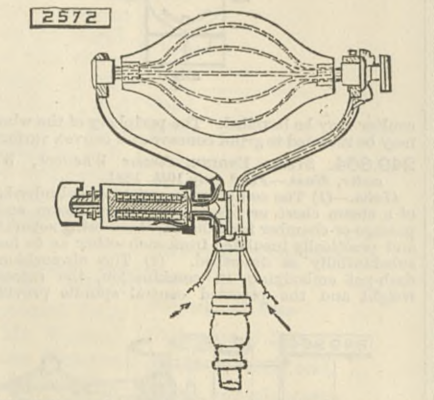

till all the carbons are exhausted. The lamp is also provided with a rotary spool furnished with coils of fine wire, and so connected with the lamp circuit that on rotation one or more, or all, the coils can be thrown into the lamp circuit, thereby varying or extinguishing the light at pleasure. In the figure the carbons are shown by dotted lines; the regulator of the light is shown in section, as are some of the other parts.

2574. Kneading, Dividing, and Moulding Dough for Bread Making, *B. J. B. Mills, London.—14th June, 1881.—(A communication from E. R. von Skoda, Pilsen, Bohemia.)* 6d.

This consists of a machine for the manufacture in a mechanical way of bread loaves of variable, but for each adjustment of uniform size, whose essential features are a pressing or kneading plate provided with adjustable slots, and pressing the dough against a wall with apertures of adjustable area, and two scissor-like movable knife blades, by which latter the aforesaid apertures of the wall are alternately opened and closed, and the dough, which by the pressing plate is pressed through the said apertures of the wall, is cut in pieces of any desired size or weight.

2576. Expanding and Contracting Fire-grates, *W. J. Hopkins, Worcester.—14th June, 1881.—(Not proceeded with.)* 2d.

This consists of an arrangement that admits of the grate being readily enlarged or contracted by means of the side bars or that which unites them being made and so arranged as to slide backwards and forwards into the jamb of the fireplace or hollow tubing in such a manner that the grate can readily be expanded or contracted so as to be suited for a large or small fire.

2579. Moulds for Forming Articles of Plastic Materials, *A. M. Clark, London.—14th June, 1881.—(A communication from H. D. Attwood and W. Driscoll, Taunton, Mass., U.S.A.)* 6d.

This consists in combining the lining with a skeleton frame mould and backing, which sustains the lining against the pressure during the operation of moulding. The backing may be either rigid and non-porous or flexible and porous, the latter being preferred.

2580. Producing Alumina, &c., *J. Webster, Solihull, Warwick.—14th June, 1881.* 4d.

This consists in extracting the chief portion of the sulphur and ferric sulphate, and recovering the hydrochloric acid from the compound of a mixture of carbonaceous matter with alum while in a heated state by means of a jet or jets of steam and atmospheric air combined.

2583. Steelyards, *H. J. Haddan, Westminster.—14th June, 1881.—(A communication from F. Subra, Algiers.)—(Not proceeded with.)* 2d.

This consists of a rectangular, bevelled, or sloped arm, on which a sliding weight is applied, the sloped part having marked thereon the division from 0 to 50 kilos., the flat part the division from 49 to 150 kilos. or other weights. At the extremity of the arm immediately after the division 0 is the head of the steelyard, which is furnished with two knife edge rests. The first rests on the steeled part of a fixed chape, in the collar of which a bolt turns freely, holding a ring for suspending the steelyard.

2584. Coverings for Rollers used in Spinning Machinery, *H. J. Haddan, Westminster.—14th June, 1881.—(A communication from J. B. Prevost, Brionne, France.)—(Not proceeded with.)* 2d.

This consists in using a covering of cotton, wool, silk, hemp, or other tissue stuck to or rolled over the cloth cover in single, double, or triple layers, according to the pressure the roller has to undergo, the cover being then impregnated with a gum varnish.

2588. Locks, &c., *J. J. Glœrum, Christianssund, Norway.—14th June, 1881.—(Not proceeded with.)* 2d.

As applied to padlocks the foundation plate of the lock is fitted or formed with the usual outer enclosing rim, and has an inner circular projecting rim; within the latter there is a disc having a projecting rim at the circumference fitting in the rim on the backing, and another inner projecting rim concentric therewith; the disc is movable round its centre, but limited by one, two, or more pegs which work in slots at different distances above the backing, and have their heads pressed against the outer rim of the movable disc by means of springs. The movable disc has a fixed bolt which can engage with the usual semicircular padlock closing link.

2589. Desulphuration of Liquids and Gases, *F. Lux, Ludwigschafen-on-the-Rhine, Germany.—14th June, 1881.* 4d.

This consists in the use of native or artificial protoxide of iron, sesquioxide of iron, or oxidulated iron, or of protoxide of manganese, or sesquioxide of manganese, or their hydrates, all or any of them combined with alkalies or their carbonates.

2591. Velocipedes, &c., *W. Harrison, Manchester.—14th June, 1881.—(Not proceeded with.)* 2d.

This relates to means of preventing the cross binding of ball bearings, cone bearings, or parallel bearings; also to preventing the extra friction of the bearing by the constant cross binding caused by the twisting of the forks of velocipedes; also to enable the rider to raise or lower the handle bar; also to enable the rider to steer more easily; also to ring or whistle an alarm when making a journey; also to secure the rubbers more firmly upon velocipede wheels, also to make the spring more easy for the rider.

2594. Burners and Chimneys for Oil Lamps, *G. O. Lauckner, London.—15th June, 1881.—(A communication from N. S. Wax, Bremen, Germany.)—(Not proceeded with.)* 2d.

This consists partly in cutting away a portion of the chimney-holder, or so forming the said chimney-holder at a part close to the lighting point so as to leave a hole, which is fitted with a slide or cover plate, and so arranged that by means of the said slide or cover plate the hole can be opened and closed at will.

2596. Lamps for Mineral Oils, &c., *R. H. Brandon, Paris.—15th June, 1881.—(A communication from L. Sépulchre, Liége, Belgium.)—(Not proceeded with.)* 2d.

This relates to the employment of two excentric tubes for the wick to pass between them, and to the mechanism for actuating the wick.

2598. Fire-lighters, *S. Rigby, Blackpool.—15th June, 1881.—(Not proceeded with.)* 2d.

This consists in taking any kind of combustible matter in pieces of any convenient size and saturating them in any fatty, resinous, or other sufficiently combustible fusible matter. They are then put into a vessel containing gluten in solution or other substance containing oxygen, and are afterwards put into an oscillating vessel or receptacle containing sawdust, shavings of wood, cork, or other dry and inflammable material which gives them an outer coating in order to make them more convenient to handle and still easy of ignition.

2599. Binding and Making Covers for Books, &c., of Metal with Flexible or Textile Joints, *H. Rees, Lambeth.—15th June, 1881.—(Not proceeded with.)* 2d.

This relates to the employment of pieces of textile fabric which are fixed into grooves formed by turning of the edges of the metal sides and backs.

2600. Washing or Cleaning Potatoes, &c., *J. Boardman, Rainsford, Lancaster.—15th June, 1881.* 6d.

This consists of an apparatus in which the produce to be operated upon is introduced at one end of a barrel or cylinder revolving in a trough of water and carried or passed to the other by means of an archimedean screw.

2601. Leggings and Gaiters, *J. Frankenburg, Salford.—15th June, 1881.* 4d.

This relates to a reversible legging and to the stud for fastening the same.

2603. Washing Wool, &c., *J. Clough, Keighley.—15th June, 1881.* 6d.

This consists in the use of a series of reciprocating bars having spikes secured thereto for carrying or propelling the fibre to be washed in a longitudinal direction through the washing troughs.

2605. Sun-lights, *W. T. Sugg, Westminster.—15th June, 1881.* 6d.

To the rim of the reflector A is secured a light metal frame G. It is preferred that two at least of the ribs of this frame shall be tubes in connection with a gas

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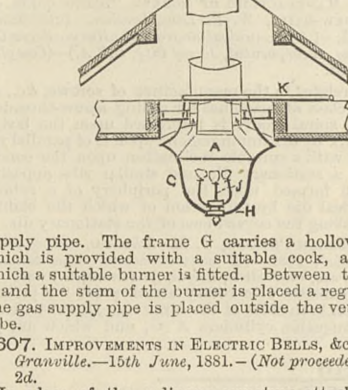

supply pipe. The frame G carries a hollow block, which is provided with a suitable cock, and into which a suitable burner is fitted. Between the block H and the stem of the burner is placed a regulator J. The gas supply pipe is placed outside the ventilating tube.

2607. Improvements in Electric Bells, &c., *W. P. Granville.—15th June, 1881.—(Not proceeded with.)* 2d.

In place of the ordinary armature attached to a hammer, by the attraction of which the bell is rung, the inventor so constructs the electro-magnet that one of its poles is made capable of movement to and from the other pole; the movable pole operating the hammer.

2608. Machine for Capsuling Bottles, &c., *F. Wirth, Frankfort.—15th June, 1881.—(A communication from F. Fehr, Wiesbaden, Germany.)—(Not proceeded with.)* 2d.

This relates to the employment of suitable cast iron jaws, which are worked by means of levers and links.

2609. Lace-up Boots, &c., *G. A. M. d'Haisne, Paris.—15th June, 1881.—(Not proceeded with.)* 2d.

The laces are held by means of clips.

2610. Securing the Tops and Bottoms of Cylindrical Metal Boxes or Cans, *W. Downie, Wood Green, and W. F. Lotz, London.—15th June, 1881.* 6d.

This relates to machinery for securing the ends to the body of boxes or cans in such a manner that the joints will be air-tight without the use of solder.

2614. Ventilating Mines, Pits, &c., *J. Onions, Rotherhithe.—16th June, 1881.—(Not proceeded with.)* 2d.

This relates to a system of pipes connected to a tank and an air pump.

2615. Wrenches and Drills, *H. L. Lunt, Crewe.—16th June, 1881.—(Partly a communication from T. McLean, New York.)—(Not proceeded with.)* 2d.

This relates to an instrument for the purpose of saving time and labour in the screwing up of nuts and bolts and also in drilling.

2616. Manufacture of Chimney Pieces, Columns, &c., *G. Hodson, Loughborough.—16th June, 1881.* 4d.

This consists in improvements in the manufacture of chimney-pieces, &c., in imitation of marble, granite, and other ornamental surfaces produced by the processes of enamelling and polishing upon articles produced in cement, and in the composition of materials employed therefor.

2617. Blocking the Upper Leathers of Boots, *F. H. Morris, London.—16th June, 1881.—(A communication from L. Bouthoux.)—(Not proceeded with.)* 2d.

This consists essentially of a plate, on one edge of which the leather to be blocked is stretched and pressed, some jaws, by which the edges of the leather is held, slides and screws, by which the jaws are moved backwards and forwards, and a mould which corresponds with the shape of the edge of the plate, and which mould is caused by appropriate mechanism to press the leather on to the edge of the plate, together with a suitable stand or other attachment.

2618. Improvements in Governing Dynamo-electric Machines, &c., *J. Jameson.—16th June, 1881.—(Not proceeded with.)* 2d.

This invention consists in the use of a solenoid, with a bar of soft iron and a spring acting against the induced magnetism. This arrangement is so connected with the machinery as to control the speed of the dynamo machine, and consequently the current.

2621. Mechanical Musical Instruments, *J. Pulford, Islington.—16th June, 1881.—(Not proceeded with.)* 2d.

This relates to means whereby the tune bands of music sheets may be readily and quickly placed in position and removed or replaced.

2625. Valves for Steam Engines, *J. H. Slatter, Salford Priors.—16th June, 1881.—(Not proceeded with.)* 2d.

This consists in forming valves of steam engines as a substitute for the usual slide valves of two flat circular discs, the one disc being bored through for the port holes and exhaust hole, the other disc bored through with a quadrant-shaped slot on one half, and sunk on the underside with a bell crank-shaped sinking through part of the thickness only.

2626. Striking Mechanism of Clocks, &c., *A. W. L. Reddie, London.—16th June, 1881.—(A communication from H. J. Davies.)* 6d.

This consists mainly in so combining a musical device for producing a tune with a clock that, in addition to its function as a time-indicator, the clock will impart motion to the said musical device, and that in what is known as an alarm clock, motion will at any pre-determined time be imparted to the musical device to play a tune as an alarm instead of ringing a bell as in ordinary alarm clocks.

2627. Receptacles for Lucifer Matches, *M. Wilson, London.—16th June, 1881.—(Not proceeded with.)* 2d.

This relates to constructing a holder or receptacle for matches so as to prevent the flying-off of lighted particles of the igniting material when a match is being struck upon the roughened or serrated surface of the holder.

2628. Dressing and Cutting Stone, &c., *W. W. Beaumont, Camberwell, and J. Wielman, Poole.—16th June, 1881.* 6d.

A cutting or dressing tool of suitable form, as shewn in Fig. 1 is employed, which tool is so held and arranged that a rapid vibratory motion may be imparted to it, which motion will produce the required effect of

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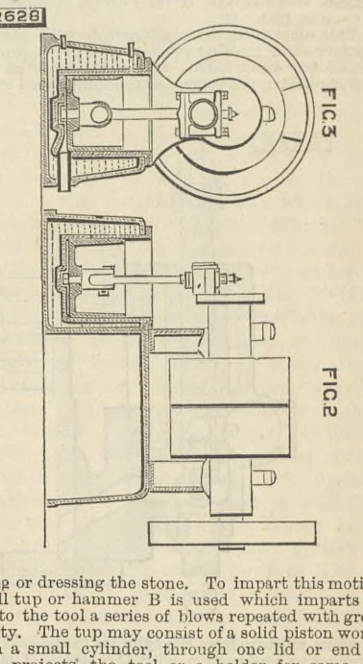

cutting or dressing the stone. To impart this motion a small tup or hammer B is used which imparts or gives to the tool a series of blows repeated with great rapidity. The tup may consist of a solid piston working in a small cylinder, through one lid or end of which projects the tool or a holder for same. A cushioning appliance, such as india-rubber washers, resting on the lid or end is used, and between the lid or end of the cylinder and collars on the dressing tool or tool-holder, to supply the necessary elasticity to provide a

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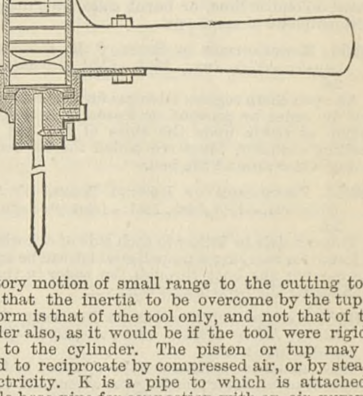

vibratory motion of small range to the cutting tool, or so that the inertia to be overcome by the tup in this form is that of the tool only, and not that of the cylinder also, as it would be if the tool were rigidly fixed to the cylinder. The piston or tup may be caused to reciprocate by compressed air, or by steam, or electricity. K is a pipe to which is attached a flexible hose pipe for connection with an air pumper, as shown in Figs. 2 and 3.

2629. Compositions for Forming Blocks for Use in Buildings, &c., *G. A. Wright, Portsmouth.—16th June, 1881.* 6d.

The composition consists of washed sand 2 parts breeze 3 parts, Portland cement 1 part, lime ½ part, loam ½ part.

2631. Distance Indicator for Bicycles, &c., *E. and T. A. Underwood, Birmingham.—16th June, 1881.—(Not proceeded with.)* 2d.

This relates to the employment of a dial divided in ten or any other suitable number of equal parts representing miles and subdivided into furlongs. The dial is provided with a pointer. The dial is also marked with a tens or other accumulating dial of a much smaller diameter, also with a pointer. Suitable mechanism for actuating the pointers is described.

2633. Window Blinds, *T. Hodgkinson, Manchester.—16th June, 1881.* 2d.

This relates to the method of printing and ornamenting window blinds, or window blind material.

2634. Reading Tables, *J. G. Wilson, Manchester.—16th June, 1881.—(A communication from G. A. Richter, Rixdorf, Prussia.)—(Not proceeded with.)* 2d.

This relates to the construction of reading tables provided with desks, which can be easily turned in any direction and fixed in any desired or convenient position by the user.

2636. Gas Cooking and Heating Stoves, *G. J. Cox, Maidstone.—16th June, 1881.* 6d.

This relates to the construction of gas cooking and heating stoves, boilers, and other apparatus with closed bottoms, whereby air is prevented from entering direct into the stove or apparatus, and wherein are provided channels, divisions, or heating spaces, through which all air necessary for the perfect working of the stoves or apparatus must travel into same, either in vertical directions at sides or in horizontal directions under bottoms, in which apparatus the burner or burners are also closed within and enveloped in heated air.

2637. Cigarettes and Cigarette Papers, *H. Black, London.—16th June, 1881.* 2d.

This consists in the application and employment for coating the ends or mouthpieces of cigarette papers of a solution of pyroxylin or gun-cotton, ordinarily known as collodion.

2638. LAMPS, *F. Siemens, Dresden.—17th June*, 1881. 6d.

This consists in the combination of a straight row of gas tubes with a regenerator or passage for heating the air supply to the flame on one side of a straight or curved division wall, and a regenerator or passage for taking up heat from the products of combustion on the other side of the said wall, the upper part of which wall, extending to a certain height above the gas tubes, being formed of porcelain or other refractory material, and having an aperture for the downward passage of the products of combustion.

2640. KNIVES FOR PEELING AND PARING VEGETABLES AND FRUITS, *H. Brandes, Hamburg.—17th June*, 1881.—*(Not proceeded with.)* 2d.

This consists in passing through the main blade of a knife a subsidiary blade disposed at a right angle to the main blade, or having its cutting surface placed at an angle to the cutting surface of the main blade.

2641. SAFETY VALVES, *H. J. Haddan, Westminster.—17th June*, 1881.—*(A communication from C. Codron, Lille, France.)—(Not proceeded with.)* 2d.

This consists of a steam chamber fitted with two equilibrium valves on one spindle, with seatings between the two valves: two or more escape tubes are provided.

2644. SELF-ACTING SWITCHES FOR STREET TRAMWAYS, *R. Hitchen, Manchester.—17th June*, 1881.—*(Not proceeded with.)* 2d.

This relates to arranging the switches or points of street tramways so as to dispense with the necessity for switch men.

2645. GAS ENGINES, *C. W. Purkey, Smethwick.—17th June*, 1881. 6d.

This consists in the combination with the hollow reciprocating igniting plunger of a gas engine of the regulating screw valve S and parts connected with it, for regulating the passage of the compressed explosive

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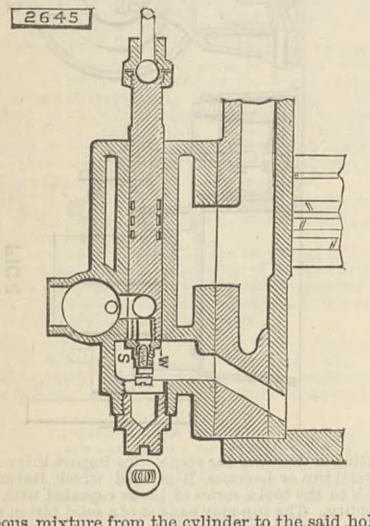

gaseous mixture from the cylinder to the said hollow plunger in conjunction with the series of layers of wire gauze W near the acting end of the said screw valve.

2648. WORKING MOVING OBJECT TARGETS FOR RIFLE PRACTICE, &c., *W. B. Blaikie, Edinburgh.—17th June*, 1881. 6d.

This relates to the arrangement and construction of targets for rifle and other similar practice, made to traverse in imitation of moving objects.

2649. MANUFACTURE OF GYPSUM AND MAGNESIA, *C. Scheibler, Berlin.—17th June*, 1881.—*(Not proceeded with.)* 2d.

This relates to the treatment of caustic dolomite, or burnt dolomitic lime, or burnt calcareous magnesite, with sulphate of magnesia.

2651. MANUFACTURE OF STEEL, *C. W. Siemens, Westminster.—17th June*, 1881.—*(Not proceeded with.)* 2d.

An open earth regenerative gas furnace is employed, but in order to prevent or lessen the destructive action of scoria upon the sides of the bed of the melting chamber, pipes are added thereto for circulating water around the bed.

2652. PROPULSION OF ROWING BOATS, *W. J. Sage, Walworth.—17th June*, 1881.—*(Not proceeded with.)* 2d.

This consists in fitting to each side of a rowing boat a frame for carrying a propeller which can be operated for moving the boat through the water in the direction facing the person who works it.

2655. RAISING AND SUPPORTING PATIENTS, *F. R. A. Glover, Isle of Wight.—17th June*, 1881.—*(Not proceeded with.)* 2d.

This relates to appliances to be attached to the bedsteads of invalids for enabling the attendant to lift a helpless patient.

2659. BOTTLE STOPPER, *F. W. Woodman, Brighton.—17th June*, 1881.—*(Not proceeded with.)* 2d.

This relates to a bottle stopper so constructed that by a mere pressure of the hand it may be instantly caused to expand and fit tightly in the bottle neck, and may be as quickly released and withdrawn therefrom.

2676. RAIL JOINTS FOR RAILWAYS, *W. Story, Linsdale, Bucks.—18th June*, 1881.—*(Not proceeded with.)* 2d.

One end of a rail is constructed so as to leave a couple of projections thereon, and in the other end of the rail recesses are formed to receive the projections on the abutting edge of an adjoining rail, so that the ends of the rails are interlocked.

2678. CYCLES AND VELOCIPEDES, *A. Lafargue, Kensington.—18th June*, 1881.—*(Not proceeded with.)* 2d.

This consists partly in providing an arrangement of mechanism by which the trail wheel of a bicycle can be divided into two wheels, revolving separate, and so making a tricycle.

2679. FASTENINGS FOR BAGS, DRESSING CASES, RETICULES, &c., *E. Marks, Golden-square.—18th June*, 1881.—*(Not proceeded with.)* 2d.

This relates to the employment of a catch and catch plate.

2684. BREAKING STONES, ORES, &c., *H. J. Ramu, Brussels.—18th June*, 1881. 6d.

This consists partly in the combination of a case or chest provided internally with a rotating shaft, from which project elastic or rigid arms carrying hammers or beaters with independent sorting or classifying apparatus, the said case or chest being constructed and arranged so that the breakage of the material is effected exclusively within, and that the broken pieces of the material are immediately after the action of the hammers evacuated or discharged into the independent classifying or sorting apparatus.

2699. MACHINES FOR PRESSING WADS OF WAX BETWEEN TWO PUNCHES, *W. Lorenz, Carlsruhe, Baden.—20th June*, 1881. 6d.

This relates to the manufacture of wads or discs of wax in a continuous and expeditious manner by first preparing the wax in the shape of a continuous rod or thread, which is then fed forward under the action of a cutter, by which definite lengths are cut off that are then subjected to the action of punches in a die to form them into wads of the desired configuration.

2700. ROLLER MILLS FOR TREATING GRAIN, *M. Benson, London.—20th June*, 1881.—*(A communication from O. Oexle, Augsburg, Germany.)—(Complete.)* 8d.

This relates to improvements on patent No. 2186, dated 29th May, 1880, and consists partly in the means of regulating and holding the rollers apart and mode of working and applying the adjusting springs to the bearings of the adjustable rollers, for adjusting the rollers together or holding their surfaces in proper working position, and also for preventing the springs from being unduly compressed by the regulating mechanism.

2701. CANVAS STRETCHERS FOR OIL PICTURES, *M. Lazerges, Paris.—20th June*, 1881. 4d.

This consists in the method of stretching canvas frames by means of tapering grooves and keys, tenons, and mortices.

2716. APPARATUS FOR FILTERING WATER, *P. M. Justice, London.—21st June*, 1881.—*(A communication from J. W. Hyatt, Newark, U.S.A.)* 1s. 6d.

The distinctive novelty of this invention consists chiefly in the employment of certain means for agitating the granular material whereby the silt and other impurities of an analogous nature are separated from the filtering material, and being of inferior specific gravity have been permitted to rise, are removed by means of a current of water or otherwise, according to the conditions of the case.

2796. MANUFACTURE OF LOZENGES, &c., *W. Sharp, Birmingham.—25th June*, 1881. 6d.

This relates to the printing mechanism by which the strip or sheet of sugar or other paste is printed with a series of separated inscriptions, designs, or ornaments, which printed parts of the paste are subsequently cut out by the cutters into lozenges or other like articles of confectionery.

2806. SHEEP SHEARS, *W. E. Gedge, London.—27th June*, 1881.—*(A communication from J. J. Bogard, Tehema, California, U.S.A.)* 6d.

The object is to render the blades detachable; and it consists in providing each of the blades with an extended shank, by which they are attached by a peculiar joint to the arms or handles of the spring bow.

2817. LAMPS AND LANTERNS, *W. R. Lake, London.—27th June*, 1881.—*(A communication from E. P. Follett and A. J. Bixby, Rochester, U.S.A.)* 6d.

A lamp formed of any desirable form is provided, and an air chamber and tubes, which lead into the said air chamber in the usual manner. A burner is set in the top of the air chamber beneath a deflector, and around the deflector is a rest or support for the globe.

4121. ATTACHING AND ADJUSTING DOOR KNOBS, &c., TO THEIR SPINDLES, *W. Macvitie, Birmingham.—11th October*, 1880.—*(Not proceeded with.)* 2d.

The knob is fixed by means of a spring having a tooth.

4445. MANUFACTURE OF SCREWS, SCREW-BOLTS, AND SCREW-NAILS, *W. R. Lake, London.—12th October*, 1881.—*(A communication from The Harvey Screw Company, Incorporated, Jersey City, U.S.A.)—(Complete.)* 1s. 2d.

This relates to the manufacture of screws, &c., and to that class of machines for rolling screw-threads in which a spiral groove is impressed upon the body of the blank by the impingement upon it of parallel ribs, formed with a suitable inclination upon the concave face of a stationary die, and similar ribs oppositely inclined formed upon the periphery of a rotating cylindrical die by the action of which the blank is rolled along the curved face of the stationary die.

4611. STEAM PRESSES, *L. M. Schmiers, Leipzig.—21st October*, 1881.—*(A communication from Schmiers, Werner, and Stein, Leipzig.)—(Complete.)* 8d.

This consists of a rotary steam press for printing sheets on both sides at the same time, furnished with two changeable cylinders A A^1, and which are pro-

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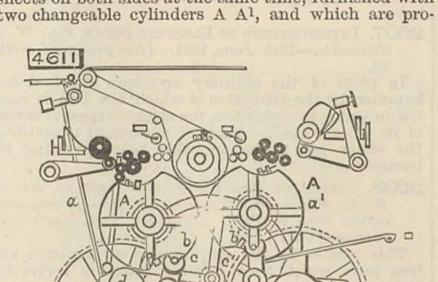

vided with printing surfaces a a^1 and surfaces for the distribution of colours b b^1, and which can be pressed elastically against each other by the pressure of springs, and can alternately be brought to a standstill by forks c and c^1 and excentrics d and d^1, whereby a careful insertion of the printing paper, and a double rolling in of the printing plates A and A^1 is made possible.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

249,651. JACK FOR METAL LASTS, *Samuel Mawhinny, Worcester, Mass.—Filed March 7th*, 1881.

Claim.—(1) In a jack mechanism for hollow metal lasts, the combination of a support or standard provided with a last supporting seat at its top end, a reciprocating draw-bar or tongue projecting through said seat with its end adapted to enter the cavity of and form a lock-connection with the last, and mechanism for depressing said tongue and jacking the last

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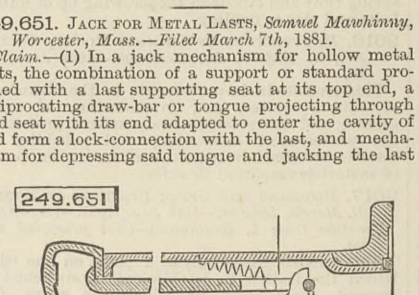

against said seat, as hereinbefore set forth. (2) The combination, substantially as hereinbefore described, of the supporting-column having the top seat or last-bearing surface provided with a recess or depression, as set forth, the tongue or bar adapted to lock on to an offset or lug within the cavity of the last, and mechanism for depressing said tongue, for the purposes stated.

249,746. APPARATUS FOR GRINDING AND POLISHING PLOUGH-COULTERS, &c., *J. T. Duff, Pittsburg, Pa.—Filed March 30th*, 1881.

Brief.—The grinding wheels and the pintles for the coulters are mounted on rotating and reciprocating carriages. Friction rollers are mounted on the carriage with the pintles, and regulate the rotation of the coulters while being ground. One edge of the grinding wheels is bevelled, so that on setting the stones at an angle to each other the edges of the

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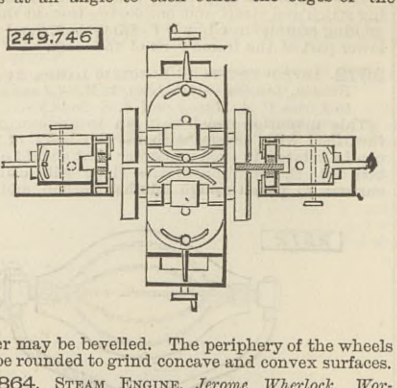

coulter may be bevelled. The periphery of the wheels may be rounded to grind concave and convex surfaces.

249,864. STEAM ENGINE, *Jerome Wherlock, Worcester, Mass.—Filed July 19th*, 1881.

Claim.—(1) The combination, within a cylinder-bed, of a steam chest or passage for direct steam and a passage or chamber for exhaust, these being separated and practically insulated from each other as to heat, substantially as described. (2) The air-cushioned dash-pot embodying, in combination, the recessed weight and the pivotted central spindle provided

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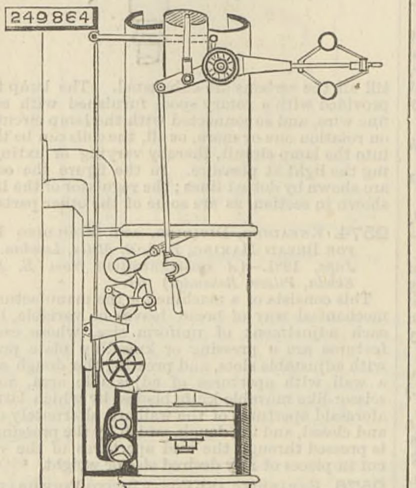

with the base-plate and valve, substantially as described. (3) The combination, with the steam-chest, of a seat for a throttle-valve outside of said chest, the valve-plate provided with wings and prevented from rotation, and the rotative valve-stem tapped into the hub of the valve-plate and provided with a collar for packing against the housing for the stem, substantially as described.

250,078. BAND-SAW GUIDE, *Hiram A. Kimball, Philadelphia, Pa.—Filed February 17th*, 1881.

Claim.—(1) The adjustable side guides M, in a single strip of steel bent double, so as to have resilient ends to bear on the opposite sides of the saw-blade, in combination with the sheath I, having a horizontal

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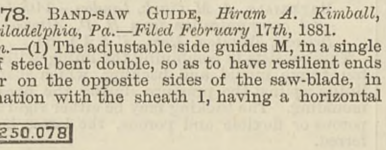

slot to receive the middle and doubled part of the strip and a confining-screw N, the sheath being held in its position by means of the upright shaft J or other suitable device, substantially as described.

250,206. CORE FOR FORMING SCREW-THREADS ON CASTINGS, *G. Cowing, Cleveland, Ohio.—Filed January 16th*, 1878.

Claim.—(1) The combination of two or more seamless screw-cores having male threads and ventilating core-arbors, which project and form dowels, with a

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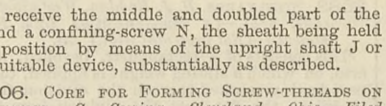

main ventilated core having dowel sockets, substantially as and for the purposes set forth. (2) The seamless screw-core, in combination with a tubular ventilating core-arbor, the end of which projects and serves as a dowel, substantially as and for the purpose set forth.

250,248. GRAIN THRASHING AND SEPARATING MACHINE, *Edward Huber and Frederick Strobel, Marion, Ohio.—Filed June 2nd*, 1881.

Claim.—(1) The combination in a grain separator of the concave of the thrashing cylinder, the pivotted arms C, a transverse shaft D, the excentrics E on this shaft, the guides F on the frame, a ratchet wheel G, on said shaft, and a pawl H, all substantially as

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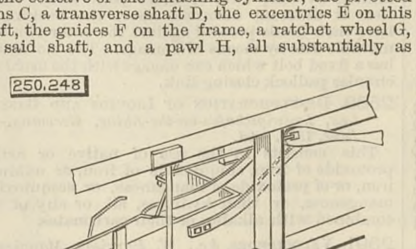

described. (2) The combination, with the grain-chute R^1, of the jointed supporting links S^1, the cross-bar T^1, and the suspension links U^1, whereby the chute can be inclined to the right or left and given an endwise shaking motion, substantially as described. (3) The combination of the bottom L^1, the comb A^2 hinged to the main frame above the extension of bottom L^1, and the riddle T, having its tail end arranged above the jointed end of the comb, substantially as described. (4) The combination, with the shoe A^1, of the supporting braces B^1, pivotted at their convergent ends, and the suspension springs C^1, having their flat blades in planes radiating from the pivot of the said braces, substantially as described.

250,273. METHOD OF AND APPARATUS FOR DEMAGNETISING WATCHES, *Hiram S. Maxim, Brooklyn, N.Y.—Filed September 7th*, 1881.

Claim.—(1) The method of demagnetising watches or other similar articles of or containing steel, which consists in subjecting the same to rapid reversals of polarity in a gradually weakened magnetic field, substantially as described. (2) The method of demagnetising watches or other articles of or containing steel, which consists in gradually withdrawing them from the influence of a rapidly alternating magnetic attraction, as set forth. (3) In an apparatus for the demagnetisation of watches or other articles, the combination, with an electro-magnet and means for revolving the same, of a rotary holder for presenting

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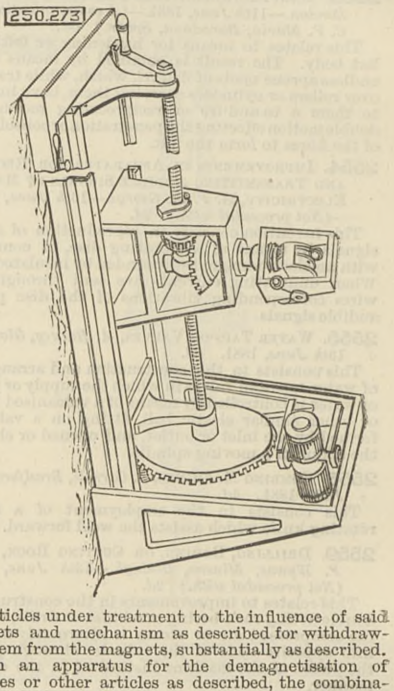

the articles under treatment to the influence of said magnets and mechanism as described for withdrawing them from the magnets, substantially as described. (4) In an apparatus for the demagnetisation of watches or other articles as described, the combination, with the revolving magnet, of a movable frame or carriage, a holder for the watch mounted thereon, and means for rotating the holder simultaneously in horizontal and vertical planes, as and for the purposes specified.

CONTENTS.

THE ENGINEER, January 20th, 1882.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending Jan. 14th, 1882:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 12,835; mercantile marine, building materials, and other collections, 4496. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. till 4 p.m., Museum, 1666; mercantile marine, building materials, and other collections, 426. Total, 19,423. Average of corresponding week in former years, 16,161. Total from the opening of the Museum, 20,662,162.