THE CONTINUOUS BRAKES RETURN.

THE continuous brakes return for the six months ending December, 1882, has just been issued, and a few of the leading facts may be interesting. The coaching stock of the railways continues to increase, and now amounts to 46,101 vehicles. The first return issued for June, 1878, showed only 39,185 vehicles; thus, the increase in coaching stock in four and a-half years amounts to 6916 vehicles, or an average of about 4 per cent. per annum. Of the 46,101 vehicles, one third are fitted with brakes which appear to comply with the Board of Trade conditions; one third with other brakes, which certainly do not do so; while the remainder have no brakes at all. During the half year, the railway companies have fitted 2610 vehicles either with brakes or connections, and three-fourths of these were of the automatic kind. Omitting the sectional brakes, as exploded contrivances, and dealing only with continuous brakes, there are now, it appears, 15,065 vehicles fitted on the automatic system, and 6339 on the non-automatic. Further, of the automatic brakes now in use, two-thirds are Westinghouse. As to the failures of the various brakes, we notice the usual anomalies in the returns from the various companies using the same brake. The North-Eastern Railway, for instance, can work the Westinghouse brake for over 41,200 miles per incident; while the Midland Company confesses itself unable to run, on an average, more than 9200 miles. It will be remembered that the returns are ordered to be made under three heads, viz., (1) Failure, or partial failure, to act when required in case of an accident to a train, or a collision between trains being imminent. (2) Failure, or partial failure, to act under ordinary circumstances to stop a train when required. (3). Delay in the working of trains in consequence of defects in, or improper action of, the brakes. We have before pointed out that these returns can be of but little service in illustrating the absolute merits of any brake, even if all the companies were animated by a desire to procure the best; and certainly the record sent in by the Midland Company must be held to be more than ordinarily misleading; for not only does it not represent, by a long way, the best work of which the Westinghouse brake is capable, but there are clearly some important omissions in the return of failures of its own, or the Clayton brake. The most important omission is that of the collision with the buffer stops at the Central Station, Liverpool, on September 22nd last year. Major Marindin, who investigated the matter, remarks: "It would, however, appear from the evidence, that the brakes upon this train did not act as they should have done when they were last applied;" and he concludes, by adding, "I think that the unsatisfactory manner in which the train brake behaved on this occasion strongly supports the conclusion which was arrived at by Col. Rich, when reporting upon the somewhat similar accident which occurred on the 25th April, 1882, at Port Skewet, on the Great Western Railway, viz., 'That the efficiency of this class of brake is materially interfered with by the leakage hole in the piston head.'"

Upon what grounds therefore does the Midland Company fail to include this accident under the No. 1 heading? Presumably it reasons somewhat in this way—that since the brake is provided with a device for leaking itself off in a short time, such incidents as that at Liverpool are, in reality, not failures, but very gratifying successes. In addition to all this, however, it is to be noted that this company makes no return for the Clayton brake of cases under the second head, whereas many cases of overrunning have occurred, and have been mentioned in our correspondence columns, without the slightest contradiction. The Great Northern Company, using the Smith's vacuum brake, again takes the lead in positive failures and cases of overrunning, and returns the only failure, which is reported under the first head. Considering that there are forty other cases of overrunning under the second head in the returns for the same brake, it seems singularly fortunate that this inability to stop trains should have resulted in only one accident, viz., the collision with the buffer stops at Edgware on December 29th last, which resulted in injury to the guard and six out of the twelve passengers in the train. The case was so very plain that the company could hardly help returning it under the first head as a failure of the Smith's vacuum brake, though its method of doing it is scarcely to be commended. The report runs thus:—"Driver reports that after reducing speed almost to a stand the engine bounded forward, owing, as he alleges, to pipes between the vehicles named becoming uncoupled, and ran into buffer stops. Driver suspended on suspicion of being under the influence of drink." Major Marindin having held an official inquiry, reports that it was "to the parting of the vacuum brake coupling that this accident was immediately due," and further, that "the statement of the porter who was on the platform that, as the train was passing him, he heard an unusual noise as of air or steam rushing out, is confirmatory of the driver's explanation, and disposes of any suspicion that the pipe was disconnected by the accident or by the driver after the accident." The inspector concludes by saying that "if the brake had been an automatic one, the effect of the coupling coming asunder would have been the application of the brake and the consequent prevention of the accident." Under all the circumstances, therefore, it appears quite unnecessary to place on record such a charge against the driver. It would appear, moreover, that the attempt to make the Smith vacuum brake automatic has not met with much success, since the returns indicate one failure to only 6500 miles. In relation to Major Marindin's remark, as given above, on the Edgware accident, it is interesting to note that the Lancashire and Yorkshire Company reports a case of overrunning in consequence of the Smith automatic vacuum brake failing to act, from the fact that "the coupling between the engine and the train became uncoupled owing to that on the engine being improperly fixed." How was it that the brake, being automatic, did not stop the train when the couplings parted? It is not suggested that there were any valves in the couplings which could prevent the application of the brakes. It is clear that had there been buffer stops in the way a similar accident to that at Edgware would have occurred, and from the same cause; although in the one case the Smith's vacuum brake was automatic and in the other non-automatic.

As an example of the nature of the failures to which the vacuum brake is liable, we may cite the following extracts from the returns of the Great Northern Company:—

July 28th.—Brake would not act beyond truck, owing to the socket valve of one of the cross pipes breaking, closing the air passage, thus partially destroying the brake power.

Aug. 3rd.—Brake would not act beyond truck, owing to the socket valve of one of the cross pipes breaking, closing the air passage, thus partially destroying the brake power; overran station.

Aug. 22nd.—Pipes became disconnected through improper coupling; train stopped by hand brakes.

Aug. 30th.—Pipes became disconnected through improper coupling; overran station.

Sept. 5th.—Pipes became disconnected through improper coupling; overran station.

Sept. 8th.—Vacuum pipe under carriage became detached; overran station.

Oct. 17th.—Pipes became uncoupled through improper coupling; overran station.

Oct. 23rd.—Pipes became uncoupled through improper coupling; overran station.

Oct. 31st.—Pipes became uncoupled; overran station.

Nov. 4th.—Pipes became uncoupled through improper coupling; train stopped by hand brake.

Nov. 10th.—Washer on flap of air valve defective; overran platform.

Nov. 18th.—Vacuum pipe not connected at Hatfield; overran station; driver fined for neglecting to test brake before starting.

So far in moderate weather. In winter it would seem that the couplings are all right, but a new set of troubles began. Thus we have:—

Dec. 2nd.—Train delayed 7 minutes by water having accumulated in diaphragm.

Dec. 4th.—Train delayed 2 minutes by water having accumulated in diaphragm.

Dec. 5th.—Train delayed 33 minutes by water having accumulated in diaphragm.

Dec. 6th.—Train delayed 22 minutes by water having accumulated in diaphragm. Train delayed 6 minutes by coupling being ineffectually put on dummy plug at the end; inexperience of servant.

December 11th appears to have been a peculiar disastrous day for the vacuum brake, which seems to have failed all over the Great Northern system. Here is the return for this single day:—

Dec. 11th.—Train delayed 13 minutes by water having accumulated in diaphragm. Train delayed 2 minutes by water having accumulated in diaphragm. Train delayed 4 minutes by water having accumulated in diaphragm. Train delayed 4 minutes by water having accumulated in diaphragm. Train delayed 4 minutes by water having accumulated in diaphragm. Train delayed 7 minutes by water having accumulated in diaphragm. Train delayed 19 minutes by water having accumulated in diaphragm. Train delayed 16 minutes by water having accumulated in diaphragm. Train delayed 27 minutes by water having accumulated in diaphragm.

Nor was the next day much better:—

Dec. 12th.—Train delayed 3 minutes by water having accumulated in diaphragm. Train delayed 20 minutes by water having accumulated in diaphragm. Train delayed 6 minutes by water having accumulated in diaphragm. Train delayed 3 minutes by water having accumulated in diaphragm. Train delayed 12 minutes by water having accumulated in diaphragm.

Nor was water the sole cause of trouble. When water is present in cold weather, and a vacuum is made, ice is very likely to follow. So we find:—

Dec. 10th.—Vacuum pipe frozen; 2 minutes delay. Vacuum pipe frozen; slight delay.

Dec. 11th.—Vacuum pipe frozen; 13 minutes delay. Vacuum pipe broke when disconnected; slight delay. Vacuum pipe frozen; 2 minutes delay. Vacuum pipe frozen; 4 minutes delay. Vacuum pipe frozen; 4 minutes delay.

Dec. 12th.—Vacuum pipe burst owing to frost; vehicle detached; 4 minutes delay. Vacuum pipe frozen; 2 minutes delay. Vacuum pipe frozen; 2 minutes delay. Vacuum pipe frozen; 13 minutes delay. Vacuum pipe frozen; 2 minutes delay.

Notwithstanding their untrustworthy character, there are many curious and significant facts and inferences to be gleaned from these brake returns, and it would be perhaps impossible to suggest a subject better adapted for the display of blind neglectful trust on the part of railway directors, of favouritism by officials, and incompetence by many railway servants, than continuous brakes.

NON-CONDENSING STEAM ENGINES.

IN our impression for April 6th we published an article on non-condensing steam engines, in which we endeavoured to show that about 21 lb. of steam of 100 lb. pressure was the smallest quantity which would suffice to develope an indicated horse-power with a five-fold expansion. An occasional contributor to scientific literature, well known for the somewhat peculiar views he holds on molecular physics, has criticised this article in the pages of a contemporary. He has apparently failed to understand our meaning, and undertakes the task of correcting what he believes to be our mistakes. However, with the results we arrived at, and the general conclusions we have drawn, he has apparently no fault to find. He does not assert that a horse-power can be got out of a non-condensing engine with less than 21 lb. of steam, nor does he appear to think that 3 lb. of coal per horse per hour is too much to allow under the circumstances. The head and front of our offending is to be found in our very first paragraph. We spoke of the well-known formula for the efficiency of a heat engine $\frac{T - t}{T}$. He takes us to task for not adding 461 deg. to the sensible temperatures in the cases we cited. Thus, we wrote, "$E = \frac{328 \text{ deg.} - 228 \text{ deg.}}{328 \text{ deg.}} = \cdot 304$;" and for a condensing engine, "$E = \frac{328 \text{ deg.} - 170 \text{ deg.}}{328 \text{ deg.}} = \cdot 481$;" when we should, he holds, have written $E = \frac{789 - 689}{789} = \cdot 127$. Our critic has, however, something to learn concerning this very formula. He does not go on to complete the correction, for a reason which ought to become sufficiently obvious in a moment, so we supply the omission, and write $\frac{789 \text{ deg.} - 631 \text{ deg.}}{789 \text{ deg.}} = \cdot 2$. Now, it so happens that we used the formula only for the purpose of illustrating the necessary difference between the efficiency of a non-condensing and condensing engine, but we drew no deduction whatever concerning the *absolute* efficiency of the two on this basis. Our critic says that if we had completed our calculation we could have arrived at a consumption of but ·8 lb. of coal per horse-power. Just so. But we did not carry out the calculation for the simple reason that, as we have said, we used the formula for a totally different purpose from that which our critic pleases to imagine, and as far as this purpose was concerned, the addition or omission of 461 deg. makes no difference. As our figures stand on page 269, the efficiency of a non-condensing engine being 304, that of a condensing engine is 481. Using the figures given above, the efficiency of a non-condensing engine being 127, that of a condensing engine is 200. Now, 481 is to 304 as 200 is to 126·4, the relative efficiencies being 0·1264 and 0·2 instead of 0·127 and 0·2. Thus, the actual error introduced is but 0·0006, an almost infinitesimal fraction, which disappears if the fractions ·127 and ·2 are extended.

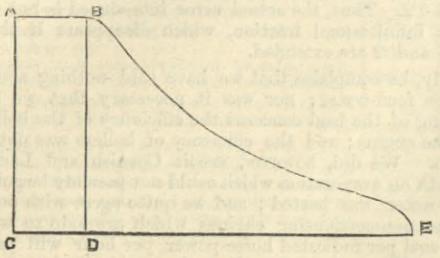
Secondly, he complains that we have said nothing about the use of hot feed-water; nor was it necessary that we should. The heating of the feed concerns the efficiency of the boiler, not that of the engine; and the efficiency of boilers was not under discussion. We did, however, credit Cornish and Lancashire boilers with an evaporation which could not possibly be got unless the feed-water was heated; and we quite agree with our critic that "the non-condensing engines which are said to work on $2\frac{1}{2}$ lb. of coal per indicated horse-power per hour will probably have the feed-water heated by the exhaust steam to nearly the boiling point, say, 200 deg. Fah." We have no objection to say that 200 deg. Fah. is a common temperature for the feed-water of economical non-condensing engines; but the fact has nothing to do with the matter in hand, unless, indeed, as seems to be the case, our critic fancies that there is a direct connection between the temperature of feed-water and the weight of steam consumed per horse-power per hour by an engine.

Lastly, our critic flatly contradicts a statement which he admits he does not understand. We wrote, "There is this great difference between working with steam and with hot air, that in the first case we have to make our working fluid, and in the latter case we find it made to our hand. In unmaking steam—if we may use the word—by condensing it we can gain a certain advantage—that is to say, a portion of the work expended in evaporating the water will be returned, and this is what is gained by using a condensing engine. The energy expended in making steam is used up in two ways, namely, in overcoming the resistance of the air, and in overcoming the force which retains the water molecules in propinquity. Now, this latter force is much greater than that exerted by the air, but no known means exist of getting any portion of the work done in overcoming it back again—that is to say, no work can be got out of the liquefaction of steam standing alone." Our critic writes, "We find that just the reverse of this statement is true. The work recovered in such an engine as that under discussion is a small part of that represented in the quotation as overcoming the resistance of the air, and the rest is about one-half due to the loss of motion of the gas molecules represented by the specific heat at constant volume through the change of temperature, and the other half is due to the recovery of the energy of the latent heat which went out of existence in overcoming the force which retains the water molecules in propinquity." This curiously involved sentence deserves some consideration, but before dealing with it we may explain that it is *apropos* of nothing which we said; our statement remains perfectly accurate. Out of the liquefaction of steam standing alone no work can be got. Liquefaction is a concomitant of expansion when work is done, but it is caused by the performance of work, and does not cause it. This is quite another affair.

Now, let us return to the sentence we have quoted. We confess we do not understand what is meant by the "latent heat which went out of existence." To begin with, there is really no such thing as latent heat to go out of existence; and one who can write so glibly about the motion of molecules ought to be aware of this fact. When water is submitted to the action of fire, its sensible temperature rises, and it is heated in the true sense of the word. But once the boiling point is reached, the further increments of heat supplied to it are converted into work, and are no longer heat, either latent or sensible. It would be as proper to say that the heat developed in the furnace of a locomotive hauling a train was rendered latent in the train, as to say that heat becomes latent in water. Our contemporary seems to have some glimmering of the truth, because he speaks of the "latent" heat which went out of existence. Why latent? And while we are asking questions, we go on to say, is our contemporary quite sure that the work developed in the cylinder is due to the liquefaction of steam in it? To repeat his own words, we find that just the reverse of the statement is true. The liquefaction of steam in a cylinder is, as we have just said, due to the performance of work. The performance of work is not due to liquefaction; and in the sense in which we have written—but which our critic has, he admits, failed to understand—what we have said is perfectly accurate; and had he construed our words in the obvious way, he would, perhaps, have spared his readers half a column of argument about nothing. The views which we and many others hold concerning what takes place in a steam cylinder, the true nature of heat, steam, molecules and so on, differ in many ways, no doubt, from the views apparently held by one who can still talk of latent heat as though it were an entity shut up and concealed from our senses in some mysterious way. But as we have already said, this is all beside the question really at issue, and unless our contemporary is prepared to show that work can be got out of the liquefaction of steam standing alone, all that he has written is so much waste of ink. It is, we think, to be regretted that the energy thus expended was not devoted to better purposes.

So far as we comprehend the involved sentence quoted above, our critic's views on what takes place within a cylinder are inaccurate. Taking a pound of water at 32 deg. and evaporating it all, we use up 1146·6 thermal units, representing 885,175·2 foot-pounds, expended in the following way:—First, in increasing the temperature of the water from 32 deg. to 212 deg., and lessening the cohesion of the water between 32 deg. and 212 deg., 180·898 units, and 139,653·359 foot-pounds. Secondly, in increasing the volume of water between 32 deg. and 212 deg., 0·00187 units, and 1·440 foot-pounds. Thirdly, destroying the cohesion of the water, that is converting it into steam, from the boiling point, 893·665 units and 689,910·025 foot-pounds. Fourthly, increasing the volume of the water from that which it had as water at 212 deg., to that which it had as steam at 212 deg., 72 034 units, and 55,610 37 foot-pounds. The work in an engine working expansively can be divided into two portions. The full pressure part of the stroke represents one part, the expansion part of the stroke the other. *Now the whole of the first*, represented by the rectangle A B C D in the accompanying diagram, *is done in the boiler*, a fact which our critic entirely overlooks; the steam being made and pushed out of it, and acting on the piston much as though it were a solid ram, one end of which was in the boiler and the other pressing against the piston.

Only the expansive work is done in the cylinder. During the first part of the stroke no liquefaction takes place—it is assumed, of course, that we are dealing with a non-conducting cylinder—the steam acting, as we have said, merely as a mechanical plug or ram, and there is no loss of quantity any more than there would be if water were employed instead. In fact, under the conditions no thermal phenomena of any kind occur in the cylinder, the steam entering it and leaving it as unchanged as so much water. During the expansion part of the stroke the steam, if it did no work, would become superheated by a small amount represented by the difference between the sums of the sensible and so-called latent heat of the steam at the initial and terminal pressures. As, however, work is done, this superheat is, it is said, used up first. The performance



of more work entails the liquefaction of a portion of the steam; but how or in what manner the force originally expended in driving the water molecules apart is obtained in the form of mechanical work no one knows. To assert that one half the work done in a cylinder is due to the loss of motion of "gas molecules," as our critic does, is only to assert something which can neither be proved nor disproved. It is certain, however, that the statement as laid down is erroneous in one respect; that is to say, saturated steam is not a gas in any sense or way, following entirely different laws as to expansion, and behaving in a different way under compression. Rankine has shown that to convert 1 lb. of water at 32 deg. into steam gas at 212 deg. requires $1092 + \cdot475 \times 180 = 1177$ units of heat, being more than the quantity required to make saturated steam at the same temperature in the ratio $\frac{1177}{1146} = 1{\cdot}028$. The second statement, that the other half of the work "is due to the recovery of the energy of the latent heat which went out of existence in overcoming the force which retains the water molecules in propinquity," is, if it has any meaning at all, equally erroneous, only a very small part of this energy, represented by the liquefaction due to the performance of work which takes place in the cylinder, being thus recovered, because only a small portion of the steam is liquefied. For one who so eagerly takes us to task for assumed inaccuracies, our critic writes with an astonishing want of care in the selection of terms. Is it possible that he really believes that saturated steam is a gas, and that heat becomes latent, and that the whole of the latent heat can be got back in the form of work?

It may, perhaps, be necessary to add that what we have just written applies to theoretical and not actual steam engines, although it is very nearly true of engines with jacketted cylinders and very small clearances.

ON THE STRENGTH OF SHAFTING WHEN EXPOSED BOTH TO TORSION AND END THRUST.*

By Prof. A. G. Greenhill.

The object of the present short paper is to bring before the attention of mechanical engineers some points arising out of the formula required in the design of shafting, which is made to transmit at once a thrust and a twisting moment, as is the case with the screw shaft of a steamer. The writer has worked out a mathematical investigation establishing, for this case, the following formula†:—

$$\frac{\pi^2}{l^2} = \frac{P}{EI} + \frac{T^2}{4E^2I^2} \quad \ldots\ldots \quad (1)$$

where the quantities involved are as follows:—

P = end thrust of shaft.
T = twisting moment of shaft.
I = moment of inertia of cross section.
E = Young's modulus of elasticity.
l = maximum distance between bearings, which will allow a straight shaft to be stable.

The civil engineer, in the design of structures, has usually to deal with columns subject only to thrust; and in that case the formula (1) becomes—

$$\frac{\pi^2}{l^2} = \frac{P}{EI} \quad \ldots\ldots \quad (2)$$

which is the well-known formula of Euler. But the mechanical engineer, in designing shafting, has to make the shafting sufficiently stiff to transmit some twisting couple T, and in that case, if there is no end thrust, the formula (1) becomes simply—

$$\frac{\pi}{l} = \frac{T}{2EI} \quad \ldots\ldots \quad (3)$$

Lastly, as mentioned above, there are cases, such as that of a screw shaft, where a thrust P and a couple T are both to be transmitted; and the general formula (1) must then be employed. In this formula it is assumed, as is usual in practice, that the angular velocity is sufficiently small for the effect of centrifugal whirling to be neglected; although in the mathematical investigation the writer has shown how this centrifugal whirling may be taken into account if necessary. As a practical application of formula (1), take the case of the Cunard s.s. Servia, of which the following details have been extracted from a description in *Engineering*:—The I.H.P. is 10,350, with 53 revolutions per minute. The propeller shafting is of wrought iron, 164ft. long, in eight lengths, and 22½in. in diameter. The pitch of the screw is 35ft. 6in. Supposing there were no slip, this would give, at 53 revolutions per minute, a speed of nearly 19 knots an hour; but the actual speed measured was 17·85 knots. Measuring, as in Unwin's "Machine Design," dimensions in inches, and forces in pounds, and assuming the whole of the power to be utilised by the propeller, we find that in the propeller shaft the mean thrust—

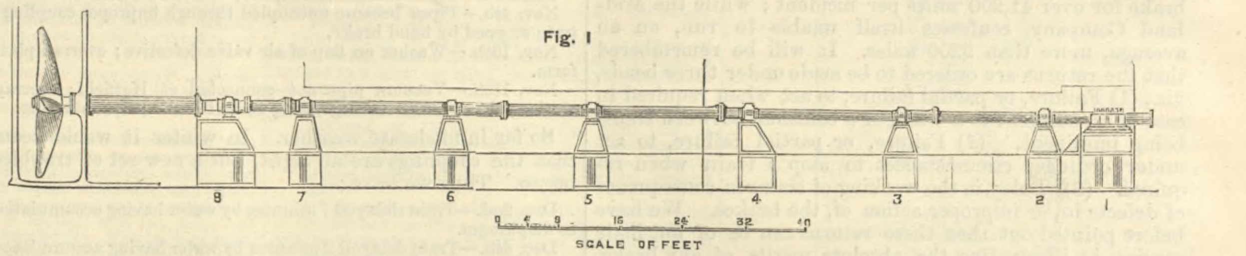
$$P = \frac{10{,}350 \times 33{,}000 \times 12}{53 \times 35\frac{1}{2} \times 12} = 181{,}530 \text{ lb.};$$

and the mean twisting moment—

$$T = \frac{P \times 35\frac{1}{2} \times 12}{2\pi} = 213\frac{P}{\pi} = 12{,}307{,}000 \text{ inch-lb.}$$

This mean value of T must be multiplied by the factor 1·77 in the case of a three-cylindered engine—"Machine Design," p. 192—to obtain the maximum value of T, which maximum will therefore be given by T = 21,785,000. Also d = diameter of shaft in inches = 22·5; thence $I = \frac{1}{64}\pi d^4 = \frac{\pi}{64}(22{\cdot}5)^4 = 12{,}581$; and E = 29,000,000, for wrought iron. Substituting these values in formula (1), we shall find l = 4452in. = 371ft. Now, in the engraving—Fig. 1—representing a longitudinal section of the shaft tunnel, the distance between the thrust-block and the stern-post bearing is about 120ft.; and in this length the shaft is supported by no less than five bearings. According to the above theory, however, the shaft between the thrust block and the stern post bearing would have ample stiffness against the thrust P and the twisting moment T, without these intermediate bearings. The practical suggestion to be deduced from the above theoretical considerations is, therefore, that, so far as stability of stiffness is concerned, these intermediate bearings might be suppressed, which would allow a greater amount of elastic yielding in the shaft, under the action of strains in the hull, and of other causes, and would therefore diminish the risk of its fracture. It may, however, be found necessary to support the shaft between the thrust block and stern post against the bending effects due to gravity, and to the rolling of the ship; but it is suggested that this might be done by taking the weight of the shaft upon mere level supports, allowing side play; or if this arrangement should be found to make the shaft roll out of line and to be difficult to lubricate—as suggested to the writer by Mr. W. J. Clark, of Southwick Engine Works, Sunderland—then the weight of the shaft at intermediate points might be taken by means of revolving endless chains, passing over pulleys above, and thus allowing lateral deviation. Another plan, which has been suggested to the author, would be to have india-rubber cushions on each side of the bearing, between it and the plummer block. At all events, neglecting the bending effects of gravity and the rolling of the ship, the screw shaft of any steamer ought to possess ample stiffness with bearings only at the thrust block and the stern post. In further illustration of this subject the writer drew attention to a drawingof the s.s. Dorset, kindly supplied by Mr. W. J. Clark. From diagrams supplied at the same time, the maximum twisting moment of the engine in inch-pounds, which we have denoted by T, appears to be 1,981,583. Mr. Clark assumes that only 42 per cent. of the I.H.P., in this case 1683, is utilised in propelling the ship. The pitch of the propeller being 20·5ft., this would make the mean thrust on the shaft, which we have denoted by P, to be 17,787 lb. Taking, however, the maximum value of P, corresponding to the above maximum value of T, with a pitch of 20·5ft. we have—

Fig. 1



$$P \times 20{\cdot}5 \times 12 = T \times 2\pi,$$
$$\text{or } P = 50{,}613 \text{ lb.}$$

With the same notation as before—

$$E = 29{,}000{,}000$$
$$I = \frac{1}{4}\pi d^2 \times \frac{1}{16}d^2,$$
$$d = 13{\cdot}375\text{in.}$$

With these data we have—

$$1{,}000{,}000 \times \frac{P}{EI} = 0{\cdot}88252$$
$$1{,}000{,}000 \times \frac{T^2}{4E^2I^2} = 0{\cdot}00029847.$$

So that

$$1{,}000{,}000 \times \left(\frac{P}{EI} + \frac{T^2}{4E^2I^2}\right) = 0{\cdot}88281847.$$

We here see how small $\frac{T^2}{4E^2I^2}$ is compared with $\frac{P}{EI}$, so that it may almost be neglected, and formula (2) employed instead of formula (1). If l denote the length of shaft between bearings, then from the formula—

$$\frac{\pi^2}{l^2} = \frac{P}{EI} + \frac{T^2}{4E^2I^2}$$

we shall find—

$$l = 3343{\cdot}6\text{in., or } 278{\cdot}5\text{ft.}$$

Except, therefore, for the purpose of supporting the weight of the shaft, the intermediate bearings numbered 2, 3, 4, 5, 6 are not required, the stiffness of the shaft being ample without them. A few words may be added on the important question of hollow shafts, as now frequently adopted for large vessels. In comparing the stiffness of solid and hollow shafting, the only quantity affected is I, the moment of inertia of the cross section; and the ratio of stiffness may be taken to be the ratio of the value of I. Thus, if a shaft have a hole bored through it, of diameter $\frac{1}{n}$ th of that of the shaft, then the new value of I is $\left(1 - \frac{1}{n^4}\right)$ of the value for the solid shaft, while the fraction $\frac{1}{n^2}$ of the material has been taken away. For instance, if the diameter of the hole is ½ that of the shaft, then the stiffness is reduced only about 6 per cent.—*i.e.*, $\frac{1}{16}$th—by a removal of 25 per cent. of material. Again, for two shafts of the same weight, the one solid, the other hollow, the hole being $\frac{1}{n}$ th of the external diameter, the stiffness of the latter is to that of the former in the ratio of $\frac{n^2+1}{n^2-1}$; and if $n = 2$ as before, this ratio is $\frac{5}{3}$, showing a gain of 66 per cent. in stiffness in the hollow shaft. It may, however, be objected that a crack in the hollow shaft will have much more serious effect than in the solid shaft, and this point therefore requires consideration. In calculating the effect of a crack in the shaft on the value of I, we may consider separately the effect of a longitudinal crack and a transverse crack. A longitudinal crack extending in a diametral plane right through the shaft will make the stiffness drop to from one-third to one-fifth of its original value, according as the shaft is solid or hollow; for the value of I must now be taken to be the sum of the moments of inertia of the two halves of the cross section, taken about axes drawn through the centres of gravity of the two halves parallel to the plane of the crack. Secondly, for a transverse crack, like a cross cut, extending inwards to a certain fraction, say $\frac{1}{m}$ th of the radius, the new value of I must be taken as the least moment of inertia of the remaining cross section. In this way the diminution of stiffness due to a crack of any assigned depth may easily be calculated. A transverse crack, however, once made, has a tendency to extend itself, because the fibres in the neighbourhood of the crack are the most strained, and it may thus gradually lead to the shaft being completely disabled. A longitudinal crack, on the other hand, may extend right through the shaft, and still leave it serviceable under a reduced strain. To apply these principles to actual practice, take the case of the shaft of the steamship City of Rome, which is composed of a hollow cylinder of external diameter 25in., and internal diameter 14in.; therefore

$$I = \frac{\pi}{64}\left\{(25)^4 - (14)^4\right\}$$
$$= \frac{\pi}{64} \times 352209$$
$$= 17287;$$

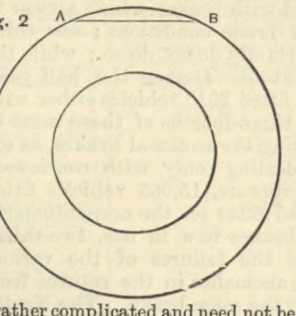
and the ratio of this value of I to what it would be for a solid shaft of the same external diameter is $1 - \left(\frac{14}{25}\right)^4$, or 0·9 nearly. On the other hand, the rate of the solid shaft, compared to the hollow one would be in the ratio—

$$\frac{25^2}{25^2 - 14^2} = 1{\cdot}45.$$

Again, the diameter of a solid shaft of the same weight would be $\sqrt{25^2 - 14^2} = \sqrt{429} = 20{\cdot}7$in.; the value of I for the hollow shaft, compared to the solid shaft of the same weight, will be—

$$\frac{25^2 + 14^2}{25^2 - 14^2} = \frac{821}{429} = 1{\cdot}9.$$

Fig. 2



It may be urged, as mentioned above, that, granting these results while the two shafts remain perfect, yet a crack will have a much more serious effect in the hollow shaft than in the solid. Let us therefore consider the effect of a transverse crack, reaching to a depth of 1in. along the line A B, Fig. 2. The determination of the value of I for the remaining sound cross-section of the shaft, about an axis through its centre of gravity parallel to A B, is rather complicated and need not be given in full; but the new value is approximately I = 16,328, while for the sound shaft the value of I was found to be 17,287; so that there is a loss of nearly 6 per cent. of stiffness in the shaft in consequence of the crack. This loss of stiffness will increase very rapidly, with an increasing depth of the crack. On the other hand, the value of I, in the case of a solid shaft of the same diameter, will be diminished from 19,200 to 18,240, or by about 5 per cent. Thus, even in this particular, there is only one advantage of about 1 per cent. on the side of the solid shaft, as against all the various disadvantages which have been mentioned above. It is with much diffidence that the author, as a mere theorist, ventures to bring these calculations and suggestions before the Institution of Mechanical Engineers, not being acquainted with the practical difficulties to be surmounted, in order to make the best design for shafting, and to diminish to the utmost the risk of fracture.

In the discussion which followed this paper Mr. Rennie pointed out that as a rule there was, under the arrangement now generally adopted, very little or no end thrust on the screw shaft, and that there was not therefore in these cases the loss or the strain assumed by the author.

Mr. E. A. Cowper suggested that the value of the paper and the formulæ given would have been much more if the author had applied them in some examples, showing whether certain shafts at work or which have broken should be at work, or should have broken or not. This, of course, the author might have done by reference to the Lloyd's register of broken shafts; and the *Transactions* of the Institution of Naval Architects contains some papers which would have afforded the necessary data from which the author might have given the practical-minded engineer some idea of the value of his equations.

Professor Unwin pointed out that the applicability of formulæ for the determination of the strength of and the stresses on screw shafting could not be proved by reference to experiments made on specimens of small section, and while he agreed with the author's remarks as to reduction in the number of bearings for large shafts, especially with a view to more easy flexible yielding with the hull, so as to prevent friction caused by this, he suggested that the shaft might have received some support as against sagging if it were allowed to rest in open vee bearings. He also gave an expression for the strength of a shaft to resist simultaneous thrust and torsion strains, which was a form of that given at p. 73 of the book referred to in the foot-note.

Mr. Reynolds made some remarks which afforded a curious exemplification of the notions held by some men of considerable and valuable practical experience on the nature, applications, and position to be assigned to theoretical deductions. His idea seems to be that science consists of a set of hard-and-fast rules of the cookery-book order, and that when the engineering cook, without scientific knowledge, follows a rule and makes a failure, he has proved that theory is a mistake, and science a dead sell. Experience does not show some men that when a cutler makes a scythe or a razor he does not necessarily show men how to use them without cutting their ankles or their throats. Mr. Reynolds spoke of screw shaft accidents and engine framing failures as "science tumbling about your ears." There is, however, something to be said in favour of Mr. Reynolds' remarks on the superiority of solid shafts over hollow shafts of equal sectional area when those shafts are exposed to bending stress. It will require a little more reasoning, however, to satisfy intelligent engineers on this point than is to be found in any dogmatic reference to statistics or proofs that the hollow shaft will not stand as many blows from a falling weight as a solid one, which seems to be Mr. Reynolds' "practical" way of proving the value of a structure never intended to be subjected to such a strain. As well might an ordnance engineer test a bridge with charges of gunpowder because he uses that method with cannon.

Professor Kennedy pointed out that the author's formulæ were in the first part derived from Euler's formulæ for the strength or strains in columns, while the second part dealt with the stress due to torsion, and that the latter was so small that it might, as the author had suggested, be neglected. He pointed out that Euler's formulæ did not seem to be applicable, because it dealt with buckling strains which did not obtain with screw shafting, and he supported Mr. Reynolds on the one point, that the central parts of a solid shaft did undoubtedly come into play in aid of the whole in a way not mathematically determinable, but probably for the same reason that the central parts of a beam conferred greater strength upon it than would be expected from calculation.

Professor Greenhill briefly replied to the discussion.

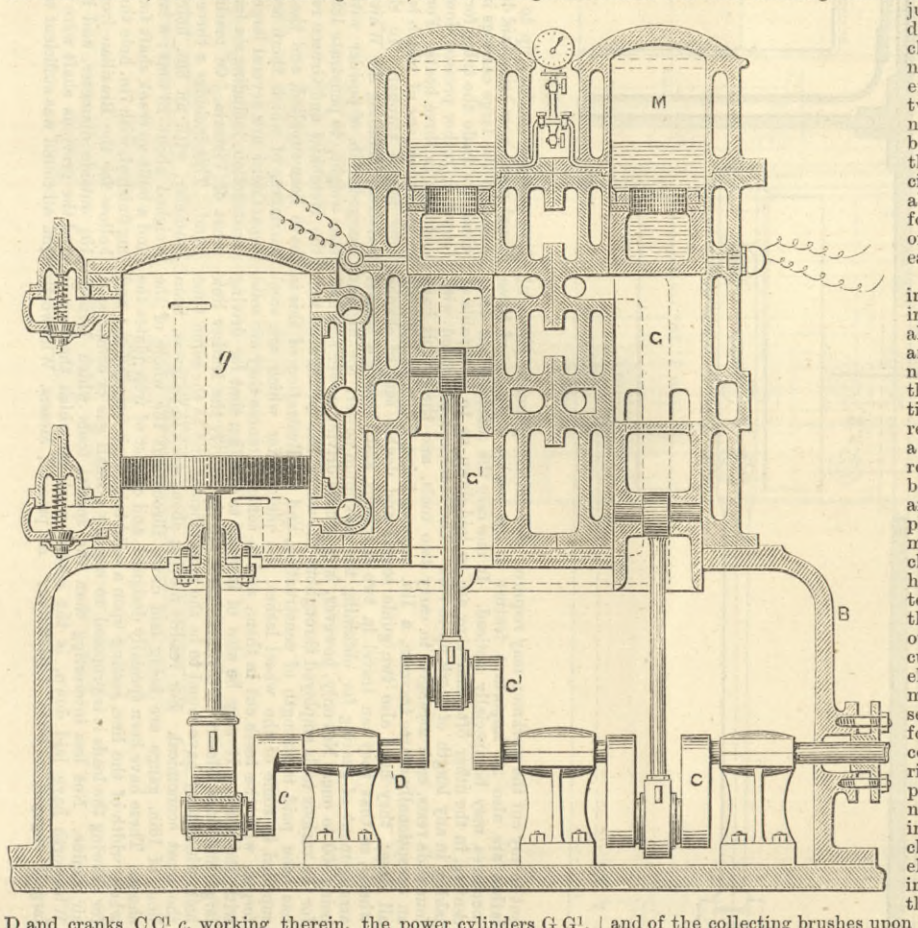
* Paper read before the Institution of Mechanical Engineers.

† This formula will be found on page 74 of the 4th edition of "Machine Design," by Professor W. C. Unwin, to whom the writer communicated it. He is not aware of its having been given previously, though such may have been the case.

We have received a copy of Berly's Electrical Directory, the full title of which is "J. A. Berly's British, American, and Continental Electrical Directory and Advertiser, the Electrician's Vade Mecum; containing a Complete Record of all the Industries Directly or Indirectly Connected with Electricity and Magnetism, and the Names and Addresses of Manufacturers in England, &c." It is now published at several places, and has become a portly, if not a pretentious volume. It is a very complete directory, considering that this is but the second edition. There are, however, many names in the lists which seem to have no claim to a place, and many names are absent which should not be, while Mr. Berly's name is very prominently printed big under many heads. Advertisements are inconveniently scattered throughout the volume; but at present it is the most complete directory of its kind.

A NEW GAS ENGINE.

THE accompanying engraving illustrates a gas engine patented by Mr. E. J. Frost, of Philadelphia. It will be seen that this belongs to the class of engines with separate compressing chambers. Ignition is effected by electricity. The claims of the inventor are for, in a gas engine, the combination, with the cylinder and its driving piston, of the compression chamber and secondary piston, substantially as and for the purposes set forth. The combination of a cylinder having entrance and exhaust ports at its opposite ends, a driving piston whose downstroke uncovers the exhaust port, and a compression chamber adjacent to the cylinder, and provided with a secondary piston, whose downstroke terminates immediately above the entrance port, whereby the charge is permitted to expand on both sides of the entrance port, but after expansion is driven below the said entrance port by the return of the secondary piston, and is finally expelled by the entering charge. In a gas engine, the combination, with the cylinder, of a power piston, a secondary piston, and igniting chamber, the said igniting chamber being alternately covered and uncovered by the movement of the said secondary piston, substantially as set forth. In a gas engine, the combination, with the lubricating box B, of the driving shaft



D and cranks C C¹ *c*, working therein, the power cylinders G G¹, and gas supply cylinder *g*, mounted upon the said box and above the driving shaft, substantially as set forth. The combination of the compression chamber M with the secondary piston and its hydraulic packing, substantially as and for the purposes set forth.

THE INSTITUTION OF CIVIL ENGINEERS.

SOME POINTS IN ELECTRIC LIGHTING.

THE fourth of the series of six lectures on the application of electricity was delivered on Thursday evening, the 5th of April, by Dr. John Hopkinson, F.R.S., M. Inst. C.E. The subject was "Some Points in Electric Lighting." The following is an abstract of the lecture :—The science of lighting by electricity was divided by the lecturer into two principal parts—the methods of production of electric currents, and of conversion of the energy of those currents into heat at such a temperature as to be given off in radiations of which the eye was sensible. The laws known to connect together those phenomena called electrical were essentially mechanical in form, closely correlated with mechanical laws, and might be most aptly illustrated by mechanical analogues. For example, the terms "potential," "current," and "resistance," had close analogues respectively in "head," "rate of flow," and "coefficient of friction" in the hydraulic transmission of power. Exactly as in hydraulics, head multiplied by velocity of flow was power measured in foot-pounds per second or in horse power, so potential multiplied by current was power, and was measurable in the same units. Again, just as water flowing into a pipe had inertia and required an expenditure of work to set it in motion, and was capable of producing disruptive effects if that motion were too suddenly arrested, so a current of electricity in a wire had inertia; to set it moving electro-motive force must work for a finite time, and if arrested suddenly by breaking the circuit the electricity forced its way across the interval as a spark. Corresponding to mass and moments of inertia in mechanics there existed in electricity coefficients of self-induction. There was, however, this difference between the inertia of water in a pipe and the inertia of an electric current—the inertia of the water was confined to the water, whereas the inertia of the electric current resided in the surrounding medium. Hence arose the phenomena of induction of currents upon currents, and of magnets upon moving conductors—phenomena which has no immediate analogues in hydraulics. The laws of induction were then illustrated by means of a mechanical model devised by the late Professor Clerk Maxwell. In the widest sense, the dynamo-electric machine might be defined as an apparatus for converting mechanical energy into the energy of an electro-static charge, or mechanical power into its equivalent electric current through a conductor. Under this definition would be included the electrophorus and all frictional machines; but the term was used in a mere restricted sense, for those machines which produced electric currents by the motion of conductors in a magnet field, or by the motion of a magnetic field in the neighbourhood of a conductor. The laws on which the action of such machines are based had been the subject of a series of discoveries. Oersted discovered that an electric current in a conductor exerted force upon a magnet; Ampère that two conductors conveying currents generally exerted a mechanical force upon each other; Faraday discovered—what Helmholtz and Thomson subsequently proved to be the necessary consequence of the mechanical reactions between conductors conveying currents and magnets—namely, that if a closed conductor moved in a magnetic field, there would be a current induced in that conductor in one direction, if the number of lines of magnetic force passed through the conductor was increased by the movement, in the other direction if diminished. Now all dynamo-electric machines were based upon Faraday's discovery. Not only so; but however elaborate it might be desired to make the analysis of the action of a dynamo machine, Faraday's way of presenting the phenomena of electro-magnetism to the mind was in general the best point of departure. The dynamo-machine, then, essentially consisted of a conductor made to move in a magnetic field. This conductor, with the external circuit, formed a closed circuit in which electric currents were induced as the number of lines of magnetic force passing through the closed circuit varied. Since then, if the current in a closed circuit was in one direction when the number of lines of force was increasing, and in the opposite direction when they were diminishing, it was clear that the current in each part of such circuit which passed through the magnetic field must be alternating in direction, unless, indeed, the circuit was such that it was continually cutting more and more lines of force, always in the same direction. Since the current in the wire of the machine was alternating, so also must be the current outside the machine, unless something in the nature of a commutator was employed to reverse the connections of the internal wires in which the current was induced, and of the external circuit. There were, then, broadly, two classes of dynamo-electric machines; the simplest, the alternating current machine, where no commutator was used; and the continuous current machine, in which a commutator was used to change the connection with the external circuit just at the moment when the direction of the current would change. The theory of the alternate current machine was then explained, and it was proved that two independently driven alternate current machines could not be worked in series, but that they might be worked in parallel circuit, and hence were quite suitable for distribution of electricity for lighting without the necessity of providing a separate circuit for each machine.

It was easy to see that, by introducing a commutator revolving with the armature, in an alternate current machine, and so arranged as to reverse the connection between the armature and the external circuit just at the time when the current would reverse, it was possible to obtain a current constant always in direction; but such a current would be far from constant in intensity, and would certainly not accomplish all the results obtained in modern continuous current machines. This irregularity might, however, be reduced to any extent by multiplying the wires of the armature, giving each its own connection to the outer circuit, and so placing them that the electro-motive force attained a maximum successively in the several coils. A practically uniform electric current was first commercially produced with the ring armature of Pacinotti, as perfected by Gramme. A dynamo machine was not a perfect instrument for converting mechanical energy into the energy of electric current. Certain losses inevitably occurred. There was the loss due to friction of bearings, and of the collecting brushes upon the commutator; there was also the loss due to the production of electric currents in the iron of the machine. When these were accounted for, there remained the actual electrical effect of the machine in the conducting wire; but all of this was not available for external work. The current had to circulate through the armature, which inevitably had electrical resistance; electrical energy must, therefore, be converted into heat in the armature of the machine. Energy must also be expended in the wire of the electro-magnet, which produced the field, as the resistance of this also could not be reduced beyond a certain limit. The loss by the resistance of the wires of the armature and of the magnets greatly depended on the dimensions of the machine. To know the properties of any machine thoroughly, it was not enough to know its efficiency and the amount of work it was capable of doing; it was necessary to know what it would do under all circumstances of varying resistance or varying electro-motive force; and, under any given conditions, what would be the electro-motive force of the armature. Now this electro-motive force depended on the intensity of the magnetic field, and the intensity of the magnetic field depended on the current passing round the electro-magnet and the current in the armature. The current then in the machine was the proper independent variable in terms of which to express the electro-motive force. The simplest case was that of the series-dynamo, in which the current of the electro-magnet and in the armature was the same, for then there was only one independent variable. The relation between electro-motive force and current might be most conveniently expressed by a curve. When four years ago the lecturer first used such a curve—since named by Deprez the "characteristic curve"—for the purpose of expressing the results of his experiments on the Siemens dynamo machine, he pointed out that it was capable of solving almost any problem relating to a particular machine, and that it was also capable of giving good indications of the results of changes in the winding of the magnets or of the armatures of such machines. The use of the characteristic curve was illustrated with reference to charging accumulators and Jacobi's law of electric transmission of power. When the dynamo machine was not a series dynamo, but the current in the armature and in the electro-magnet, though possibly dependent upon each other, were not necessarily equal, the problem was not so simple. In that case there were two variables, the current in the electro-magnet and the current in the armature; and the proper representation of the properties of the machine would be by a characteristic surface, of which a model was exhibited. By the aid of such a surface any problem relating to a dynamo machine could be dealt with, no matter how its electro-magnets and its armature were connected together. Of course in actual practice the model of the surface would not be used, but the projections of its sections. The properties of a machine depended much upon its dimensions. Suppose two machines alike in every particular, excepting that the one had all its linear dimensions double that of the other. The electrical resistances in the larger machine would be one-half those of the smaller. The current required to produce a given intensity of magnetic field would be twice as great in the larger machine as in the smaller. The comparative characteristic curves of the two machines, when driven at the same speed, were shown in a diagram. The two curves were one the projection of the other, having corresponding points with abscissæ in the ratio of one to two, and the ordinates in the ratio of one to four. At first sight it would seem that the work done by the larger machine should be thirty-two times as much as that which would be done by the smaller. Practically, however, no such result could possibly be attained for many reasons. First, the iron of the magnets became saturated, and consequently instead of eight times the electro-motive force, there would only be four times the electro-motive force. Secondly, the current which the armature could carry was limited by the rate at which the heat generated in the armature could escape. Again, the larger machine could not run at so great an angular velocity as the smaller one. And lastly, since in the larger machine the current in the armature was greater in proportion to the saturated magnetic field than in the smaller one, the displacement of the point of contact of the brushes with the commutator would be greater. Shortly, the capacity of similar dynamo machines was pretty nearly proportionate to their weight, that was to the cube of their linear dimensions; the work wasted in producing the magnetic field was directly as the linear dimensions; and the work wasted in heating the wires of the armature was as the square of the linear dimensions. A consideration of the properties of similar machines had another important practical use. Mr. Froude was able to control the design of ironclad ships by experiments upon models made in paraffin wax. It was a much easier thing to predict what the performance of a large dynamo machine would be, from laboratory experiments made upon a model of a very small fraction of its dimensions. As a proof of the practical utility of such methods, the lecturer stated that by laboratory experiments he had succeeded in greatly increasing the capacity of the Edison machines, without increasing their cost, and with a small increase of their percentage of efficiency, remarkably high as that efficiency already was. The electric properties of the electric arc were experimentally illustrated; in particular it was shown that the difference of potential between the carbons was nearly independent of the current. When a current of electricity passed through a continuous conductor, it encountered resistance, and heat was generated, as shown by Joule, at a rate represented by the resistance multiplied by the square of the current. If the current was sufficiently great, heat would be generated at such a rate that the conductor would become incandescent and radiate light. Attempts had been made to use platinum and platinum iridium as the incandescent conductor. But these bodies were too expensive for general use, and besides that, refractory though they were, they were not refractory enough to stand the high temperature required for incandescent lighting, which should be economical of power. Commercial success was not realised until very thin and very uniform threads or filaments of carbon were produced and enclosed in reservoirs of glass, from which the air was exhausted to the utmost possible limit. Such were the lamps made by Mr. Edison with which the Institution was temporarily lighted. The electrical properties of such a lamp were examined, and in particular it was shown that its efficiency increased and its resistance diminished with increase of current. The building was lighted by about 230 lamps, each giving sixteen candles light, produced each by seventy-five watts of power developed in the lamp. To produce the same sixteen candles' light in ordinary good flat-flame gas-burners, would require between 7 and 8 cubic feet of gas per hour, contributing heat to the atmosphere at the rate of 3,400,000 foot-pounds per hour, equivalent to 1250 watts, or nearly seventeen times as much heat as the incandescence lamp of equal power. At the present time, lighting by electricity in London must cost something more than lighting by gas. What were the prospects of reduction of this cost? Beginning with the engine and boiler, the electrician had no right to look forward to any marked and exceptional advance in their economy. Next came the dynamo; the best of these were so good that there was little room for economy in the conversion of mechanical into electrical energy; but the prime cost of the dynamo-machine was sure to be greatly reduced. Hope of considerably increased economy must be mainly based upon probable improvements in the incandescence lamp, and to this the greatest attention ought to be directed. It had been shown that marked economy of power could be obtained by working the lamps at high pressure, but then they soon broke down. In ordinary practice, from 140 to 200 candles were obtained from 1-horse power developed in the lamps, but for a short time he had seen over 1000 candles per horse-power from incandescence lamps. The problem, then, was so to improve the lamp in details that it would last a reasonable time when pressed to that degree of efficiency. There was no theoretical bar to such improvements, and it must be remembered that incandescence lamps had only been articles of commerce for about three years, and already much had been done. If such an improvement were realised, it would mean that it would be possible to get five times as much light for a sovereign as could be done now. At present electric lighting would succeed commercially where other considerations than cost had weight. Improvements in the lamps were certain, and there was a probability that these improvements might go so far as to reduce the cost to one-fifth of what it now was. He left the meeting to judge whether or not it was probable, nay, almost certain, that lighting by electricity was to be the lighting of the future.

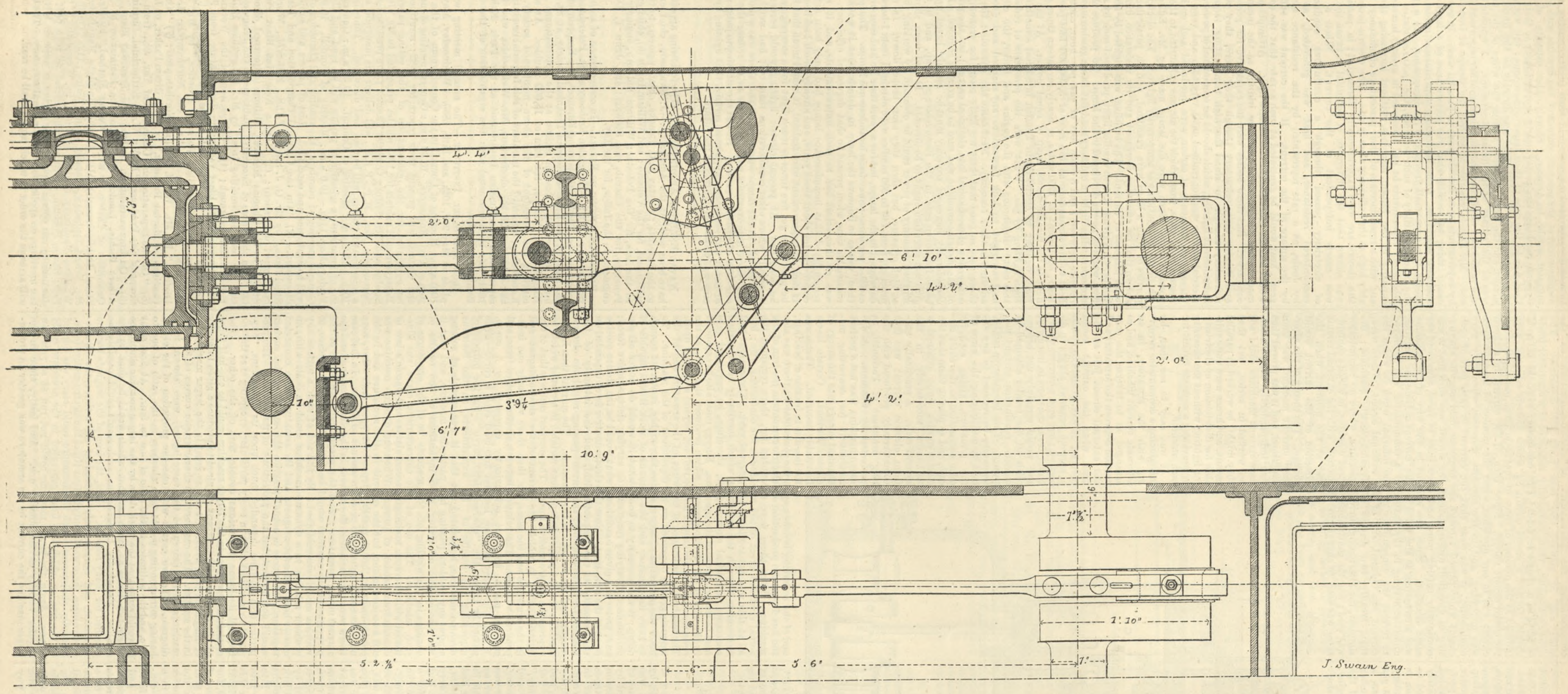
NAVAL ENGINEER APPOINTMENTS.—The following appointments have been made at the Admiralty :—J. Swainson, chief engineer, to the Satellite; Gustav A. C. Beneke, chief engineer, to the Asia, additional, for the Volcano; and William Inglis (b), chief engineer, to the Asia, for the Polestar; William Siddorn, engineer, to the Penelope, for the Cherub, vice Stewart; and John T. Downing, engineer, to the Indus, for the Tay.

ELECTRIC LIGHTING IN RUSSIA.—In consequence of an intervention by the Austrian-Hungarian Embassy at St. Petersburg, and a report of the Russian Minister on Finances, the Emperor of Russia has allowed the Imperial Russian Technical Society, at St. Petersburg, for forming a Russian section at the International Electric Exhibition in Vienna, the sum of 15,000 roubles. At a recent meeting the president of the above-mentioned society, Prince Kotschubey, informed the members of this Imperial resolution, and the chairman of the electricians, Mr. Welitschko, who likewise represented the Russian Department at the Paris Exhibition, 1881, has been entrusted with the organisation of the Russian Exhibition group.

IRON AND STEEL INSTITUTE.—The annual meeting will take place on May 9th, 10th, and 11th, 1883. Wednesday, May 9th.—10.0 a.m.: Meeting of Council in the Council-room of the Institution of Civil Engineers. 10.30 a.m.: General meeting of members; the Council will present their report for 1882; scrutineers will be appointed for the examination of the voting papers; the Bessemer gold medals for 1883 will be presented to Mr. George J. Snelus and Mr. Sydney Gilchrist Thomas; the president-elect, B. Samuelson, Esq., M.P., F.R.S., will deliver his inaugural address; a selection of papers will be read and discussed. Thursday, May 10th.—10.0 a.m.: Meeting of Council. 10.30 a.m.: General meeting of members; a selection of papers will be read and discussed. Friday, May 11th.—10.0 a.m.: Meeting of Council. 10.30 a.m.: General meeting of members; the reading and discussion of papers will be continued and concluded. List of papers and subjects for discussion.—(1) "On the Chemical Composition and Testing of Steel Rails," by Mr. G. J. Snelus, F.C.S., F.R.S.M., Workington (adjourned discussion); (2) "On a New Hot Blast Fire-brick Stove," by Mr. Thomas Massicks, Millom (adjourned discussion); (3) "On the Value of Successive Additions to the Temperature of the Air used in Smelting Iron," by Mr. I. Lowthian Bell, D.L., F.R.S., Middlesbrough; (4) "Comparison of the Working of a Blast Furnace with Blast varying in Temperature from 990 Fah. to 1414 Fah.," by Mr. William Hawdon, Middlesbrough; (5) "On American Anthracite Blast Furnace Practice," by Mr. Thomas Hartman, Philadelphia; (6) "On the Northampton Iron Ore District," by Mr. W. H. Butlin, Northampton; (7) "On Steel Castings for Marine Purposes," by Mr. William Parker, of Lloyd's; (8) "On the Separation and Utilisation of Tar, &c., from Gas in Siemens' Gas Producers," by Mr. W. S. Sutherland, Birmingham; (9) "On Improvements in Railway and Tramway Plant," by M. Albert Richie, London; (10) "On the Estimation of Minute Quantities of Carbon by a New Colour Method," by Mr. J. E. Stead, Middlesbrough; (11) "On the Tin-plate Manufacture," by Mr. Ernest Trubshaw, Llanelly, South Wales; (12) "On the Coal-Washing Machinery used at Bochum, in Westphalia," by Mr. Fritz Baare, Bochum. Members who intend to take part in the discussions can obtain copies of the papers a week in advance of the meetings, on application to the general secretary. The Council will arrange the order in which papers shall be read.

FOUR-COUPLED EXPRESS LOCOMOTIVE, GREAT EASTERN RAILWAY.

MR. T. W. WORSDELL, ENGINEER, STRATFORD.



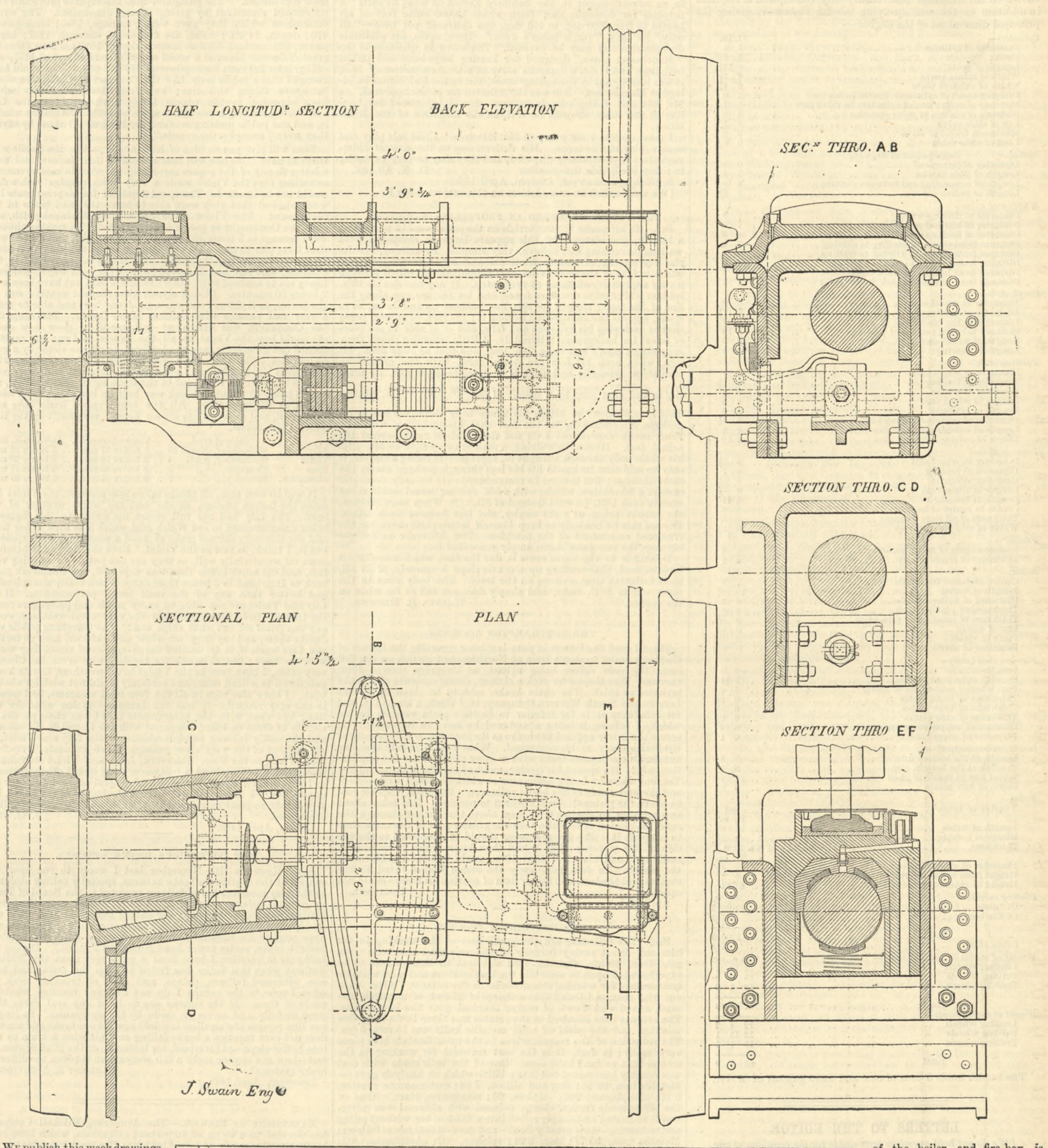
Death of Major-General Scott.—Major-General H. Y. D. Scott, C.B., F.R.S., late of the Royal Engineers, died early this week at his residence, Silverdale, Sydenham, at the age of sixty-one. He was educated at the Royal Military Academy, Woolwich, and entered the Royal Engineers in 1840. He acted as instructor in surveying and practical astronomy at Chatham, and also as examiner of military topography for the Military Education Department at the War Office. He retired from the army in 1871 as a Major-General, and became director of buildings at South Kensington, acting as architect to the Royal Albert Hall and the Science Schools. He was secretary to the Royal Commissioners of the 1851 Exhibition. He had just finished superintending the construction of the great International Fisheries Exhibition Building at South Kensington. He leaves a widow and a very large family.

Noble's Useful Rules and Tables.—Colonel Noble, R.A., has just brought out a new and greatly enlarged edition of his "Useful Rules and Tables," which we commend to any of our readers who are engaged in work dealing with any foreign weights and measures, or who are interested in work connected with gunnery. Most of us know by experience how trying it is to be brought even to a temporary stop by some dimensions or other figures that require to be converted. We can speak from experience of the help we have received from Noble's tables, which have enabled us, among other things, to give the results of foreign experiments in The Engineer with speed and ease in English, as well as foreign weights and measures, as in the case of the Spezia plate experiments last November and December. There are some new gunnery tables for ballistic calculations prepared from results of experiments with the Bashforth chronograph, which are very valuable for artillery problems; but we lay stress on the work for more general purposes.

Messrs. Whitworth and Co.'s New Works at Openshaw.—The new works built by Sir Joseph Whitworth and Co., at Openshaw, near Manchester, were some time back, shortly after their opening, briefly described in our pages. At that time they were only in partial operation, but they have now been got into full working order. The works have now a covered-in area of about eight acres, and are fitted throughout with a most modern plant of special tools constructed by Messrs. Whitworth themselves to meet their exceptional requirements. The most recent addition to their special class of tools is the application of hydraulic power to the boring and slotting machines. One of these machines is constructed for boring out at both ends simultaneously; the boring bar is forced forward from a headstock at either end to the work in the centre under a pressure from the accumulator of 1600 lb. to the square inch, and the work is made to revolve round the tool. This arrangement gives steadiness to the boring tool and ensures an even bore throughout the entire length, which is absolutely essential in boring out the hoops required for building up the present heavy class of ordnance. This machine weighs about 128 tons, and is constructed to bore up to 4ft. 6in. diameter and about 25ft. at each end, the bed of the machine being about 60ft. long. In the slotting machine, apart from the enormous hydraulic driving power, a special advantage is secured in which it is applied direct, without the intervention of gearing. This machine, which weighs about 50 tons, has a 5ft. stroke, and is entirely automatic in its action, whilst the arrangement secures a quick return to the tool, and it can be readily put to any cut the workmen may require. Several exceptionally powerful lathes are also an important feature in the works, and two of these machines may be specially noticed. In one case the machine has 48in. centres, in the other 5ft., and they are so laid down as to be capable of taking in any length of work up to 70ft. The machines are fitted with four slide rests, each arranged to carry two tools, and these tools have an exceptionally coarse traverse, a 1in. traverse being taken for finishing all sizes; they have also two guide screws and double sets of change wheels, so that they can travel in two directions, and there is a special arrangement of gearing for obtaining the maximum power, the highest being 300 to one. Not only, however, is enormous driving power required for the various tools employed throughout the works, but special attention has been paid to strength of construction, and an illustration of this is supplied in some of the wheel lathes, the pinions for which are steel forged, with the teeth cut in them, and in some instances they are solid with the shaft. It may be also of interest to mention that for driving large machines, Messrs. Whitworth now use exclusively the leather link belts which they have found to be the most efficient and at the same time the most economical. For readily moving about work in progress, tram lines of 18in. gauge are being laid down throughout the whole of the shops. These have been specially designed, and consist of iron plates the whole width of the line, resting upon a solid brickwork foundation; and for drawing the loads it is proposed to employ a small gas or compressed air engine. Not less interesting than the special tools which Messrs. Whitworth have laid down, is the special work on which the firm is largely engaged in every department. At present, Messrs. Whitworth turn out steel castings up to nearly 40 tons in weight, but with the additional plant now being laid down, they will be able to cast up to 60 tons. Amongst the large castings in hand are several of 32 tons weight, out of which are made the tubes for the 100-ton Armstrong guns, and these are forged or rather pressed down from an ingot of 47in. diameter to 27in. diameter in three heats. For the same guns there are also in hand several of the tubes, one of which is 22ft. long, and 27in. diameter, with a 15in. hole forged through. In the gun department is ordnance of various patterns, including the Whitworth 9in. 20-ton gun, to fire as an ordinary charge 200 lb. of powder with a projectile weighing rather over double that weight, to penetrate 18in. of solid armour plating. Also several of the Hotchkiss and Grusen revolving cannon, of which upwards of 12,000 have been supplied, and the Nordenfelt new rapid firing guns with their carriages, of which there are a large number in hand. In the erecting department are several large lathes and other machine tools in course of construction, including six large wheel lathes being made for the Government of Victoria. Of marine engine work there is also a good deal in hand. This includes a three-throw crank shaft, 29ft. 6in. long, and 17in. diameter, with an 8in. hole, for H.M.S. Jumna, and which as a forging weighed about 23 tons; a large double-throw crank for H.M.S. Triumph, and a built-up crank shaft for the Inman steamer City of Montreal, weighing finished, with 7in. hole through, 19 tons; the second stern shaft forged hollow for the Brazilian ironclad Riachuello, measuring 50ft. long by 15½ outside diameter, and having a hole through 9in. diameter. This and the previous shaft were forged so near to the finished dimensions that ⅛in. all round was sufficient to turn them up true.

FOUR-COUPLED EXPRESS LOCOMOTIVE, GREAT EASTERN RAILWAY

MR. T. W. WORSDELL, ENGINEER, STRATFORD.



WE publish this week drawings showing the general arrangement and other views of an express engine designed by Mr. Worsdell, locomotive superintendent of the Great Eastern Railway, and constructed at the company's works, Stratford, to work the through express trains from London to Norwich. The frequent sharp curves between London and Cambridge have necessitated that the wheel base should not be entirely rigid. The required flexibility has been obtained by employing a radial axle-box on the leading wheels, giving 1½in. of side motion each way, and controlled by a horizontal elliptical spring fixed in a bearing beneath the axle, with adjusting arrangement as shown in the engraving. The valve motion is worked out on Joy's principle, the slide valves being placed on the top of the cylinders, which are thus enabled to be brought so close together that not only are larger cylinders available than is usual when these are placed inside the framing, but longer bearings are obtained on the driving axle, there being a shorter distance between the webs of the cranks, as excentrics are not required as in the case of the ordinary link motion. Mr. Worsdell has found the working of this valve gear to be superior to that of the best kind of link motion, as the friction is certainly reduced and the working parts are much simplified. It will take less oil and attention than the link, and the whole is immediately under the eye of the driver from the footplate, and can be easily examined when in motion. A reference to the detail drawings will clearly show the arrangement of this valve gear as applied in this class of engine. The shell of the boiler and fire-box is composed entirely of steel plates, the fire-box is of copper, and the tubes are of brass. The crown bars of the fire-box are formed of steel plates, each with bolts through it screwed with nuts on the top. The boiler is fed by two injectors, Nos. 9 and 10, the No. 9 being placed on the fireman's side. The working pressure is maintained 140 lb. per square inch. The engines are fitted with the Westinghouse automatic high-pressure brake, the pump being carried within the splashers between the wheels and the reservoir and valves, &c., underneath the foot-plate. The frames are made each of a single steel plate 1in. thick. The frame cross stays and buffer beams are also of steel, and the motion plate is of cast steel. On account of the distance between the centres of the coupled wheels being so great, it has been found advisable to make the coupling rods of an H section. The engines are provided with dry sand boxes for the driving and trailing wheels, all the gearing for working the sand boxes, cylinder cocks, blower ash-pan, and brake, are arranged so as to be worked

Angle of Quadrant	Forward Gear, Maximum opening: Front Port	Forward Gear, Maximum opening: Back Port	Backward Gear, Maximum opening: Front Port	Backward Gear, Maximum opening: Back Port	Cut off Percentages, Forward: FP	Cut off Percentages, Forward: BP	Cut off Percentages, Backward: FP	Cut off Percentages, Backward: BP	Travel of Valve: Forward	Travel of Valve: Backward
0°					6½	7	6½	7	2 5/8	2 5/8
3°					12½	14	15	19	2 11/16	2 11/16
6°					24	24	27½	31½	2 13/16	2 15/16
8°					33	33	36	40	2 15/16	3 1/8
10°					42	41	44½	48	3 3/16	3 3/8
12°					50	50	52½	55	3 3/8	3 5/8
14°					57½	57½	60	60	3 5/8	3 15/16
15°					60½	60½	63	63	3 3/4	4 1/16
16°					63½	63½	66	65½	3 15/16	4 1/4
17°					66½	66½	69	67½	4 1/8	4 1/2
18°					68½	69	72	69½	4 1/4	4 5/8
19°					71	72½	75½	71½	4 7/16	4 13/16
20°					73	75	77	73	4 9/16	5
21°					75	77			4 13/16	
22°					77	79			5	

from the foot-plate. It is intended to fix an exhaust steam injector on each of this class of engine now building. A number of these engines are now at work and giving good results. The railway curves have a radius of 9 chains, with an ascending gradient of 1 in 90. The construction of the engines is so clearly shown on the drawings that hardly any description is required in addition to the accompanying tabular statement giving the principal dimensions of the engine:—

	ft.	in.
Cylinders—		
Diameter of cylinder	1	6
Stroke	2	0
Length of ports	0	11¾
Width of steam ports	0	1¾
Width of exhaust ports	0	4⅛
Distance apart of cylinders centre to centre	2	0
Distance of centre line of cylinders to valve face	1	1
Distance of centres of valve spindles	2	0
Lap of slide valve	0	1⅛
Maximum travel of valve	0	5
Lead of slide valve	0	0 3/16
Motion— Joy's patent to drawing.		
Diameter of piston-rod	0	3
Length of slide blocks	1	3
Length of connecting-rod between centres	6	10
Length of radius rod	3	9¼
Wheels and axles—		
Diameter of driving-wheel	7	0
Diameter of trailing-wheel	7	0
Diameter of leading-wheel	4	0
Distance from centre of leading to driving	8	9
Distance from centre of driving to trailing	8	9
Distance from driving to front of fire-box	2	0
Distance from leading to front buffer-plate	4	6
Distance from trailing to back buffer-plate	4	3
Crank Axle—		
Diameter at wheel seat	0	9
Diameter at bearings	0	7½
Diameter at the centre	0	7
Distance between centres of bearings	3	10
Length of wheel seat	0	8
Length of bearing	0	9
Trailing Axle—		
Diameter at wheel seat	0	9
Diameter at bearings	0	7½
Diameter at centre	0	7
Length of wheel seat	0	8
Length of bearings	0	9
Diameter of outside coupling pins	0	4¼
Length of outside coupling pins	0	4
Throw of outside coupling pins	0	12
Leading Axle—		
Diameter at wheel seat	0	8½
Diameter at bearing	0	7
Diameter at centre	0	6½
Length at wheel seat	0	6¾
Length at bearing	0	11
Centre to centre of bearings	3	8
Thickness of all tires on tread	0	3
Width of all tires on tread	0	5⅝
Frames—		
Distance apart of main frames	4	0
Thickness of frame (steel)	0	1
Boiler—		
Centre of boiler from rails	7	6
Length of barrel	11	5¼
Diameter of boiler outside	4	2
Thickness of plates (steel)	0	0 7/16
Thickness of smoke-box tube plate	0	0¾
Lap of plates	0	2½
Pitch of rivets	0	1 13/16
Diameter of rivets	0	0 13/16
Fire-box shell (steel)—		
Length outside	6	0
Breadth outside at bottom	3	11
Depth below centre line of boiler	5	6
Thickness of front plates	0	0½
Thickness of back plates	0	0½
Thickness of side plates	0	0½
Distance of copper stays apart	0	4
Diameter of copper stays	0	1
Inside fire-box (copper)—		
Length at the bottom inside	5	4
Breadth at the bottom inside	3	3
Top of box to inside of shell	1	4
Depth of box inside	6	2½
Tubes—		
Number of tubes	201	
	ft.	in.
Length of tubes	11	9¼
Diameter outside	0	1¾
Thickness	No. 11 and No. 13 w.g.	
	ft.	in.
Diameter of exhaust nozzle	0	4¾
Height from top of top row of tubes	0	2
Height of chimney from rail	12	11
Heating surface—	sq. ft.	
Of tubes	1082·5	
Of fire-box	117·5	
Total	1200·0	
Grate area	17·3	

	tns.	c.	qr.
Weight of engine in working order—			
Leading wheels	12	19	1
Driving wheels	15	0	0
Trailing wheels	13	3	3
Total	41	3	0
Weight of engine empty—			
Leading wheels	12	4	2
Driving wheels	12	15	1
Trailing wheels	13	1	1
Total	38	1	0

The tender holds 5 tons of coal and 3200 gallons of water.

LETTERS TO THE EDITOR.

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

THE JARROW FERRY LANDINGS.

SIR,—In your issue of March 30th appear drawings of the Jarrow ferry landings, by Mr. Petree, of Newcastle-on-Tyne, which will well bear careful examination, as the principle is, with one exception, a novel one, and it has also the advantage of having been tried for five years and found to answer perfectly.

Mr. N. Allan, the clever ferry superintendent at Middlesbrough, designed and erected two landings on the Tees precisely similar, except as to details, with those shown in your paper. A few months ago the borough surveyor and chairman of Ferry Committee of Jarrow came over to see them at work, and on their return the surveyor wrote to say they had decided to adopt the design. Is it fair, therefore, for Mr. Petree to make the drawings and then claim the design without in any way acknowledging from whence the latter was obtained? But Mr. Allan is not an engineer, much less a C.E., and therefore can hardly expect better treatment. The landings at Middlesbrough are at work now, as they have been ever since they were erected.

FREDK. WILLIAMS.

Middlesbrough, April 12th.

THE SMOKE ABATEMENT COMMITTEE'S OFFICIAL REPORT.

SIR,—In your issue of the 30th March I proved, in reference to Mr. Frederick Edwards' assertions, that for the purposes of the tests there was not a pin to choose between the South Kensington 8⅝in. chimney and the Manchester climbing-boy chimney, 14in. square; that, in fact, one was just as good as the other. Thus I disposed of Mr. Edwards' mare's-nest, and his statement in your issue of April 6th—that I muttered something about the chimney being too small—is absolutely untrue. But he had discovered another mare's-nest in the assumption that members of the committee disclaimed responsibility for the tests. This statement is false and libellous.

Mr. Edwards in the same letter refers to a report by me quoted in an advertisement in the *Sanitary Record* on what he calls "a fireplace for domestic use," from which 13,000 cubic feet of air heated to from 380 deg. to 440 deg. was delivered per hour—"fit only," he says, "for a baker's oven." Here, again, his plausible disingenuousness may be exposed. The stove in question is the "Manchester stove," designed for heating large halls and public buildings, and is not a domestic stove at all. As a matter of fact, it was tested, not in the testing-house, but in the Exhibition buildings at Manchester. Nor was it "selected for public approval," as Mr. Edwards disingenuously asserts. It was submitted for test, like all the other subjects for test, on the initiative of the Exhibition.

I must confess I am weary of Mr. Edwards. I like fair play and square play in discussion. His deliverances on the sizes of chimneys are not particularly disputed, and they may be very valuable, but they are beside the question.

D. K. CLARK.

8, Buckingham street, Adelphi, April 16th.

[We can publish no more letters on this subject.—ED E.]

THE POWER EXPENDED IN PROPELLING A BICYCLE.

SIR,—In reference to your article on the power used in propelling a bicycle, the reason why this appears large as compared with walking or running is, I believe, very simple. In walking, besides the overcoming of various frictional and other resistances, the whole weight of the body is not only supported, but raised through a very appreciable distance at every step. If any one doubts this, let him walk beside a wall or fence, and let his eye run along the line of the top. He will see this line bobbing up and down, so to speak, against the background beyond it; the fact, of course, being that at each step his eye rises and falls, and so is able to see more or less of the background alternately. A little reflection shows that, supposing a man's legs to be 30in. long, and that he steps 30in., his legs, when both his feet are down, form with the ground an equilateral triangle, and that if he keeps his knee stiff, he must rise in the next step by a height of $30 - \frac{\sqrt{3}}{2} 30 = 4$in. nearly. This is equivalent to lifting his whole body through a height of, perhaps, 3in., allowing for the fact that his foot does not rise. From rough experiment I do not think this is much beyond the actual fact. Hence, in walking, a man at every 2½ft. or 3ft. lifts his whole body through a height of, say, 3in. In riding a bicycle, it may be said that he has to lift his legs through perhaps about the same distance; but it must be remembered: (1) he only does this once in a revolution, which, with a 5ft. driving wheel would mean once in each 15ft. forward instead of 3ft. (2) When once started, the cranks being at right angles, the legs balance each other. Beyond this he has only to keep himself steady, and overcome the frictional resistances of the machine. The difference in fatigue between the two cases seems amply accounted for.

Doubtless to the same cause is due the fact, which many must have noticed, that walking up a gentle slope is scarcely, if at all, more fatiguing than walking on the level. The body rises in the same way in both cases, and simply does not fall so far when on the incline.

WALTER R. BROWNE.

THE NORTHAMPTON ACCIDENT.

SIR,—I read the letters in your last issue reporting the failure of Clayton's brake to stop a train at Northampton station on the 3rd inst., the poor driver being aghast, as his gauge showed 15in. vacuum. Was there ever such a clumsy, deceiving brute of a brake invented as this? The chain brake, said to be given up by the London and North-Western Company, is, I think, a king to it, and for reliability it is far inferior to Smith's plain vacuum brake, which, I believe, is being abandoned by some in its favour. It seems the driver applied the brake at the junction, which exhausted the brake-power at his command. What a farce to rely upon an automatic continuous brake with a store of power for one application only! He opened his ejector, and had rapidly 15in. vacuum—Yes, but where? In the brake pipe to which his gauge is connected, and the under side of the brake cylinders. But what vacuum had he above the pistons? Possibly next to nothing. If it takes about two minutes to destroy a vacuum above the pistons through the small leak holes, it will also take the greater part of the same time to re-create it. The driver's gauge should be connected to the top side of the pistons; they would then know what vacuum they really had, and also find that 10in. would just rub the blocks to the wheels. In fact, take away the steam brakes fitted to the engines and tenders, and this system of continuous brakes could not exist.

ENGINEER.

April 16th.

SIEMENS' DIRECT PROCESS.

SIR,—The following are the particulars of the working in the Siemens' direct rotary furnace of the separated magnetic iron sand from Moisie, Canada, that was sent to these works to be experimented upon to ascertain the best mixture and most suitable temperature for working this material in the rotator. After various trial charges I found that a charge of 25 cwt. of magnetic iron sand, mixed with 6 cwt. of coal or charcoal, gave the best results. The average time required in the rotator was three hours forty-five minutes, and the yield of solid metallic balls was 15 cwt. 3 qrs. The reduction of the magnetic iron to the metallic state took place very easily; in fact, it is the best material for working in the rotator that so far I have seen. One of the balls made with coal was roughly hammered out into a billet which on analysis gave:—Metallic iron, 96·95; slag and silicon, 3·04; carbonaceous matter, 0·17; phosphorus, ·002; sulphur, ·03; manganese, trace. One of the billets made from a charge reduced with charcoal was afterwards re-heated and simply rolled into a finished bar without piling and re-heating—as is usually done—and gave on analysis as follows: Metallic iron, 95·77; slag, 3·91; sulphur, ·02; phosphorus, ·02; manganese, trace; carbon, ·11. The tensile strength of this bar was 21·5 tons per square inch with 23 per cent. elongation. Most of the balls made were taken straight from the rotator, and used in the Siemens furnace for the production of mild steel; they were found to be very suitable for this purpose, and gave excellent results. There would be no difficulty in getting six charges, or about five tons, per day of balls out of such rotator when working with this magnetic iron sand, which would be a weekly make of at least thirty tons per each rotator. Working the rotator in pairs, the wages would come to about 5s. per ton on the rough balls. The fuel required for the Siemens gas producer to heat the rotator is as near as possible one ton per ton of balls produced. Generally speaking the magnetic iron sand appears to me peculiarly well adapted for the production direct of a very fine quality of steel or iron in the Siemens rotary furnace, and if it can be cheaply obtained should yield a very handsome profit in working.

New Steel Works, Landore, April 16th. JAS. DAVIS.

THE IRISH MAIL CONTRACT.

SIR,—The drawings and information which you have published in your issue of April 13th, about the Violet, and also your excellent leading article of March 30th on the above important subject, give an example of the real way for anyone interested in the matter to take it up. It is the topic of the day on this side of the Channel, and the various papers are nearly always full of it. Nevertheless, I have never read any paper which went into the subject thoroughly or from a mechanical point of view—which after all is what should be done—as you have in your last number. The Dublin Chamber of Commerce issued a pamphlet on the subject dated 8th March, professing to give reliable information about the boats, but which, in reality, was erroneous throughout, and therefore would only mislead those who trusted its accuracy, more than they were misled before by those who really knew nothing of the matter, and cared less. Glancing through this pamphlet, I read:—"Lily and Violet: These vessels are in every way inferior to the four mail packets, as will be seen by their dimensions." The pamphlet then attempts to prove this very unfounded statement by giving wrong dimensions. The wrong dimensions which they gave were—tonnage, 1035; horse-power 470; depth, 14·4ft.; which are correctly—tonnage, 1137; horse power, 600 nominal, 3000 indicated; depth, 15·6ft. Now there is a great difference between a vessel of 1035 tons and one of 1137, and still greater between horse-power of 470 and 600. One would have thought that a public body like the Chamber of Commerce would be above taking this line; but from the statements which have appeared in the papers lately with regard to the Lily and Violet, nothing is too bad to say about them, no matter what it is, and one public meeting reached the limit of all abuse by saying they were "unseaworthy vessels."

That will give you an idea of how much justice the public wish them to have. No one will hear a word in their favour, and even a letter to any of the papers correcting an error in measurements, or stating that the Violet made a very quick passage such a day, would not be inserted. The speed trials of the express boats last week showed that they were able to leave the mail boats in the background. The Violet made her trip on Wednesday 4th, and gave the Connaught as good a beating as could be, making the outward passage in 3 hours 10 minutes, light to light, and a little over that from pier to pier. On the return passage she did it in 3 hours 20 minutes. During the whole day it was blowing hard in the Channel, and she had the wind against her both ways, besides a heavy sea to contend with, otherwise she would not have been over 2 hours 50 minutes. I think myself that the bad weather was all the better, as it showed she was a good sea boat and able to make a very fast passage with nothing in her favour. The same day the Connaught was driven at full speed to show how easily she could beat the Violet, as all the papers told us; but matters turned out differently, and the latter came off the victor by a good 55 minutes. The Connaught was 4 hours 13 minutes doing what the Violet did in 3 hours 17 minutes, pier to pier; and even going from Kingstown to Holyhead in the morning in light weather, she took 3 hours 40 minutes, which was half an hour over the Violet's record at the same time. All the four express boats have now been tried, and each one has shown herself very swift by the time which I give below.

	Date of trial.	Time—Outward.	Inwards K. to H.
Lily	Wednesday, March 28	3 hours 37 min.	3 hours 30 min.
Violet	Wednesday, April 4	3 hours 10 min.	3 hours 20 min.
Rose	Thursday, ,, 5	3 hours 38 min.	3 hours 47 min.
Shamrock.	Saturday, ,, 7	3 hours 44 min.	3 hours 15 min.

It will be seen that, all things taken into account, the Violet has made the fastest passage, as she had the worst weather of the four. The Lily had not full steam up, owing to the engineers being unaccustomed to the Welsh coal which was used in her trial, and she therefore did not make as good a passage as was expected, but is, I think, as fast as the Violet. Both the Rose and Shamrock came off wonderfully well, as they are not put down as being very fast, and did much better than was expected, the Shamrock going back to Holyhead in 3 hours 15 minutes, which really was splendid, and better than any of the mail boats' performances. If the Lily and Violet are not able to carry mails and passengers across the Channel in 3½ hours in all but the very worst weathers, would any one point me out what ships can? The travelling public who dislike them, and say they are slow and inferior, may go farther and fare worse if it is another large species of vessel they would wish to have; but to speak for myself, who cross the Channel very often, I have been in the Violet in all weathers, from a heavy gale down to a dead calm, and certainly could not wish for a better boat. I have also been in all the four mail steamers, and crossed in one very recently—it was the Leinster—to see what she was like; but what with the extortionate fare I was charged, the incivility of those on board compared with the L. and N. W. officers, and the vastly inferior accommodation to the Lily and Violet, to say nothing of the very slow passage which we made, I resolved that so long as the Rose, Shamrock, Lily, and Violet are running from Dublin to Holyhead, I will never cross in any other steamers, as I find that for speed, comfort, and general convenience they are unmatched. I hope you will excuse the length of my letter, but as you take so great an interest in the subject, I think that will be overlooked.

J. G. B.

Dublin, April 14th.

THE CONTINUOUS BRAKE RETURNS.

SIR,—Upon the 24th November last I wrote to you upon the subject of the continuous brake returns, specially calling attention to the very incorrect list of failures reported to the Board of Trade by certain railway companies. I have looked over the return lately published for the half-year ending December 31st, 1882, and find it even more incorrect than the former ones. For instance, upon page 48 the Midland Company, reporting upon the Sanders-Bolitho brake, states under head No. 1 and 2 "Nil." During the half-year in question I have been a passenger upon the Midland Railway when this brake has failed to stop the train, and have also witnessed failures, delays, and cases of breaking loose, yet when I refer to the return I do not find any mention whatever made of them. If the returns are to be of any real value they must be fully and correctly made by the companies. So long as one line reports the smallest incident against one brake and another does not even mention a brake failing and allowing a train to run into buffer-stops—at Liverpool, for instance, on the 22nd September last—how can anyone make a fair comparison between the different brake systems?

CLEMENT E. STRETTON.

Leicester, April 18th.

EXTENSIONS AT ELSWICK.—The Armstrong-Mitchell Company has decided on a series of important extensions, which have been begun simultaneously at Low Elswick. The most important is the filling up of the familiar haughs lying in front of the large joinery establishment formerly belonging to Mr. Bowman. On the higher level of the ground that will be so formed the company intend to erect large steelworks; on the lower portion—that nearest the riverside—the new shipbuilding yard will be made. It is intended that the vessels shall be launched from slipways pointing down the Tyne, and the arrangements to be made will be such—with the ample depth of water to be had at high tide—as will ensure perfectly safe and satisfactory launches. Further up the riverside, and on the summit of the massive stone wall that faces Dunston, a number of entirely new shops are being built. There was, until a month or two since, a large open space between the workshops at this place. The space, however, is now disappearing, and in its place erections are well on towards completion that, when finished, will form a long line of new shops, to be used by the blacksmiths of the establishment. Immediately at the end of the wall, and near the Crooked Billet, the heavy bank which has hitherto separated the eastern and western parts of the large manufactory is being removed. The earthwork here—which has existed time out of memory—is one of the old haughs of Tyneside on which the people of Newcastle of a generation or two ago used to rusticate during the summer holidays. It is a somewhat substantial hill, and will require a considerable amount of shifting. It is, however, disappearing day by day, and in its place the firm propose shortly to erect a building that will do duty as a large gun carriage establishment. When the whole of the extensive work now in operation has been completed, the two miles of factory with which the Armstrong-Mitchell Company have hitherto been credited will have been increased to a very great extent. —*Newcastle Chronicle.*

RAILWAY MATTERS.

TRAM-CAR engine-drivers will have to get a better idea of the relative widths of their engines and their cars. On Monday morning a tram-car, drawn by an engine, came in collision with a coal cart in Leeds. The engine passed the coal cart safely, but the car struck it, and dragged it forward until it came in contact with a lamp-post. The horse was very seriously injured, and the windows and framing of one side of the car were smashed.

THE Sultan of Turkey is again interesting himself in a railway to Bagdad, and M. Collas has been, it is said, entrusted to finance a scheme in France. The last scheme is the proposal of Terkis Bey Ballian, the architect of the Imperial palaces. The starting point would be Saledieh, near the mouth of the Orontes, and the line would have a length of 1100 kilometres. M. Caralet's scheme for a line at first only as far as Damascus is thought not to command support enough to secure a concession.

THE Berne correspondent of the *Leeds Mercury* telegraphs that at Monday's sitting of the Federal Parliament, the President of the Confederation, M. Ruchonnet, replying to an interpellation on the subject of the proposed piercing of the Simplon, said the matter had been under the consideration of the Federal Council, who had decided, before permitting the work to commence, to forward to the Governments of France and Italy the new plans and specifications for the construction of the tunnel. These Governments had been invited to give expression to their views as to the desirability of sanctioning the enterprise.

IN rebuilding the Pittsburgh and Western Railway as a standard-gauge road an extensive change was made at the Summit tunnel. The *Railroad Gazette* says: "Its bed was lowered 9ft. without stopping a train. The work was accomplished by the excavation of the bed of the tunnel while the track was kept up by trestle work. A row of blasts would be fixed ready for firing, and as soon as a train had passed through they would be touched off and the *débris* cleared up before the next train arrived. The track for the broad gauge was laid 9ft. below the narrow gauge, and when all was ready cars were run in on the lower tracks and the trestle for the narrow gauge knocked down and dragged out." A similar operation was carried out some years ago with the tunnel near Blackburn when Pulman cars first began to run in this country.

THE Society of German Railway Administration has resolved upon opening every three years prize competitions of a total amount of 30,000 marks, for important inventions in railway matters, namely:—(1) For inventions and improvements in the construction of railroads—1st prize, 7500 marks; 2nd prize, 3000 marks; 3rd prize, 1500 marks. (2) For ditto in the means of transportation, and their use—prizes the same as at 1. (3) For ditto respecting the general administration of railroads, railroad statistics, and prominent subjects of railroad literature—1st prize, 3000 marks; 2nd and 3rd prizes, 1500 marks each. The award of a prize is not to prevent the inventor from patenting his invention or his sale of the patent. The first competition of this kind has been made public, and applications are to be sent in between January 1st and July 15th, 1884, to the managing director of the society at Berlin.

THE report of engine, tender, and passenger car wheel mileage on the Lake Shore Railway for the year 1882 has just been issued. The average mileage of 2265 33in. cast iron chilled wheels drawn was 60,580 miles each; the average of 747 30in. wheels was 57,519; that of 393 28in. wheels was 56,088, and six 26in. wheels averaged 97,297 miles each. Of the 2265 33in. wheels drawn, 1609 were worn out; 536 were flat, owing to bad chill or crumbled tread; 51 had broken treads; 25 broken plates, and 44 sharp flanges. Besides the 2265 33in. wheels removed for the causes named, 407 were drawn because they had been made flat by sliding. The average mileage of these 407 wheels was 25,168 miles each. The average mileage of all cast iron wheels removed during five years from the equipment named above, which does not include freight cars, excepting those made flat by sliding, was as follows:—33in. wheels, 60,335; 30in. wheels, 48,299; 28in. wheels, 49,867; 26in. wheels, 63,878. The average mileage of all the wheels reported "worn out" during five years was 71,059, and the average mileage of wheels made flat from sliding in the same time was 24,065. The number of wheels removed from the latter cause was as follows:—In 1878, 18; in 1879, 45; in 1880, 72; in 1881, 205; and in 1882, 407. The *Railroad Gazette*, from which we quote, says:—"The great increase in the number removed from this cause in 1881 and 1882 is probably due to the use of continuous brakes, or, perhaps, rather from inexperience in the use of them."

THE following, from an article in the *National Car Builder*, headed, "What Happens When Cars Turn Over," is not likely to lessen the English love of the well-made English carriage, with its fixed partitions and seats:—"The train was running at about twenty-five miles an hour on a level track, the embankment of which was about 8ft. above the natural surface of the ground. The engineer noticed that the train suddenly pulled hard, and on looking back saw that the wheels of the forward truck of the smoker were running on the ties. The car immediately headed for the edge of the embankment, taking the two baggage cars along with it, all three of them going over. The rear cars fell over on their sides. A number of persons were killed and injured in consequence of the cast iron seat ends breaking or pulling loose from the floor, and the seat backs turning over as the cars fell upon their sides. One passenger was thrown through one of the large windows and killed by the car falling on him. These results indicate that stronger fasteners are needed for seat ends, and also good strong locks to the seat back arms, to prevent the backs from reversing when the car is thrown over. The large windows, also, which have been so much in vogue for some time past, should be protected in some way so that passengers will not be thrown through them; and one road, at least, has furnished such protection by placing two brass bars across each of the large windows in its cars."

A REPORT to the Board of Trade by Major-General Hutchinson has been published on the accident which occurred on the 8th February, at Charity Junction, near Darlington, on the North-Eastern Railway. In this case as the 10.30 p.m. down empty train—consisting of two engines and tenders, forty empty wagons, and two brake vans—from Tebay to Shildon, was passing a set of facing points in a sharp curve of seven chains radius at Charity Junction, near Darlington, the leading engine left the rails, and, after running about 65 yards from the facing points, separated from the tender and turned over on its left side. The driver and fireman of the leading engine were jammed between the engine and tender and killed on the spot. From a consideration of the evidence the conclusion is that this accident was probably due to the right tongue of the facing points not having closed perfectly home to the stock rail when the road was made and the signals lowered for the train from Tebay to Shildon. These points are situated on a sharp curve of about seven chains radius, the super-elevation of the outer rail not exceeding 1¼in. at the points; the right tongue should have been close to the outer rail when the points were made for the train. Owing to the sharpness of the curve, the small super-elevation of the outer rail, the comparatively high speed, fifteen to eighteen miles an hour, at which the train was running round the curve, and its rather tight gauge, the right wheels of the engines grinding closely along the right rail, and the leading wheels of the leading engine meeting the slightly projecting tip of the right tongue of the facing points, must have mounted the right rail. "Considering the distance of these points from the cabin and the importance of their closing accurately, it is most necessary that they should be provided with a proper locking bolt. Looking also to the sharpness of the curve and the difficulty—on account of crossing—of giving the proper super-elevation—which, according to the usual rule, should be at least two inches—for a speed of fifteen miles an hour, it should certainly be provided with a check rail. The speed round the curve should be restricted to—at the very most—ten miles an hour."

NOTES AND MEMORANDA.

A BRASS cannon, 6ft. long, has been found by an agriculturist, whilst ploughing, at Coorum, near Soopa, in the Bhimthudy talooka. This cannon, it is said, was manufactured by Michael Burgerhays, and is dated 1640.

AT the Royal Observatory, Greenwich, the mean reading of the barometer last week was 30·03in. The mean temperature was 44·0 deg., and 3·0 deg. below the average in the corresponding week of the twenty years ending 1868. The extreme range in the week was 31.1 deg.

THE Guion mail steamer Alaska, the "Greyhound of the Atlantic," has made another rapid Atlantic passage. She left New York at 10 a.m. on Tuesday, the 10th inst., and arrived at Queenstown at 2.24 p.m. on Tuesday, the 17th. Her runs were as follows:—390, 383, 375, 411, 406, 410, 400, and 460 miles from Fastnet to Queenstown.

IN London last week 2598 births and 1803 deaths were registered, or 15·4 and 10·3 per hour respectively. Allowing for increase of population, the births were ninety-two below, whereas the deaths exceeded by forty-two, the average numbers in the corresponding weeks of the last ten years. The annual rate of mortality from all causes, which had been equal to 28·3 and 25·6 per 1000 in the two preceding weeks, declined to 23·8.

IN connection with the photo-chemical action of ferric oxalate, Mr. Victor Jodin has observed that when 162·5 parts—one equivalent—of perchloride of iron, and sixty-three parts of crystalised oxallic acid, dissolved in a litre of water, are exposed in the sunlight, carbonic acid gas is set free in such quantity as to supply the requirements of plants inclosed in a vessel with it, the absorption and decomposition of carbonic acid by the plant being likewise a photo-chemical action, because it requires sunlight to aid it.

IN the tabular results of experiments with different coals at the late Smoke Abatement Exhibition, Mr. D. K. Clark gives the evaporative power of Nixon's navigation coal as 13·25 lb. of water from and at 212 deg. per lb. of coal, and North-country coal at 12·22 lb. Of the Nixon's coal 11·82 lb. and of the North-country coal 16·73 lb. of coal were burned on each square foot of grate per hour. The latter coal was burned at the rate of 20·87 lb. per square foot on a smaller grate, and it then evaporated 12·62 lb. of water from and at 212 deg. Fah. The approximate temperatures of escaping gases were respectively 500 deg. and 612 deg. A report of the coal trades of Northumberland and Durham, by Messrs. H. Ayton and T. W. Bunning, draws attention to these good results and to the high quality of North-country coal.

THE following, from the report of the British Iron Trade Association, gives the production in the United Kingdom of different descriptions of manufactured iron in 1882:—Ship plates, 495,000 tons, or 30·53 per cent. of the total production; angles, 169,000 tons, or 10·42 per cent. of the total production; bars, 434,200 tons, or 26·78 per cent. of the total production; rails, 60,339 tons, or 3·72 per cent. of the total production; sheets, 114,200 tons, or 7·04 per cent. of the total production; hoops, 71,000 tons, or 4·38 per cent. of the total production; wire rods, 81,000 tons, or 4·99 per cent. of the total production; coke bars—for tin-plates—35,000 tons, or 2·15 per cent. of total production; strips, 42,600 tons, or 2·62 per cent. of the total production; Tee iron, 21,720 tons, or 1·33 per cent. of the total production; packing iron, 3500 tons, or ·21 per cent. of the total production; fencing wire, 10,800 tons, or ·66 per cent. of the total production; nail rods, 18,600 tons, or 1·14 per cent. of the total production; boiler and other plates, 64,000 tons, or 3·94 per cent. of the total production.

M. G. TISSANDIER has described to the Paris Academy of Science his new electrical motor for balloons. It consists of a screw propeller with two helicoidal blades nearly 10ft. in diameter, a Siemens dynamo-electrical machine of new design, and a light bichromate of potash battery. It is intended to propel an elongated balloon of about 1000 cubic yards capacity. The frame of the screw propeller weighs 15½ lb., is stretched with silk varnished with india-rubber lacquer, and kept taut by steel wire stretchers. The dynamo-electric machine has four electro magnets in the circuit, and frame parts are of cast steel, so as to bring the weight down to 121 lb. It drives the screw by gear, which reduces the speed in the proportion of 10 to 1; thus, if the coil makes 1200 revolutions a minute the screw makes 120. It gives out 220 foot-pounds per second with a useful effect of 55 per cent. The bichromate battery gives a better yield than accumulators of the same weight. It consists of an element divided into four series and arranged in tension. The element consists of an ebonite cell holding four litres—or 0·88 gallon—and containing ten plates of zinc and eleven cakes of retort carbon, arranged alternately. The immersed surface of the zinc is one-third that of the carbons. This battery, charged with a highly concentrated and very acid solution, is constant for two hours. The liquid becomes heated as it is impoverished, and the duration of activity may be prolonged by the addition of chromic acid.

AT a recent meeting of the Royal Society, Edinburgh, Sir William Thomson read two papers on gyrostatics and on oscillations and waves in an adynamic gyrostatic system. The papers were in great part experimental illustrations of the theorems regarding gyrostatic stability which are laid down in Thomson and Tait's "Natural Philosophy." It was thus demonstrated to the eye that a system when under gyrostatic domination is stable in positions for which, statically considered, the system is unstable as regards an even number of degrees of freedom; so that, to take a particular case, a gyrostat which is unstable, because statically unstable as regards one mode, is rendered stable by making it statically unstable as regards two modes. Hence also an ordinary spinning top is stable because it is statically unstable in two of its degrees of freedom. The curious behaviour of a gyrostat resting horizontally on gimbals with its axis of rotation vertical was also shown, viz., its instability as soon as the framework on which it rested was moved in the opposite rotational sense to the spin of the gyrostat. The author then proceeded to point out that all phenomena of elasticity which are ordinarily treated by assuming forces of attraction or repulsion between parts or stresses through connections, can be as readily explained by the assumption of connecting links subject only to gyrostatic domination. The gyrostatic hypothesis led to other consequences which the ordinary dynamic assumption did not involve; but it had not been found as yet that elasticity had properties corresponding to these.

AT the meeting of the Chemical Society on the 5th inst., a paper was read "On the Chemistry of the Cerite Metals," by Mr. B. Brauner. In the first part of the paper the author gives an account of a most careful determination of the atomic weight of didymium. The numbers obtained by chemists differ widely from each other, from 142 to 147·39. The author finds that the so-called pure didymium can be split up into heterogeneous constituents. By an elaborate process of purification a sulphate was obtained which was proved, by fractional precipitation with ammonia and with sulphate of potassium, to be homogeneous. From this preparation the atomic weight of didymium was found to be 145·4. In a previous paper the author obtained the number 146·58, while Cleve gave the atomic weight as 147·2. Such discrepancies seemed to indicate the presence of some metal of higher atomic weight, and of a less basic nature. This metal the author eventually succeeded in isolating. Its formiate is difficultly soluble, and by its absorption spectrum it was identified with samarium. The author has calculated its atomic weight to be 150. The effect of the presence of samarium on the absorption spectrum of didymium is carefully studied. The paper concludes with an investigation as to whether cerite contains earths of the yttria group as well as those of the cerium group. By taking advantage of the solubility of the formiates of the yttria group, the author separated out a fraction with atomic weight 114·5, whose spark spectrum showed the presence of yttria, whilst holmia, thallia, and erbia were recognised by their absorption bands, and the presence of terbia also was suspected.

MISCELLANEA.

THE third annual Furniture Trades' Exhibition will open on Monday, in the Agricultural Hall, and will remain open until the 16th May. The Exhibition will be open every evening until 10 p.m.

ON Friday evening last Mr. Philip Shrapnel, secretary to the Building Trades Exhibition, was entertained at a complimentary banquet by the exhibitors, and was presented with an address of appreciation of his management of the Exhibition.

A LOCAL paper is responsible for the following: At the works of Messrs. Hawks, Crawshay, and Sons, Gateshead, the greater portion of the foremen and officials are stated to have received a three months' notice to terminate their engagements.

IT is said that the American patentees of the system of regulating clocks by imparting an impulse to the gas in the existing gas mains of a town, with which the clocks must be in communication, have not yet succeeded in getting gas companies to "see it."

A PROSPECTUS has been issued by Messrs. Lipsius and Tischer, Kiel, of a new book entitled "Die Schiffsmaschine, ihre Construction, Wirkungsweise and Bedienung," by Carl Busley, of the Royal Navy. The illustrations are to be coloured lithographs, and the examples published in the above are very clear and well executed.

UP to the present date, *Nature* understands, there have been received in answer to the official letter of inquiry to the members of the British Association, as to whether they intended to go to Montreal or not, replies in the affirmative from 340. Among these are a good many who may be said to be really representative of English science, but, as might be expected, the younger men are present in a larger proportion than the older.

ACCORDING to the American *Sanitary Engineer* no temporising is employed in Chicago in dealing with electrical companies. All the wires of the Mutual Union Telegraph Company, in Chicago, were, it says, cut by order of the Mayor, March 2nd, because the provision of the franchise which required the company to put its wires underground by March 1st had not been complied with. The wires of the Board of Trade Telegraph Company were also cut.

ENORMOUS quantities of materials are now daily arriving at the International Fisheries Exhibition. The Chinese court will be the first ready for exhibition. Canada and the United States have delivered several hundreds of tons of exhibits. The Executive Committee have received from the German Consul-General official intimation of the appointment of delegates to represent at the Exhibition the fishery industries of Germany, prominent among whom is a pisciculturist of European reputation, Dr. Max von dem Borne. Although the Imperial Government, for reasons unexplained, has not thought fit to appoint a special Commissioner for Germany, instructions have been sent to the consulate to take charge of the interests of German exhibitors having no agents of their own.

THE following is from the "Passing Notes" of the *Echo*:—"It has been stated recently that in the manufacture of soda water, marble dust and oil of vitriol are largely used; and although there may be exaggeration in this, as there generally is in assertions of a wholesale character, still the imputation is one which the great brewers should be anxious to refute, as indeed they did successfully refute the charge of using aconite instead of hops in the manufacture of bitter beer." Let us hope the *Echo* will never learn anything about the extent to which coal is decomposed in the manufacture of beer, or of the way in which sulphuric acid and carbonate of lime are used in the raw grain process of brewing, or that it will not experience any pain on learning the origin of carbonic acid in aerated water.

THE cobweb state of overhead London is attracting some attention like that which has removed overhead wires from some towns in America. At a meeting of the City Commission of Sewers, on Tuesday, a letter was received from the joint committee of the vestries of St. Marylebone, St. George's, and St. James's, stating that they had under consideration the subject of the great increase in overhead telegraphic and telephonic wires across the public streets, and the consequent danger to life and property, and being of opinion that full control should be given to the local authorities over the erection and maintenance of overhead wires, they had determined to seek an interview with the Home Secretary on the matter. We may again call attention to the opportunity which the construction of the Inner Circle Completion Railway affords for leaving a splendid subway for telegraph and electric mains.

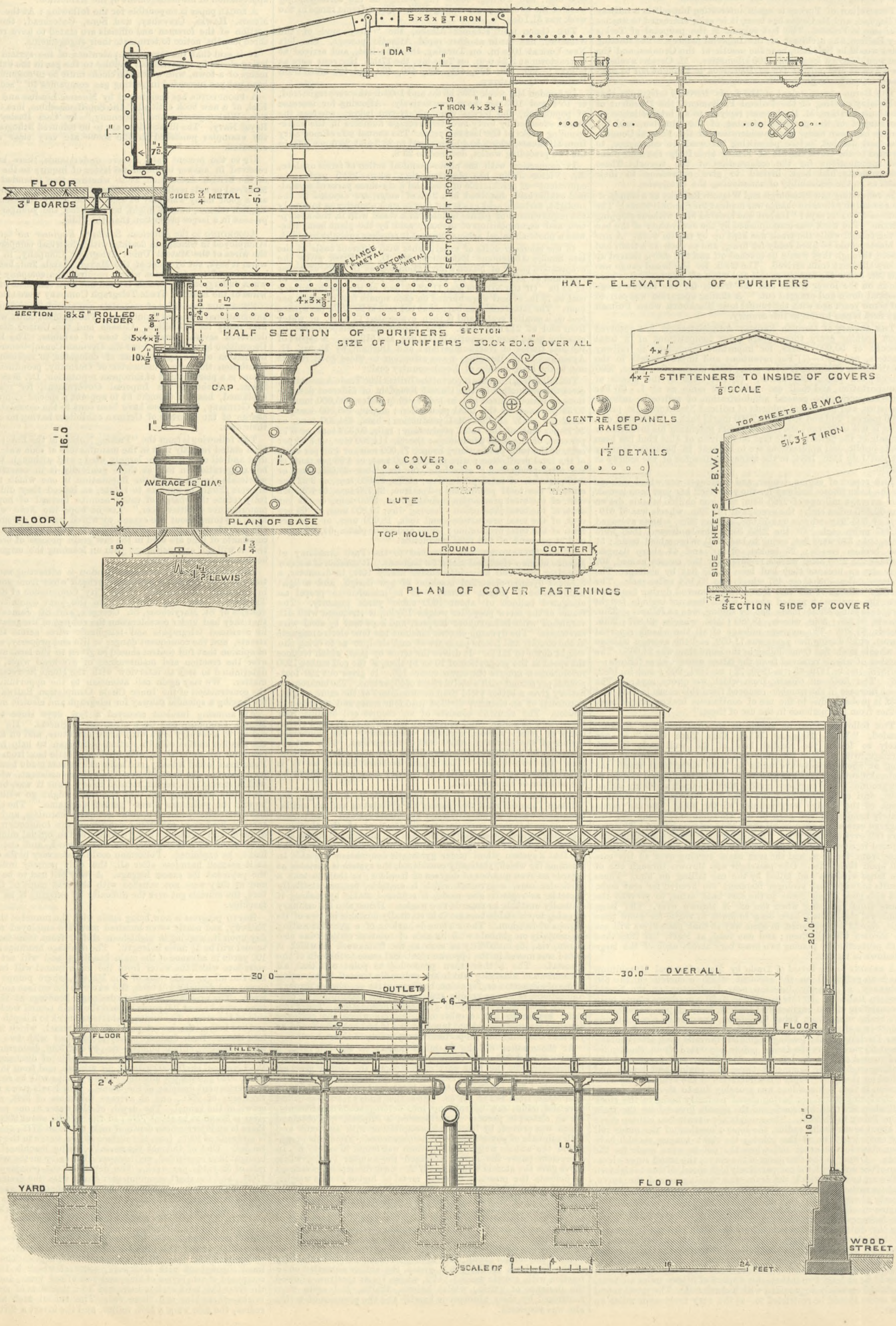
AN amusing incident occurred a few days since to one of Messrs. Crompton and Co.'s electrical engineers. He was proceeding to a country town with a new armature, and on arriving at the London station called a station policeman to help him, there being no porter in sight, with his heavy little box from the cab. Policeman found it heavy, and natural instincts made him question its contents. At first, Messrs. Crompton's assistant, who speaks with a strong Irish accent, refused to say what it was, but finding that time was going and that the train might go without him, he told the policeman it was "part of a dynamo." The electrician was immediately looked upon as not quite harmless, and the contents of his box as something dangerous, the connection between dynamo and dynamite being obvious to the official mind. Both were taken to a side place, the box opened, and the contents had to be explained. Policeman could make very little of it, but as it seemed harmless after all, the only penalty inflicted was the payment for excess luggage. A way bill had to be filled up, and as they were not satisfied with the real name of the armature, the officials got over the difficulty by entering it as a sewing machine.

RAPID progress is now being made with the tunnel of the Mersey Railway, and nearly seven hundred men are employed night and day upon it, working in eight-hour shifts, from four faces. The tunnel will be 3⅛ miles in length. The drainage headings are about 100 yards in advance of the main headings, and will act as reservoirs into which the water from the main tunnel will be drained and run off to both sides of the Mersey, where pumps of great power and draught will bring the water to the surface and into the river. The excavations of these drainage headings at the present time extend about 100 yards beyond the main tunnel works at each side of the river. The drainage shafts are sunk to a depth of 180ft., and are below the lowest point of the tunnel, which is drained into them. Each drainage shaft is supplied with two pumping sets, consisting of four pumps—viz., two of 20in. diameter, and two of 30in. diameter. These pumps are capable of discharging from the Liverpool shaft 6100 gallons per minute, and from the Birkenhead, 5040 gallons per minute. These pumps will be required for the permanent draining of the tunnel. The levels give a minimum thickness of 25ft., and an average thickness of 30ft, above the crown of the tunnel. The depth of the water in one part of the river is found to be about 72ft.; in the middle about 90ft.; and as there is an intermediate depth of rock of about 27ft., the distance is upwards of 100ft. from the surface at low water to the top of the tunnel. One of Colonel Beaumont's boring machines has been brought into requisition, and is expected to carry on the work at the rate of 50 yards per week. The depth of the pumping shaft is 170ft., and the shaft communicates direct with the drainage heading. This circular heading has advanced about 737 yards. It is 7ft. in diameter, and the amount of it under the river is upwards of 200 yards on each side. The main tunnel, which is 26ft. wide and 21ft. high, has also made considerable progress at both the Liverpool and the Birkenhead ends. From the Liverpool shore the tunnel now extends over 430 yards, and from the opposite shore about 590 yards. This includes the underground stations, each of which is 400ft. long, 51ft. wide, and 32ft. high. The tunnel is lined throughout with brickwork, some of which is 18in. thick, composed of two layers of blue, and two of red brick, and towards the river this brickwork is increased to a thickness of six rings of bricks—three blue and three red. The tunnel arch has a 13ft. radius, the side walls a 25ft. radius, and the invert a 40ft. radius,

CONTRACTS OPEN.—PURIFIER HOUSE, BURY GASWORKS.

MR. J. CARTWRIGHT, ASSOC. M. INST. C.E., BURY.

(*For description see page 310.*)



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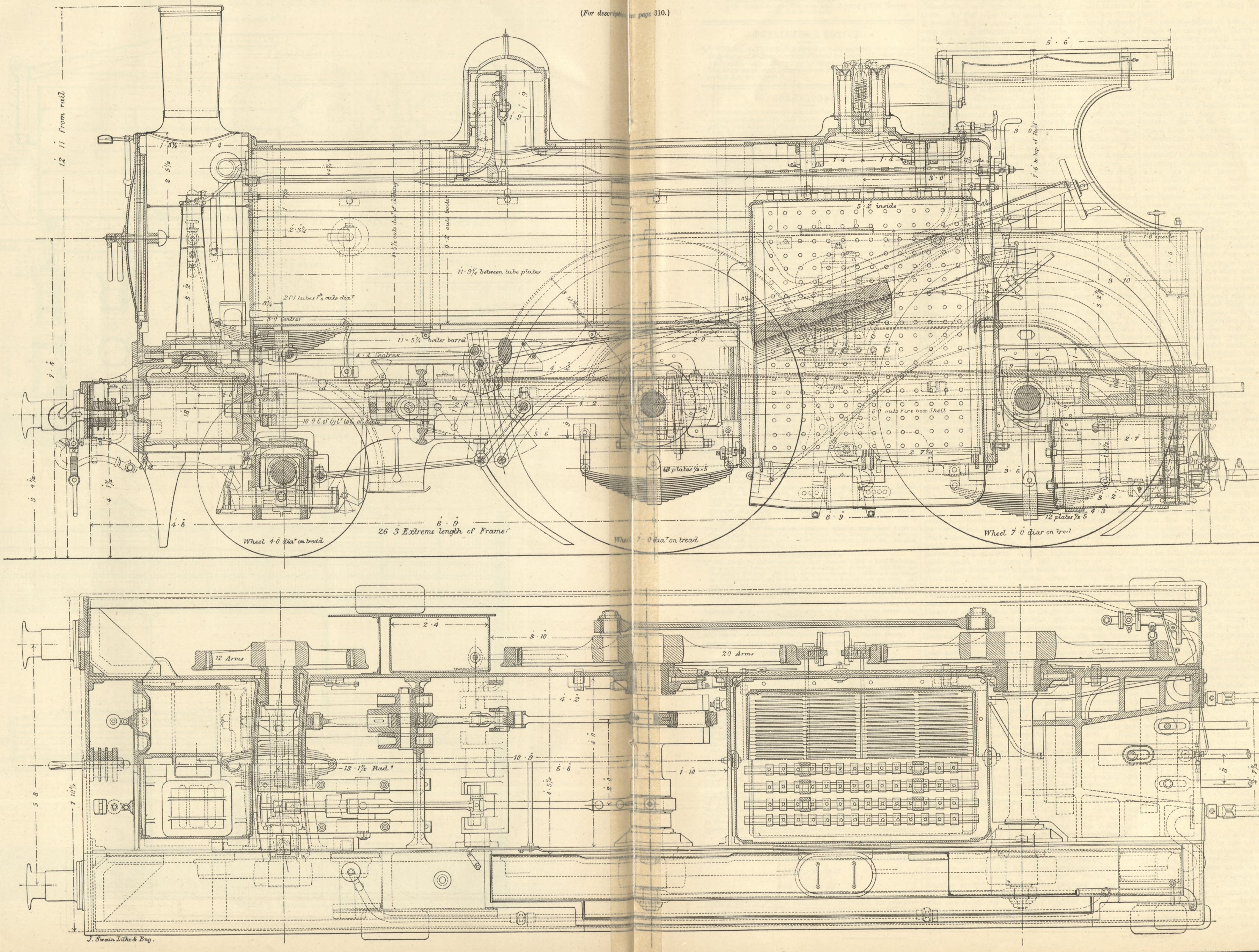
CONSTRUCTED FROM THE DESIGNS OF MR. T. W. WORSDELL, LOCOMOTIVE SUPERINTENDENT, AT STRATFORD WORKS.

(For description see page 310.)



J. Swain Litho & Eng.

PUBLISHER'S NOTICE.

**** With this week's number is issued as a Supplement, a Two-page Engraving of a Four-Coupled Express Locomotive for the Great Eastern Railway. Every copy as issued by the Publisher contains this Supplement, and subscribers are requested to notify the fact should they not receive it.*

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.*

*** *We cannot undertake to return drawings or manuscripts; we must therefore request correspondents to keep copies.*

CONDENSER.—*There is practically nothing to choose between the two plans. Neither will give you a quarter of an inch vacuum better than the other.*

J R. (Newport).—*We do not know of a good book on the subject having the English measures alone. Almost all books of the kind are written with metric measures.*

A. Z.—*Taking the facts as stated, the invention would be worth protection if new, and supposing that the machine when it lifts the 2lb. is lifting ½ lb. more than it would ordinarily if in proper working order, or more than other existing machines. It would be impossible to give a definite answer to your question without more information.*

NEMO.—*Ten feet driving wheels were once tried on an English railway. The Bristol and Exeter broad gauge railway was worked until a comparatively recent period with double bogie tank engines, designed by Mr. Pearson. They had a single pair of driving wheels 9ft. in diameter, and cylinders 17in. by 24in. stroke. The Great Northern and Great Western express engines have driving wheels 8ft. in diameter. These last are the largest wheels now in use. The Cornwall, London and North-Western locomotive, had 9ft. drivers.*

GEOGRAPHICAL CLOCK.

(*To the Editor of The Engineer.*)

SIR,—Can any of your readers kindly furnish the address of Mr. Juvert, a Swiss resident in America, the inventor of a new nautical or geographical clock? SEAMAN.

Cronstadt, April 5th.

MACHINES FOR CUTTING AND MAKING HESSIAN BAGS.

(*To the Editor of The Engineer.*)

SIR,—Will any of your readers kindly inform me where I can obtain the machine for cutting and making Hessian bags? I understand the machines are made in Glasgow. J. C.

Manchester, April 18th.

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Advertisements cannot be inserted unless Delivered before Six o'clock on Thursday Evening in each Week.

Letters relating to Advertisements and the Publishing Department of the paper are to be addressed to the Publisher, Mr. George Leopold Riche; all other letters to be addressed to the Editor of THE ENGINEER, 163, *Strand.*

MEETINGS NEXT WEEK.

THE INSTITUTION OF CIVIL ENGINEERS.—Tuesday, April 24th, at 8 p.m.: Ordinary meeting. Paper to be discussed, "The Introduction of Irrigation into New Countries, as Illustrated in North-Eastern Colorado," by Mr. P. O'Meara, M. Inst. C.E. Paper to be read, "Resistance on Railway Curves as an Element of Danger," by Mr. John Mackenzie, Assoc. M. Inst. C.E.

SOCIETY OF TELEGRAPH ENGINEERS AND ELECTRICIANS.—Thursday, April 26th, at 8 p.m., the discussion will be continued on the following papers:—"On Some New Forms of Telephone Transmitters, with a Note on the Action of the Microphone," by Mr. John Munro, Associate. "On the Influence of Surface Condensed Gas upon the Action of the Microphone," by Messrs. I. Probert and Alfred W. Seward, Associates. "On Microphonic Contacts," by Mr. Shelford Bidwell, M.A., LL.B., Associate.

SOCIETY OF ARTS.—Monday, April 23rd, at 8 p.m.: Cantor Lectures, "The Transmission of Energy," by Professor Osborne Reynolds, M.A., F.R.S. Lecture I.—General considerations relating to the transmission of energy. The means by which, and the distances through which, energy is transmitted in Nature. The distribution of energy on the earth, and the means of concentrating and distributing it. Tuesday, April 24th, at 8 p.m.: Special meeting. Adjourned discussion on the paper by Mr. H. Trueman Wood, B.A., "On the Government Patent Bill." Mr. Richard E. Webster, Q.C., will preside. Wednesday, April 25th, at 8 p.m.: Nineteenth ordinary meeting, "Economy of Sanitation," by Captain Douglas Galton, C.B., F.R.S. Mr. Robert Rawlinson, C.B., will preside. Thursday, April 26th, at 8 p.m.: Applied Chemistry and Physics Section, "A New Process for the Separation and Recovery of the Volatile Constituents of Coal," by Mr. T. B. Lightfoot, M. Inst. C.E. Sir H. Hussey Vivian, Bart., M.P., will preside.

THE ENGINEER.

APRIL 20, 1883.

THE PATENT BILL.

ON Monday night Mr. Chamberlain moved the second reading of the Patent Bill, in, on the whole, an effective speech. Practically no criticism of the measure followed, nor is it likely that there will be any keen discussion of its clauses until it is committed. We have already published the text of the Bill, and no doubt most of our readers are well acquainted with its provisions. That it will become law precisely as it stands is, of course, highly improbable; but worse things might happen. The Bill is open to improvement, and we venture to hope that Mr. Chamberlain will admit the necessity of certain modifications. At the same time, radical changes in it are to be deprecated, for the measure as it stands is in most respects very good. A determined effort will be made, we understand, to introduce the principle of examination for novelty; and against anything of the kind it is impossible to protest too strongly. Mr. Chamberlain put the case against examination effectively; but much more will be heard on the subject. The principal points urged in favour of examination are that the Crown, by granting a patent for an invention not novel, virtually obtains money by false pretences. This is Sir F. Bramwell's contention, and it is based from first to last on a total misconception of the functions of the Crown and the nature of a patent. In former days patents were monopolies. They were not granted for inventions alone, but either as rewards for services rendered, or they were sold for money. Thus a man might obtain a monopoly for the importation or sale of a given species of goods. The modern patent is only a monopoly in name. It is a formal recognition by the State of a man's property in ideas. A patent no more confers a monopoly than do the title deeds of a house or an estate; and the law stamps such deeds, and charges for the stamps without any inquiry into the validity of the title. That is the affair of the individual who pays for the stamps. We do not suppose that Sir F. Bramwell holds that when a £5 stamp is put on a worthless deed at Somerset House, the Government has obtained money under false pretences. Many persons look on a patent as a favour conferred by the Crown on an inventor. This is the old idea, originating in the time when monopolies existed. The modern patent ought to be obtained by right, and not as a matter of favour—which is the existing legal theory—and is nothing more after all than a permission to sue anyone who attempts to appropriate the inventor's ideas. The State has decided that this property in ideas shall not endure more than fourteen years. Some persons hold that it should endure for ever; but whatever may be said of the theoretical propriety of such a contention, the carrying of the theory into practice is simply impracticable. If we look on patents from the point of view we have stated, it will be seen that there is absolutely no reason whatever why Government should pronounce any opinion concerning the novelty of an invention.

Many persons admit all this, but while they decline to go so far as to demand examination for novelty as a right, they do not hesitate to say that it ought to be insisted on as a matter of extreme convenience. If it could be shown that infallible examiners could be had, then perhaps there might be no objection to the system; but we do not hesitate to say that it would be quite impossible to get together anything like a competent staff of examiners, or to effect anything really valuable with their aid if they could be procured. Lacking infallibility, they must be worse than useless; and this we think will be understood if we consider for a moment the intricate nature of the questions they would be called upon to decide. Let us suppose that a man invents a new valve gear. This gear to the eye of the ordinary engineer is identical with one already in use, but the inventor knows that there are such differences between the two that he gets a much better diagram than can be had from that which apparently anticipates it. The difference may to all appearance be very small, and yet, nevertheless, it may be one of vital importance. Is it to be supposed that an examiner would perceive the difference? There can be but one answer to this question. No. To suppose the contrary of valve gears is to suppose the contrary of a thousand other inventions which would be submitted to the examiner during his official career. It is admitted, however, that the examiner might make mistakes, and the power of appeal from his decision is granted; but the moment this is conceded the whole edifice built on the theory of examination falls to the ground. Grant that the examiner may make a mistake, and the guarantee of novelty which examination is supposed to confer ceases to have existence. If we go on to appeal, the case becomes worse in another respect, because this appeal means loss of time and money, as anyone who has tried to get an American patent knows. There is another argument used in some quarters, namely, that under no circumstances should the grant of a patent be refused, but that a staff of examiners should tell the intending patentee that he was anticipated by such and such prior patents, and warned that his patent would, in the opinion of the examiners, be worthless; and some persons would even go so far as to have the statement of the examiner endorsed on the patent. We are at one with Mr. Chamberlain in saying that "no manufacturer would deal with a patent so endorsed. Again, it has been suggested that such result of the examination should not be endorsed on the patent, but should be privately communicated to the inventor. That is a proposal of a very specious character; but it must not be forgotten that the examination suggested could be far better made by the inventor himself, who could tell much better where to put his finger on previous specifications affecting his own, than any other person. Lastly, why should the Government "make an exception in favour of the inventor in order to assist him in his own business. Sir J. Stephen suggested that to do so would be very much the same as for a court of justice to advise a suitor whether or not he had a good cause of action. The Government would give the inventor every facility in prosecuting his search; but they could not take upon themselves to make it for him." Another point desiring careful attention is the proposed examination for fitness. On what principle are those to act who are called upon to decide whether an invention is a fit subject for a patent or not? This is a matter which requires very painstaking consideration. Again, we find that a patent is to be granted for only one invention. This seems at first sight to be quite a reasonable stipulation, but as a matter of fact, if it is carried into effect, it will deprive the Bill of a very large portion of the advantages which it proposes to confer, and will besides lead to endless worry and litigation. The matter is so important that we make no apology for dealing with it at some length.

Inventions admit of being divided into two classes, viz, simple and compound. As an example of the former may be cited putting a small lamp in the heel of a boot to keep the foot warm in winter. The proposed innovation would leave inventions of this class untouched. But Messrs. Farad and Volt invent a new dynamo, one of the special features of which is the commutator, and this commutator is made in four different ways. Now, under the existing law Messrs. Farad and Volt take out a single patent for "improvements in dynamo-electric machines," and they describe all four commutators as modifications of the whole machine, and they pay in stamp duties £25 for their patent. But in the United States four distinct patents would have to be taken out, and in this country, if Mr. Chamberlain's Bill becomes law in its present form, it would seem that much the same result would ensue. We met with an instance not long since in which a well-known American electrician had to take out seventeen patents, when one or at most two would have sufficed in this country. It is, we admit, highly desirable that too many things shall not be included in one specification. But there is no reason to think that the present system has been abused in this way; and it is not by any means easy to see how the sub-division of patents can be effected as proposed, without entailing a great deal of hardship, especially on poor inventors. Mr. Trueman Wood read a paper before the Society of Arts on Wednesday evening, in which, dealing with this question in a slightly different form, he said:—"The patent is only to be granted for a single invention, and if these words are not construed in too close and exacting a spirit, there can be no objection to such a provision. It is, however, the opinion of some well qualified to judge, that the rules will be interpreted to mean that only a single claim will be permitted. Sir Edward Reed, answering Sir John Lubbock's objection to this clause in the debate on Monday, said that this was not the intention; but at any rate, there is grave doubt whether the Bill does not admit of such a rendering, and the point ought to be made clear. How in the world could anybody, after constructing a complicated machine, state, in a single sentence, what it was he demanded protection for? How is the inventor of a new steam engine, an improved loom, or any other complicated piece of machinery, to formulate his demands in a single claim? The invention may consist partly in a new adaptation of old parts, partly in the application of new parts; or it may be wholly and entirely new. The thing would be perfectly hopeless, unless, indeed, the inventor is allowed to take refuge in the usual American claim for 'the whole invention substantially as described,' in which case it would be almost impossible to prove infringement." Mr. Anderson, speaking on Monday night, said "the only pretence of justification that had ever been made for the high charges of patents in England was that an English patent covered as much as three or four American patents. The President of the Board of Trade, who made that defence for the present charges two years ago, did not tell the House that by the present Bill he was going to do away with that advantage. By Clause 31 no patent was to cover more than one invention, and an English patent would in future cover no more than an American. In that case the reduction of fees entirely disappeared, and a man might have to pay in future £462 where he now paid £154. If that clause were to be adhered to, it would be a good reason for lowering the fees to the same level as the American." This constitutes really one of the most important questions for discussion and amendment in the whole Bill, and we trust will receive in Parliament the consideration which is imperatively demanded in the interests of the inventor.

We have not space to do more than glance at one other point, namely, the sense in which the words "first and true inventor" are used. These words ought to be expunged. They have no meaning; and it is quite immaterial whether the patent is granted to the first and true inventor or not, so long as it is granted with his consent. The applicant for the patent should declare that he is in possession of an invention; and that should suffice. As has been pointed out in our columns, hosts of patents are now granted to men who are in no sense or way the true inventors. Thus a foreman of works hits on a new thing. He takes it to his employers, and the result is that a joint patent is taken out by the foreman and one, or perhaps two, members of the firm. The principals do nothing whatever in the way of inventing; nor do they make the least scruple in going through the form of making the declaration. We could cite many instances of this. Now if the members of the firm only declared that they were in possession of the invention, every useful purpose would be served. As matters stand, the declaration is a dead letter; making it is regarded as a mere legal form; and to prove it to be untrue is, of course, impossible, unless the implicated party chooses to convict himself. In one sense, every time an action is brought to break down a patent, an attempt is made to show that the patentee is not the first and true inventor, and records of our law courts show how difficult it is to prove anything of the kind.

There is much to be said concerning many other points raised by the Bill, to the consideration of which we shall return. For the moment we must content ourselves with pointing out, as we have done, that in one vital respect the greatest precautions must be taken to prevent a mistake being made. It is necessary that the Government should at once state very definitely, and as clearly as possible, what is meant by the statement that a patent is only to be granted for a single invention. It is very well for Sir Edward Reed, or any other member of Parliament, to say that it is not intended to place a rigid interpretation on any particular claim; but nothing is more certain to lead to litigation than this vague way of making law. We believe that a very moderate amount of supervision would suffice to keep even the most exuberant inventor within bounds. Up to the present no complaints have been made that too much has been claimed in one specification, and the contemplated reduction in Patent-office fees and expenses generally will diminish the temptations of inventors to sin in this way. Therefore, it will be less necessary than ever to make a change, which we cannot help thinking would be a change for the worse. The Bill, as a whole, has our warm approval. Indeed, our readers will not fail to see that it follows very closely the lines we ourselves sketched out before the draft Bill was made public. The points on which we and Mr. Chamberlain differ are not numerous or important, and nothing could be better than the spirit in which he proposed the second reading. He concluded his speech by saying that the Bill undoubtedly proceeded upon a belief of his own that an inventor was a person to be encouraged, and not repressed. He was a creator of trade, and, accordingly, they desired in every way in their power to stimulate his inventive capacity and the capacity of others similarly situated. The object was one in which he took a deep interest, having had some experience of patents and knowing the obstacles in the way of inventors. The matter was one of general and large importance. There was no article which we used, there was nothing connected with the necessities of our life, or that contributed to the health or happiness, or security of the population, which had not at some time or other been the subject of a patent for an invention; and, accordingly, he would be very glad indeed if, with the assistance of the House, he was able to do anything to stimulate the inventive capacity of the people, and to add in that way to the resources and the prosperity of the country."

THE PROGRESS OF THE LOCOMOTIVE.

To paraphrase a well-known adage, one may say to a railway company, show me your locomotives, and I will tell you what your line is. The development of the locomotive, there is reason to believe, has in almost every case followed, instead of preceding, the development of traffic. The prominent features in modern locomotive improvement are increase in power, and a still greater increase in weight. The former has been rendered necessary by the demand for high speeds and heavy trains; the latter because there seems to be a consensus of opinion among locomotive superintendents that the heavier an engine is the longer will it keep out of the repair shops. An excellent example of our meaning is supplied by the history of locomotives on the Great Eastern Railway. We illustrate this week the latest type of high-speed passenger engine in use on that line. Some twenty years ago all, or practically all, the fast passenger traffic was worked by outside cylinder single-driver engines, designed by Mr. Sinclair. The most improved of these engines were built by Messrs. Schneider and Co., of Creusot, and a few of them are, we believe, still running. The great defect of Mr. Sinclair's engines was that the cylinders would work loose, for reasons which we fully explained in a recent article; but as traffic developed, and the weight of trains increased, it was found that this type of engine was no longer sufficiently powerful, and Mr. Johnson and Mr. Adams built heavier and heavier engines. When Mr. Massey Bromley took the place of locomotive superintendent, he broke new ground, and abandoning to some extent English practice, he constructed several engines closely resembling the American Mogul type, using, however, plate instead of bar frames. These are four-coupled, outside cylinder engines, with a four-wheeled bogie in front, and a single pair of guide bars above the piston-rod. In several respects these engines have disappointed the expectations formed of them, but they have always been able to haul their trains with certainty and punctuality. Their principal defects have been that they are not economical, and that the valve gear has given trouble. The valves are placed American fashion on the tops of the cylinders, and are driven by weigh shafts, which we believe have in some cases been twisted across. Again, the slide bar and cross-head arrangement has for some reason not quite clear proved defective, requiring a good deal more attention and lubrication than the ordinary system. The mass of reciprocating weight too is increased, and this seems to have told unfavourably on the engines. But there is a great deal about the design to recommend it, and it is possible that further experience with it would have shown how the defects could be eliminated.

In the engine which we illustrate it will be seen that Mr. Worsdell has taken a new departure. The work to be done by the Great Eastern Railway has increased so much that nothing but locomotives of the heaviest class can deal with it in the summer or excursion season. The express engines have to maintain high speeds with as many as twenty-four coaches, all well loaded, up long inclines of as much as 1 in 90, and round curves of as little as nine chains radius. The astonishing development of traffic has rendered extremely powerful engines necessary, and in pursuance of what we have stated in the beginning of this article, the heavy engine has been called into existence by the traffic, not the long trains by the heavy engine. Twenty-two and twenty-four coaches are run in a train, not because it happens that there are engines ready to draw them, but because there are passengers ready to fill them, and the number of trains cannot be increased. To deal with this traffic, therefore, Mr. Worsdell has provided, as will be seen from our drawings, engines with 18in. cylinders, 24in. stroke, and four 7ft. driving wheels. The tractive effort of these engines is equal to 92·5 lb. for each pound of average pressure in the cylinder. This last may be taken at about 75 lb. in full gear corresponding to a gross tractive effort of about 3 tons, and the adhesion necessary to utilise this would be supplied by a weight of 18 tons; but in starting a train the average pressure will probably nearly reach or even exceed 100 lb. on the square inch, and in slippery weather the adhesion will be less than one-sixth. The total weight of the engine in running order is about 42 tons, and so large a part of this is carried by the driving wheels that the engine will not lack adhesion.

There are several features in the design which will amply repay attention, and can hardly fail to meet with general approval from locomotive superintendents and others. Among these may be particularly mentioned the way in which the valve gear has been constructed, the manner in which it is put together and worked out being in several respects superior to that adopted by Mr. Webb. This is not to be wondered at, however, for improvement follows experience. An examination of a drawing, however carefully made, fails to convey a good idea of the dimensions of parts; and an inspection of the engine can alone make plain how ample are all the proportions adopted. The driving wheels are probably the strongest of the diameter ever put under a locomotive, weighing as they do complete, 4 tons 15 cwt. per pair. The boiler is of unusually large size, especially as regards the fire-box and grate, and the result is that steam is kept with the utmost ease, and so far as can yet be learned, with great economy. We have said that these engines have on the Cambridge line to traverse curves of very small radius. Flexibility has been provided not by a bogie, but by a radiating leading axle-box, the construction of which is clearly shown in our engravings. An elliptical spring controls the motion of the axle, or, rather, of the engine, right and left. The fittings are simple, compact, and very unlikely to get out of order. There are some special advantages claimed by many engineers for the radiating axle-box over the bogie. One is that there is less chance of the engine jumping off the metals when there is only a single pair of leading wheels, because the weight holding it down is greater than the weight on a leading pair of bogie wheels. Again, the radial arrangement shown is about one half the weight of, and much less expensive than a four-wheeled bogie would have been; and furthermore, the single axle will always radiate truly to the curve, while it is obvious that both axles of a bogie cannot do this. Against the radiating arrangement it is urged that an excessive load is brought on a single pair of wheels as compared with the more perfect distribution and subdivision of about one-third of the weight of the whole engine, effected by the bogie; but, on the other hand, it is argued that in any case the rails will have to carry a greater load on the driving wheels, and that whether the leading wheels are or are not loaded nearly as much, makes no manner of difference to the rails. The great objection, in our opinion, to the traversing axle-box as hitherto made is its tendency to move in jerks, and this is especially true when inclined planes are used as steadiers. The Bissel truck is a notorious offender in this respect. To get rid of the objection various steadying devices have been employed, such as india-rubber buffers acting laterally; these always fail in a little time—either oil gets access to them or they become hard. Helical springs are so used to better purpose; but such springs are either too stiff or not strong enough, for it is by no means easy to make a very short helical spring which shall have a play of an inch and a-half or so without much variation in resistance. Mr. Worsdell appears to us to have put in the best solution of the difficulty yet devised, because he obtains by the use of an elliptical spring plenty of uniformity of action and sufficient length of play, without undue stiffness; and the spring lies comfortably, as will be seen, in a species of pocket, where it is accessible for examination, and from which it can be removed with considerable ease for inspection or repair, or to be replaced by another which is not the case with most other arrangements for steadying traversing axle-boxes; helical springs being sometimes so fitted that they cannot be properly examined without jacking the engine up and taking out the leading axle. Nor have the results disappointed Mr. Worsdell's anticipations. These engines run round short curves at sixty miles an hour with the utmost steadiness, and will take them at that speed without jerk or jolt.

The cylinders are cast in one, and while much fitting is saved, a perfectly firm job is made. The valve chests are on top of the cylinders, and to the normal eye the crank shaft presents a curious appearance, being without excentrics. Concerning the working of the valve gear it need only be said that Mr. Worsdell informs us that it leaves nothing to be desired. As a series of papers on Joy's valve gear is now being published in our columns, it would be superfluous to say much concerning it here. It will be seen that its adoption has has indirectly led to the raising of the centre of the boiler high above the rails. This comes about in this way:—It is well-known that it is almost impossible to get in a pair of 18in. cylinders with the valve chests between them between the frames of a locomotive for the 4ft. 8½in. gauge. It can just be done and no more, and when it is done the crank shaft bearings must be made very short, which means plenty of re-fitting of brasses—a thing of all others to be avoided. With Joy's gear, however, the valves find their legitimate place on the top of the cylinders, and this, without the aid of rocking shafts having to be called in. But when the inside valve chests are eliminated the cranks can be brought closer together, and bearings of ample length can be got; but the closer the cranks; the higher must be the boiler, in order that it may clear them, and when we combine a 7ft. wheel, a 24in. stroke, and a boiler about 4ft. 3in. in diameter, we are bound to have a lofty engine. To engines with high centres of gravity some persons have, we know, a great objection; but it is questionable if it is in any sense or way a defect. No one ever heard of a locomotive being upset, save by running off the line, so that element of danger may be excluded from our calculations; and for the rest it seems to be generally conceded that the high engine will run more easily and steadily and spare the road more *lateral* shocks than the low engine will.

In this engine we have what may be regarded as perhaps the very latest development of the locomotive engineer's skill and science in this country. The most noteworthy departure from normal practice is the adoption of the Joy gear; and from the experience so far acquired with it, and the favour which it has met with, both in this country and abroad, we are strongly disposed to believe that it will ultimately supersede the link motion. The ease with which an engine fitted with it can be handled, and the admirable distribution of the steam which it effects, leave nothing to be desired. The only possible weak points in it which we can see are the two radius rods, as they may be called, extending horizontally forward to the horn plates. These rods have very little strain on them, but their motion is very peculiar, and at high speeds they seem to be tossed about in a strange fashion. They are, as fitted by Mr. Worsdell, made of tubes with solid ends forged in them, for the sake of lightness. It may yet be found that such rods will give trouble, though they have given none as yet, and it is open to question whether some arrangement of slot and die might not be found preferable. To say that the engine we illustrate reflects credit on Mr. Worsdell and the Great Eastern shops at Stratford is no more than is due to both; and although engineers may differ as to the merits and demerits of certain points of detail, every railway man of experience and knowledge will admit that the locomotive in Mr. Worsdell's hands has made considerable progress.

PLATE PRODUCTION IN THE NORTH.

Although it has had its fluctuations, the plate manufacture is so greatly the support of the iron trade of the North of England, that it is worth while at the present time to learn the extent of the production to estimate the effects upon that manufacture of the attempt to restrict the output of iron in the North that has now been commenced. We have in the returns of the Board of Arbitration the best test, for though they do not include the whole of the plates made in the North, yet they include the great bulk, and they may be taken as a fair criterion all through—the quantity made by the outside makers being proportionate probably all through the years. The production as shown by the official returns was in the year 1872 a little over 177,850 tons, and it fluctuated up and down for a few years, the quantity for 1876 being slightly over 172,370 tons; but in the following year it shot up to 214,723 tons. In 1880 it had reached 316,000 tons; in 1881 the quantity was 391,000 tons; and in 1882 it reached the unexampled quantity of 433,216 tons. For the present year it is not probable the output of the past year will be exceeded; indeed it is much more likely that it will be rather reduced, because two plate mills—one at Bishop Auckland and the other at Darlington—have been closed for three months. The effect of the restriction must also on the whole reduce the output, because although there may be a larger production in each of the shifts to be worked, it cannot be expected that that will be to an extent sufficient to counterbalance entirely the loss of those that are idle. Concurrently with that reduction of the production of plates, there will be, to some extent in the North of England, an increased consumption, because some of the shipbuilding yards that have been in course of commencement for a few months will add to the consumption as they put down vessels. Hence it may be readily believed that the cost of iron plates will tend upwards; and as there is no such movement likely in the cost of steel plates, there may be more competition between the two metals. This is the probable outlook for the present, but a time must come when the demand for plates for shipbuilding purposes will know some check, and as it does, the full extent of the competition between steel and iron for plates for shipbuilding uses will be felt. This is the time to be looked forward to, when the effect of the restrictive policy that has now been entered upon will be apparent.

LITERATURE.

[Concluding Notice.]

Equilibrio Interno delle Pile Metalliche. By L. Allievi. Rome. 1882.

Signor Allievi treats separately, first, piers with only two vertical columns, which may be termed "plane" piers, since all the bracing lies in one plane; secondly, piers with four vertical columns at the corner of a rectangle; thirdly, piers with two columns leaning towards each other; and fourthly, those with four columns leaning towards an upper apex. Each horizontal section, or lattice compartment, is—in the second and fourth cases—composed of four upright pieces, twelve horizontal pieces, including the horizontal diagonals, and eight diagonal pieces on the vertical faces—that is, twenty-four pieces altogether, and there are eight joints. If there be n joints in a plane lattice, it is well known that $2n - 3$ is the number of links required to make it stiff, and the excess of the actual number of pieces over this is a measure of its "redundancy." In a lattice structure of three dimensions if there be n joints, there are needed $3n - 6$ links to stiffen it. In the above case of a single compartment of the pier, where $n = 8$, the number of links required is eighteen, so that of the twenty-four actual pieces six are redundant. For instance, one of the diagonals of each face might be dispensed with. Now, taking m such compartments one over the other, there are $4(m + 1)$ joints. The number of links needed for stiffness is thus $12(m + 1) - 6 = 12m + 6$. But there are $4m$ vertical links; $6(m + 1)$ horizontal pieces, and $8m$ side diagonals—that is, $18m + 6$ links altogether. Of these, therefore, there are $6m$ that are redundant. If one of each pair of crossing diagonals were removed, this would reduce the number of links by $(m + 1)$ horizontal diagonals, and $4m$ side diagonals, or $5m + 1$ altogether, thus still leaving $6m - (5m + 1)$, or $m - 1$ too many. Thus besides one diagonal from each side face, all the horizontal diagonals except two—on different horizontal planes—could be removed. This means simply that with this reduced number of links, if all the pieces were made enormously strong, a small force would not produce any appreciable deformation. But any one who has practical ideas on the subject can see, or a simple experiment will suffice to show that the links not being enormously strong, and the joints not fitting perfectly, and the forces of load and wind not being very small, the structure would be very greatly and even destructively deformed when thus shorn of all its redundant pieces. It would be especially deficient in stiffness against twisting round the vertical axis of the pier. The redundant pieces are put in to make good this deficiency of practical stiffness, and prevent these otherwise inevitable large deformations. Now, it should be more generally understood than it is that the influence of these extra pieces in altering and re-distributing the stresses through the structure is proportional to the magnitude of the deformations that would arise if these extra pieces were omitted. If this is remembered, the importance and practical utility of calculating by a correct method the effect of the redundancy will be more readily recognised, and this slightly difficult and tedious task more willingly undertaken in cases where life and the expenditure of much money and labour are involved.

The continuity of the columns from top to bottom introduces a fresh element of redundancy. Its influence is extremely small—as mentioned above—so long as the load is wholly vertical, but is greater when side wind pressures begin to act. In any case it cannot be precisely calculated because the general theory of bending is in an extremely imperfect condition. The jointing of the bracing members to the columns—not by pin joints, but by stiff flange or rivet joints—is one more element of redundancy which Signor Allievi shows to be of considerable importance in the case of side-pressures on the pier.

The method of investigation followed in this memoir is to consider separately the effect of a symmetrically distributed vertical load and that of side pressures or other forces producing bending moments, and then to add the separate results together. This is known to be a legitimate method so long as the whole deformation of the structure is small, and it is a highly convenient method. It is here generally referred to as the method of superpositions of small strains; but it should not be forgotten that this method becomes wholly fallacious as soon as the deformation becomes so large as to appreciably alter the moments of the applied forces. It is from oversight of this fact that a very erroneous theory of the strength of struts has been very commonly adopted by German and some English engineers.

Adopting this method, our author calculates everything in the first place in terms of the "displacements"—that is, the shiftings from the unloaded positions—of the joints. The difference of the displacements of the joints at the two ends of a bar gives the strain of that bar, and from this the stress is calculated by means of Young's Modulus of Elasticity.

The consideration of the symmetrically-distributed vertical load gives the sum of the displacements of the two or four joints at one level. That of the side pressures and bending moments gives the differences between these displacements. The sums and differences being thus found, the displacements are at once obtainable. Thus if there be two such joints, and the sum is found to be p and the difference q, then if δ and δ' be the two displacements, we find—

$$\delta + \delta' = p$$
$$\delta - \delta' = q$$
$$\therefore \delta = \tfrac{1}{2}(p + q) \text{ and } \delta' = \tfrac{1}{2}(p - q)$$

The equations for the solution of the problem are furnished by the following considerations. There being n joints, and each joint having a possible displacement in each of three directions, there are altogether $3n$ displacements to be determined. Of these six—in a structure that is not "plane"—are either zero, or are fixed arbitrarily by the mode of support. For instance, suppose one joint absolutely fixed; this determines its three displacements as each zero. This leaves the whole structure movable anyhow round this joint. Another joint now may be fixed so that it can only move along the line joining it with the first joint. This determines two of its three displacements as being zero, and we have now the whole structure still capable of being slewed round the line joining these two joints. A third joint may now be restrained from moving perpendicularly to the plane of these three joints, determining one of its three displacements as zero, and leaving two to be determined by the stresses. The six zero displacements fix the general position of the structure relatively to the earth. There remain $3n-6$ displacements to be calculated.

The equilibrium of the forces on the pins at the n joints furnishes $3n$ equations among the forces, because the resultant force in each of three directions must be zero. But of these $3n$ equations, six really indicate the balance of the structure as a whole—that is, the balance of what are termed the "external forces," the resultant external force being zero in each of three directions, and having zero moment round each of three axes. Thus $3n-6$ equations are left indicating the balance of the forces at the $3n$ joints, and are sufficient to determine the $3n-6$ displacements required if these equations are written in terms of the stresses per unit of sections on the links, the sections and lengths of the links, and of the modulus of elasticity of the material. These equations cannot be solved one by one, but must be combined as simultaneous equations in order to obtain the desired result, and thus arise the complications and tediousness of the whole process. Fortunately, all the equations are of the first dimension—involve no squares or higher powers of the unknown quantities—and the difficulty of the practical work is reduced to the laborious drudgery of a lot of simple arithmetical calculation, which, however, must be performed without mistake from beginning to end.

Four-fifths of the book are devoted to the calculation of the stresses, supposing the sections already determined. Of course the usual practical problem is the inverse of this, viz., to calculate the requisite sections, so that known safe stresses will not be overstepped. In most structures of a high degree of redundancy it is impossible to make the stresses in all the members uniformly the same. All that can be done is to insure them being less than what is considered unsafe. Unfortunately, only a very short final chapter is devoted to this practical converse problem, and it does not seem so satisfactory as those which precede it, in which the writer has checked off most of the equations and found them correct.

Another confessed deficiency in the book is that it supposes the loads and stresses to be constant and steady, so that the effect of oscillation of stress is left out of account. This is not extremely difficult to supply, however, by applying suitably different safe stresses for the different members, but the treatment would then become much more complex. Again, in compression members, the stress is taken as simply proportionate to the shortening, and thus the effect of buckling is disregarded Probably this does not affect the approximate accuracy of the results very seriously, if care be taken to allow comparatively low stresses on specially long struts, as is done by Signor Allievi in some numerical examples he gives.

A translation of the book into English might be useful if it were possible to simplify very greatly the mathematical modes of expression, but in its present form it would not find many English readers.

BOOKS RECEIVED.

The Student's Mechanics; an Introduction to the Study of Force and Motion. By Walter R. Browne, M.A., M.I.C.E. London: Charles Griffin and Co. 1883.

Weale's Series. Electro-metallurgy Practically Treated. By Alex. Watt. Eighth edition. London: Crosby Lockwood and Co. 1883.

Sixth Annual Report of the New York State Survey for the Year 1881. James T. Gardiner, Director.

L'Année Maritime Revue des Evenements qui se sont accomplis dans le Marines Française et Etrangères. Par Henri Durassier, Vol. v. Années 1880-1881. Paris: Challamel Ainé. 1883.

Electric Light; its Production and Use: Embodying Plain Directions for the Treatment of Voltaic Batteries, Electric Lamps, and Dynamo-electric Machines. By J. W. Urquhart. Edited by F. C. Webb, M.S.T.E. Second edition. London: Crosby Lockwood and Co. 1883.

Technologie der Waerme und des Wassers mit besonderer Bermerksichtigung des Dampfkesselbetriebes. Von Franz Schwackhoefer. Wien: G. P. Faesy. 1883.

Cotton Spinning; a Practical Treatise. By H. E. Walmsley. London: Simpkin, Marshall, and Co. 1883.

SIR CHARLES WILLIAM SIEMENS.

LAST week we had the pleasure of placing on record the fact that the Queen has been pleased to bestow honours on two scientific men; to-day it is again our duty to call attention to a similar honour which has been conferred on Dr. C. W. Siemens, the President of the British Association of last year. Sir Charles has written a good deal on comparatively varied subjects, and we need only direct attention to the chief of them to show that they treat of subjects which largely affect the times in which we live. His first paper appeared, in 1851, in the Proceedings of the Institute of Mechanical Engineers, on a "New Regenerative Condenser for High-pressure and Low-pressure Engines." During the next year or so appeared others on the "Expansion of Isolated Steam," and on the "Total Heat of Steam," in the Journal of the Franklin Institute, and on the "Conversion of Heat into Mechanical Effect." Then on a "Regenerative Steam Engine," which was read before the Royal Institution, and is to be found in the Proceedings of that body. Then we find there appeared the paper on "A Bathometer, or Instrument to Indicate the Depth of the Sea on Board Ship without Submerging a Line," in the Report of the British Association for 1861, which is a very remarkable instrument. Again, in the *Chemical News* for the next year, his paper on a "Regenerative Gas Furnace as Applied to Glass-houses, Puddling, Heating, &c.," appeared, while the next year was published, in the Report of the British Association of that date, his observation on the electrical resistance and electrification of some insulating materials under pressures up to 300 atmospheres.

The outer covering of deep-sea cables next engaged his attention, and on this he wrote in 1865; and about the same time appeared his paper "On Improved Chronometric Governors for Steam Engines" in the Proceedings of the Institute of Mechanical Engineers. Then we find him turning his attention to the conversion of dynamical into electrical force without the aid of permanent magnetism, for the results of which inquiries see Proceedings of the Royal Society for 1867; and again he returned to an old subject, viz., regenerative gas furnaces as applied to the manufacture of cast steel, the details of which appeared in the volume of the Journal of the Chemical Society for 1868. The next year he was elected president of the Mechanical Section of the British Association, and provided the opening address for the meeting of that section; and during this year appeared his paper in *Les Mondes* "On a Thermometer for Measuring the Temperature of the Bottom of the Sea." Again, after a lapse of two years, he gave the Bakerian Lecture before the Royal Society "On the Increase of Electrical Resistance in Conductors with Rise of Temperature and its Application to the Measure of Ordinary and Furnace Temperature;" and ten years ago he read before the Iron and Steel Institute his paper "On the Manufacture of Iron and Steel by a Direct Process." Since this date he has written of gas flames, electric lights, growth of vegetables by the electric light, conservation of energy, and a number of other interesting subjects. He is one of several brothers, all of whom have become distinguished in different branches of science; and the honour which has been paid him is one which is well-deserved.

THE ROYAL SHOW AT YORK.

THE indications of success at the forthcoming show at York are of an exceedingly promising nature. Now that the entries in the implement and machinery section have closed, it has been ascertained that the extent of this department, at least, will exceed the large display at Reading last year, and this notwithstanding the continuance of the heavy charges which have been in force for the last four years, especially as regards articles which are classed as "not exclusively agricultural," these exhibits being paid for at the rate of £1 per foot run. We append a tabular statement of the various descriptions of shedding allotted to the 373 exhibitors who have entered for the York meeting, compared with each of the last seven years:—

Shedding in Implement Yard—in feet.

Description of shedding.	York, 1883.	Reading, 1882	Derby, 1881.	Carlisle. 1880.	London, 1879.	Bristol, 1878.	Liverpool, 1877.	Birmingham, 1876.
	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.
Ordinary..	9,514	9,326	9,138	6,662	16,000	11,735	12,183	11,304
Machinery in motion	1,618	2,289	2,102	2,060	4,683	2,847	2,733	2,492
Side sheds	1,941	1,402	1,511	1,059	2,220	954	880	886
Total	13,103	13,017	12,751	9,781	22,903	15,546	15,796	14,682

The entries for live stock, butter, cheese, hives, honey, &c., do not close until the 1st of May; but inasmuch as the premiums offered reach a total of £5300, against £4000 competed for at Reading last year, there can be little doubt that the extent of these departments—more particularly live stock—will be considerably greater than at previous gatherings.

CONTRACTS OPEN.

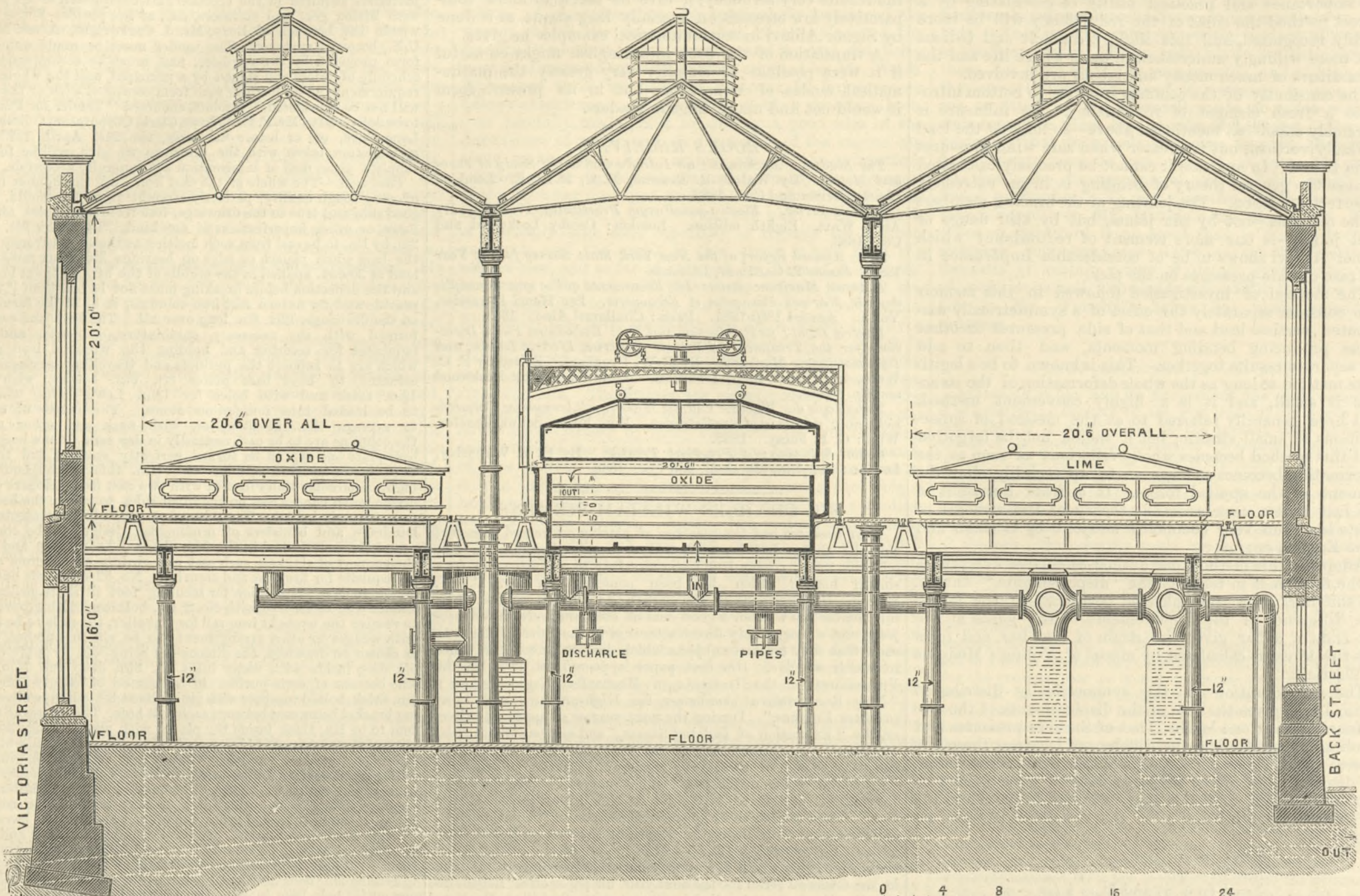
BURY GASWORKS.

THE Corporation of Bury require tenders for various works and materials required in the erection and completion of six purifiers with lifting gear and elevators, &c., at the purifier house, Elton, within the borough of Bury, Mr. J. Cartwright, Assoc. M. Inst. C.E., borough surveyor. The tender must be made out on the form provided by the engineer, and must be accompanied by a schedule of prices and signed by a principal, and the whole of the requirements as set forth in such form complied with or the tender will not be considered. Tenders, endorsed "Tender for Purifiers," to be delivered to Mr. F. Bull, Town Clerk, Corporation Offices, Bury, Lancashire, on or before Saturday, the 21st April, 1883. The specification taken with the drawings we give, will be found to supply a great deal of information not generally accessible.

Cast iron.—The whole of the cast iron work throughout must be of good tough quality, perfectly straight from the mould, with a good skin and true to the drawings, free from sand holes, air holes, flaws, or other imperfections of any kind. Test bars 3ft. 6in. by 2in. by 1in. to be cast from such melting as the engineer may direct; the bars when placed on edge on bearings 3ft. apart must bear a load of 30 cwt. applied in the middle of the bars, without breaking, and the deflection before breaking must not be less than $\frac{5}{16}$in. To provide and fix sixteen cast iron columns, to be of the form shown on the drawings, 12ft. 8in. long over all. The base and cap to be formed with the necessary entablature, supports, and other requisites for securing and holding the wrought iron girders, which are to support the purifiers and travelling carriages. The columns to have base plates 2ft. 6in. square, with metal $1\frac{3}{4}$in. thick and with holes for $1\frac{1}{2}$in. Lewis bolts, which are to be leaded into foundation stone. The shafts of columns to average 12in. in diameter, with neck and other moulds, the columns are to be cast vertically in dry sand in one length, the base plate and cap to be turned perfectly straight and true, the thickness of metal in columns to be 1in. thick throughout. One flight of circular stairs formed with two cast iron stringers of neat design, with flanges cast on the inner sides to which the heads are to be securely bolted. The sides of staircase to be protected with handrails and banisters of ornamental design, to be continued round the well formed in the floor above. To provide and fix for the support of staircase such cast iron girders or columns as may be requisite for firmness and security. No. 52 standards out of 1in. metal, to have preparation for securing feet to short girders, each standard to be secured with No. 2 1in. bolts and with groove at top to receive the wrought iron rail for traveller, the rails to be secured with wedges or other arrangement; to be six in number, erected as shown on drawings, the dimensions being 30ft. by $20\frac{1}{2}$ft. over all, 5ft. deep inside with water lutes 2ft. 9in. deep and $7\frac{1}{2}$in. wide. The bottom of each purifier to be formed of twenty-four plates $\frac{3}{4}$in. thick, bolted together with $\frac{3}{4}$in. bolts at 6in. pitch, a strengthening bracket being cast between each bolt hole. The flanges at the bottom to be 1in. thick inside the plates, with planed fillets 3in. deep clear of the plate and of $1\frac{1}{4}$in. metal. The side plates and water lutes to be cast together, formed by twenty cast iron plates, $\frac{3}{4}$in. thick, with planed overlap joints, bolted with $\frac{3}{4}$in. bolts, 6in. pitch, flanges same as bottom plates, except to be outside instead of inside. The opposite side of each purifier box to have cast on five ribs $1\frac{1}{4}$in. broad, to carry the wood grids, the other two sides to have snugs to carry the T-iron bearers. To have ornamental beads and panels of approved pattern on sides of lutes and heavy moulding on upper edge. Ribs are to be cast on the outside of the side and end plates to receive 3in. floor boards. Each purifier to have one inlet and one outlet hole 18in. in diameter, formed in the bottom plates in the positions shown on drawings, also two holes 24in. in diameter for outlet shoots, the metal round these holes to be thickened to $\frac{7}{8}$in. for the width of the pipe flange, and to be prepared for $\frac{7}{8}$in. bolts, with holes corresponding with bolt holes in pipe flanges. The gas inlet holes to be fitted with wrought iron hoods of $\frac{1}{4}$in. plate, and all other appliances for the carrying of T bars, and protection of oxide and lime from entering the pipes. Each purifier to have in the position shown a rectangular outlet pipe, about 2ft. 6in. by 1ft. 6in. wide, formed of plates $\frac{5}{8}$in. thickness, with 1in. metal flanges secured with $\frac{3}{4}$in. bolts to the side plates. The outside of these pipes to have ribs cast on corresponding to those upon the side plates. Underneath each purifier to be two cast iron shoots $6\frac{1}{2}$ft. long, tapering from 24in. at the top to 18in. at the bottom end. Each outlet to be fitted with one of Morton's patent self-sealing lids. The shoot is to be securely bolted to bottom plates, as before described, and preparation made for a padlock to be applied to secure the same. The inlet to the shoot to be fitted with tiers of hinged grids, with the necessary chains and handles to allow the opening of the same from within the purifying box, in order to empty the spent oxide. Each purifier to be provided with cast iron pillars for supporting one end of T-iron bearers, bolted to the bottom plates each with four $\frac{3}{4}$in. bolts, and snugs cast on to receive the ends of bearers to correspond in height with those upon the sides of the purifiers. The four oxide purifiers to be worked by one of C. and W. Walker's 18in. dry faced centre valves, to work three boxes at a time, one being shut off. The two lime purifiers to be worked by two 18in. four way dry centre valves, C. and W. Walker's make, so as to work both at once or either, and also to bye-pass both. No. 2 18in. slide valves, double faced, to be fixed as shown, to be of the most approved make. The mains for both inlet and outlet to purifiers will be laid by the gas committee to within 2ft. of the outer walls of purifier house, and the contractor shall allow for the supply and coupling up of pipes to these points.

Wrought iron.—The whole of the wrought iron is to be that known as best Staffordshire, to be capable of bearing a tensile strain of 10 tons per square inch of section without permanent set, and at least 21 tons per square inch before fracture. The iron for bolts and rivets to be capable of bearing a tensile strain of at least 18 tons to the circular inch before fracture. The whole of the plates, tee and angle iron, to be sound, tough, free from cracks, flaws, indentations, or other imperfections; to be carefully straightened, flattened, or curved to the required shapes before being drilled, so that all surfaces be in contact metal to metal; they shall gauge everywhere the full thickness and dimensions figured or shown on drawings, truly planed at the ends where girder meets girder, so as to make accurate butt joints; they shall in all respects be well and truly fitted and put together with all necessary packing pieces, rivets, bolts, and screws, whether shown on the drawings or not. The edges of all plates must be planed so as to show a clean and perfect line on all sides. The main girders must have provision for bolting together with No. 6 1in. bolts at each joint, and also for bolting down to the columns. They must have shoes supported from the bottom flange for securing the "cross girders" and "short girders," each of which must be bolted to main girder by No. 2 1in. bolts, the particulars as to construction and workmanship to apply equally to both main, cross, and short girders, all of which must have the angle iron continued at the ends, and also have $\frac{5}{8}$in. plate covers at end securely rivetted to angle iron. The cross and short girders must have provision for securely bolting the same to the main girders, the whole forming when fixed one rigid and complete framework, the upper surfaces of which shall all be flush, strictly level, and true for receiving the purifier boxes. All rivetting of girders throughout to be 4in. pitch and $\frac{3}{4}$in. diameter rivets; great care must be taken to have the rivets and bolt holes opposite each other; all holes must either be drilled or carefully punched to the exact size required, the rivets on the top surface and ends being all countersunk and finished to a level and smooth surface, the rest of the heads throughout to be cup-headed and machine pressed either by steam or hydraulic power. No rivet or bolt hole shall be made nearer the edge of plate than its own diameter plus $\frac{1}{8}$in. The several forms and dimensions of girders are set forth in the schedule of quantities attached. Each purifier to be provided with a wrought iron cover 29ft. 6in. by 19ft. 6in. by 3ft. deep at the sides. Top sheets to be No. 8 B.W.G., side sheets No. 4 B.W.G., with T-iron strengthening piece round

CONTRACTS OPEN—BURY GASWORKS.



SECTION. A.B.

0 4 8 16 24 SCALE OF FEET

bottom edge, each cover to be trussed as shown on drawings, and every provision made for the filboes for lifting covers as shown. The plates' rivets to be 1⅜in. pitch. To provide T-iron bearers 3in. by 4in. by ½in. to be fitted in the purifiers for carrying wood grids. To provide iron rails of the section shown on drawings, to be securely bolted down to standards supported by iron girders. To have twenty sets of holding-down lugs with all necessary preparations for cotters and wrought iron holders, as shown on drawings. All bolts and nuts to have square heads, and nuts and bolts to have square shanks under the head. The whole of the cast iron to have one coat of oxide paint, and the wrought iron one coat boiled oil at the manufactory before any rust has established itself. The whole after erection to have two coats of oxide of iron paint, best quality.

Quantities.—For the assistance of the contractor, the following summary of the approximate quantities of the various materials required are given, but the contractor must carefully examine the drawings which are attached herewith, and compare for himself as to their accuracy, as after the acceptance of the tender no allowance whatever will be made for any deficiencies, errors, or omissions that may afterwards be discovered :—

Wrought Iron :—

	No.	Length	Span	Depth.	Two flanges	Four angle irons.	Web.	Two T-iron stiffeners every 4ft.
		Average ft. in.	ft. in.	in.	in. in.	in. in. in.	in	in. in. in.
Plate girders	18	26 0	23 6	24	10×½	5×4×½	⅜	5×3×½
	42	18 0	17 0	15	—	4×4×⅜	⅜	4×3×⅜
Rolled girders.. ..	16	9 0	8 0	8	5	—	—	—
	16	6 6	5 6	8	5	—	—	—

1813 lineal feet of T-iron bars, 4in. by 3in. by ½in.; 450 lineal feet of iron rails, 7in. deep, 6in. bottom flange ; No. 6 purifier covers, 29ft. by 19ft. 6in. by 3ft. sides.

Cast Iron.—No. 6 purifying boxes, 30ft. by 20ft. 6in. over all by 5ft. clear inside ; No. 16 columns, 12ft. 8in. long, 12in. average diameter, 1in. metal, with base-plate 2ft. 6in. by 2ft. 6in., cap 2ft. 6in. bearings ; No. 52 standards for carrying rails about 2ft. high ; No. 278 standards for carrying T-iron bars ; No. 1 circular staircase, 5ft. diameter.

No. 3 travelling cranes, with lifting gear. Oxide and lime elevators as per own particulars.

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

(*From our own Correspondent.*)

THE week succeeding the quarterly meetings is usually very quiet. This week has been no exception; and buyers have had a particular reason for refraining from entering the iron market hurriedly, in the uncertainties concerning prices which have arisen from the calling together of the coal trade.

Sheet makers have gained most immediate benefit from the quarterly meetings. Orders are now reaching them more freely, and here and there makers cannot accept any more orders for delivery this side the end of June. Such firms now ask £7 15s. to £8 for "singles," £8 5s. to £8 10s. for doubles, and £9 5s. to £9 10s. for lattens.

Thin sheet makers are mostly active. Several of them are busy for export, and are running full time. Messrs. E. P. and W. Baldwin and Messrs. Jno. Knight and Co. are prominent in this connection. The latter firm have given up the manufacture of marked bars and wire rods, declaring them to be unprofitable. An average price for working up sheets is about £10 10s. per ton. Morewood and Co. quote their "Woodford" B. sheets £13, and their ordinary sheets £9 5s. Messrs. Baldwin quote "Wilden" B. £13, and "Severn" singles £12.

Boiler plates are in decidedly better request than two months ago, at £9 per ton upwards.

Marked bars are in scarcely so good demand. The competition of the best marked bar firms keeps severe. £7 10s. continues the price for marked bars, and unmarked sorts range from £7 to £6. Hoops are fairly brisk at £6 10s. to £7, according to quality. Gas strip is £6 5s. to £6 7s. 6d. For Welsh bars delivered here £6 7s. 6d. to £6 5s. is asked.

The Shropshire wire rod mills are irregularly employed, and makers complain of the Germans having taken the trade ; £7 per ton delivered in Liverpool is about an average for the standard numbers.

Nail rods are in increased sale for shipment to eastern markets. One firm has lately booked an order for 500 tons, as to which early delivery is imperative. Prices rule from £7 5s. to £6 10s.

Better reports are to hand from New South Wales. The galvanisers and the makers of fencing wire are particularly glad of this. Should the improvement be sustained, there will be less reason for arriving at the restriction of output which the makers determined at their quarterly meeting was desirable. Prices have seriously fallen off. Messrs. Morewood and Co., however, keep full of work. Some makers quote £13 2s. 6d. for sheets of 22 to 24 w.g. in bundles delivered Liverpool, and £13 7s. 6d. delivered London.

Tin-plates are steady, and a few big orders have been booked. Messrs. Jno. Knight and Co. quote 24s. for I.C. charcoals delivered Liverpool, and 20s. for I.C. cokes per box. Welsh cokes are changing hands on our exchanges at 15s 9d. to 16s. per box delivered in Liverpool.

Pig iron does not show much movement. But, except as to all-mine qualities, the outturn of the forty-seven furnaces now blowing is mostly going steadily into consumption. All-mines remain at 65s., with 67s. 6d. as the quotation of the Earl of Dudley. Part-mines are 50s. to 45s., and cinder sorts are 40s. The "Stanton" brand—one of the best Derbyshires—is quoted 48s. 9d., and Northamptons are 47s. 6d. Hematites are 65s. to 62s. 6d.

A meeting of the coal trade and the miners' delegates was held this afternoon in Birmingham, Mr. Fisher Smith in the chair. The masters enlarged upon the necessity for a reduction in price and wages, but the men strongly opposed. Ultimately it was resolved to drop furnace coal 1s. per ton on May 1st, making Earl Dudley's quotation 10s. Thick coal wages will fall 4d. per stint, and thin coal wages 2d. The Ironmasters' Association discussed the wire gauge question to-day. They resolved that any alteration in the existing gauge was, as regards the iron trade, undesirable.

Most of the constructive ironwork manufacturers keep steadily engaged upon bridge and girder work. The demand for steam pumps and small engines for the Australian colonies is better. The cable and anchor firms report trade quieter of late, particularly in the supplying of foreign needs. Heavy ironfounders continue to find regular employment for their hands ; but the contract prices are very low. Light ironfoundry goods sell rather slowly ; but for naval ironmongery the demand is fully up to the average.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—There is a continued absence of any animation in the iron trade of this district. As regards pig iron, there are at present scarcely any buyers of importance in the market, most of the large consumers still working on with deliveries under the contracts given out a month or so back, whilst for finished iron also orders still come forward very slowly, and it is exceptional when makers are at all well supplied with work, most of them being barely kept going from hand to mouth. Although pig iron makers have, as a rule, sufficient orders to keep them going for the present, the absence of new orders coming in is beginning to tell upon prices, and during the week local makers have reduced their list rates 1s. per ton, whilst district brands are also gradually easing down from the top figures quoted of late; and in finished iron, makers, although they are not giving way further, find it difficult to maintain prices even at the low rates which have recently been current.

Business was exceedingly quiet at the Manchester market on Tuesday. Lancashire makers of pig iron even at their reduced prices were still practically out of the market, as some of the district brands could be bought for less money. For delivery equal to Manchester local pig iron is quoted at 46s. 6d. to 47s. less 2½, but where offers are made they do not come within 6d. or 1s. per ton of these figures, and as makers are not at present disposed to come down to buyers' prices, little or no business is being done. Lincolnshire iron is to be bought at comparatively low figures, 45s. per ton less 2½ delivered equal to Manchester being about the basis on which sales of forge iron have been made during the week, with foundry qualities quoted at 46s. 6d. less 2½.

Hematite makers are showing more anxiety to secure orders; in some cases 62s. 6d. less 2½ is being held as the minimum figure for foundry qualities delivered here, but for prompt sales orders could be booked at as low as 60s. per ton less 2½.

In finished iron a firmer tone is being maintained than buyers seem to have anticipated, and this has tended somewhat to check the underselling which has been going on of late. It is, however, scarcely on the amount of business coming forward, or on the strength of their order books, that manufacturers are making a stand, but rather because they have got to the minimum price they are prepared to take. For delivery equal to Manchester £6 5s. is the average ruling figure, and it is only in exceptional cases that sellers are to be found at under this. In hoops there has been a fair amount of buying going on for shipment to America, at prices averaging £6 15s. for ordinary up to £7 2s. 6d. for prepared cotton tie hoops delivered at Liverpool. For sheets delivered equal to Manchester prices average £8 2s. 6d. to £8 5s. per ton ; for common plates, £6 17s. 6d. to £7 ; and for good ordinary boiler plates £8 5s. to £8 10s. per ton.

Although I hear occasional complaints that activity in the engineering trade is, if anything, slackening off, I do not find that this applies so far as the leading engineering firms in the district are concerned, and certainly the reports which are periodically issued by the trades' society organisations connected with the above branch of industry do not show any falling off in employment. The last returns of the Amalgamated Society of Engineers show a continued decrease in the number of members receiving out-of-work support, with the general engineering and tool-making branches well employed all through this district, machine-making being the only department in which there is any slackness ; but even in the machine trade the principal firms are fairly well off for orders, and the number of men actually out of work is not large. The report of the Steam Engine Makers' Society also shows a further decrease in the number of unemployed, there being at present less than 1 per cent. of the members receiving out-of-work relief. The reports received as to trade were also stated, as a whole, to be cheerful. As regards Lancashire, with the exception of Bury and St. Helen's, where trade is returned as only moderate, there is general activity throughout the district, and in Manchester and Salford the society has none of its members out of work. Throughout the country generally, Norwich, Stoke, Wolverhampton, and Worcester, where short time has been resorted to, are the only exceptions to the satisfactory reports, which from all the northern branches are good throughout.

The present activity in most departments of the engineering trade, and especially in iron shipbuilding, which is, in fact, so abnormally busy that the demand for men is more than sufficient to absorb any suitable surplus from other branches, is causing a restless feeling amongst the men with regard to wages and hours of labour, which it is feared there may be some difficulty in keeping within reasonable bounds. At Glasgow and Middlesbrough representative meetings have been held, and committees appointed with the view of securing an advance in the rate of wages, and at Sunderland an agitation has been commenced with the object of effecting a reduction in the hours of labour, which is certain to meet with the strongest opposition on the part of the employers.

The members of "The Joule Club" held a meeting last week at the Manchester Electrical Exhibition, and Mr. Heys read a paper descriptive of some of the exhibits, and also giving a rough outline of the principle of the dynamo as illustrated in a few of the typical modes of construction; the storage of currents, and the methods of distribution and illumination. The machine to be used for any special purposes was, he said, not easily determined; but for arc lighting the series machines were the best, whilst for incandescent lamps, which it would be unsafe for domestic purposes to put in series, a shunt machine should be employed. In the application of electricity for general purposes, they were faced with the difficulty that the current could only be distributed economically at a high pressure, which in our houses would be highly dangerous, and how to surmount this difficulty had puzzled many inventors. To meet this difficulty, and the certainty of a higher pressure current in the future, some local system of distribution would be necessary, and this, Mr. Hays considered, would be found in the adoption of storage batteries, which need not be applied to every house, but would only be required for every convenient section.

The Electrical Power Storage Co., which was not able to complete its stand at the Manchester Exhibition until recently, shows the fifty cells which were employed to drive the tramcar during the recent experiment in London. With these it is lighting sixty of the Swan incandescent lamps of 20-candle power each, from twenty-five cells, and one Pilsen arc lamp of 2000-candle power nominal. The company is also driving several machines, including a small lathe, with Reckenzaun's motor, from six cells, a sewing machine, with a Griscomb's motor from four cells; a band saw, with Ayrton and Perry's motor, worked from ten cells; and at the opposite end of the hall one of Proctor's mechanical stokers, with a Dr. Meritan's motor, is worked from ten cells. In all cases sufficient power is developed to drive the apparatus effectively, and the actuating of the stoker about 100 yards distant has been watched with considerable interest.

In the coal trade business is quieting down, but deliveries from the collieries are still taking away the present output, and there is no material accumulation of stocks. So far the reductions in Manchester have not been followed by any general downward movement, but there is a good deal of pressure on the part of buyers for lower prices, which has necessitated some little giving way in odd cases. At the pit mouth prices remain at about 9s. 6d. for best coals; 7s. 6d. to 8s. for seconds; 6s. 6d. to 7s. for common; 5s. 6d. to 6s. 3d. for steam and forge coal; 4s. 9d. to 5s. for burgy; and 3s. 6d. to 4s. for good ordinary slack.

Shipping is very quiet, with low prices being taken to secure orders. Lancashire steam coal delivered at the Garston Docks can be bought at 7s. 3d. to 7s. 6d., and at the high level, Liverpool, at about 7s. per ton.

An effort is being made to establish a coal exchange for Liverpool similar to the one in existence in Manchester, and a meeting of the trade is to be held on the 30th with a view of giving a definite basis to the movement, which has already been well supported.

Barrow.—Although there is no increase to note in the demand for hematite pig iron, the demand is, nevertheless, steadily maintained all round. The market, however, is quiet, and although the business done has not fallen off, sales give no promise of increasing yet awhile. Prices are as last given, 53s. per ton being the price for mixed samples of Bessemer. Stocks are increasing in makers' hands. The chief part of the metal produced is being used by steel makers. Makers are firm in their prices, in spite of the slow demand, and show no disposition to lessen the output at the furnaces. The steel trade is very steadily employed in all departments, more especially rails. Prices are unchanged, and a fair amount of business is being transacted. Iron ore quiet at last quotations. Much of the ore raised is being "banked." Iron shipbuilders, in view of the orders they have secured, will be better employed shortly. Nothing worthy of note in connection with other industries.

THE SHEFFIELD DISTRICT.

(*From Our Own Correspondent.*)

THE dispute in the file trade is assuming serious dimensions. At a meeting of the manufacturers, held on the 13th inst., it was decided to insist on the 10 per cent. reduction, and as the workmen are equally determined, there seems every prospect at present of a serious rupture. Five hundred men are now out on strike, and on the 21st it is probable that the number will be doubled. The file-making operatives are the most powerful association in the town. In one branch alone—the file-cutters—they have 2000 adult members, and it is calculated that some 6000 persons are altogether engaged in the production of files. The men are receiving the support of the organised trades, and make no secret of their determination to resist the reduction on every side.

The Canadian Government do not seem to be going towards free trade. In their new tariff they have raised the duty on files from 30 per cent. to 37½ per cent. They have put 5 cents per lb. upon files 9in. and under, and 3 cents per lb. upon files over 9in. This advance, it is feared, will have a very depressing effect upon importations of this article, as the Canadian-made files are already competing keenly with the imported ones. Steel in ingots, bars, sheets, and coils are to pay 5 dols. per ton on and after July next, when steel will be manufactured in Canada. Steel railway bars, or rails, fish-plates, and steel for the manufacture of saws are to be admitted free till the close of that session of the Canadian Parliament, and it is expected they will continue to be on the free list.

In the razor trade there is also little prospect of an amicable settlement of the dispute. Here the workmen are demanding an advance of 10 per cent. The razor manufacturers are undoubtedly very busy, but the demand is really little more than a "spurt," caused by the anxiety of the American merchants to get heavy stocks in before the increased duties come into operation next July, when the new tariff on razors will be 50 per cent., a rise of 15 per cent. There were about 800 persons engaged in the production of razors in Sheffield, and the number is strictly limited by the men themselves, with the view of keeping the trade as "select" as possible and restraining over-production.

The Gas Exhibition, held under the auspices of the Sheffield Gas Company, is succeeding beyond expectation in the purpose for which it was promoted—to bring before the public the various uses to which gas can now be put for heating and cooking purposes. Some seven thousand persons have visited the Exhibition. Cooking stoves, which the company are prepared to let out on hire at very moderate terms, have been the chief attraction, and when the Exhibition closes on Saturday, it is believed that some 300 of these contrivances will be on their books, to be placed in the houses of Sheffield people. Miss Coles, late staff teacher at South Kensington, has given cookery lectures to illustrate the adaptation of gas stoves to domestic purposes, and these have been attended by audiences numbering 600 and over. The Exhibition is to be kept open till Tuesday next.

The proposed abolition of the silver duties caused much dissatisfaction in Sheffield, where silver plate and electro-plated goods are so extensively manufactured. The leading houses forwarded a memorial to the Right Hon. A. J. Mundella, our senior member, with a request that he would forward it to the Chancellor of the Exchequer. Writing to Messrs. James Dixon and Sons, of Cornish Place, Mr. Mundella, under date of 17th of April, states:—"Your letter of the 12th reached me in due course, and I at once laid it before the Chancellor of the Exchequer. You will have seen from his answers to questions in the House of Commons last night, that he has definitely abandoned the proposal to repeal the duties on silver plate."

The trade in silver-mounted ware is at present changing from Crown Daly to Doulton, with a gradual revival of the deep-toned Wedgwoods, than which there are few more effective examples of British pottery. The new silver ware of the Lambeth firm seems to be making way, and in the form of salad bowls, &c., is very effective in its silver setting; but there is nothing to equal the colouring of the faience ware, taken by itself.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

THE Cleveland iron market, held at Middlesbrough on Tuesday last, was well attended, and the tone of affairs was more cheerful than it has been for some time. During the last fortnight makers have been doing a considerable amount of business direct with consumers and with foreign merchants, and there is every probability that trade will be more active for two or three months. The Baltic ports are now again free from ice, and large quantities of pig iron are being shipped. The inland deliveries are also improving, notwithstanding that the local mills and forges are no longer at work on Mondays. Most of the pig iron recently sold is for spring delivery, sellers not being at present disposed to sell far ahead, as they expect that better prices will shortly be obtainable. On Tuesday most of the sales were at 40s. per ton f.o.b.; for No. 3 g.m.b., in one or two cases, 39s. 10½d. was accepted.

Warrants are nominally 40s. per ton, but there is little activity at present in respect of them.

The stock of Cleveland iron in Messrs. Connall's Middlesbrough stores continues to decrease steadily. The quantity held on Monday night was 80,856 tons, being a reduction of 729 tons for the week.

Up to the same date the shipments for the month from the Tees were as follows:—Pig iron 47,976 tons, and manufactured iron and steel 19,925 tons. In March, during the corresponding period, the first item had only reached 36,285 tons, and in April, 1882, it was but 36,522 tons.

There is nothing new to report with regard to the finished iron trade. Most of the mills are fully employed and have an average amount of work in hand. Prices remain the same as quoted last week, viz.:—Ship plates, £6 5s. to £6 10s. per ton; ship angles, £5 15s.; and common bars, £6, all free on trucks at works, less 2½ per cent.

Messrs. Stevenson, Jaques, and Co., of Middlesbrough, are about to blow out one of their four blast furnaces, and it is said another firm in the district intend to blow out a furnace also. The object is probably simply to re-line them.

The three blast furnaces at West Hartlepool, which have been idle since 1875, and which were recently purchased by a new company, called the "Seaton Carew Iron Company," were blown in last week. The new company have made considerable alteration in the plant, and will be able to turn out about 80 tons of pig iron per day. They have made a start with ore which they have imported from one of the islands in the Grecian Archipelago.

Last week an important wages claim was decided against the Bishop Auckland Iron and Steel Company. It appears that when the company was obliged to close its works in December last, it did not give the men the usual week's notice, as it was thought the works would be started again in a short time. One of the iron-workers has now taken the matter up, and sued the company for a week's wages in lieu of notice; and the judge has given a verdict in his favour for the amount claimed, with costs. It is said that some 200 hands are likely to be affected by this decision.

The Cleveland Iron Trade Foremen's Association held their thirteenth annual dinner at Middlesbrough on Saturday last. Mr. Raylton Dixon presided, and in the course of his remarks referred to the shipbuilding trade, with which he is connected. He stated that last year there was a larger tonnage built than in any previous year, the quantity being 1,200,000 tons, which represented a consumption of from 700,000 to 800,000 tons of manufactured iron. He stated that the net addition to the commercial navy was 460,000 tons. Referring to the frequently repeated allegation that iron ships are built of inferior material, he said he had been in the shipbuilding trade for thirty years, and could confidently assert that, though the price of shipbuilding iron was extremely low, the quality had never during that period been better than at present.

The fifth meeting of the session of the Cleveland Institution of Engineers was held at Middlesbrough on Monday evening last. Mr. Jones, the president, occupied the chair, and there was a large number of members present. Mr. T. H. Bell, of the firm of Messrs. Bell Bros., of Port Clarence, read a highly interesting paper on "The Salt Deposit of Middlesbrough and South Durham, and the Mode of Winning It." Mr. Bell sketched the history of the Middlesbrough salt industry. John Vaughan put down the first bore-hole in 1862, and was therefore the original discoverer. His own firm followed with another bore-hole in 1874, and again with a larger one, which they are now using practically, in 1881. He described the method adopted for making, pumping, and finally obtaining salt from brine. Mr. Bell estimates the quantity of salt to be about 200,000 tons per acre. Messrs. Bell Brothers are now producing about 320 tons of salt per week. The members of the Institution will pay a visit to the Clarence Salt Works on Saturday next, in order to inspect the machinery and other above-ground appliances.

A meeting of the subscribers to the guarantee fund for entertaining at Middlesbrough the members of the Iron and Steel Institute next autumn was held in the Exchange Board-room on Tuesday last. Mr. E. W. Richards presided. It was announced by the secretary *pro tem.*, Mr. Walter Johnson, that about £1700 had already been guaranteed, and that this sum was considerably more than would probably be required. It was decided to send forthwith a formal invitation to the president, Mr. Josiah T. Smith, and in anticipation of its acceptance, a committee was formed to carry out the necessary arrangements.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

THE pig iron market has again been very dull this week, prices having receded to the lowest point. There is a want of inquiry from abroad, and until an improvement of a decided nature takes place in this respect, there is small chance of the market getting into a more satisfactory state. Reports from New York as to the demand for Scotch pigs there were a shade more cheering, the expectation being that a little more may be wanted soon, but it is now regarded as improbable that the shipments will expand to the dimensions of last year. The continental demand is not at all up to expectations, and merchants with long experience of that branch of the trade give it as their firm belief that quotations will yet go lower. The stock of pig iron in Messrs. Connal and Co.'s stores has decreased about 1200 tons in the course of the week. An additional furnace has been relighted at the Langloan Ironworks, and there are 111 in operation as compared with 108 at the same date last year.

Business was done in the warrant market on Friday forenoon at 47s. to 47s. 1d. cash, and 47s. 2½d. one month, and in the afternoon at 47s. to 47s. 0½d. cash, and 47s. 2d. to 47s. 2½d. one month. Transactions were effected on Monday forenoon at 47s. 1d. to 46s. 11d. cash, and 47s. 3½d. to 47s. 1½d. one month, the quotations in the afternoon being 46s. 11½d. to 46s. 10d. cash, and 47s. 1½d. to 47s. one month. The market was flat on Tuesday, when as low as 46s. 9½d. cash was accepted. The market was firmer on Wednesday from 46s. 10½d. to 47s. 2d. cash, and 3½d. less at the close. To-day—Thursday—business was done at 47s. to 47s. 1½d. cash, and 47s. 2½d. to 47s. 4d. one month.

Although the demand for pig iron at home shows no abatement, makers are more anxious to press sales on account of the unsatisfactory nature of the American inquiry; the consequence is that prices are a shade easier, as follows:—Gartsherrie, f.o.b., at Glasgow, per ton, No. 1, 61s. 6d.; No. 3, 55s.; Coltness, 63s. 6d. and 55s.; Langloan, 64s. 6d. and 55s.; Summerlee, 61s. 6d. and 51s. 6d.; Chapelhall, 60s. 6d. and 54s.; Calder, 62s. 6d. and 52s. 6d.; Carnbroe, 55s. 6d. and 50s.; Clyde, 51s. 6d. and 49s. 6d.; Monkland, 48s. 6d. and 46s. 6d.; Quarter, 48s. 6d. and 46s. 6d.; Govan, at Broomielaw, 48s. 6d. and 46s. 6d.; Shotts, at Leith, 64s. and 56s.; Carron, at Grangemouth, 51s.—specially selected, 57s. 6d.—and 48s. 6d.; Kinneil, at Bo'ness, 48s. and 47s.; Glengarnock, at Ardrossan, 55s. and 49s.; Eglinton, 49s. and 47s.; Dalmellington, 50s. and 49s.

There is a fair demand for most kinds of manufactured iron at firmer prices. The foundries, with the exception of pipe works, are nearly all very busy, and engineers are also well employed. The shipments of iron manufactures from the Clyde in the past two weeks embraced £44,500 worth of machinery, £13,737 sewing machines, £9400 steel manufactures, £54,000 iron manufactures, exclusive of pig iron, the shipments of which were valued at about £20,000.

The coal trade in the west of Scotland is still comparatively active. Cold weather has again somewhat improved the domestic inquiry, and the shipping demand has been fairly good at most ports, while in some cases it has been very brisk. There is an improvement in the demand in Fifeshire, and the Baltic trade is expected to begin immediately, and to impart more volume to the trade. Prices are still low, being quoted for Burntisland at 6s. 3d. to 6s. 9d. per ton. The shipping demand at Bo'ness has been larger than usual, the week's despatch of coals being 5500 tons. At Grangemouth there has been less doing, and there is still a slackness at Leith.

The strike of colliers in Mid and East Lothian is now at an end, the men, after being idle about six weeks, having gone back to their work on the employers' terms of a reduction of 10 per cent. in their wages. They had scarcely any chance from the first of being successful, so long as the masters had to compete in the same markets with those of Fife, where a similar reduction and lower prices of coal were in operation.

The proposal in Fifeshire to restrict the working time to five days per week seems to have fallen through in the meantime, and the executive board of the union has recommended the miners to make applications for an advance in wages, in view of the improved demand for coals.

The West of Fife Coal Company, which has been for some time engaged sinking pits on the farm of High Holm, about two miles to the north of Dunfermline, has struck a seam of 8ft. 6in. in thickness, at a depth of 70 fathoms. The coal has been found of excellent quality, and will be turned to account as soon as possible.

The Mining Institute of Scotland held its annual meeting at Hamilton a few evenings ago. It was reported that the membership had increased during the year from 317 to 411. Mr. Ralph Moore, H.M. inspector of mines, vacated the chair, and Mr. James McCreath, M.E., Glasgow, was elected president. On taking the chair, the gentleman delivered an interesting address, in the course of which he said that there were now 610 mines in Scotland, employing 67,900 persons, and that last year they had raised 24,349,480 tons of minerals. The meeting agreed by a majority to memorialise the Government not to put any needless restrictions on the manufacture of blasting gelatine.

WALES AND ADJOINING COUNTIES

(*From our own Correspondent.*)

THE strike at Ynyshir Colliery has been ended, one of the officials being dismissed. The Welsh steam coal trade is very brisk at Cardiff. Over 170,000 tons were sent away, foreign and coastwise, last week. The Newport exports were below the average. Trade there was unmistakeably flat, and this is partly attributable to a little stagnation which has begun to characterise the house coal trade there. Swansea is taking credit for having held the highest position relatively of the Welsh ports during the last three months. According to the returns Swansea and Briton Ferry show an increase of 29·75 per cent., Cardiff and Penarth 15·00 per cent., while Newport figures at 3·38 per cent. decrease.

The price fixed at Birmingham for coke plates—16s.—has not had any favourable effect on the tin-plate trade. This is still very low, and notices are out in several works for cessation of contract, which means, or is understood to mean, a stoppage of work. Still I hear rumours of companies being in formation to re-start the stagnant works, so there are some who believe that there is yet hope for the tin-plate trade.

The Miners' Provident Society is gradually becoming one of the most successful movements of the century. At a meeting lately held in the Rhondda it transpired that fully 800 members had been enrolled at Risca, a place where a community, growing township, and fair prospects were utterly wrecked a few years ago by a mining disaster. The Provident Society is one of three of the most important measures which have affected the condition of the colliers in South Wales. The first was the Mines Regulation Act; the second, Coalowners' and Colliers' Association; and the third is the Provident Society. When the history of the coal trade is written it will be interesting to see the ameliorating features which have accompanied its use and development.

Some of the more substantial of the iron orders are going north. I hear that a northern firm has secured a contract for 90,000 tons of steel rails, and that the Great Eastern order of 20,000 is gone to the West Cumberland Steel Company. Yet prospects here are good, and the Welsh ironmasters do not complain.

Tonnage to America from Cardiff is improving, and as much as 11s. per ton has been paid for rails to New York.

The preliminary steps are being taken by the Rhymney Railway Company with respect to the making of its branch to Merthyr. The contractor is pushing on with the Newport and Rhondda line, but if open by the autumn it will be as much as can be expected, considering the difficulty to be surmounted.

IT is estimated that in the spinning mills of the United States there are now 15,000,000 spindles, of which 3,000,000 have been added during the past year.

INTERNATIONAL ELECTRICAL EXHIBITION, VIENNA, 1883.—We have received the following paragraph from Vienna respecting the protection of visitors' watches from the effects of near approach to a dynamo-machine, and print it as received:—The Commission of this Exhibition is preparing a measure, to the better understanding of which a little excursion on scientifical department be allowed. As is well known, does every magnet influence certain objects round it. Its sphere of activity may be perceived in a certain way from the reach of the invisible; if, for instance, iron filings are dusted on a sheet of paper, and put near a pole of a magnet. These small bodies then arrange themselves around the pole in curving lines, and mark thus the so-called lines of force of the magnetic field. Bodies which possess the ability of being made magnetical, yield therefore near a powerful magnet to the influence of it, and thus it might happen that watches worn by viewers of dynamo-machines may be brought to a standstill by magnetising the echappement. There is, it is true, a simple means of providing against magnetising by resorting to the other side of the dynamo-machine, where the second pole loosens what the first has exorcised; or, being turned round of his axis above the dynamo, the watch will soon be found to have lost his magnetism. In order to cut off, however, the invisible agent in the way, and not to compel the visitor to make experiments, it will suffice to make use of the screen effect of the iron. Such as Thomson surrounding his ship's compass with a pent-house to prevent the reaction of the magnet needle on the large bulks of iron of the ships, a light mantle of iron plate around the watch will prevent the above-mentioned magnetising of it. At the International Electrical Exhibition the visitors of the machine department will find facilities to provide their watches with such mantles during the term of their visits.

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 April, 1883.

1794. Secondary Batteries, R. Tatham, Rochdale, and A. Hollings, Salford.
1795. Laundry Pans, &c., T. Hartley and Z. Sugden, Halifax, and C. Parker, London.
1796. Bridges, W. R. Kinipple, London.
1797. Stamping Minerals, &c., J. H. Johnson.—(*N. W. Condict, New Jersey, U.S.*)
1798. Stoppers for Bottles, &c , N. Thompson, Brooklyn, U.S.
1799. Tool for Extracting Stoppers from Bottles, J. Hamer, Stalybridge.
1800. Tipping Vans, &c., C. Hill, London.
1801. Conductors of Electricity, J. Parker, Plymouth.
1802. Brick-making Machinery, P. M. Justice.—(*C. Chambers, jun., Philadelphia, U.S.*)
1803. Dynamo-electric Machines, P. M. Justice.—(— *Keegan, Washington, U.S.*
1804. Mechanism for Cutting, &c., Sheet Metal, A. N. Hopkins, Birmingham.
1805. Electric Pile, J. C. Mewburn.—(*M. and P. Azapis, Paris.*)
1806. Combing Machines, J. C. Walker, Shipley.
1807. Compressing Materials for making Ensilage, T. Potter, Alresford.
1808. Gas Regulators, S. Slack, Sheffield.
1809. Vessels for Fluids, R. Dunlop, Cardiff.
1810. Removing Cores from Apples, &c., W. Downie and W. J. Sage, London.
1811. Adjusting Shafts of Carriages, C. Healey, Gloucester.
1812. Electric Lamps, &c., H. Edmunds, jun., London.
1813. Carriage Wheels, B. Mills.—(*C. Dégrange, Lyons.*)
1814. Meter for Electric Currents, A. M. Clark.—(*G. Hochreutiner and A. Boucher, Lausanne.*)
1815. Bands, &c , for Hooping Bales, A. A. Eichler, London.
1816. Producing Fresh Water, J. Kirkcaldy, London.
1817. Making Vaseline, W. P. Thompson.—(*H. and M. Böhm, Vienna.*)
1818. Apparatus for Steering Vessels, J. Philp and W. Forrester, Liverpool.
1819. Steam Boilers, W. R. Lake.—(*G. Stollwerck, Cologne-on-the-Rhine.*)
1820. Boats with Adjustable Keels, S. Glyn, London.
1821. Chimney-tops, &c., T. J. Baker, Newark.
1822. Hose-pipes, J. C. Merryweather, Greenwich.
1823. Steam Pump, J. G. Joicey, Newcastle.
1824. Ships' Aerostats, Projectiles, N. de Telescheff, Paris.
1825. Rails, W. P. Alexander.—(*G. Cowdery and E. R. Thomas, Sydney.*

11th April, 1883.

1826. Taps for Liquids, H. Cullabine, Sheffield.
1827. Thrashing Machines, J. Coulson, Stamford.
1828. Winding Thread on Shuttle-bobbins, J. McHardy, Dollar, N.B.
1829. Electrical Signalling Apparatus, B. J. B. Mills.—(*J. U. Mackenzie, New York, U.S.*)
1830. Regulating Paper in Cigarette Machines, A. C. Henderson.—(*E. F. Leblond, Paris.*)
1831. Plush Fabrics, J. H. Cunliffe, Rochdale.
1832. Electric Lamps, J. W. Swan, Bromley.
1833. Breech-loading Hammerless, &c., Guns, W. Anson and J. Deeley, Birmingham.
1834. Folding Bath, &c , O. Wolff, Dresden.
1835. Gas Motor Engines, J. J. Butcher, Newcastle.
1836. Apparatus for Cleaning Lead, &c., T. Archer, jun., Dunston.
1837. Railway Signalling, W. Lawson, Dumfries, and T. Forrest, Glasgow.
1838. Pianos, E. G. Brewer.—(*L. N. Letailleur and P. Scholtus, Paris.*)
1839. Apparatus for Removing the Ends of Eggs, R. H. Rowland and T. F. Stidolph, Woodbridge.
1840. Lubricating Apparatus for Machinery, T. Holland, Troy, U.S.
1841. Device for Holding a Pencil, E. Lane, London.

12th April, 1883.

1842. Producing Ammonia, R. Tervet, Clippens, N.B.
1843. Ventilating Buildings, &c., R. Oakley, London.
1844. Providing a Safeguard against the Passage of Water down Ventilating Shafts on Shipboard, R. Oakley, London.
1845. Warming Fresh Air in Buildings, R. Oakley. London.
1846. Ventilating Churches, &c., Invisibly, R. Oakley, London.
1847. Polo Sticks, J. C. Rogers, Paignton.
1848. Electric Lamps, A. Partz, Hampstead.
1849. Projectiles for Fire-arms, L. A. Groth.—(*H. Bischoff and Z. d. A. Mieg, Bavaria.*)
1850. Steam Boilers, J. Richards, Clifton Junction.
1851. Machinery for Cutting, &c., Tickets, J. Lewthwaite, Halifax.
1852. Piled Fabrics, &c., H. J. Haddan.—(*F. A. Parellada, Barcelona, Spain.*)
1853. Lathes, M. Wadsworth, Halifax.
1854. Breech-loading Fire-arms, W. Gardner, London.
1855. Making Gas, G. Redfern.—(*S. Giraudon, Paris.*)
1856. Coke Ovens, R. Dixon, Crook.
1857. Electric Telegraphs, P. A. Favarger, Neuchatel, Switzerland.
1858. Wick Trimmers, A. Boult.—(*W. Seaton, Quebec.*)
1859. Apparatus for Reducing Wood, A. J. Boult.—(*H. André, Le Thor, France.*)
1860. Making Steel, &c , Suitable for Casting, A. J. Boult.—(*G. W. Francis, Middlesex, U.S.*)
1861. Tricycles, &c., Thomas Leigh, Liverpool.
1862. Road Vehicles, W. J. Brewer, London.
1863. Washing Machines, W. R. Lake.—(*K. Grav, Christiania.*)
1864. Life-buoy, G. J. Kirchenpauer & L. H. Philippi, Hamburg.
1865. Making Vulcanised India-rubber, A. H. Huth, London.
1866. Treating Textile Materials, W. R. Lake.—(*G. M. F. Foret, Paris.*)
1867. Automatically Guiding Fabrics, J. Kerr, Church.
1868. Rotary Pumps, &c., J. H. Johnson.—(*B. G. Griendl and L. Poillon, Paris.*)
1869. Permanent Way, G. Wilson, London.
1870. Apparatus for Utilising Solar Heat, W. L. Wise.—(*La Société Centrale pour l'utilisation de la Chaleur Solaire, Paris.*)

13th April, 1883.

1871. Electric Lamps, A. P. Lundberg, London.
1872. Combined Grooving Plane and Plough, E. C. Bourne, London.
1873. Hand-power Lifts, A. Attwood and T. W. Barber, Ulverston.
1874. Brakes, J. C. Stevenson, Liverpool.
1875. Preventing Waste of Heat, E. Maw, Liverpool.
1876. Artificial Fuel, E. Goad & T. Chappell, London.
1877. Apparatus for Measuring Electric Currents, R. E. Crompton, London, and G. Kapp, Chelmsford.
1878. Bogie Trucks, W. M. Smith, Tayport.
1879. Electric Signalling, J. H. Johnson.—(*A. Jeanjean, and L. J. H. Bon, Paris.*)
1880 Sewing Machines, C. Pieper.—(*R. Gritzner, Baden.*)
1881. Jointed Knee-cap for Horses, E Edwards.—(*O. A. Deschamps, St. Valéry en Caux, France.*)
1881. Apparatus for Heating Water, &c., H. Brinsmead, Ipswich.
1883. Explosive Compounds, F. W. Gilles, Cöln-on-the-Rhine.
1884. Making Corrugated Metal, G. W. von Nawrocki.—(*G. Kammerich, Berlin.*)
1885. Facilitating Starting of Tramway Cars, &c., J. E. Dawson, London, and A. C. Bluett, Watford.
1886. Cushioning Valves, W. P. Thompson.—(*J. Flower, U.S.*)
1887. Moulding Articles of Pottery, &c., S. Crowder, Natal.
1888. Reversing, &c., Motion of Machines, P. R. Allen, London.
1889. Electric Cables, &c., W. R. Lake.—(*W. J. Phillips and G. L. Kitson, Philadelphia, U.S.*)
1890. Apparatus for Sewing Soles of Boots, &c., W. R. Lake.—(*J. H. Cutten and L. E. Moore, Boston, U.S.*)
1891. Preventing the Passage of Flames from one Storey to another, A. M. Clark.—(*J. McCarroll, New York, U.S.*)
1892. Apparatus for Preparing Aerated Beverages, F. Bennett, London.

14th April, 1883.

1893. Stud, &c., Fastener, A. Combault, London.
1894. Pavement, W. Berry and P. Stuart, Edinburgh.
1895. Generating, &c., Electricity, R. Ash, London.
1896. Sewing Machinery, J. Heggan, Dromore.
1897. Apparatus for Making Mortar, &c., H. J. Haddan.—(*T. F. Leupolt, Zittau, Saxony.*)
1898. Railway, &c., Tickets, J. H. Johnson.—(*M. Vezzosi, Paris.*)
1899. Trap for Rats, &c., E. Edwards.—(*J. A. H. Marty, Villefranche, France.*)
1900. Tempering Steel Articles, V. Milward, Redditch.
1901. Making Bolts, &c., T. Jeavons.—(*W. Taylor, Pittsburgh, U.S.*)
1902. Valise, W. A. F. Blakeney, Glasgow.
1903. Breech-loading Fire-arms, E. Harrison and F. Beesley, London.
1904. Looms, T. Singleton, Over Darwen.
1905. Machinery for Winding Yarn, &c., J. Liddell, J. S. and S. H. Brierly, F. W. Hirst, and D. Hamer, Huddersfield.
1906 Stoves, J. A. Hanna and T. Shillington, Belfast.
1907. Apparatus for Protecting Firemen, &c., W. R. Lake.—(*S. Richards. Philadelphia, U.S.*)
1908. Seats for the Outside of Tram Cars, &c., W. Walker, London.
1909 Fire-arms, H. H. Lake.—(*J. Schulhof, Vienna.*)
1910. Screw-cutting Machines, A. M. Clark.—(*L. E. Lepine, Paris.*)
1911. Electrodes, W. Houghton, Paris.
1912. Making Carbonate of Strontia, W. A. Rowell, Newcastle.
1913. Driving Gear, F. Jenkin, Edinburgh.

16th April, 1883.

1914. Furnace-bars, &c., G. L. Scott, Manchester.
1915. Collars for Spinning, W. Jackson, Kingston-upon-Hull.
1916. Cooling, &c., Fluids, F. T. Bond, Gloucester.
1917. Water Meters, O. Imray.—(*C. Michel and A. Frager, Paris.*)
1918. Apparatus to be employed in Harmonising Melodies, B. S. Maitland, London.
1919. Knitting Machinery, H. J. Haddan.—(*C. Young, Chicago, U.S.*)
1920. Armour-plates, J. W. Spencer and W. Bagshawe, Newcastle.
1921. Apparatus for Extinguishing Fires, F. H. F. Engel.—(*G., T., and W. Leser, Hamburg.*)
1922. Forks, G. Pickhardt, Hagen.
1923. Screw Propellers, S. Snowden, West Hartlepool.
1924. Electrical Heating, J. S. Sellon, London, and R. P. Sellon, Surbiton.
1925. Pulley Blocks, &c., T. H. Ward, Tipton.
1926. Construction of Walls, &c., in Buildings, A. M. Clark.—(*J. McCarroll, New York, U.S.*)
1927. Making Tennis Balls, J. Burbridge, London.
1928. Hanging Ships' Rudders, S. W. Snowden, West Hartlepool.

Inventions Protected for Six Months on Deposit of Complete Specifications.

1763. Horseshoe Blank Rolls, H. J. Haddan, London.—A communication from S. T. J. Coleman, J. N. Clarke, and E. B. Reynolds, Cincinnati, U.S.—*7th April*, 1883.
1813. Carriage Wheels, B. J. B. Mills, London.—A communication from C. Dégrange, Lyons.—*10th April*, 1883.
1824. Ships' Aerostats, Projectiles, &c , N. de Telescheff, Paris.—*10th April*, 1883.
1860. Making Steel, &c., Suitable for Casting, A. J. Boult, London.—A communication from G. W. Francis, Middlesex, U.S.—*12th April*, 1883.
1866. Cushioning Valves, W. P. Thompson, Liverpool.—A communication from J. Flower, U.S.—*13th April*, 1883.

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

1524. Washing, &c., Cement, T. Matthews, London.—*14th April*, 1880.
1910. Finishing Cut Pile Fabrics, J. Worrall, Manchester.—*10th May*, 1880.
1512. Utilising Alkali Waste, &c., W. A. Hills, Chester.—*13th April*, 1880.
1497. Dark Lanterns, P. B. Bicknell, Lincoln.—*12th April*, 1880.
1503 Producing Matrices, G. D. Macdougald, W. Adie, G. R. Adams, and P. Fleming, Dundee.—*12th April*, 1880.
1574 Preventing "Double" in Spinning, A M. Clark, London.—*16th April*, 1880.
1481. Refrigerators, A. S. Haslam, Derby.—*12th April*, 1880.
1519. Scouring Fibrous Materials, J. and W., jun., McNaught, Rochdale.—*14th April*, 1880.
1535. Apparatus for Holding Documents, W. R. Lake, London.—*14th April*, 1880.
1505. Ventilating Buildings, &c., J. B. Papier, London.—*13th April*, 1880.
1531. Small-arms, A. Martin, London.—*14th April*, 1880.
1572. Motive Power Engines, P. W. Willans, London.—*16th April*, 1880.
1578. Destructive Distillation of Shale, W. Young, Clippens, N.B.—*17th April*, 1880.
1614. Instruments for Detecting Variations of Pressure, G. E. Pritchett, Bishop's Stortford.—*20th April*, 1880.
1520 Making Ice, F. N. Mackay, Liverpool.—*14th April*, 1880.
1544. Machinery for Grinding, &c., R. J. and A. Edwards, London.—*15th April*, 1880.
1555. Knitting Machines, T. Coltman, Leicester.—*16th April*, 1880.

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

1795. Lamps, C. J. Davis and J. T. C. Thomas, London.—*28th April*, 1876.
1540. Machinery for Snipping Fibres, J. McKean and J. McGrath, Castle Blayney.—*11th April*, 1876.
1566. Water-closets, &c., A. Tylor, London.—*13th April*, 1876.
1577. Spring Connections, &c., W. R. Lake, London.—*13th April*, 1876.
1619. Treating Waste from Caustic Lyes, T. W. Spalding and W. Laughton, Edinburgh.—*18th April*, 1876.
1564. Sewing Machines, H. B. Goodyear, Paris.—*13th April*, 1876.
1607. Railway Couplings, &c., W. R. Lake, London.—*15th April*, 1876.

Notices of Intention to Proceed with Applications.

(*Last day for filing opposition*, *4th May*, 1883.)

5393. Joints of Pipes, W. N. Hutchinson, Wellesbourne, near Bideford.—*13th November*, 1882.
5839. Treating Silk, G. W. von Nawrocki, Berlin.—A communication from W. Meister.—*7th December*, 1882.
5863. Watch or Clock, J. Pallweber, Salzburg, Austria —*8th December*, 1882.
5864. Manufacture of Caoutchouc, &c , W. C. Horne, Old Charlton.—*8th December*, 1882.
5869. Manufacture of Beverages, J. Armstrong, Clapham.—*8th December*, 1882
5878. Iron Permanent Ways, J. E. Walsh, Halifax.—Com. from C. Verhoesen.—*9th December*, 1882.
5879. Joints and Coverings for Roofings, &c., J. E. Walsh, Halifax.—A communication from M. G. Mitter and Dr. L. A. Hoffman.—*9th December*, 1882.
5891. Pocket Knives, A. J. Boult, London.—A communication from J. W. Rauh.—*9th December*, 1882.
5893. Billiard Cloths, J. and G. E. Stead, Leeds.—*9th December*, 1882.
5894. Automatic Indication, &c., of Temperatures, G. L. Winch, London —*9th December*, 1882.
5904. Looms for Weaving, A. Smith, Bingley.—*11th December*, 1882.
5951. Surfacing the Insides of Reversing Links, C. Pieper, Berlin.—A communication from H. Friederichs.—*13th December*, 1882.
5945. Manufacture of Cup and Screw Hooks, &c., A. H. Adams, Handsworth.—*13th December*, 1882.
5961. Dynamo, &c , Machines, G. L. Anders and J. B. Henck, jun., London.—*13th December*, 1882.
5969. Valves of Motive-power Engines, W. Hargreaves and W. Inglis, Bolton.—*14th December*, 1882.
5971. Covering Stairs, H. Hawgood, Richmond.—*14th December*, 1882.
5977. Galvanic Batteries, J. Rapieff, London.—*14th December*, 1882.
5993. Breaking, &c., Stones, L. L. Loizeau, Paris.—*15th December*, 1882.
6023. Telephonic Apparatus, W. R. Lake, London.—Com. from G. M. Torrence.—*16th December*, 1882.
6024. Screw Nuts, A. S. Paterson, London.—A communication from H. A. Harvey.—*16th December*, 1882.
6068. Open Stoves or Firegrates, E. R. Hollands, London.—*19th December*, 1882.
6086. Banjos, W. R. Lake, London.—A communication from F. H. Chase.—*20th December*, 1882.
6098. Sewing Machines, B. J. B. Mills, London.—A communication from C. Vernay and F. Roux.—*21st December*, 1882.
6100. Cultivating Land, D. Greig, Leeds, and G. Greig, Edinburgh.—*21st December*, 1882.
6110. Cushions, &c., for Permanent Way, W. P. Thompson, Liverpool.—A communication from M. J. L. B. du Pont.—*21st December*, 1882.
6144. Water Heaters, I. S. McDougall, Chadderton, near Manchester.—*23rd December*, 1882.
6198. Covers of Carding Engines, W. Hurst, Rochdale.—*28th December*, 1882.
190. Furnaces, J. Williams, Cardiff.—*12th January*, 1883.
193. Centrifugal Machines, J. E. Meyer, Copenhagen.—*12th January*, 1883.
214. Hot-air Engines, H. H. Lake, London.—Com. from J. Screiber and M. Fellner.—*13th January*, 1883.
258. Strain Governor for Engines, J. Munro, West Croydon.—Com. from G. Keith.—*16th January*, 1883.
432. Weft Forks, &c., for Looms, W. B. White, Colne.—*26th January*, 1883.
563. Organs, &c., J. B. Hamilton, London.—*1st February*, 1883.
676. Telephonic Apparatus, H. H. Eldred, London.—*7th February*, 1883.
961. Miners' Safety Lamps, G. H. Stimmis, Stourbridge.—*21st February*, 1883.
995. Purification of Coal Gas, J. T. McDougall, Manchester.—*23rd February*, 1883.
1017. Furnaces, I. S. McDougall, Chadderton, near Manchester.—*24th February*, 1883.
1144. Preparing Agents to be Used in Treating Sewage, &c., W. C. Sillar, Blackheath, and J. W. Slater, London.—*3rd March*, 1883.
1214. Clipping Machines, J. Range, Nottingham.—*7th March*, 1883.
1224. Truss, E. M. Bourjeaurd, London.—*7th March*, 1883.
1262. Adjusting Roller and other Axles in their Bearings, J. A. A. Buchholz, London.—*8th March*, 1883.
1271. Receptacles used in Sanitary Closets, C. K. Lawton, Manchester.—*9th March*, 1883.
1323. Purifying Gas, W. W. Box, Crayford, and G. Waller, London.—*13th March*, 1883.
1338. Button-hole Feeding Mechanisms for Sewing Machines, A. W. L. Reddie, London.—A communication from the National Machine Company, Incorporated.—*13th March*, 1883.
1349. Producing Sulphurous Acid, &c., I. S McDougall, Chadderton, near Manchester.—*13th March*, 1883.
1353. Pencils, T. Lehmann, London.—*13th March*, 1883.
1363. Compound Applicable as Cement, J. Imray, London.—Com. from E. Pink.—*14th March*, 1883.

(*Last day for filing opposition*, *8th May*, 1883.)

5804. Cruet Frames, J. F. Homer, Birmingham.—*5th December*, 1882.
5912. Breech-loading Fire-arms, J. S. Jarmann, London.—*11th December*, 1882.
5913. Producing Magnesia Salts from Sulpho-acids, F. Wirth, Germany.—A communication from Farbfabrik vormals Brönner.—*11th December*, 1882.
5920. Air Pumps, J. C. Baker, Liverpool.—*12th December*, 1882
5926. Applying Electric Currents to Organic Bodies, H. Haug and A. Wienand, Germany.—*12th December*, 1882.
5929. Collapsible Tubes, C. E. H. Cheswright, London.—A communication from C. Cheswright.—*12th December*, 1882.
5931. Capsules for Bottles, C. E. H. Cheswright, London.—A communication from C. Cheswright.—*12th December*, 1882.
5933. Ornamenting Glass, R. E. Frank, London.—Com. from D Scotellari.—*12th December*, 1882.
5934. Sawing Wood, W. R. Lake, London.—A communication from R. S. Greenlee.—*12th December*, 1882.
5944. Covers for Bottles, E. Edwards, London.—*13th December*, 1882.
5950. Railway Signal Apparatus, W. R. Sykes, Nunhead.—*13th December*, 1882.
5958. Combing Wool, &c., J. H. Whitehead, Leeds.—*13th December*, 1882.
5959. Tanning Skins, &c., P. Jensen, London.—A communication from S. A. Garveri.—*13th December*, 1882.
5963. Engraving Machines, F. Wirth, Germany.—A communication from L. Limberd and M. Salm.—*13th December*, 1882.
5964. Shedding Apparatus of Looms, J. Irving, Barnsley.—*13th December*, 1882.
5965. Slide Valves, C. Pieper, Berlin —A communication from E. Blass.—*14th December*, 1882.
5972. Igniting Gas, T. Rowan, London, and S. Williams, Newport.—*14th December*, 1882.
5973. Spinning Fibres, F. Ripley, Bradford.—*14th December*, 1882.
5974. Looms for Weaving, D. Eastwood, Luddenden Foot.—*14th December*, 1882.
5987. Hydraulic Steering Gear, C. Stout, Conway, and C. H. Hillcoat, Liverpool.—*15th December*, 1882.
6000. Lighting or Distributing Light, C. L. A. Baatsch, London.—*15th December*, 1882.
5002. Generating Electric Currents, A. M. Clark, London.—A communication from G. Trouvé.—*15th December*, 1882.
6003. Electrical Conductors, &c., S. H. Emmens, London.—*15th December*, 1882.
6006 Miners' Safety Lamps, D. Ballardie, Glasgow.—*16th December*, 1882.
6012. Excavating Machinery, J. Imray, London.—A communication from P. Jacquelin, and V. Chèvre.—*16th December*, 1882.
6018. Audible Signalling Apparatus, J. Steven and T Burt, Glasgow.—*16th December*, 1882.
6042. Clearing Snow from Railways, E. Barnes, Ulverstone.—*18th December*, 1882.
6044. Spinning Fibres, E Tweedale, Accrington.—*18th December*, 1882.
6046. Electric Lamps, H. H. Lake, London.—A communication from J. Kremenezky.—*18th December*, 1882.
6095 Cutting Fabrics, C. D. Abel, London.—A communication from La Société A. Labrosse et J. Richard.—*21st December*, 1882.
6124. Colour Boxes, T. Foxall, London.—*22nd December*, 1882.
6135. Kiers, J. Dimmock, Over Darwen.—*23rd December*, 1882.
6156. Sash Fasteners, J. E. Cope, Birmingham.—*23rd December*, 1882.
6176. Glucose Syrup, H. J. Haddan, London.—Com. from Dr. H. Endemann.—*27th December*, 1882.
22. Indicating Apparatus for Public Vehicles, W. L. Wise, London.—A communication from C. de Cuyper. *1st January*, 1883.
101. Applying Eosine in Photographic Processes, C. D. Abel, London.—A communication from P. A. Attout and J. Clayton.—*8th January*, 1883.
208 Colour Boxes, T. Foxall, London.—*13th January*, 1883.
427. Fibrous Material, C. Weygang, London.—*26th January*, 1883.
544. Flushing Apparatus, F. J. Austin, London.—*1st February*, 1883.
716. Soda, L. Mond, Winnington Hall, Northwich.—*8th February*, 1883.
744. Hydrants, T. Suffield, London.—*10th February*, 1883.
785. Feed-water Purifiers, W. P. Thompson, London.—A communication from C. Elliot.—*13th February*, 1883.
963. Guard for Carving-forks, A. M. Clark, London. Com. from F. Curley.—*21st February*, 1883.
1089 Making-up the Legs of Trousers, C. Wills, London —*28th February*, 1883.
1121. Obtaining Materials to be Used in Constructing, &c., Primary Voltaic Batteries, D. G. Fitz-Gerald and T. J. Jones, London.—*1st March*, 1883.
1231. Automatic Musical Instrument, M. A. Weir, London.—*7th March*, 1883.
1239. Fresh Air Injector, S. Low, jun., London.—*7th March*, 1883.
1245. Governors, W. Murdock, Glasgow.—*8th March*, 1883.
1255. Electric Lamps, J. G. Statter, Snapethorpe, near Wakefield.—*8th March*, 1883.
1270. Life-saving Apparatus, R. E. Pinhey, Oxton.—*9th March*, 1883.
1320. Generating, &c , Steam, J. Hodgart, Paisley.—A communication from D. Provand —*13th March*, 1883.
1322. Governors for Regulating the Speed of Engines, F. M. Rogers, London.—A communication from J. M. Gorham.—*13th March*, 1883.
1331. Sewing Machines, S. Pitt, Sutton.—A communication from L. B. Miller.—*13th March*, 1883.
1336. Baking Ovens, F. Smith, London.—*13th March*, 1883.
1371. Commutators for Dynamo-electric Machines, S. Z. de Ferranti and V. S. Szezepanowski, London.—*14th March*, 1883.
1398. Bending Metallic Plates, C. Scriven, Leeds, and J. Tweedy, Walker-on-Tyne.—*16th March*, 1883.
1407. Treating Ores, T. Bowen, London.—*16th March*, 1883.
1415. Laying Out, &c., Lines of Track, A. Haman, San Francisco, U.S —*17th March*, 1883.
1433. Ventilated Tap, T. Peacock, Battersea, and J. S. Sworder, Loughton, Essex.—*19th March*, 1883.
1465. Trucks or Bogies for Railway Carriages, J. C. Mewburn, London.—A communication from E. Whiting and J. M. Smith.—*20th March*, 1883.
1509 Iron and Steel, T. Griffiths, Abergavenny.—*22nd March*, 1883.
1763. Horseshoe Blank Rolls, H. J. Haddan, London.—A communication from S. T. J. Coleman, J. N. Clarke, and E. B. Reynolds —*7th April*, 1883.
1824. Ships, &c., N. de Telescheff, Paris.—*10th April*, 1883.
1860. Steel, &c., A. J. Boult, London.—A communication from G. W. Francis.—*12th April*, 1883.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the 13th April*, 1883.)

4891. Gas Stoves, G. E. Webster, Nottingham.—*14th October*, 1882.
4904. Washing, &c., Bottles, W. W. Horner, Dulwich.—*14th October*, 1882.
4913. Boilers, W. H. Thompson, L. Hardaker, and J. M. Porter, Leeds.—*16th October*, 1882.
4914. Umbrellas and Parasols, J. B. Seel, Urmston.—*16th October*, 1882.
4916. Looms for Weaving, J. Bywater, C. Bedford, and T. Kershaw, Bywater.—*16th October*, 1882.
4917. Waterproof Explosive Compounds, &c., P. Jensen, London.—*16th October*, 1882.
4918. Disintegrating Fabrics, I. C. Watson, Leeds.—*16th October*, 1882.
4920. Fastenings for Neckties, P. Ambjorn, C. de Sparre, Paris.—*16th October*, 1882.
4922. Setting, &c., the Spokes of Velocipede and other Tension Wheels, R. Adams, London.—*16th October*, 1882.
4923. Velocipedes, E. H. Hodgkinson, London.—*16th October*, 1882.
4924. Fountain Pens, R. Enright, London.—*16th October*, 1882.
4932. Clogs, D. Pickles, Halifax.—*17th October*, 1882.
4939. Sewing Machines, W. P. Thompson, London.—*17th October*, 1882.
4943. Writing Slates, J. and W. Williams, Llanfair, North Wales.—*17th October*, 1882.
5001. Telephonic Instruments, G. L. Anders, London.—*20th October*, 1882.
5014. Regulating Electric Currents, L. Campbell, Glasgow.—*21st October*, 1882.
5088. Moulding and Casting, J. and T. A. Boyd, Shettleston.—*25th October*, 1882.
5115. Manhole Doors, &c., T. H. Collins, Winchester.—*27th October*, 1882.
5129. Insulating Conductors of Electricity, C. W. Torr, Birmingham.—*27th October*, 1882.
5219. Cooling Rooms, J. Y. Johnson, London.—*1st November*, 1882.
5297. Treating Fibre-bearing Leaves, H. C. Smith, Richmond.—*6th November*, 1882.
5423. Steering Vessels, W. Pepper, Kingston-upon-Hull.—*14th November*, 1882.
5601. Secondary Batteries, A. Tribe, London.—*24th November*, 1882.
5633. Telephonic Apparatus, H. H. Lake, London.—*27th November*, 1882.
23. Breech-loading Fowling-pieces, &c., H. W. Holland and J. Robertson, London.—*1st January*, 1883.
365. Velocipedes, J. Hopwood, Heaton-Norris.—*23rd January*, 1883.

(*List of Letters Patent which passed the Great Seal on the 17th April*, 1883.)

4600. Suspending Pictures, W. R. Lake, London.—*27th September*, 1882.
4940. Millstone Balance, A. J. Boult, London.—*17th October*, 1882.
4954. Utilising Balloons for Photography, J. Templer, London.—*18th October*, 1882.
4957. Vehicles, J. Macdonald, London.—*18th October*, 1883.
4958. Coverings for Locks and Latches, H. Fleming, Halifax.—*18th October*, 1882.

4959. COMBING MACHINERY, P. Kelly, Bradford.—*18th October*, 1882.
4961. OIL CANS, J. Kaye, Kirkstall.—*18th October*, 1882.
4973. PAPER-CUTTING MACHINES, W. Crosland, Newton Heath.—*19th October*, 1882.
4974. REDUCING IRON ORE, W. E. Gedge, London.—*19th October*, 1882.
4988. ELECTRIC ARC LAMPS, A. Serraillier, London.—*19th October*, 1882.
4990. MOULDS, J. V. Hope, Wednesbury.—*19th October*, 1882.
4911. SECONDARY BATTERIES, J. E. Liardet, Brockley, and T. Donnithorne, London.—*19th October*, 1882.
4998. LAMPS, A. W. Kershaw, Lancaster.—*20th October*, 1882.
5018. TREATING SMALL COAL, C. E. Hall, Sheffield.—*21st October*, 1882.
5021. HARROWS, A. Clarke, Stevenage.—*21st October*, 1882.
5023. CARBONS for INCANDESCENT LAMPS, M. Bailey, London.—*21st October*, 1882.
5026. HEELS and TOES of BOOTS, G. Chambers, Brixton.—*21st October*, 1882.
5032. DRY DISTILLATION, J. Jameson, Akenside Hill.—*23rd October*, 1882.
5038. PERMANENT WAY, J. Morison and R. Armstrong, Newbattle, Dalkeith.—*23rd October*, 1882.
5050. ELECTRIC LIGHTING APPARATUS, H. H. Lake, London.—*23rd October*, 1882.
5063. CONTINUOUS FLEECE-DIVIDING MACHINES, L. A. Groth, London.—*24th October*, 1882.
5068. LIQUID METERS, J. C. Mewburn, London.—*24th October*, 1882.
5076. COKE, J. Jameson, Akenside Hill.—*24th October*, 1882.
5086. PRODUCING PRINTING SURFACES from GELATINE RELIEFS, R. Brown, R. W. Barnes, and J. Bell, Liverpool.—*25th October*, 1882.
5101. ROTARY ENGINES and PUMPS, T. S. Greenaway and A. Kitt, London.—*26th October*, 1882.
5104. MATERIALS for USE in PLACE of LEATHER, M. Bauer, L. Broquard, and J. Ancel, Paris.—*26th October*, 1882.
5132. KILNS, S. de la G. Williams, Birmingham.—*27th October*, 1882.
5152. PAPER TUBES, J. C. Mewburn, London.—*30th October*, 1882.
5158. PRODUCING, &c., ELECTRICITY, J. D. F. Andrews, Glasgow.—*30th October*, 1882.
5161. ROLLING CYLINDERS of IRON and STEEL, B. Walker, Leeds.—*30th October*, 1882.
166. CIRCUITS for TELEPHONIC COMMUNICATION, H. Alabaster, South Croydon, and T. E. Gatehouse, Camberwell.—*30th October*, 1882.
5167. TELEPHONIC RECEIVERS, H. Alabaster, South Croydon, and T. E. Gatehouse, Camberwell.—*30th October*, 1882.
5169. DECORATING EARTHENWARE, &c., C. Barlow, Hanley.—*30th October*, 1882.
5178. FOLDING TABLES, F. F. Atkinson, New York.—*31st October*, 1882.
5276. UTILISING the MOTIVE FORCE of WAVES, W. R. Lake, London.—*4th November*, 1882.
5330. BLEACHING, &c., FABRICS, J. Gibson, jun., Mottram, and J. Platt, Manchester.—*8th November*, 1882.
5391. INDICATING, &c., the SCORE of GAMES, C. Green, Ashton-under-Lyne.—*13th November*, 1882.
5420. SECURING the ENDS of the RIBS of UMBRELLAS, C. A. Allison, London.—*14th November*, 1882.
5430. BOTTLES, S. M. Bixby, New York.—*14th November*, 1882.
5467. BASTING MEAT, J. Reynolds, Henwick Lodge, near Worcester.—*17th November*, 1882.
5885. CONTROLLING the DISCHARGE of LIQUIDS, W. A. G. Schonheyder, London.—*9th December*, 1882.
5980. BOTTLES, H. E. Newton, London.—*14th December*, 1882.
6057. DRYING SALT, S. Pitt, Sutton.—*19th December*, 1882.
6188. PRINTING MACHINES, J. H. Johnson, London.—*28th December*, 1882.
6212. BOOTS and SHOES, T. Laycock, Northampton.—*29th December*, 1882.
118. SURFACE CONDENSING ENGINES, J. Chapman, Leith.—*9th January*, 1883.
297. LOCKING DEVICES for NUTS, &c., G. Macaulay-Cruikshank, Glasgow.—*18th January*, 1883.
360. MOULDING SOCKETTED PIPES, G. Smith, Leicester.—*22nd January*, 1883.
445. FOLDING LATTICE SHUTTER, P. Born, London.—*27th January*, 1883.
462. BINDING SHEAVES, J. Howard and E. T. Bousfield, Bedford.—*27th January*, 1883.
470. GOVERNORS for ENGINES, C. J. Galloway and J. H. Beckwith.—*29th January*, 1883.
542. BREECH-LOADING SMALL-ARMS, H. Webley, Birmingham.—*1st February*, 1883.
663. GAS PRODUCERS and FURNACES, C. W. Siemens, London.—*6th February*, 1883.
689. PRINTING MACHINERY, W. W. Colley, Camberwell.—*7th February*, 1883.

List of Specifications published during the week ending April 14th, 1883.

3564, 6d.; 3779, 8d.; 3789, 8d.; 3817, 6d.; 3863, 2d.; 3924, 8d.; 3938, 6d.; 3950, 6d.; 3958, 6d.; 3960, 1s. 4d.; 3990, 6d.; 3993, 4d.; 3996, 6d.; 4000, 6d.; 4001, 8d.; 4005, 6d.; 4006, 6d.; 4012, 2d.; 4013, 2d.; 4015, 6d.; 4017, 4d.; 4018, 6d.; 4019, 2d.; 4022, 6d.; 4023, 8d.; 4028, 6d.; 4029, 4d.; 4031, 8d.; 4032, 6d.; 4033, 2d.; 4035, 6d.; 4037, 2d.; 4038, 2d.; 4040, 6d.; 4041, 6d.; 4042, 6d.; 4044, 6d.; 4046, 6d.; 4047, 2d.; 4049, 2d.; 4050, 2d.; 4052, 4d.; 4053, 6d.; 4055, 8d.; 4057, 6d.; 4058, 2d.; 4059, 2d.; 4060, 6d.; 4061, 6d.; 4062, 6d.; 4063, 6d.; 4064, 6d.; 4065, 2d.; 4066, 2d.; 4068, 6d.; 4069, 6d.; 4070, 2d.; 4071, 2d.; 4072, 6d.; 4074, 4d.; 4076, 4d.; 4078, 6d.; 4080, 2d.; 4081, 8d.; 4082, 2d.; 4083, 2d.; 4084, 6d.; 4085, 2d.; 4089, 6d.; 4090, 6d.; 4092, 2d.; 4093, 8d.; 4096, 6d.; 4097, 6d.; 4098, 4d.; 4102, 6d.; 4104, 6d.; 4105, 6d.; 4106, 4d.; 4107, 4d.; 4103, 4d.; 4109, 6d.; 4110, 2d.; 4112, 6d.; 4113, 8d.; 4115, 2d.; 4116, 2d.; 4118, 2d.; 4119, 6d.; 4127, 6d.; 4128, 8d.; 4129, 2d.; 4131, 4d.; 4132, 2d.; 4135, 6d.; 4137, 6d.; 4140, 4d.; 4144, 4d.; 4147, 6d.; 4151, 2d.; 4152, 6d.; 4154, 2d.; 4156, 2d.; 4159, 2d.; 4160, 6d.; 4161, 6d.; 4163, 6d.; 4165, 1s. 2d.; 4168, 2d. 4169, 2d.; 4170, 2d.; 4180, 4d.; 4184, 6d.; 4187, 6d.; 5048, 4d.; 5922, 6d.

*** 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.*

3195. IMPROVED VACUUM AIR PUMP, *L. R. Bishop, New Kent-road, and S. Girling, Holloway.—6th July*, 1882.—(*Not proceeded with.*) 2*d.*

The object of this invention is to do away with a considerable length of tubing and valves ordinarily used, and thus enable a better vacuum to be obtained in less time than usual.

3334. DYNAMO-ELECTRIC MACHINES, &c., *R. Matthews Hyde, Cheshire.—14th July*, 1882. 6*d.*

This relates to improvements in the construction and arrangement of dynamos with disc armatures, and also to means for governing the same. The inventor claims the placing of the magnets so as to form consecutive magnetic fields of like polarity; the combination of the current generated from part of the armature coils with a shunt current from the main circuit for magnetising the electro-magnets; apparatus for imparting an alternate reciprocating motion to the brushes or contact wheels, in order to prevent grooving and to keep the surfaces of the contact wheels clear; the construction of contact wheels in rings flexibly connected to the axis; and lastly, the combination of an electro-magnet with the valves of the governor of an engine so as to regulate the speed of the latter in accordance with the speed of the dynamo.

2512. INCANDESCENT ELECTRIC LAMPS, *E. W. Beckingsale, Chiswick.—26th May*, 1882.—(*Not proceeded with.*) 2*d.*

The object of this invention is to prevent the great radiation of heat from the carbons of ordinary incandescent lamps, and the inventor proposes to accomplish it by enclosing them in two glass globes.

3564. FURNACES FOR KILNS, &c., *B. Finch, Westminster.—27th July*, 1882. 6*d.*

The invention comprises the introduction of a fire-box enclosing the fire at bottom, front, and sides closely, leaving the top open wherein the fuel is placed. The back is provided with an outlet for the flame generated to pass into the flue. The bottom of the box is filled with spent ashes, upon which the fuel rests, forming an arch or hollow fire in front of the flue.

3595. ELECTRIC TELEGRAPHY, *J. H. Johnson, Lincoln's-inn-fields.—29th July*, 1882.—(*A communication from E. Estienne, Paris.*) 1s. 2*d.*

This relates to an improved system of signals based on the Morse alphabet, and improvements in the construction and arrangement of the transmitting and receiving apparatus. In carrying out the invention reversed currents are employed, each emission being instantaneous and of the same duration. When acted on by a positive current the receiver reproduces a signal instantaneously. A similar effect is produced by a negative current, but a different signal is given. The signals in this system are vertical, instead of horizontal as in the Morse system. The inventor claims to be able to transmit messages with greater speed and precision by this means.

3752. TRANSMITTING ELECTRICITY FOR LIGHT AND POWER AND OTHER PURPOSES, *T. J. Handford, Southampton-buildings.—5th August*, 1882.—(*A communication from T. A. Edison, Menlo Park, New Jersey, U.S.*) 6*d.*

The object of this invention is to divide a current of high electro-motive force into a number of currents of low electro-motive force, by which means a great saving in conductors can be effected. One method of carrying this out is by supplying a main circuit with a continuous current of high tension by one or more dynamo machines, and by throwing into the main circuit at a number of points a counter electro-motive force, which causes between certain points a definite drop in the tension of the main current. From these points are run pairs of conductors, and the translating devices, such as lamps or motors, are located in multiple arc circuits from these auxiliary conductors. Each pair of auxiliary conductors with its translating devices forms a shunt from the main circuit. Electro-motors may be used to produce the counter electro-motive force, but the inventor thinks that economy is best secured by means of secondary batteries.

3779. ELECTRIC LAMPS, *B. J. B. Mills, Southampton-buildings.—9th August*, 1882.—(*A communication from W. M. Thomas, Cincinnati, Ohio, U.S.*) 8*d.*

This relates to improvements on patent No. 578, 7th February, 1882, granted to the present inventor for arc lamps, and consists in a method of equalising such lamps when used in series, so that one may not take more current than another, and so cause the others to diminish in brightness. It consists principally in a method of shunting the current past a lamp when the arc resistance of such lamp becomes higher then normal.

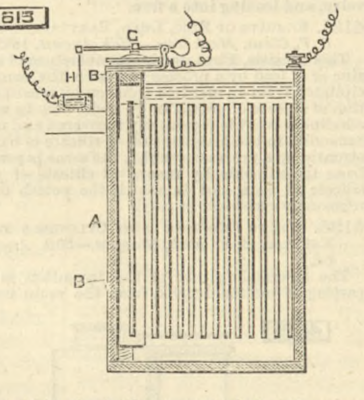
3789. OXIDISING ALCOHOLS, &c., *E. A. Brydges, Berlin.—9th August*, 1882.—(*A communication from D. Sandmann, Charlottenburg.*) 8*d.*

This relates to improvements in oxidising alcohols and other similar matter or fluids, which improvements can be employed for producing concentrated acetic acid, and is based upon the well-known fact that alcohol by the action of oxygen or ozone becomes oxidised to acetic acid.

3813. REGULATING AND MEASURING ELECTRIC CURRENTS, *J. S. Beeman, W. Taylor, and F. King, Cannon-street.—10th August*, 1882. 6*d.*

This relates to the storage of electric energy in secondary batteries, and to a means for regulating the charging of such batteries. Referring to the illustration, B is a gas chamber containing a plate A made

3813



proportionate in size to the amount of electric energy intended to be stored. When the pressure of the gas evolved in the process of charging rises beyond a certain limit it lifts the lever C, which tilts and causes H to break contact with the mercury in the cup, and this latter being in connection with the charging dynamo, the circuit is broken.

3814. ELECTRIC LAMP APPARATUS, *H. J. Haddan, Kensington.—10th August*, 1882.—(*A communication from C. F. Brush, Cleveland, Onio, U.S.*) 6*d.*

This relates to incandescent lamps, and to means for increasing the durability of the carbon filaments, as well as the light emitted therefrom. The patentee points out that there can be no doubt that the ordinary horseshoe-shaped filaments are subject to what Mr. Crookes has termed "molecular bombardment;" that is, that minute particles of carbon are projected from the one limb of the horseshoe to the other, when in a state of incandescence; and that this "bombardment" weakens the filament. To remedy this he places a screen of mica or glass between the two limbs.

3817. SECURING DOORS AND WINDOWS AGAINST BURGLARS, *H. J. Haddan, Kensington.—10th August*, 1882.—(*A communication from W. Kilian, Berlin*) 6*d.*

This consists of a door lock provided with an alarm apparatus, and in combination with a movable lattice fastened to the inner side of a door.

3827. AN IMPROVED FLOATING VESSEL FOR AUTOMATICALLY COMPRESSING AIR BY THE MOTION OF THE WAVES OF THE SEA, AND ALSO FOR THE GENERATION OF ELECTRICITY, &c., *C. W. Harding, King's Lynn.—10th August*, 1882. 6*d.*

The inventor proposes to moor a vessel at sea by means of a chain passing over a pulley inside the vessel. This chain is secured to the bottom of the sea at one end, passes over the pulley in the vessel, through the bottom again, and terminates in a heavy suspended weight. The pulley is connected with gearing which actuates air-compressing apparatus, and is so designed that whether the vessel rises or falls the gearing works the same way. The action of the waves causes the chain to bite the pulley and to actuate the air compressors which store the air in the accumulators. Air engines are also provided connected with dynamos, and the compressed air is utilised to drive these, and so generate electricity.

3852. APPARATUS FOR INDICATING THE POSITION OF STEAM AND WATER IN STEAM BOILERS, &c., *T. Hughes, Strand.—12th August*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to apparatus to be fixed inside boilers, which shall complete an electric circuit when the water falls below a certain depth, and so give an alarm at any required distance from said boiler.

3861. ELECTRIC INCANDESCENT LAMPS, *G. Pfannkuche, Fitzroy-square, and A. A. Dixon, Gateshead-on-Tyne.—12th August*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to a novel method of preparing the filaments for incandescent lamps from hempen fibres soaked in a heavy hydrocarbon oil, and subsequently carbonised; also to a method of fixing them in the glass globe, &c.

3868. FOLDING AND ADJUSTABLE CHAIR, *E. Smith, West Dulwich.—14th August*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to the general arrangement of the parts.

3893. SECONDARY OR STORAGE BATTERIES, *H. J. Haddan, Kensington.—15th August*, 1882.—(*A communication from Dr. H. Aron, Berlin.*)—(*Not proceeded with.*) 2*d.*

This relates to the preparation of storage battery plates by impregnating capillary substances with a chemical lead combination, which is then wound round the plates; and to other improvements.

3906. ELECTRIC LAMPS, *W. R. Lake, London.—15th August*, 1882.—(*A communication from P. Tihon and E. Rézard, Lyons, France.*) 6*d.*

This relates to the class of electric lamps known as semi-incandescent, in which two carbon rods abut upon a piece of refractory substance, which is heated to incandescence by the arc. The object of the present invention is to render the light steadier than that given by other lamps of the same class. The refractory substance is in the form of a rod, which is inserted between the two carbons of the lamp, so that the latter bear against it, and are always kept at a uniform distance apart by its means.

3912. STRENGTHENING AND CHECKING ELECTRIC CURRENTS, *P. Adie, Pall Mall, and W. S. Simpson, Battersea Park-road.—16th August*, 1882.—(*Not proceeded with.*) 2*d.*

The inventors place a battery near the receiving end of a telegraph or telephonic line and cause the transmitting current to pass through it.

3924. PROPELLING TRAM-CARS, *O. Mobbs and L. G. Moore, Northampton.—16th August*, 1882. 8*d.*

This relates to a method of and apparatus for propelling tram-cars and other road vehicles by means of gas motor engines, and in starting and stopping such vehicles without stopping the engine.

3938. WASHING OR PURIFYING ILLUMINATING GAS, &c., *S. Holman, London, and C. Hunt, Birmingham.—17th August*, 1882. 6*d.*

This relates to apparatus to be used in the washing or purification of illuminating gas and other fluids for the separation of dense and volatile products therefrom, and has for its object to provide an apparatus which gives a very large acting surface in but a small space, and in which the dense and volatile products are readily separated from the gas or other fluid, and a very effective separation and purification is thereby obtained.

3941. SECONDARY BATTERIES, *N. C. Cookson, Newcastle-upon-Tyne.—17th August*, 1882.—(*Not proceeded with.*) 2*d.*

The inventor forms his plates of lead wires woven into a fabric. The wires are formed by a special process.

3946. APPARATUS FOR RECEIVING AND RECORDING TELEGRAPHIC SIGNALS, *B. H. Chameroy, Maisons Lafitte, France.—17th August*, 1882. 6*d.*

This relates to apparatus for producing visible signals on chemically prepared paper by decomposing the chemicals by means of electric sparks. The line current is made to pass through one or other of two electro-magnets, according to its sign, and these attract alternately a piece of metal placed between them and free to oscillate. Two metal points are placed on opposite sides just above the paper, which revolves on a metal drum under and between them. These metal points are charged with induced electricity. The oscillation of the above-mentioned piece of metal by the alternate attractions of the two electro-magnets, according to the sign of line current, causes it to approach one or other of the above-mentioned metal points, from which a series of sparks escape and decompose the surface of the paper, thus making a series of signals.

3949. APPARATUS FOR SUPPLYING ELECTRICITY FOR LIGHT, POWER, AND OTHER PURPOSES, *T. J. Handford, Southampton-buildings.—17th August*, 1882.—(*A communication from T. A. Edison, Menlo Park, New Jersey, U.S.*) 6*d.*

This relates to means and apparatus for supplying consumption circuits in an electric light system with a lower tension current than that in the main circuit. This is effected by the use of induction apparatus located between the main circuit and the lamps, &c., to be supplied. It consists of a series of magnetic cores having two sets of wire coils, one of high resistance connected with the main circuit and the other of lower resistance connected with the consumption circuit. the connections of the main and consumption circuits with their respective sets of coils being changed or advanced simultaneously, so that the inductive action of the magnetic cores will cause current to flow in the consumption circuit always in the same direction.

3950. DYNAMO-ELECTRIC MACHINES, *S. Z. de Ferranti, Shepherd's Bush, and A. Thompson, Russell-square.—17th August*, 1882. 6*d.*

This relates to improvements whereby the inventors cause their alternate current dynamo to give off a continuous current. This is effected by arranging a series of metallic rubbers around the outer and inner circumference of the field-magnets in such a manner as to cause the currents generated to travel continu-

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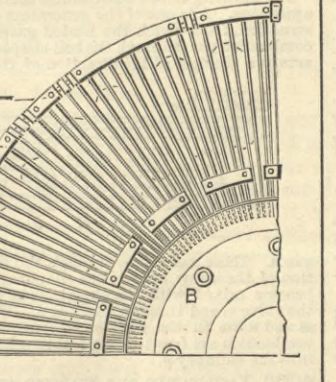

ously in the same direction. The armature in this machine consists of copper bars fixed radially round the periphery of a revolving disc, and insulated from each other and the body of the machine. To fix these bars in position the inventors make their inner ends wedge-shaped, and pinch them between the grooves of the centre wheel, which is made in two halves bolted together. The illustration herewith shows the armature with the copper bars attached to wheel B, and with contact pieces bearing against them.

3951. IMPROVEMENTS IN WATER MOTORS AND IN UTILISING THE FORCE OF RIVERS AND STREAMS FOR THE PURPOSE OF GENERATING ELECTRICITY, &c., *S. S. Allin, Bedford Park.—18th August*, 1882. 6*d.*

This relates to an improved water motor consisting of buckets suspended on pivots supported by the links of an endless chain which revolves over wheels. The inventor claims the use of the above to generate electricity by causing it to drive dynamos, &c.

3955. INCANDESCING ELECTRIC LAMPS, *T. J. Handford, Southampton-buildings.—18th August*, 1882.—(*A communication from T. A. Edison, Menlo Park, New Jersey, U.S.*) 6*d.*

This relates to the connection of the leading-in wires with the carbon filament. The inventor enlarges the two ends of the horseshoe filament and electro-plates them with copper. The ends of the leading-in wires are placed in contact with the electro-plated portions of the filament, and by means of a blow-pipe the metals are fused, so that when cool they are securely connected. To prevent harm to the filament during this latter operation it is enclosed in a metal box, with the two ends left projecting.

3958. CASTING AND MIXING METALS, *J. A. B. Bennett King's Heath, and B. P. Walker, Birmingham.—18th August*, 1882. 6*d.*

The First part relates specially to the mixing of copper and its alloys, in such a manner as to make it a brighter colour and sounder when cast, without materially interfering with the nature of either the pure copper or the alloys which may be for the time under treatment. The Second part refers to the mode in which the before-mentioned and other metals are cast.

3960. GAS APPARATUS FOR HEATING WATER, &c., *M. M. Brophy, London.—18th August*, 1882. 1*s.* 4*d.*

This relates to gas apparatus more particularly adapted to the heating or boiling of water or for the generation of steam, and consists of a ring or annular burner which surrounds a copper bulb or pear-shaped extension arranged on the vertical pipes.

3961. SECONDARY BATTERIES, *T. J. Handford, Southampton-buildings.—18th August*, 1882.—(*A communication from T. A. Edison, Menlo Park, New Jersey, U.S.*) 6*d.*

The inventor prepares his plates as follows:—Molten lead is poured from a height into water or powdered chalk, when it takes an arborescent form. It is then fused and pressed on to lead plates, or the electrodes may consist entirely of arborescent lead, which offers a large surface for action.

3964. SECONDARY OR STORAGE BATTERIES, *H. T. Barnett, St. John's Wood.—18th August*, 1882. 6*d.*

The object of this invention is to construct an accumulator which will automatically switch itself out of circuit when fully charged, and into circuit again when partially discharged; also to provide an attachment for automatically bringing over an accumulator, when several are being charged in series, directly it switches itself out of the circuit. To carry out the invention the author makes one terminal of an accumulator an electrode of copper, dipping into a solution of sulphate of copper; this is connected with a contact switch in such a way that the increase in the weight of the electrode by the electrolytic deposition of copper on it during the charging of the battery will actuate said contact arrangement.

3971. INSULATING COMPOUNDS, *C. J. Allport, Queen Victoria-street, and R. Punshon, Brighton.—19th August*, 1882. 2*d.*

The inventors mix powdered glass or silica and boiled linseed oil in about equal parts by weight, and cover the wire with the compound, which is then allowed to dry; or they mix equal parts of glass and india-rubber dissolved in benzole, naphtha, and bisulphide of carbon.

3975. SECONDARY BATTERIES, *J. E. T. Woods, Peckham Rye.—19th August*, 1882. 4*d.*

The inventor constructs his plates of carbon or alloys of chromium and iron or other suitable metals having the necessary conducting power, but he prefers the alloy of chromium and iron. He covers them with a layer of sesqui-oxide of chromium occasionally mixed with a little chromic.

3976. ELECTRIC LIGHTS, *T. J. Handford, Southampton-buildings.—19th August*, 1882.—(*A communication from T. A. Edison, Menlo Park, New Jersey, U.S.*) 6*d.*

The invention relates to means for regulating arc lamps when arranged in separate multiple arc circuits, and preventing the formation of a short circuit when the carbons come into contact. The inventor claims the combination of a lower stationary electrode, an upper movable electrode fed downwardly by gravity, and locking and lifting electro-magnets located in series with the electrodes, and opposed by retracting springs; also the combination with an arc lamp located in a cross or multiple arc circuit of means for preventing the formation of a short circuit when the electrodes come into contact.

3990. APPARATUS TO FACILITATE THE LIGHTING OF FIRES, &c., *E. Tomlinson, London.—19th August*, 1882. 6*d.*

This relates to improvements on patent No. 2931, dated 20th August, 1875, and consists partly in so arranging and constructing the holder for the wood or other igniting fuel, that it can be introduced into the grate above the bars and held in a vertical position therein, from which position it can be readily removed when the fire is ignited.

3993. DOOR MAT, BOOT AND SHOE CLEANER, *J. Hopewell, Salford.—19th August*, 1882. 4*d.*

This relates to the combination of a trough, frame, scraper, brushes, and mat in one apparatus.

3996. IMPROVEMENTS RELATING TO DYNAMO AND MAGNETO ELECTRIC MACHINES FOR REGULATING THE GENERATION OF CURRENT, *T. J. Handford, London.—21st August*, 1882.—(*A communication from T. A. Edison, Menlo Park, New Jersey, U.S.*) 6*d.*

The object of this invention is to keep the current steady in spite of unsteadiness in the driving of the engine, &c., and is effected by throwing resistance in or out of the circuit automatically. The illustration gives a diagrammatic view of the method of carrying

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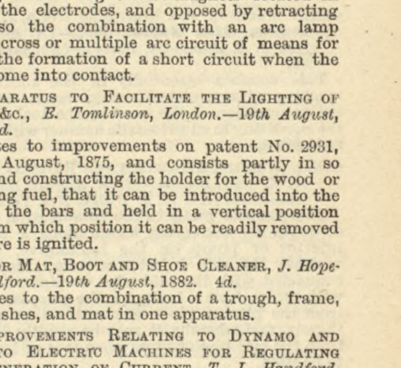

out the invention. As the parts are represented, the candle power of the lamps is normal. Should the current increase, lever G will make contact with H and complete the circuit through C, and cause the lever in front of it to vibrate with the assistance of the circuit breaker. This will cause the pawl attached to the lever to turn the ratchet wheel, and so throw more resistance into the main line until the candle power again becomes normal. Lever G will then resume its central position and break the circuit. Should the current decrease lever G will make contact at I, which will have the effect of energising D, and accordingly cutting resistance out of the main line until matters are again equalised. The main conductors leading from and to the brushes, and also the circuit of the field magnets are shown, and which, as will be seen, is at once affected by any resistance thrown into or out of the line. Another part of the invention relates to means for compensating for the taking out or putting in of lamps in the circuit.

4000. Rendering Wall Paintings Weather-proof, &c., *A. Keim, Munich.—21st August*, 1882. 6*d*.

This embraces, First, the preparation of the prime ground and of the painting ground; Secondly, the purification and the preparation of the colours; Thirdly, the preparation of the fixative; Fourthly, the fixing of the painting. The Second part of the invention consists of a process for rendering paintings absolutely unalterable.

4001. Rotary Engines and Pumps, *A. W. L. Reddie, London.—21st August*, 1882.—(*A communication from N. Tverskoy and P. Weiner, St. Petersburg.*) 8*d*.

This relates to the construction of rotary engines which may be readily converted into pumps, ventilating fans, or turbines, the principal objects in view being to equalise the radial pressures, and thereby to more perfectly balance the working parts of the engine, and also to utilise to the fullest extent the whole of the steam space within the cylinder, thus avoiding the steam cushions or "dead" spaces at present to be found therein.

4005. Non-conducting Tubes for Electrical and other Purposes, *J. C. Marsh and R. J. Smith, New Bridge-street.—21st August*, 1882. 6*d*.

This relates to the construction of tubes for laying wires in, having longitudinal divisions, so as to keep said wires separated. The tubes are made of a vitreous material, manufactured from Church Bay clay.

4006. Velocipedes, *J. Slassen, jun., London.—21st August*, 1882. 6*d*.

This relates principally to double driving and front steering tricycles.

4012. Construction and Fitting of Railway Carriage Doors, *J. Wallis, Cheapside.—22nd August*, 1882.—(*Not proceeded with.*) 2*d*.

The principal objects are to prevent the noise and shock resulting from the slamming-to of the doors; to prevent injury to the fingers of passengers by the accidental closing upon them of the doors, and to exclude wind, dust, and rain.

4013. Fastenings for Connecting Buttons to Gloves, &c., *W. B. Espeut, Hyde Park.—22nd August*, 1882.—(*Not proceeded with.*) 2*d*.

This relates to a disc fastening provided with a tongue.

4017. Manufacture of Hydrate of Glucose from Starch, *H. J. Haddan, Kensington.—22nd August*, 1882.—(*A communication from L. Virneisel, Germany.*) 4*d*.

This consists partly in the manufacture of hydrate of glucose from starch, out of a solution of starch glucose of a density of from 25 to 35 deg., with a quotient of purity not below 95.

4018. Apparatus for Cleaning and Polishing Tin-plate, *B. Williams, Cardiff.—22nd August*, 1882. 6*d*.

This relates to the employment of a system of superposed rollers, through which the tin-plates are passed, said rollers serving first as guide and delivery rollers, next as specially formed bran gripping cleansing rollers, then fluted bran cleansing rollers, and next guide and dusting, and in some cases polishing rollers.

4019. Fire-arms and Cartridges, *F. B. W. Roberts and B. T. Moore, London.—22nd August*, 1882.—(*Not proceeded with.*) 2*d*.

The cartridge is discharged by means of an electric current produced by a generator contained within the stock of the gun, or in the stand in the case of a machine gun.

4022. Rowlocks for Ships' and other Boats, &c., *S. S. Hazeland, Cornwall.—22nd August*, 1882. 6*d*.

This relates to improvements on patent No. 871, dated 1st March, 1881, and consists partly in mounting the oar in its rowlocks so as to allow of the action of the self-feathering blade upon the water being easily reversed when required.

4023. Preparing Book Covers called "Cases," *R. Birdsall, Northampton.—22nd August*, 1882. 8*d*.

This relates to the cutting half through and mechanical splitting of the back edges of a pair of solid boards, which boards are subsequently made into a book cover.

4029. Machines for Mortising Wood, *J. H. Johnson, London.—22nd August*, 1882.—(*A communication from J. B. Alexandre, Paris.*)—(*Not proceeded with.*) 4*d*.

This consists essentially in the addition to the machine of mechanical arrangements, or means for the penetration of the wood by the tool which effects the mortising in an automatic manner without liability to breakage.

4031. Heating Apparatus for Railway Carriages, *W. R. Lake, London.—22nd August*, 1882.—(*A communication from M. J. Walsh, New York.*) 8*d*.

This consists partly in the combination with a pipe or pipes for conveying steam along a train, of an injector or pump on the locomotive, and means whereby the said injector or pump may be readily connected with the said pipe or pipes, and supplied with steam from a boiler for the purpose of drawing from the pipe or pipes any water that may remain therein, and whereby it may be readily disconnected from the said pipe or pipes when it is no longer desired to be used.

4032. Manufacture of Glass Bottles, &c., *T. Pyke, South Shields.—22nd August*, 1882. 6*d*.

This relates to an improved method of and apparatus or tool for finishing the mouths of glass bottles.

4035. Metal Cans or Cases, &c., *J. A. Lloyd, London.—23rd August*, 1882. 6*d*.

This relates partly to the method of soldering a cutting wire into a recess or groove, so that it is prevented from being drawn out without cutting the metal.

4037. Stoppers for Bottles, Cans, &c., *H. J. Haddan, Kensington.—23rd August*, 1882.—(*A communication from G. A. Hardt, Cologne.*)—(*Not proceeded with.*) 2*d*.

This consists in making the stoppers from cardboard, paper, or similar material, and dish-shaped, by pressing these materials in hot moulds, and if desirable, impregnating or coating them with water-proofing or chemically inert substances.

4038. Combination Arms, *R. Howard, Southampton.—23rd August*, 1882.—(*Not proceeded with.*) 2*d*.

This consists in combining with the hilt guard of a sword a revolver pistol, so placed that the hand holding the sword can also actuate the trigger of the revolver.

4040. Mechanical Stokers, *J. Proctor, Burnley.—23rd August*, 1882. 6*d*.

This relates to improvements on patent No. 2047, A.D. 1875. On cross shafts operated by wheels and tappets, by means of levers, the inventor operates the movable grate bars, imparting to them the requisite to-and-fro motion.

4041. Machines for Preparing Cotton, &c., *W. Lord, Todmorden.—23rd August*, 1882. 6*d*.

This relates to improvements on patent No. 3914, dated September 9th, 1881, the object being to provide a regular feed and cleaner work, and an efficient and durable "porcupine" or cylinder.

4042. Manufacture of Steel for Corsets, &c., *J. S. W. Whitehead, Halifax.—23rd August*, 1882. 6*d*.

This relates to the manufacture and employment of perforated strips of steel.

4044. Telephone Receiving Apparatus, *R. and M. Theiler, Canonbury-road.—23rd August*, 1882. 6*d*.

This relates to improvements on the inventors' patent, dated 16th November, 1881, for telephone receivers, and consists in the employment of a stem or knob of ivory, wood, or other substance that can be conveniently inserted in the ear. This knob may have a tongue of soft iron fitted to it in such a matter that one end can vibrate freely close to the poles of an electro-magnet.

4045. Warning or Signalling Apparatus for the Protection of Property, &c., *H. Diggins and A. Glück, London.—23rd August*, 1882. 6*d*.

This consists in indicating by a visible signal the entrance or presence of intruders within a room or any other part of a structure, or the opening of doors and windows by such intruders to persons outside the said room or structure.

4046. Electric Arc Lamps, *J. K. D. Mackenzie, Halifax.—23rd August*, 1882. 6*d*.

This relates to apparatus for regulating the feed of the carbons, of which a front view is given in the accompanying figure. The following is the action of the apparatus:—Supposing the carbons to be together, and the current turned on, then A A is drawn towards

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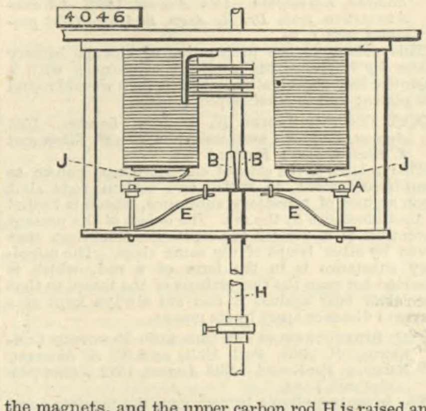

the magnets, and the upper carbon rod H is raised and held in its place by the jaws B B of the armature. As the arc increases the power of the magnet lessens, and the springs E E and J J draw each half of the armature down. The carbon holder H is thus released and falls, until the magnets again resume their energy, and cause the jaws B B to clutch it once more.

4047. Combined Lamp and Oil Feeder, *W. E. Gillmore, Deptford.—23rd August*, 1882.—(*Not proceeded with.*) 2*d*.

The object is to combine an oil feeder or can with a lamp, so that the light therefrom may be concentrated on the spot or any part of machinery required to be lubricated.

4048. Manufacture of a Blue Colouring Matter, *F. Wirth, Frankfort.—23rd August*, 1882.—(*A communication from B. Oehler, Offenbach.*) 4*d*.

This consists in the production of a blue dye stuff or colouring matter by the treatment of the nitroso-derivatives of dimethyl, diethyl, or ethylmethylaniline in a solution of concentrated sulphuric or phosphoric acid with sulphuretted hydrogen or metallic sulphides.

4049. Commutators for Dynamo or Magneto-electric Machines, *H. R. Lewis, Bartholomew-lane, and W. C. Smythe, Haymarket.—23rd August*, 1882.—(*Not proceeded with.*) 2*d*.

This relates to an arrangement of commutators by which neutral points of the magnetic field are cut out of circuit, and the whole of the currents collected and sent forth either in tension or quantity.

4050. Steel Wire for Musical Instruments, *J. R. Gibson, J. S. Baptie, and A. Squire, London.—24th August*, 1882.—(*Not proceeded with.*) 2*d*.

This consists in magnetising the wire.

4055. Construction of Engines or Motor Machines, *T. Charlton and J. Wright, London.—24th August*, 1882. 8*d*.

The object is the more complete utilisation of the energy in any heated medium used for the purpose of giving off force and inducing motion—for instance, air as a motor when it is used direct from the furnace, or steam as a motor when taken direct from the generator, or it may be upon either of the said media after having been partially de-energised in producing a motor force—for instance, air after a partial expansion, or exhaust steam after being used in the cylinder of the engine.

4059. Gas Fires or Stoves, *A. J. Boult, London.—24th August*, 1882.—(*A communication from P. Geofroy-Gomez, Toulouse.*—(*Not proceeded with.*) 2*d*.

A box placed below or about the level of an ordinary grate has tubes or burners projecting upwards, and has also openings or branches for the admission of gas and air. Wire gauze or equivalent is provided all round, or where required to prevent explosion.

4060. Machine for Painting, Varnishing, or Sizing Flat and Irregular Surfaces, *W. H. R. Toye, Philadelphia.—24th August*, 1882. 6*d*.

The machine consists of a framework in which is mounted a reservoir or reservoirs (to contain the liquid or size which it is intended to use) and a system of rollers to which a rotary, lateral, and vibratory movement is imparted. The roller having the vibratory movement receives the paint, varnish, or size, and transfers it to distributing rollers, whose function it is to evenly spread it on flexible impression rollers, whence it is imparted to the material to be treated. In combination with this system of rollers is employed a pressing roller or rollers, or a movable flat pressing surface for imparting pressure to the material, and bringing the same into contact with the flexible impression rollers.

4064. Regenerative Furnaces, *C. A. W. Schön, Hamburg.—24th August*, 1882. 6*d*.

The drawing shows a horizontal section of the entire apparatus. A is one of the generators of ordinary construction, from which the heated gases or products of combustion pass through the bell-shaped tank B, which acts as a changer of the direction of the course of such

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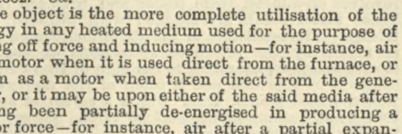

gases. These gases pass through the flue in the direction of the arrow *a* up to the diaphragm *e*, and there become mixed with the air which is free to enter at the valve *m* and through the flue *b*. When the valves *m* and *n* are in the position shown, the products of combustion are free to escape through the flues a^1 b^1 into the chimney *g*.

4066. Facilitating the Starting of Horse Tramcars, *J. E. Walsh, Halifax.—25th August*, 1882.—(*A communication from E. Gerig, Berlin.*—(*Not proceeded with.*) 2*d*.

This consists in the employment on each axle of the car of a lever spanning the axles and carrying a ratchet, which operates a ratchet wheel. A chain is connected to the lever and passes over a pulley on the draw rod, so as to pull the lever upwards when the car is started and thus actuate the ratchet wheels, and so move the wheels round.

4071. Apparatus for Printing, *W. C. Haigh, Manchester.—25th August*, 1882. 2*d*.

The surfaces of rollers or blocks are either covered with a gelatinous composition or india-rubber, and the device to be printed is engraved, etched, stamped, or cast thereon in relief; or such surfaces are covered with cement, and the device transferred thereon.

4078. Spring Hinges for Swing Doors, *E. Barnes, Mile End.—25th August*, 1882. 6*d*.

The shoe or bottom plate is mounted on a square headed vertical pivot with an excentric projection. The pivot works in a footstep, in a case containing two blocks, one on each side of the excentric projection. Springs force the sliding blocks towards the projection. The excentric forces one of the blocks back when the door is open, and its spring forces it to return to its normal position.

4082. Cans or Vessels for Holding Oil or other Liquids, &c., *T. S. Marriage, Reigate.—26th August*, 1882.—(*Not proceeded with.*) 2*d*.

The cover is formed so that when turned in one direction an opening is brought opposite the spout or outlet of the can, and a second opening opposite an air inlet, while when turned in the opposite direction the can is securely closed.

4085. Guiding or Leading in and Hauling Fishing Nets and Lines, *H. Davids, Aberdeen, N.B.—26th August*, 1882.—(*Not proceeded with.*) 2*d*.

This consists of a light vertical frame secured to the boat rail, so as to be free to swivel. Near its upper edge are pulleys over which the ropes pass, one pulley being fitted with a ratchet and pawl to prevent backward movement.

4091. Wind Motors, *H. Lübben, Hanover.—26th August*, 1882. 6*d*.

This relates to a wind motor, consisting principally of a vertical driving axle with arms, carrying wind sails capable of turning upon axles, which lie somewhat away from the middle point of the breadth of the sails, so that the sails bend to keep their surfaces in the direction of the wind, but are prevented from so doing when on the one side of the vertical axle by ropes, or a crown wheel or cam, or other suitable means, in such a manner that on one side of the said axle as broad a surface as possible is offered to the wind, whilst on the other side of the said axle the wind strikes against the edge of the wind sails, and the motor is thus continuously rotated.

4102. Cranes, *A. Grafton, Cannon-street.—23th August*, 1882. 6*d*.

This relates to improvements in the slewing or rotating gear of cranes which revolve about a centre, and it consists in making a circular roller path and toothed ring, or the two combined in one entirely loose, and distinct from the bed, and allowing them to revolve subject to certain resistance applied by friction only. By this arrangement, first, the breaking of the teeth in the wheel or rack or its pinion is prevented; secondly, the roller path by being moved from time to time wears more equally; and thirdly, the parts may be renewed without destroying the whole foundation or bed plate.

4112. Baths, *W. Morgan Brown, London.—29th August*, 1882.—(*A communication from W. W. Rosenfield, New York.*) 6*d*.

This consists essentially in so arranging a shower or spray pipe in a bath that the shower of water therefrom may pass directly on the person when recumbent in the bath.

4119. Propelling Ships and Vessels, *G. F. Harrington, Isle of Wight.—29th August*, 1882. 6*d*.

This relates to improvements on patents No. 2813, dated 24th July, 1877, and No. 3582, dated 3rd September, 1880, and consists in arranging propeller shaft

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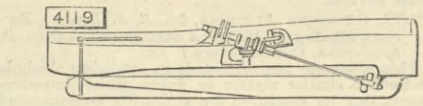

thrustwards and thrust friction wheels, so that the downward actions and the upward reactions of the engine power expended shall resolve into horizontal lines to propel vessels.

4129. Bakers' Ovens, *H. J. Haddan, Kensington.—29th August*, 1882.—(*A communication from C. M. Valjort, France.*—(*Not proceeded with.*) 2*d*.

The top of the baking space has an inlet for heating gases near the mouth of the oven, and several outlets over its circumference, each outlet having a register or valve, and leading into a flue.

4131. Silicate of Zinc, Lead, Baryta, and Strontia, *C. F. Claus, Mark-lane.—29th August*, 1882. 4*d*.

This consists, First, in the manufacture of silicate of zinc or of lead by a process in which the same is precipitated from an alkaline solution by means of a solution of silicate of potash or of soda, and in which the alkaline solvent is repeatedly recovered and used; and Secondly, in the manufacture of silicate of baryta or of strontia by a process in which the same is precipitated from its sulphide by means of silicate of potash or silicate of soda, and in which the potash or soda is repeatedly recovered or used.

4135. Valve Motions and Cylinders of Steam Engines, *A. C. Kirk, Glasgow.—30th August*, 1882. 6*d*.

The essential feature of the invention is the imparting of motion derived from the main connecting

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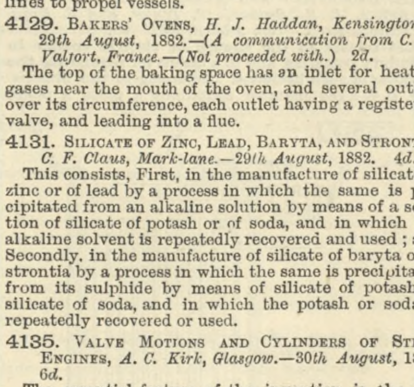


rod through a compensating lever and radius rod, so as to rock a curved link centred on a pin having motion derived from the piston-rod.

4137. Flanging Holes in Metallic Plates, *A. C. Kirk, Glasgow.—30th August*, 1882. 6*d*.

A simple form of hydraulic press is employed, and the plate, with a hole cut in it, is placed over a supporting ring made to suit the outside of the required flange, the ring being put on top of the hydraulic cylinder. A rod attached to the ram passes through the hole in the plate, and is then fitted with a die, which on descending forms the desired flange.

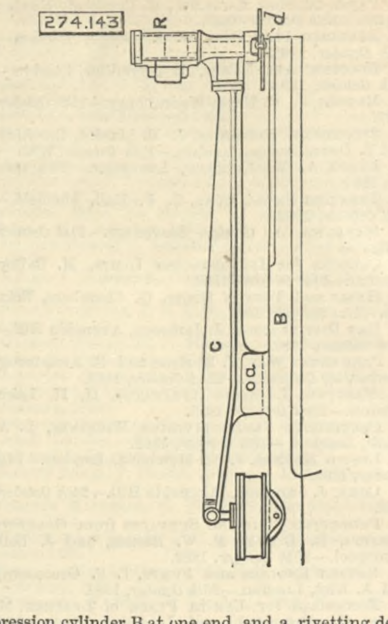
SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

274,143. Rivetting Machine, *John Rohan, St. Louis, Mo.—Filed October 21st*, 1882.

Brief.—The rivetting device is supported on the end of a lever and held against the work by pressure, the plunger of the rivetting device being also operated by pressure. *Claim.*—The stationary arm B, provided with suitable end die *d*, in combination with lever C, turning on a joint bolt *a*, and provided with a compression cylinder B at one end, and a rivetting device R at its outer end, arranged to operate in the manner and for the purpose substantially as described.

274.143



274,154. Steam Pump, *Eli Thayer, Worcester, Mass.—Filed March 18th*, 1882.

Claim.—In a steam pump, a central casting provided with a support, and in which the valves are located, having on each side an open cylinder, said cylinders being in line with one another, the induction chamber in said central casting occupying the entire space between said cylinders, substantially as and for the purpose specified. In a steam pump, the combination of part A, having induction chamber F and settling chamber *f*, cylinders B B, piston-rod C, extending

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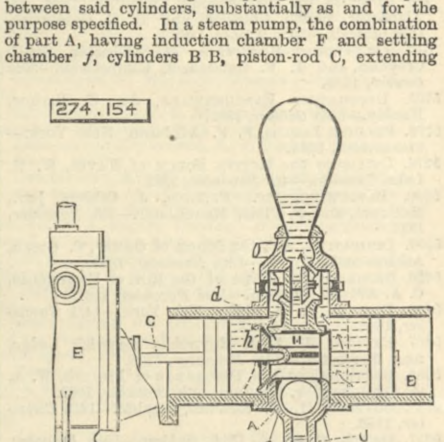

through part A, pistons D D, induction valve H, surrounding the piston-rod C, and adapted to admit water alternately to each cylinder, ports *d d*, chamber I, eduction valve J, located therein, and adapted to alternately open ports *d d*, with chamber I and steam cylinder E. The induction valve, which consists of the two oppositely-arranged valve faces h h^1, connected together by a hub or its equivalent, in combination with piston-rod C and packing box h^3

CONTENTS.

The Engineer, April 20th, 1883. PAGE

South Kensington Museum.—Visitors during the week ending April 14th, 1883:—On Monday, Tuesday, and Saturday, free from 10 a.m. to 10 p.m., Museum, 10,621; mercantile marine, Indian section, and other collections, 3411. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. to 6 p.m., Museum, 1956; mercantile marine, Indian section, and other collections, 311. Total, 16,299. Average of corresponding week in former years, 1,6764. Total from the opening of the Museum, 21,893,045.