THE ELECTRICAL TRANSMISSION OF POWER.

By PROFESSOR OLIVER J. LODGE.

No. III.

SINCE the functions of hyperbolic trigonometry intrude themselves into the discussion of the behaviour of an imperfectly insulated line wire, while the hypothesis of a perfectly insulated line is but of small practical utility; and since, for some unexplained reason, it is customary for people to learn only circular trigonometry, it is necessary to say a few words about these functions. They are related to the rectangular hyperbola just as the ordinary sine, cosine, &c., are related to the circle, and they are commonly written with an *h* after them, to distinguish them from the circular functions. The circular functions are periodic; the hyperbolic ones are not. The fundamental equation of circular trigonometry is

$$\cos^2 x + \sin^2 x \equiv 1;$$

that of hyperbolic is

$$\cosh^2 x - \sinh^2 x \equiv 1.$$

The curve $y = \sin x$, or curve of sines, is the well-known curve traced by a tuning fork on smoked glass. The curve $y = \sinh x$ is like the figure. It represents the distribution of magnetism in a theoretical bar magnet, extending to infinity in both directions with perfect symmetry, and passing through O at 45 deg.

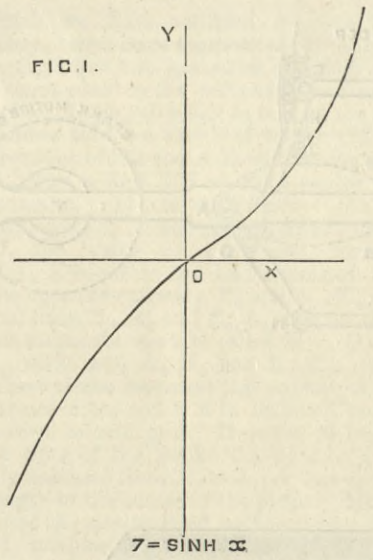


FIG. 1.

$y = \sinh x$

The curve $y = \cosh x$ is the common catenary, or curve in which a free chain hangs, its smallest ordinate being 1.

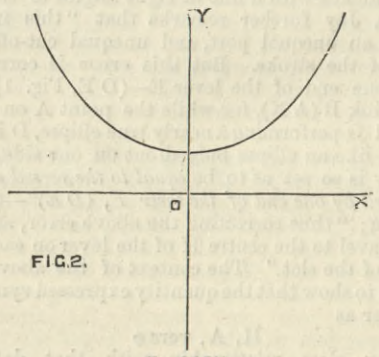


FIG. 2.

$y = \cosh x$

The cosh of a small quantity is 1; the sinh of a small quantity is equal to the small quantity itself. The sinh and the cosh of a large quantity are equal, and are very large. To calculate the value of the sinh and cosh of a fairly small quantity to any degree of approximation required, the following expansions are useful:—

$$\sinh x \equiv x + \frac{x^3}{6} + \frac{x^5}{120} + \ldots .$$

of which the first term is sufficient if x be very small; and

$$\cosh x \equiv 1 + \frac{x^2}{2} + \frac{x^4}{24} + \ldots .$$

of which the first two terms are usually sufficient.

If x is not small, these expansions are not much use, and we must then use the following identities, analogous to Euler's expressions for sin and cos, which are given in every book on the differential calculus:—

$$2\sinh x \equiv \epsilon^x - \epsilon^{-x}$$
$$2\cosh x \equiv \epsilon^x + \epsilon^{-x},$$

where $\epsilon = 2{\cdot}71828$, the natural base of logarithms.

In the present case we have to deal with the sinh and cosh of $\sqrt{\frac{R}{S}}$, R being the conduction resistance, and S the insulation resistance of the line wire. Now, for the short stout line likely to be used for transmission, S is likely to be much greater than R, and so the approximations

$$\sinh\sqrt{\frac{R}{S}} = \sqrt{\frac{R}{S}}$$

and

$$\cosh\sqrt{\frac{R}{S}} = 1 + \frac{R}{2S}$$

will usually be sufficiently accurate.

But for long telegraph lines S is not so very much greater than R, and in these cases we can proceed thus: First obtain cosh from the equation

$$\cosh\sqrt{\frac{R}{S}} = 1 + \frac{R}{2S} + \frac{R^2}{24S^2},$$

and then calculate sinh from

$$\sinh = \sqrt{(\cosh^2 - 1)}.$$

These values will be very nearly accurate, even if S and R are equal.

Discussion of the Despretz experiment.—Now let us apply our equations to the case of M. Marcel Despretz's experiments, namely, the transmission of half a horse-power along 1000 ohms of ordinary telegraph wire. There has been some uncertainty as to the efficiency with which this was done, M. Despretz having claimed 60 per cent., and M. Cabanellas having argued that the actual efficiency was only 20 per cent. We shall find that M. Cabanellas is about right, though his reasoning is very unsatisfactory.

The data as quoted in THE ENGINEER of November 24th, 1882, are as follows:—

Actual power obtained on the brake at the distant end, $\frac{1}{2}$-horse power.

Resistance of the wire on each machine, $\rho_1 = \rho_2 =$ 460 ohms.

Resistance of line wire R = 1000 ohms.

Potential of the wire at sending end, $e_1 = 2400$ volts.

Potential of the wire at receiving end, $e_2 = 1600$ volts.

Strength of current = $\frac{1}{2}$ Ampère.

The speeds of the machines are also given, but we probably need not use them. They are—sending machine, 2100 revolutions per minute; receiving machine, 1400 revolutions per minute. The machines were too similar Gramme "carcasses," wound with extra thin wire in order to make them give a high electro-motive force. They seem to have been precisely alike, though it might have been better to wind the receiving machine with thinner wire than the sending.

In discussing these data, I shall have to assume that they are rigorously correct, though the figures bear the impress of being rather round numbers.

The first thing one is struck with is the poor insulation of the line which they reveal. On a perfectly insulated line the current ought, of course, to be $\frac{e_1 - e_2}{R}$, or ·8 Ampères, whereas it is stated only to have been ·5 Ampères.

It is not said whether this current was measured at the sending or receiving end; but it must have been at the receiving end, for the existence of a leak would tend to increase the strength of the current at the sending end above ·8, instead of lessening it. I shall therefore consider that $C_2 = {\cdot}5$.

To get an idea of the insulation resistance of the forty miles of wire—I believe that a return wire was used, and that therefore there were eighty miles altogether—we may proceed thus:—

$$\text{Approximately } R = \frac{e_1 - e_2}{\frac{1}{2}(C_1 + C_2)},$$

$$\text{and also approximately } S = \frac{\frac{1}{2}(e_1 + e_2)}{C_1 - C_2};$$

the first of which relations gives us $C_1 = 1{\cdot}1$ Ampères; while the second then gives us S = 3333 ohms.

The data being imperfect, it is difficult to be sure how far this is correct, for a slight error in the determination of C_2 would make a great difference in the value of S. Thus, if C_2 had been really ·7, S would have come out 9000 ohms; and if C_2 had been ·8, S would have come out infinity.

However, without further information, it is safest to assume that $C_2 = \frac{1}{2}$ is a correct determination, and to proceed to calculate S accurately, which we can do by means of equation (24).

$$C_2\sqrt{RS}\cdot\sinh\sqrt{\frac{R}{S}} = e_1 - e_2\cosh\sqrt{\frac{R}{S}}.$$

Solving this as best we can, we find that S = 3100 ohms, so we are constrained to suppose that the insulation resistance of the line employed was only 3·1 times its conduction resistance; and as the length of wire was eighty miles, this gives the ratio between the insulation and conduction resistances per mile as 20,000 : 1, which, I believe, a telegraphist would consider very low.

However, this is what the figures give, and we will proceed on the presumption that it is true. The first thing is to write down the value of the required auxiliary quantities based on $\frac{R}{S} = \frac{1}{3{\cdot}1}$, viz.:—

$$\cosh\sqrt{\frac{R}{S}} = 1 + \frac{R}{2S} + \frac{R^2}{24S^2} = 1{\cdot}1664$$

$$\sinh\sqrt{\frac{R}{S}} = \sqrt{\cosh^2 - 1} = \sqrt{{\cdot}36} = {\cdot}6$$

$$\sqrt{RS} = 1761$$

and now we can obtain all the unknown quantities we like.

The current at the sending end, by equation (23), was

$$C_1 = \frac{1199}{1057} = 1{\cdot}13 \text{ Ampères.}$$

The current at the receiving end, by equation (24), was

$$C_2 = \frac{534}{1057} = {\cdot}5,$$

as it was stated to be.

The electro-motive force of the sending machine was (see 2), $E_1 = e_1 + \rho_1 C_1 = 2920$ volts; and the opposition electro-motive force of the receiving machine was (by 9), $E_2 = e_2 - \rho_2 C_2 = 1370$ volts.

The net power applied to the production of the current in the armature of the sending machine must therefore have been

$P_1 = E_1 C_1 = 3300$ Watts, or nearly $4\frac{1}{2}$-horse power.

The gross power conferred by the current upon the armature of the receiving machine, part of which was expended in friction and in churning the air, was similarly

$p_2 = E_2 C_2 = 685$ Watts, or ·92-horse power;

but of this only about half a horse-power seems to have been actually obtained on the brake.

The theoretical or electrical efficiency is thus

$$F = \frac{p_2}{P_1} = 20{\cdot}8 \text{ per cent.}$$

The actual mechanical efficiency was no doubt less than this.

It may be instructive to modify this calculation so as to fit the hypothesis of a perfectly insulated line wire, but we must select data which are consistent with this hypothesis.

Recalculation of the Despretz experiment on the assumption that the line was perfectly insulated.

Case 1: Let the data be

R = 1000 ohms
$\rho_1 = \rho_2 = 460$ ohms
$e_1 = 2400$ volts
$e_2 = 1600$ volts.

Then we calculate at once

$$C = \frac{e_1 - e_2}{R} = {\cdot}8 \text{ Ampères}$$
$$E_1 = e_1 + \rho_1 C = 2768 \text{ volts}$$
$$E_2 = e_2 - \rho_2 C = 1232 \text{ volts},$$
$$\text{and the efficiency } F = \frac{E_2}{E_1} = 44{\cdot}5 \text{ per cent.}$$

Case 2:

Let the data be

R_1 ρ_1 and ρ_2, as before,
$e_2 = 1600$ and $C = \frac{1}{2}$.

Then we get

$e_1 = 2100$,
$E_1 = 2330$, $P_1 = 1165$,
$E_2 = 1370$, $p_2 = 685$,
and F = 59 per cent.;

just what M. Despretz thought it was.

Recalculation on the hypothesis of a fairly insulated line.—If the eighty miles of wire had been what a telegraphist would call fairly well insulated, S would, I believe, have been about 16 R. On this assumption

$$\sqrt{RS} = 4000;$$

$$\cosh\sqrt{\frac{R}{S}} = 1{\cdot}0313 \qquad \sinh\sqrt{\frac{R}{S}} = {\cdot}252.$$

Case 1:

Hence if the data had been R = 1000 , S = 16000 , $\rho = 460$, $e_1 = 2400$, $e_2 = 1600$, we should calculate

$$C_1 = \frac{875}{1008} = {\cdot}868$$
$$C_2 = \frac{750}{1008} = {\cdot}744$$
$$E_1 = 2800$$
$$E_2 = 1257$$
$$P_1 = 2440$$
$$p_2 = 938$$

and F = 38·3 per cent.

Case 2:

But if S = 16000, $e_2 = 1600$, and $C_2 = \frac{1}{2}$ had been the data, R and ρ being as before, we should have calculated

$$e_1 = 2154$$
$$C_1 = {\cdot}616$$
$$E_1 = 2437$$
$$E_2 = 1370$$
$$P_1 = 1500$$
$$p_2 = 685$$
$$F = 46 \text{ per cent.}$$

It will be understood, I hope, that these hypothetical cases have been worked out, not to resuscitate insufficiently known data in a particular experiment, but to illustrate the influence of various changes on the resulting efficiency, to exhibit the kind of calculation which can be applied to given data, and also to illustrate the kind of data which it is desirable to have recorded. For these purposes the above calculations would be just as instructive, even if the Despretz experiment had never been performed.

There is one more point, however, which it is perhaps important to specify, namely, that it is impossible to measure directly the conduction resistance only of an imperfectly insulated line. The resistance value obtained with the far end to earth will really be not R, but something more like $\frac{RS}{R+S}$. When the far end is insulated, indeed, S may be measured without trouble, and by the two observations R can be readily calculated. But the worst of S is that it cannot be trusted to remain constant, and it ought to be measured by means of a strong current if the value obtained is to apply to the transmission of power case; for an insulation resistance is well known to depend often on the strength of the current, and also on whether the wire is above or below the potential of the earth. Hence S is probably best calculated from the transmission experiments themselves, as we have been doing. But if this be so, R must be really determined in the same way, for all that a direct measure of the resistance of the line can give will be $\frac{RS}{R+S}$.

If we can measure electro-motive forces accurately as well as currents, the best data to determine in a transmission experiment are, therefore, e_1, e_2, C_1, C_2, besides, of course, ρ_1 and ρ_2, the resistances of the wire on the dynamos.

It will probably also be well to make a check determination, as accurately as possible, of "the resistance of the line," viz.: $\frac{RS}{R+S}$.

Then calculation can proceed as follows:—

$$RS = \frac{e_1^2 - e_2^2}{C_1^2 - C_2^2}, \qquad \ldots \quad (21)$$

which we can approximately split into factors, as said before, viz.:

$$R = \frac{e_1 - e_2}{\frac{1}{2}(C_1 + C_2)} \qquad \ldots \quad (32a)$$

$$S = \frac{\frac{1}{2}(e_1 + e_2)}{C_1 - C_2}; \qquad \ldots \quad (32b)$$

or, more accurately, we can combine (23) with (24), and obtain R and S with rigour.

More complete discussion of the Despretz case.—Illustrating this point by the Despretz experiment, we shall have to suppose that a thousand ohms was not the true resistance of the line as stated, but that really the leak-shunted resistance

$$\frac{RS}{R+S} = 1000 \text{ ohms.}$$

Then taking

$$C_2 = \tfrac{1}{2}$$
$$e_1 = 2400$$
$$e_2 = 1600$$

as the data, we can calculate C_1 thus:

$$1000 = \frac{(21)}{(32a)+(32b)} = \frac{e_1^2 - e_2^2}{2(e_1 - e_2)(C_1 - C_2) + \frac{1}{2}(e_1 + e_2)(C_1 - C_2)}$$

whence $C_1 = {\cdot}833.$

Hence, without more ado,

$$E_1 = 2785$$
$$E_2 = 1370$$
$$P_1 = 2320$$
$$p_2 = 685$$
$$F = 29{\cdot}5 \text{ per cent.}$$

We may mention further that in this case R comes out 1200 ohms, and S 6000, or S = 5 R.

If Despretz had recorded the current at *both* ends of his line, he would have saved us a good deal of trouble, and as this is a very easy thing to do, it should never be omitted in a future experiment.

In a future experiment, then, let it be remembered that however many data of secondary importance be given, such as speeds, sizes, &c. &c., nothing should interfere with the exact determination of the following six primary quantities :—

$$\rho_1 \quad \rho_2 \quad C_1 \quad C_2, \quad \text{and two others.}$$

What these two other primary quantities are must depend upon accessible instruments and upon convenience. If their constancy can be depended on, $\frac{R\,S}{R+S}$ and S are the best to determine. But e_1 and e_2 will do instead; only it is not easy to measure accurately high electro-motive forces in a workshop.

If more than six quantities be determined they will act as checks, for they will be connected with the others by established formulæ with which they ought to be consistent; and if they are not consistent, some of the measurements are wrong.

In the present article I have not made use of the equations obtained at the end of last week's article, which expressed everything in terms of the big E's; but for some purposes these are convenient. In my next article I will summarise them in abbreviated forms and apply them to the solution of certain problems of practical interest.

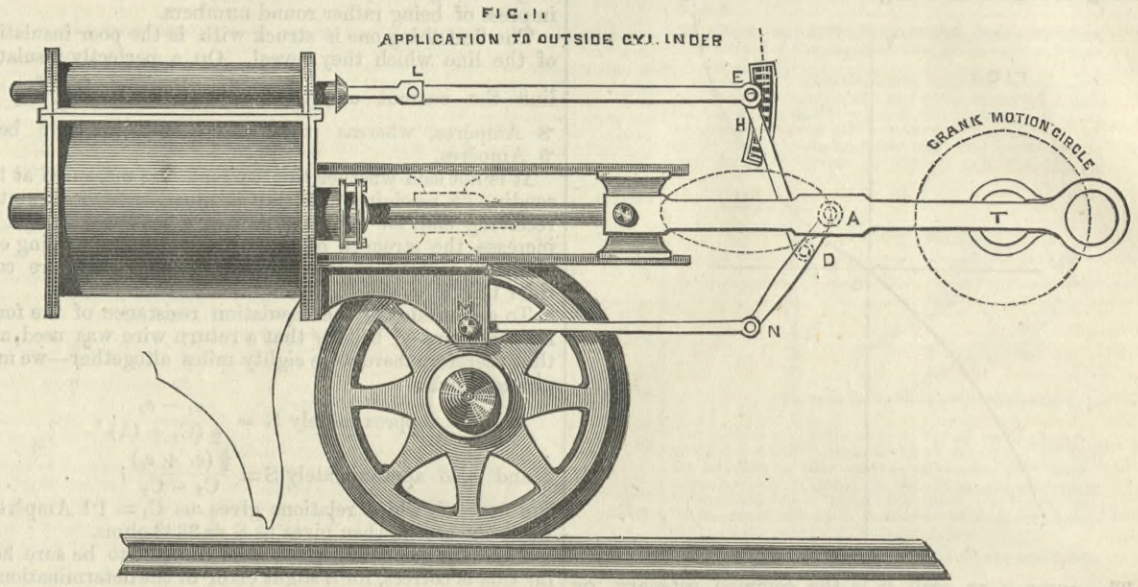
ON RADIAL VALVE GEARS.

By ROBERT HUDSON GRAHAM, C.E.

No. I.

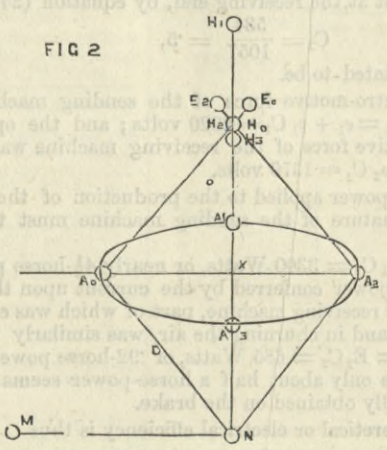
Definition and analysis.—Many applications of what is termed in these papers "radial" valve gears have been recently made public, notably by Mr. Brown, of Winterthur, Mr. Marshall, of Newcastle, and Mr. Joy, of London, and it is claimed for the new gear that it not only effects a more equal distributive action, but, in addition, does away with much of the friction incident to the older excentric gearing. The first object of these papers is to give a general analysis of radial gearing, omitting all comparisons of separate systems and rival claims of different authors, the aim being to explain on scientific and mathematical grounds the working and construction of a rigid radial system. Hitherto, it seems to me, more practical art and tentative experiment have been brought into the construction of radial gears than exact scientific methods, and this is generally what takes place in every new application of an old but latent principle; so that it is only after a lapse of time that new systems come to be more closely looked into, with the result that their hidden geometric forms are brought nearer to the light, and their theory and practice reconciled, which constitutes the last and most perfect state of invention. In order to avoid in what follows a dry and uninteresting discussion of generalities, it will be better to select some particular form of radial gear as a kind of groundwork, or concrete expression of theoretical formulæ. The three systems of which mention has already been made are essentially one, as far as the use of radial rods for the transmission and transformation of motion is concerned; but the gear of Mr. Joy has been chosen for two reasons—first, because it embraces the use of radial rods as well as the radial slot, and again, because it has been recently explained to the engineering public in a paper read by Mr. Joy before the Institution of Mechanical Engineers.

(1) *Analysis.*—A motion derived from two others may assume a lineal, a conical, or a transcendent form, and the kind of resultant curve will depend upon the nature and relative amount of the component motions. As a rule, radial gearing embraces combinations of rectilineal with circular paths, giving resultant elliptic motions; but occasionally these elliptic motions are recombined with other circular components, giving finally curved paths of a transcendent nature. An example of an elliptic motion resulting from the combination of a rectilineal with a circular path is contained in the gear we intend to study, in which—Fig. 1—the centre A describes, practically speaking, an ellipse path. In Joy's gear the point A, Fig. 1, partakes of the circular motion of the crank and the rectilineal motion of the crosshead, whilst N, the other extremity of the rod A N, which is a rigid bar, is constrained to follow in the path of a circle, described about the centre M. Consequently, the point D in the rod A N will have a motion derived from the elliptic motion of A and the arcal motion of N, and may be classed with those secondary combinations before mentioned, resulting in curves of a transcendent nature. The elliptic path of A could be easily traced out from the fact that its distance from the centre of the movable crosshead is a known constant. Leaving, however, the equation of its *locus* to be determined in due order, it will be clear even now that the major axis of its ellipse is equal to the course of the piston, and the minor axis to the transverse distance between the positions of A when the crank is at right angles to the piston path, or, in other terms, when the phase of the crank motion is 90 deg. and 270 deg. approximately. The transcendent path of D will follow from the known paths of A and N, for if from each particular position of A a circle of a radius equal to A N be described, the point N must be located on the circumference of each of these circles. Moreover, it must also be located somewhere on the circumference of a circle described about the centre N, with a radius equal to M N. Therefore, the point N will be defined by the intersections of this last circle with each of the circles described about the several positions of A. Wherefore, if the distance A D be given, the position of D will be determined by setting out the given distance A D in the direction of N. But the distance A D is not a given dimension, and therefore has to be determined by a process, which it is one of the objects of this paper to develope. The moving fulcrum centre H is constrained to move in a circular slot of a radius equal in length to the valve rod, and partakes of the elliptical motion of A, in so far that the extent of its vibration depends upon the length of the minor axis of the ellipse path of A—a fact which Mr. Joy states somewhat vaguely when he says that "H partakes of the horizontal movement of the connecting rod to an extent equal to its vibration at the point A," meaning that the chord of the arc through which H vibrates is equal to the minor axis of the ellipse described by the point A.* The position of the centre of the slot follows from the localisation of D, and the required amount of lap and lead to be given to the slide valve. The extreme point E, to which the valve rod is connected, shares in the arcal motion of the fulcrum H and the abnormal motion of the centre D. In the next few paragraphs it will be sought to establish the lineal proportions which the various elements in Joy's gear bear to each other. The first and most important of these elements is without doubt the part-rod A D—



see Fig. 1—by which the unequal vibration of the centre H in the radial slot is compensated for and corrected. It will be, therefore, more in order to determine, first of all, this fundamental length A D, and, in the next place, to build up the rest of the construction.

(2) *Joy's gear treated by geometric method.*—In order to determine the element A D, it is absolutely necessary that clear notions should exist why this corrective quantity has any place at all in the gear, and it is evident that the cause of its introduction is explained by the fact that if the lever rod D E were attached directly to the connecting rod at A—Fig. 1—the fulcrum centre H would describe unequal paths on each side of the centre of the slot. The following extract from a paper of Mr. Joy's has reference to this part of the subject:—"It will be seen that if the end D of the lever D E were attached directly to the point A on the connecting rod, there would be imparted to the centre H of that lever an unequal vibration on each side of the centre of the disc K—in present instance the centre of the slot. The extent of the inequality would be twice the versed sine of the arc described by the end D of the lever D E." Some ambiguity may overshadow the exact meaning conveyed in the passage with regard to the terms of the definition of the versinal difference of vibration, but no doubt can exist as the explicit statement of some inequality being imparted to the lever D E in its supposed position of attachment to the connecting rod at A. In order to make this point clear, the following development is added without at the same time any pledge being given that it represents the true interpretation of



the above extract. Let the elliptic path of A be shown in Fig. 2 by its chief four positions A_0, A_1, A_2, A_3, and let H_0, H_1, H_2, H_3 be the correlative positions of the fulcrum H, then the part A H of the lever A E—D being supposed to coincide with A—would occupy the four positions in successive order $A_0\,H_0$, $A_1\,H_1$, $A_2\,H_2$, and $A_3\,H_3$. If at the same time $A_1\,X$ represent the half minor axis of the ellipse path of A, the distance $H_1\,H_0$ will exceed that of $A_1\,X$ by the amount due to the straightening of the rod as it passes from its initial position

* It should be observed that this minor axis lies *horizontally* in cases where the crosshead moves *vertically*, as in most marine engines.

$A^0\,H_0$ to its vertical position $A_1\,H_1$; for let the angle $A_0\,H_0\,X$, made by $A_0\,H_0$, with the vertical, be called ϕ, it will be clear that—

$$H_1\,H_0 - A_1\,X = H_1\,H_0 + H_0\,A_1 - [A_1\,X + H_0\,A_1] = H_1\,A_1 - H_0\,X.$$

But $H_0\,X = H_0\,A_0 \cos\phi = H_1\,A_1 \cos\phi$

therefore— $H_1\,H_0 - A_1\,X = H_1\,A_1\,[1 - \cos\phi] =$

$$H_1\,A_1 \text{ vers } \phi \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

On the other hand, an effect, equal in magnitude, but opposite in sense, will be produced on the return stroke of the piston, when the lever A E is again vertical. A H will then occupy the position $A_3\,H_3$, and again assuming H_0 to be the centre of the slot—

$$A_3\,X - H_0\,H_3 = A_3\,X + H_3\,X - [H_0\,H_3 + H_3\,X] = H_3\,A_3 - H_0\,X = H_1\,A_1 - H_0\,X =$$
$$H_1\,A_1\,[1 - \cos\phi] =$$
$$H_1\,A_1 \text{ vers } \phi \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

But, $A_3\,X = A_1\,X$;

therefore by (1) and (2)

$$H_1\,H_0 > H_0\,H_3 \text{ by } 2\,H_1\,A_1 \text{ vers } \phi; \quad . \quad (3)$$

or in other terms, the part amplitudes of travel on each side of the centre line of slot, in a vertical sense, differ by twice the versed sine of the angle, which the lever A E, in its initial position corresponding to the commencement of the stroke, makes with a line at right angles to the piston-path. Mr. Joy further remarks that "this inequality would give an unequal port, and unequal cut-off for the two ends of the stroke. But this error is corrected by attaching one end of the lever E—(D E, Fig. 1)—to the vibrating link B (A N), for while the point A on the connecting rod is performing a nearly true ellipse, D is moving in a figure, like an ellipse bulged out on one side, and this irregularity is so set as to be *equal to the versed sine of the arc described by one end of the lever E, (D E)*"—the italics are my own; "thus correcting the above error, and giving an equal travel to the centre H of the lever on each side of the centre of the slot." The context of the above passage would tend to show that the quantity expressed symbolically in this paper as

$$H_1\,A_1 \text{ vers } \phi$$

has a very close relationship with that defined by Mr. Joy as "the versed sine of the arc described by the one end of the lever E." But careful note must be taken that this vaguely-defined versed sine be computed for a circle of a radius equal to $A_0\,H_0$, —Fig. 2—and not to the whole lever length, D E, as the context of the citation would seem to imply.* In what immediately precedes it has been proved that the difference in lateral travel on each side of the slot centre has for its symbolic expression (In Eq. 3)

$$2 . A_1\,H_1 \text{ vers } \phi;$$

wherefore, in order to correct this error in travel, the point of attachment A of the lever A E—Figs. 1 and 2—must be depressed into some position D, from which the fulcrum H can be made to work symmetrically on each side of the centre of the slot, and since (Eqs. 1 and 2) the lateral excess and deficiency over and below the normal half travel of the fulcrum is equal to

$$A_0\,H_0 . \text{ vers } \phi,$$

the effective depression from A to D must be equivalent to the value of this expression. In order to predetermine the value of the quantity,

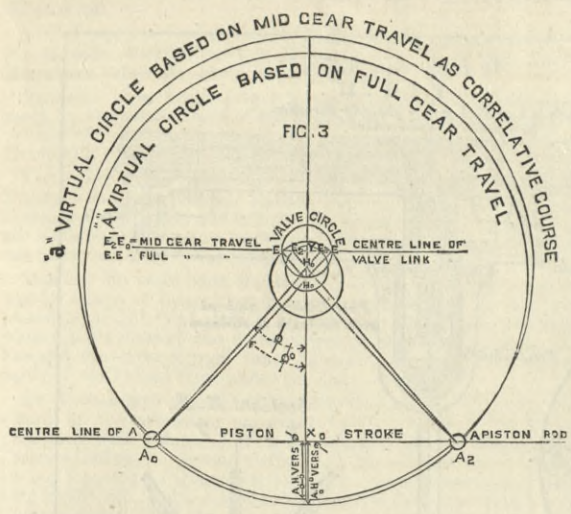
$$A_0\,H_0 . \text{ vers } \phi = \text{amount of depression,}$$

it is absolutely necessary that the radius length $A_0\,H_0$ and the angle ϕ be subject to an *a priori* construction, and it will be immediately shown that these two elements admit of predetermination for any particular case by means of what I have ventured to call the "*virtual circles.*"

The virtual circles.—In the gear under consideration there can be no doubt that we have to deal with a certain amount of revolution, for it is evident that while the end D, Fig. 1, describes an arc about a movable centre H in one sense, the other end E of the same lever describes an arc about the same movable centre, but in a sense diametrically opposite. If the motion be carefully regarded, it will be seen that supposing the end D of the rod D E, attached initially at A, the course of the piston would be a measure of the chord of the arc of revolution described by A; and it will be shown later that the mid gear travel of the slide valve measures the chord of the arc of revolution performed in equal time by the end E of the same rod. It will be evident to those who have paid close attention to the method used in the derivation of the expression, $A_0\,H_0$ vers ϕ, that it depends for its existence and absolute

* Since writing the above passage, I have been informed by Mr. Joy that he also adopts the radius, A H, for finding this versine.

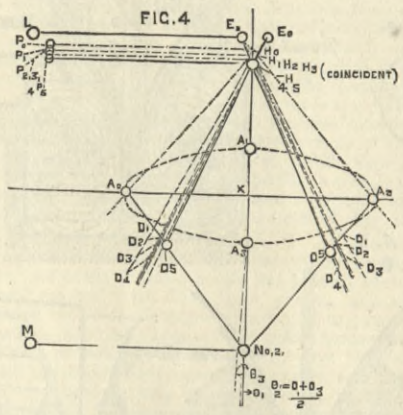
value on this implied revolution of the extremes of the lever rod D E always supposed to be initially attached at A. In Fig. 3 is given the construction of a system of



circles, which we have ventured to term the virtual circles. They have been constructed by the following methods:—(1) Draw two horizontal lines E E and A A at a distance apart equal to the perpendicular distance from the centre line of the valve link to that of the piston rod. It can be shown that the chords of the arcs of revolution of the extremities of the rod A E will be found on these lines. (2) Draw a line X Y at right angles to the two lines just drawn. (3) On each side of the line X Y lay off distances, E_2 Y and E_0 Y, equal to the half travel of the valve in mid gear, and distances A_2 X and A_0 X equal to the half course of the piston. (4) Join the opposite extremes, E_2 and A_2, E_0 and A_0, by the diagonal lines, E_2 A_2 and E_0 A_0, and let the point in which these diagonals meet be called H_0. (5) About the centre H_0, with radii A_2 H_0 and E_2 H_0, describe two circles. These circles represent the amount of revolution of the extremes of the rod D E in its initial position A E, and for motion in mid gear. It ought to be clear that during the time of the stroke the point A_2, Fig. 2, is horizontally displaced from A_2 to A_0, or through a distance equal in length to the course of the piston. Moreover, the points A_2 and A_0 are situated on the centre line of the piston rod produced. Consequently it may be safely inferred that during the time of the stroke, the rod A E revolves about the movable centre H, through an angle subtended by a chord equal in length to the major axis of the ellipse path of A, or, in other terms, to the length of the piston stroke. Again, if the engine be supposed to be working in mid gear, the centre E will be situated on the centre line of the valve link produced whenever the piston is at the ends of the stroke. (See this position of E in Fig. 1, marked E, which corresponds to the position of the piston at the end of the stroke towards the crank shaft). Further, the horizontal distance between the extreme positions of the end E of the lever, the engine working in mid gear, will be equal to the mid gear travel of the valve—that is, while the centre A_2—Fig. 2—has been horizontally displaced along the centre line of the piston to a second position, A_0, E_2 will be horizontally displaced along the centre line of the valve to a link second position—E_0—distant from the former by the amount of the travel of the valve in mid gear. We do not state—what would be absurd—that the centres A and E are located on the centre lines of the piston and valve link during the intermediate phases of the crank motion. What we do state is that the centres A and E are found on these centre lines at the ends of the stroke when the engine is working in mid gear. More than this, the distances between the two positions of the centres, A and E, corresponding to the ends of the stroke are equal respectively to the course of the piston and the travel of the valve in mid gear. Again, since the extreme E of the lever rod in its initial position, attached to the connecting rod at A, is displaced through a distance equal to the mid gear travel, whilst A is displaced through a length equal to the piston stroke, it will be seen that the mid gear travel of the valve is a measure of the chord of the arc of revolution of this centre E. For, in the first place, this revolution of the extreme E exists always, even when the travel of the valve has been reduced to a minimum; and remains constant, neither increasing nor decreasing to any appreciable extent, when the mid gear travel is enlarged to that required for working in full gear. Secondly, the difference in travel between the full and mid gear courses of the valve is due, not to any additional revolution of the lever rod, but to the inclination of the slot. On all these accounts we are justified in drawing the inference that the line A_2 A_0 representing the piston stroke, Fig. 3, and E_2 E_0, representing the mid-gear travel of the valve, may be looked upon as chords, measuring the arcs of quasi-revolution of the ends of the lever D E, supposed in its initial position A E, before the element A D has been determined, and therefore before the expression A H . vers ϕ has been calculated. But, as I have shown earlier in this paper, the dislocation of the centre H is due to this virtual revolution of the ends of the lever rod. Consequently the versinal correction A H . vers ϕ, must be deduced from the virtual circles, Fig. 3. The next part of the problem is to embody the value A_0 H_0 vers ϕ—Fig. 3—in the element A D—Fig 1—in such a manner that the effective depression of the travel of H above the centre of the slot may be equal to $A_0 H_0$ vers ϕ.

Before entering upon this second step in the process of construction, I wish to draw attention to the comparison of the two systems of virtual circles shown in Fig. 3, where one system is based on the mid-gear travel of the valve, and the other on that for working in full gear. It will be remarked how small the difference is in the resultant value of the expression A H . vers ϕ, amounting in the present case to only $\frac{3}{10}$in.—Crewe goods engine. The reason of this approximate equivalent is to be found in the fact that, in going from one system to the other, the radius A H increases, whilst the angle ϕ decreases, and *vice versa*. Practically, therefore, since the use of the virtual circles is restricted to the determination of the element A D, it would matter little which travel of the valve were chosen as the correlative of the piston course. If all friction were eliminated from the gear, the extreme E of the rod D E in its initial position would revolve through an arc, the chord of which would be equal to travel of the valve at mid gear; but in the presence of much friction between the sliding block H and the slot, it might happen that the fulcrum or block would be retarded in its path, and that in full gear this excess of friction might cause an overdue revolution of the extremes D and E. In that case it would be well to take the full travel of the valve as the normal correlative of the piston stroke in the construction of the virtual circles; remembering, however, that the mid-gear travel is the true theoretical correlative on which to construct the system. In order to apply the elemental correction, A H vers . ϕ, to the particular gear under consideration, and to embody it in the form of a depression of the centre A to a lower position D—Fig. 1—it must be well fixed in the mind at what period of the stroke the unequal travel of the fulcrum H makes itself most especially felt. And on reflection it will be seen that this period corresponds to the times when H is at its highest and lowest point in the radial slot—that is, when the centre A is at the ends of the minor axis of its ellipse path. At these periods the rod A N will be slightly inclined to the vertical—Fig. 4—and slightly more inclined when the centre A is passing the lower extreme of its minor axis A_3 than when passing the higher extreme A_1 (Fig. 4). In the figure, the angles of inclination to the vertical of the rod A N at these phases of the motion are marked by the letters θ_1 and θ_3 respectively. Let the mean of these two angles be equal to—

$$\frac{\theta_1 + \theta_3}{2} = \theta_2.$$



In order to effect the required shortening of the travel of the fulcrum H to the extent of

$$A_0 H_0 . \text{ vers } \phi,$$

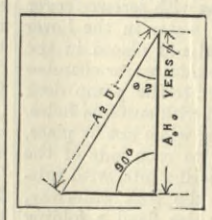
in a vertical sense the initial point of attachment of the lever rod at A_2 must be shifted down the rod A_2 N to a point D_1—Fig. 4—such that

$$A_2 D_1 \cos \theta_2 = A_0 H_0 \text{ vers } \phi,$$

in which A_0 H_0 and ϕ are found by means of the virtual circles. Consequently, by the above equation,

$$A_2 D_1 = \frac{A_0 H_0 \text{ vers } \phi}{\cos \theta_2}$$

or graphically, as in annexed figure. Let then the rod E_2 A_2 be shifted into the new position E_2 D_1, corresponding to this value of A_2 D_1—Fig. 3. It will be observed that in the *very act of shifting* the rod into its new position the centre of the slot H_0 is depressed into a new position H_1, and glides down the mid vertical line O N through a distance H_0 H_1. A new source of error is thus introduced into the travel of the fulcrum H, insomuch that the corrective element A_2 D_1 is no longer referred to the centre of the slot in its initial position H_0, so that the travel of the fulcrum becomes related to a new centre H_1, and to a new centre line P_1 H_1. Consequently, by reason of this depression of the original centre of the slot, the course of the fulcrum *above* the centre will be longer than that below it by the amount



$$2 (H_0 H_1),$$

or twice the displacement of the centre. Therefore, in order to eliminate this new error, the point D_1—Fig. 4—must be farther depressed along the rod A N into a position D_2, such that

$$D_1 D_2 = H_0 H_1.$$

It will be again observed that in the act of shifting the rod E_2 D_1 into its new and corrected position E_2 D_2, a further but relatively less displacement of the centre of the slot is introduced, the amount of which is equal to H_1 H_2; therefore the centre D_2 must be again depressed into a third position D_3, such that

$$D_2 D_3 = H_1 H_2.$$

The immediate effect of this third removal of the rod E_2 D_2 into the position E_2 D_3 upon the centre of the slot H_2 is *nil;* or is so infinitesimally small as to be neglected. But it cannot have escaped observation that the rod E_2 D_3 has been gradually increasing in length in its passage from the initial position E_2 A_2 to its last position E_2 D_3. This lengthening of the rod is not without its influence on the travel of the fulcrum, in so far that, when the rod A N is vertical, the distance A_2 H_0, which was the distance of the fulcrum H from A_2, in the initial position of the lever rod, has become lengthened into D_3 H_3. Consequently, the relative movement of the fulcrum H will be affected in position, and driven up vertically higher in the slot by an amount equal to the difference

$$D_3 H_3 - A_2 H_0;$$

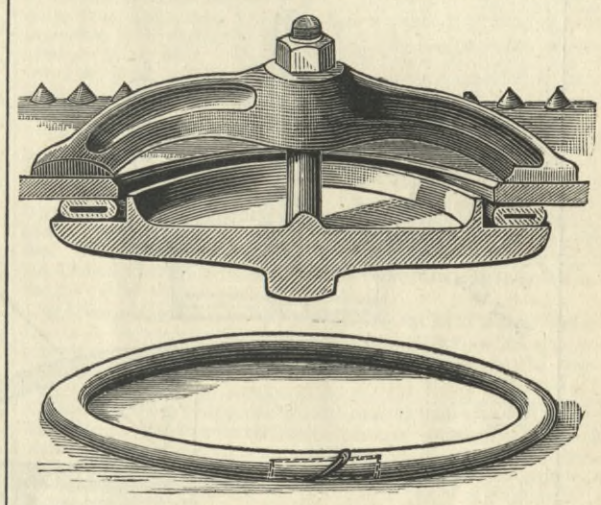
wherefore, to correct this excessive elevation of the fulcrum in its travel above the centre of the slot, the point D_3 must be farther depressed along the rod A N into a position D_4, such that

$$D_3 D_4 = D_3 H_3 - A_2 H_0.$$

The new position of the lever rod will be E_2 D_4, and a slight displacement of the centre of the slot, from H_3 to H_4, will follow this further depression of the centre D; wherefore the centre D must be lowered once more into its final position D_5, in order to provide against the last decentralisation of the slot. The last change of the centre D will in general be followed by no visible effects upon any of the centres of motion; so that H_4 and H_5 are the coincident, and therefore final positions of the centre of the slot. E_2 D_5 is the final position of the rod E_2 D, and the line P_5 H_5 will be the final position of the centre-line passing through the centre of the slot H_5. The above process of graduation has taken longer to describe than would be actually taken in the graphic delineation of the method itself, seeing that the successive amounts of decentralisation of the centre of the slot can be at once taken off by the dividers and applied along the rod A N. The angle θ_2, admitted into the determination of the value of A_2 D_1, is generally so small that the corrections for successive decentralisation need not be divided by its cosine, in order to resolve them along the rod A N, supposed to be in the position corresponding to that of A when situated at the ends of the minor axis of its ellipse path. We proceed to apply the principles explained in the foregoing pages to the gear of the London and North-Western goods engine, recently built at the Crewe Works, under the superintendence of Mr. F. W. Webb. Each step in the process of construction will be numbered, and reference will be given where required to the earlier pages of the paper, in which will be found the demonstration of any unexplained principles.

MANHOLE PACKING.

A CORRESPONDENT of the *Scientific American* suggests the system of packing manhole lids shown in the accompanying sketch. He says that the best packing for the same is a piece of ordinary rubber tubing of an internal diameter of about $\frac{3}{8}$in., cut and joined together. Both ends of the tubing are cut on a long bevel, the

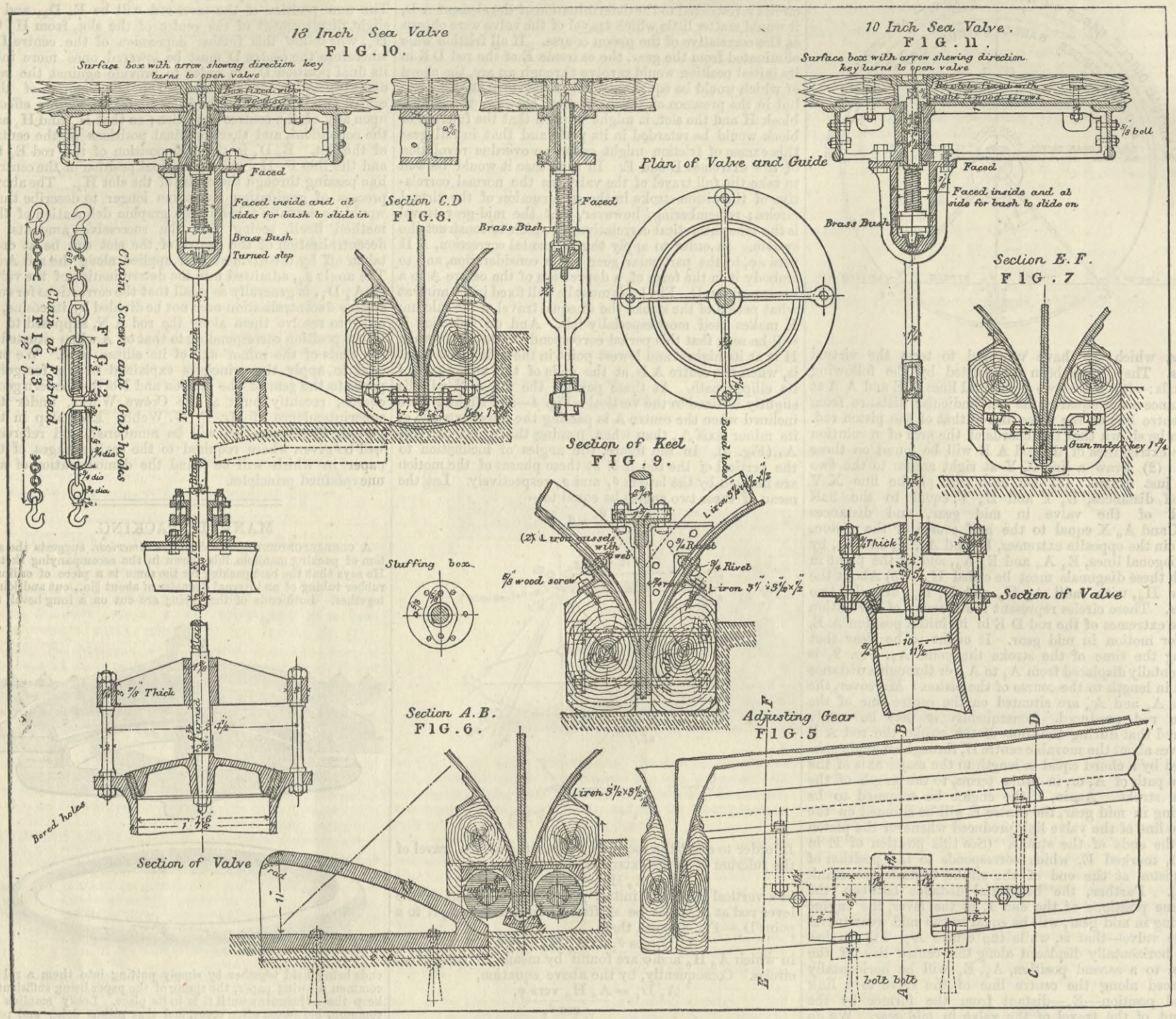


ends being held together by simply putting into them a rol. of common drawing paper, the spring of the paper being sufficient to keep the adjustment until it is in its place. Leaky manlids are common, blow-outs often occur, and that means delay and pecuniary loss. The roughest surfaced manlid will be made tight by this method, and the cost does not exceed that of plaiting a gasket. To protect the iron from the effect of sulphur contained in the rubber, coat the tube with blacklead.

KING'S COLLEGE ENGINEERING SOCIETY.—At a general meeting held on Tuesday, the 20th inst., Mr. F. C. Fairholme read a paper on "Continuous Brakes." There was a good attendance. There will be a discussion next Tuesday on "Motive Power for Tramways."

A LARGE SAFE AND STRONG-ROOM.—On Saturday week Messrs. Chubb and Sons explained to a large number of visitors to their works, Glengall-road, S.E., the construction of a large safe weighing nearly twenty tons, made for the Government of the Argentine Republic, and of an iron strong-room of 1100 cubic feet capacity built for a London bank. The fire and thief-resisting safe or room, completed for the Credito Publico Nacional of Buenos Ayres, is 9ft. 10in. high by 15ft. 9in. wide by 8ft. 4in. deep, and is made of iron boiler plates $\frac{1}{2}$in. thick, rebated at their edges, and secured by angle iron flat bars, about 5in. by $\frac{1}{2}$in., rivetted together. An air chamber and cases of non-conducting material make up a thickness of 5in. Its total weight is 19 tons 1 cwt. Entrance is obtained through doors of steel, with an inner flame-proof door, secured by a number of heavy bolts, which are locked by a small key of the size of an ordinary latch key. It was shown that these heavy doors could be secured by a key small enough to fold under a gold finger ring; or by a lock without any key, opening only by a dial being placed at certain combinations of figures; or by an electric time lock, which itself locks and unlocks the door on the inside at any times the owner pleases. One of these locks, it will be remembered, was exhibited at the Crystal Palace Electric Exhibition last year. The inside is fitted with shelving, and drawers for holding Government bonds and papers. The work of erecting this room has occupied four months. It will now be taken to pieces, and re-erected at Buenos Ayres by Messrs. Chubb's workmen, when it will be used for securing the books and papers of the Government of the Argentine Republic, who, some years ago, when the Government offices were destroyed by fire, had their important State documents saved in safes by the same makers. The larger strong-room measures 9ft. 6in. high by 17ft. 3in. wide by 15ft. deep outside. It is not intended to be fire resisting, as it will be fixed inside a fire-proof building, but the plates used in its construction are all 1in. thick; the roof is supported by strong channel iron beams, and the sides and floor are connected by flat bars and angle iron. The total weight is 24 tons. It is estimated to be large enough for the storage in bags of £48,000,000 in gold. After inspecting these safes the works were visited. These now contain the whole of Messrs. Chubb and Company's manufacturing departments, comprising safe and lock making, and tin and plate working. Over 200 men are employed. Two engines of 50-horse power, and double sets of boilers, drive the machinery employed, which is not special. The yearly turn-out is about 1000 safes, strong rooms, and iron doors, and 40,000 locks. Over 1,000,000 of the patent detector locks have been made. The work is all piecework. It was stated the average length of time each man has been in the firm's employ is seventeen years.

DETAILS OF CAISSON, GRAVING DOCK, LYTTELTON, NEW ZEALAND.



CAISSON FOR THE GRAVING DOCK, LYTTELTON, NEW ZEALAND.

In our impression of the 11th August, 1882, we gave a general description, with illustrations, of the graving dock recently completed for the Harbour Board of Port Lyttelton, and we now describe the floating caisson for closing the dock, and give illustrations above and on page 142. The caisson is made to suit a check in the masonry, having a width across the entrance, between the edges of the bearing faces of the quoins at cope level, of 62ft., and a depth from the cill to the level of the cope of 27ft., the breadth of the bearing face of the check being 1ft. The width of the caisson is 12ft. at the top, 13ft. 4in. at the pump deck, and 19ft. at the water ballast deck, from outside to outside of sheathing. The bearing faces, one on each side, which have been carefully fitted to the stone face, are made of greenheart blocks, fixed with through bolts, and with wood screws through angle irons rivetted to the sheathing—see Fig. 9. It will be seen by reference to Figs. 2, 3, and 9, that the body of the caisson is formed with a bilge, like an ordinary ship, but with stem and stern alike. The keel plate is 2ft. broad and $\frac{3}{4}$in. thick. For facility of shipment the frames, of 3½in. by 4½in. by ½in. angle iron, are made in three parts, the junction between each contiguous part being effected at the water-tight decks. The sheathing is formed of wrought iron plates, varying from $\frac{5}{8}$in. garboard to $\frac{3}{8}$in. upper strakes. The decks, shown by Figs. 1, 2, 3, and 4, are made of wrought iron plates on deck beams, supported at their centres by stanchions, the lower deck being further supported by diagonal struts of angle iron tied at the junction with the frames by transverse tension bars. These decks divide the caisson into three compartments; the lower one constituting the brick ballast and air chamber—tidal if desired; the intermediate, the tidal water chamber; and the upper one the pump chamber. The upper or roadway deck is formed of 6in. red pine planking on deck beams, braced horizontally by wrought iron diagonal ties. In order to minimise oscillation from stem to stern, which often renders caissons unmanageable, two full bulkheads have been introduced into the lower compartment, and two half bulkheads into the intermediate one, by which the movement of the water to and fro is retarded. Communication with the lower chamber is obtained by a water-tight trunk 3ft. square in section, passing down through the intermediate chamber, and with the latter by a manhole with a water-tight door. The ingress and egress of water to the water compartments is effected by means of two 18in. and two 10in. conical valves worked from the roadway deck by powerful screw gear attached to their spindles, which are shown in Figs. 1, 2, 10, and 11. For pumping the chambers when required—which seldom occurs, as the ballast water is emptied into the graving dock when dry—two of Messrs. Blundell Bros'. 5in. "Waterwitch" pumps have been placed in the upper chamber, with suction pipes reaching to the keelson. When pumping is in progress orders are given to the men at the pumps through a scupper box with screwed cover in the roadway deck, through which the water in the lower chamber will also be gauged by a graduated rod placed in the water-tight trunk. Escape of air from the tidal water chamber is provided for by eight cast iron pipes fixed to the pump deck and the sheathing, each of which are pierced with suitable holes. The placing of the caisson, and the mooring when not in place, are facilitated by four mooring rings fixed to each side of the sheathing—Figs. 3 and 4—and by four mooring bits, with suitable chains, &c., and four fairleads fixed to the teak waterway, flanking the roadway platform, to which is also fixed a folding railing in eight sections. The adjustment of the caisson to the masonry check is effected by the gearing shown in Figs. 5, 6, 7 and 8, which serves the purpose well. It consists of a gun-metal roller on each side on gudgeons of the same metal in cast iron bearings, and two circular-backed castings fixed to the apron of the dock, on which the rollers move, so as to bring the greenheart against the masonry check.

The ends of the roadway deck are provided with folding steel chequered plates or gangways, which rest upon the masonry cope to allow cart and other traffic to pass on and off the caisson. The cost of the caisson delivered at Glasgow Harbour was £3150. It was constructed by Messrs. William Arrol and Co., contractors, Glasgow, from the designs and under the superintendence of Messrs. R. B. Bell and D. Miller, MM. Inst. C.E., Westminster and Glasgow.

A NEW ALLOY.

Mr. Alexander Dick, well known as the inventor of phosphor bronze, has, after devoting himself to the further study of copper and zinc alloys, succeeded in producing an alloy which he calls "Delta metal" which has some remarkable mechanical and physical properties, and appears to be as much superior to brass as phosphor bronze is to gun-metal or steel to iron. The chief advantages that he claims for Delta metal are great strength and toughness. We are further informed that Delta metal cast in sand has a breaking strain of 21 to 22 tons per square inch; rolled into bars or forged, over 33 tons per square inch; and drawn into wire of 22 w.g., 62 tons per square inch. It can be made as hard as mild steel, and when melted, we understand that it is very liquid, producing very sound castings of a close, fine grain. The colour can be varied from that of yellow brass to that of fine, rich gun-metal. It takes a high polish, and when exposed to the atmosphere it tarnishes less than brass. A valuable peculiarity of Delta metal is that it can be rolled and forged hot, whilst it also stands a certain amount of drawing and hammering when cold. We give above a tabular report on experiments by Mr. Kirkaldy.

Results of Experiments to ascertain the Elastic and Ultimate Tensile Strength, &c., of "Delta Metal," received per Alexander Dick, Esq.

Test number.	Description.	Original.		Stress.		Ratio of elastic to ultimate.	Contraction of area at fracture.	Stress per sq. in. of fractured area.	Extension set in 10in.				Appearance of fracture.
		Diameter.	Area.	Elastic per square inch.	Ultimate per square inch.				At 50,000 lb. per square inch.	At 60,000 lb. per square inch.	At 70,000 lb. per square inch.	Ultimate.	
Q	Bar I., 1½ diameter	in.	sq. in.	lb.	lb.	pr. cent.	pr. cent.	lb.	pr. cent.	pr. cent.	pr. cent.	pr. cent.	
		turned											
3939	As drawn	1·128	1·000	49·600 = 22·1 tons	75·235 = 33·6 tons	65·9	15·0	88·511	0·11	0·82	3·73	8·8	Granular and silky
	Bar II., 1½ diameter												
3940	Annealed	1·128	1·000	19·800 = 8·8 tons	61·130 = 27·2 tons	32·3	19·9	76·317	10·80	16·90	—	17·5	Granular and silky

Alexander Dick, Esq.,
110, Cannon-street, E.C.

90, Southwark-street, London, S.E., David Kirkaldy.

RAILWAY MATTERS.

THE public debt of New South Wales is in round numbers £18,000,000, and the railways alone have been valued at £25,000,000.

THE Marquis of Lorne has announced that the eastern portion of the Canada Pacific Railway is expected to reach the Rocky Mountains before the end of the present year.

TENDERS have been invited by the New South Wales Government for the construction of the section of the proposed railway to connect the southern and northern lines, which extends from near Homebush to the river Hawkesbury.

THE boiler of the steam navvy used in constructing the High Blantyre and East Kilbride Railway burst on Wednesday morning, killing the engineman and injuring the fireman. The upper part of the boiler was blown to a distance of fifty yards. It is stated that the boiler had been twice repaired since Monday.

THE last up train from Swansea to London on Saturday had a narrow escape of being carried into the river Wye. It had just passed Symond's Yat station, on the Ross and Monmouth line, when a large mass of the embankment at that spot between the line and the river slipped into the water, carrying about eighty yards of the ballast from under the line.

AT Wednesday's meeting of the City Commission of Sewers, the award of the arbitrator appointed by the Board of Trade was presented with reference to the ventilation of the Metropolitan District Railway. Captain Galton had decided that there should be one opening in Queen Victoria-street, near Bennet's-hill, 50ft. long by 6ft. 4in. wide, and another opposite the steps into Lower Thames-street, 23ft. by 3ft. 10in., each with balustrades 8ft. high.

THERE are now in the United States and Canada 415 working street railway companies. These companies employ about 35,000 men, and run 18,000 cars. More than 100,000 horses are in daily use, to feed which it requires annually 150,000 tons of hay and 11,000,000 bushels of grain. These companies own and operate over 3000 miles of track. The whole number of passengers carried annually is over 1,212,400,000. The amount of capital invested in these railways exceeds £30,000,000.

THE railways of New South Wales have always been looked upon as a good investment for the Colony if they did not, the *Colonies and India* says, yield any direct money return, actually pay better dividends than the average of English railways, promoted with a view to profits. Mr. Dibbs says that "even at a tariff of railway charges lower than those in existence in any other of the Australasian colonies, and purposely reduced to the lowest point for the purpose of more effectually developing the resources of the country, our net railway income is in excess of the whole amount of the annual charge for interest on our public liabilities."

DURING the past week the floods have caused much railway trouble. In the Somersetshire district the water reached a depth of 25in. over what was the level of the Great Western main line, on which locomotive traffic would be impossible had the company not raised their line 18in. after the heavy floods three years ago. Instructions were issued to the engine drivers to stop before entering the water; no two trains to meet in the water; up trains to be passed first, and speed not to exceed five miles an hour. A long piece of line between Ferns and Enniscorthy was torn up and a goods train from Harcourt-street, Dublin, was thrown off the line. The water was up to the foot-boards.

THE directors of the Caledonian Railway gave their reply to the memorial of the men on Tuesday. It states that the mineral engine-drivers and firemen will be allowed half-an-hour before leaving and another half-an-hour after returning to the shed. Engine-drivers, firemen, and brakesmen will be paid overtime at the ordinary rate. The trip system will be extended when practicable, to prevent overtime as far as possible. The three-shift or eight hours' cabin arrangement for signalmen will be introduced. The hours of mineral brakesmen will be reduced from twelve to ten. The hours of yardsmen will be twelve, but relief men will be provided in winter when necessary. The directors add that it is their desire to reduce Sunday labour to the lowest possible limit.

A NEW automatic coupling, suitable for English stock, is being brought out by Messrs. Wright and Pethick, of Plymouth. In one form of the coupling a slot or opening is provided in the end of one carriage with lips to direct the entrance of a spear-head upon one draw bar of the next carriage. Two of the edges of this spear head are bevelled off in such a manner that as it enters the slot which is at right angles to the spear-head, upon the carriages being brought together the spear-head is turned round until it enters the slot, and having passed through immediately resumes its former position at right angles to the slot, under the influence of a spring or weight, and the carriages are at once automatically coupled. To release them, all that is necessary is to turn the draw bar to which the head is attached by a lever at the side of the carriage, and the uncoupling is effected as easily as the coupling, and without the man getting between the buffers. The lever can be fastened down if desired, so that the carriages may be run up against each other without coupling.

THE report to the directors of the Mersey Railway Company by the engineers, Messrs. Brunlees and C. D. Fox, which will be presented at the meeting of the company next Tuesday, states that:—"During the half-year the contractor, Mr. Waddell, has used every exertion to push forward the works, concentrating his efforts chiefly upon the headings, and upon the tunnels under the river. The headings have now advanced to a total length of 717 yards, of which about 182 yards are under the river Mersey, and are being lined as they proceed. The excavations for the main tunnels have proceeded to a total length of 1054 lineal yards, and have been lined with brickwork for a length of 939 yards. The sandstone rock continues of the same satisfactory character. In order to expedite the work, arrangements have now been entered into for excavating the heading on the Birkenhead side by means of a machine designed by Colonel Beaumont, driven by compressed air. A preliminary trial has been made in the sandstone rock on the surface, which gave good results, and from which Colonel Beaumont estimates that a speed of 30 lineal yards per week could be attained."

AN alarming accident took place near Cannon-street on Wednesday morning, by which three trains were brought into collision. At a quarter past ten o'clock, the busiest part of the day, as the South-Eastern train leaving Hastings at 8.20 a.m., and due at Cannon-street at 10.20, was proceeding towards the City terminus, the semaphore signal over the Stoney-street box being admittedly "clear," a train came round the curve from Waterloo and into violent collision with the three hindmost carriages of the Hastings train, which were a brake van, a third-class carriage, and a first-class carriage. Of these the first-mentioned was smashed into splinters, though Wynn, the guard, escaped. The collision threw the third and first-class carriages on to the up loop line—from London Bridge—and just at this moment the up train from Maidstone came up and ran into the already dismounted carriages, the effect of this being to throw the tender of the engine of the Maidstone train off the metals. All the up and down roads were blocked. It was not until one o'clock that the lines were clear so far as the rolling stock was concerned; but it was considerably later before a train could enter or leave Cannon-street owing to the condition of the permanent way. It is said that the passengers of the loop line train had a narrow escape, and but for the fact that it was moving very slowly, a terrible disaster might have occurred. As the trains crawl round this part of the line, it may be asked where were the brakes, and why were not the trains stopped by them if they are of any use? The damage done to the rolling stock is great.

NOTES AND MEMORANDA.

COPPER, in the presence of air free from carbonic acid, is very energetically attacked by a solution of sal ammoniac.

To liquefy ozone, MM. Hautfeuille and Chappuis compressed a mixture of oxygen and ozone, in Cailletet's apparatus, under a pressure of 125 atmospheres and at a temperature which was probably —100 deg. (—148 deg. Fah.). When operating with a gas not containing more than 10 per cent. of ozone, the blue colour was very marked in all the chilled portion of the capillary tube. When the ozone is liquefied in the capillary tube, it preserves its condition for a considerable time, even under atmospheric pressure, so that it can be examined and even withdrawn for a few moments from the chilled tube.

MR. DESMOND G. FITZGERALD has recently demonstrated, by experiments we have witnessed, that carbon may be oxidised in a form of voltaic cell. In the experiments, gas retort carbon, and even common gas coke, have been employed as the positive element of a voltaic couple, instead of a zinc plate or bar. The electrolyte employed is not a fused salt, but is liquid at ordinary temperature. With a plate of carbon, of which the immersed portion was about 1·3 square inch, the current on short circuit was 0·028 Ampère. Through an external resistance of 20 ohms, the current was 0·0132 Ampère. This experimental fact is one, it need hardly be said, of high scientific interest, but at present it is looked upon as of no commercial importance.

HERR PFAUNDLER described in a recent *Wiedemann's Annalen* an explosion of a zinc-plate oxygen gasometer. Dr. Loewe states that to protect oxygen or atmospheric air from admixture of carbonic acid or acid vapour from the air of the laboratory, he has for many years placed them over lime-water. Some 20 to 30 grs. freshly slaked lime, in a powdered state, is placed in a strong linen bag, which is tied with cord just above the contents, and hung near the outflow tube of the water vessel of the gasometer. This ensures that all carbonic acid and acid vapours which the water of the gasometer may in time absorb from the air, are neutralised by lime-hydrate, and rendered innocuous. There is the further advantage, for elementary analysis, that the potash or soda lye, which is preferred for washing the gases, remains long quite caustic, and thus serves—as it ought to do—less for purification of the gas than as an indicator of the gas current.

IN their report on the water supplied to the metropolis during January, presented to the President of the Local Government Board, Messrs. W. Crookes, F.R.S., W. Odling, and Dr. C. Meymott Tidy say: "The condition of the water during the past month, in respect both to its general freedom from colour and turbidity and to its state of aëration, has continued, notwithstanding the renewal of the river floods, to be eminently satisfactory; while there has not been any appreciable increase in the proportion of its dissolved organic matter. Thus the maximum quantity of organic carbon found in any sample of the water was 0·320 part in 100,000 parts, the average of all the samples examined during the month being 0·217 part, as against an average of 0·210 part in the previous month. The maximum of 0·320 part of organic carbon in 100,000 parts of water corresponds to a little over half-a-grain of organic matter per gallon; and even this amount was present in one exceptional sample only out of the 189 samples reported on."

IN many parts of Switzerland, the Geneva correspondent of the *Times* says, are often found smooth flat stones, evidently hand polished, and covered with dots, lines, circles, and half circles. The origin and use of these stones, known among country people as *Schalensteine*, have long been a moot point among the learned. Herr Rödiger, of Bellech, in Solothurn, says *Schalensteine* are neither more nor less than topographical charts, as a comparison of them with any modern map of the districts in which they are found will show. The engraved dots correspond with existing towns and villages, the lines with roads. Even the fords and mountain passes are indicated. Herr Rödiger has examined many of these stones from various parts of the country, and he possesses a collection, picked up in Solothurn, which form together a map of the entire canton. Another significant circumstance is that the *Schalensteine* are mostly found at intervals of about two hours—say, six miles—from each other, and at spots where several roads meet. The former Herr Rödiger calls "headstones"—*Hauptsteine*—the latter he denominates "by-stones"—*Nebensteine*. If he be right in his hypothesis, the places where these stones are met with possessed considerable populations long before the dawn of history; even the villages shown on the *Schalensteine* must be far older than the Christian era.

DR. FRANKLAND reports to the Registrar-General the results of the chemical analyses of the waters supplied to the inner, and portions of the outer, circle of the metropolis during the month of January. He says the Thames water supplied by the West Middlesex, Southwark, Grand Junction, and Lambeth Companies was of somewhat inferior quality to that of the previous month. Last month we were obliged to warn people that this depresssion of the Thames water means nothing, though thus spoken of from a chemical point of view. It is of excellent quality for drinking purposes. Further on in this report Dr. Frankland says: "The Chelsea Company's water, on the other hand, showed a slight improvement, being the best of the Thames waters, whereas in December it ranked last. With the exception of the Southwark and West Middlesex Companies' supplies, which were slightly turbid, all the Thames water was efficiently filtered before delivery. The Southwark Company's water contained moving organisms." This gives some idea of the way in which he uses qualitative expressions when talking of purity of water. Here we have him speaking of a water as *slightly* better than in the previous month, when it ranked last. Now, because of what he calls a *slight improvement*, he places Chelsea water as the first and best of the Thames waters. Thus, according to Dr. Frankland's own words, there is only a *slight* difference between Thames water at its worst and at its best, and at its best, even in January, it is as good as water which he praises in the highest possible terms.

M. CHEVREUL found metals to have, in certain cases, a remarkable influence on the oxidation of oils. Recently, the *Times* says, M. Livache has used, in this relation, finely divided metal—such as is got by precipitation—instead of metallic plates, and the effect is greatly increased. He thus tried lead, copper, and tin, and found lead to have the strongest action. If precipitated lead, moistened with oil, be exposed in air an increase in weight is very soon observed, and this is greater the more siccative—or drying—the oil. With linseed oil, the increase of weight reaches a maximum in 36 hours; whereas, exposed alone to air, the oil would take several months to reach this maximum. A solid and elastic product is obtained. With non-drying oils the increase of weight is much less, and takes much longer to be completed. The result in question, M. Livache points out, cannot be attributed to a simple division of the matter, allowing more active circulation of air, for the same experiment made with various other substances in fine division does not result in any like increase of weight; the effect here is merely like that in the case of a thin layer of oil exposed to air. The change in the other case must be attributed to a direct action of the metal. Operating with different oils, M. Livache found the increments of weight proportional—except in the case of cotton seed oil—to those observed in the fatty acids of the oil exposed to air for several months. He suggests that industry may derive certain advantages from the facts observed. Thus, a rapid method is indicated of distinguishing dry from non-drying oils. Further, the heating of oils might be advantageously replaced by a circulation in contact with air and in the cold state, over iron or fine plates having precipitated metaliic lead on their surface. The oils so obtained would be always less coloured, and would retain great fluidity, while the objectionable odours and the danger of fire which attend the present mode of treatment would be avoided

MISCELLANEA.

TOWARDS the Aveling Memorial Fund a sum of £343 7s. has now been subscribed. Mr. R. Prall, of Rochester, is the honorary secretary, to whom subscriptions should be sent.

THE name of the Crown Prince Archduke Rudolphus, of Austria, has been placed at the head of the list of the patrons of the International Electric Exhibition, Vienna, 1883.

ARRANGEMENTS finally have been made to determine correct Australian longitudes. This was to be done early this year, when the boundary between Queensland and the adjoining colony will be clearly defined.

WE are requested to state that the business of Messrs. John Bagnall, Sons, and Co., of West Bromwich, is being carried on by the liquidators, the name of the firm and the address remaining unaltered.

THE boring of a tunnel 4000ft. in length under the river Hudson at Weehawken, N.J., has been completed. Most of the tunnelling has been boring through rock from several faces, entered by five shafts, seventy air rock-drills having been employed on these faces. The tunnel is 27ft. wide and 21ft. high.

A SUGAR house is being erected at Chicago for treating 12,000 bushels of Indian corn daily. As each bushel of maize yields about 28 lb. of sugar, the production will be, it is estimated, about 50,000 tons yearly. The buildings, occupying nearly 25 acres, will cost about £320,000; and the boilers will be of 7000-horse power.

THE Governmental *North German Gazette* refers reproachfully to the fact that the North German Lloyd Company has ordered from a well-known Clyde firm a couple of steamers, each of 2500 tons burden and 6000-horse power. Such conduct, it suggests, is both unpatriotic and anti-protectionist—two very heinous faults in the eyes of the German Chancellor and his accredited organs.

THE effect on plants and shrubs of the products of combustion of gas is showing itself already at the Crystal Palace Exhibition. An enormous quantity of gas is being burnt in parts of the nave, and the big lamps are closely spaced. Yet there is an absence of what we may call an atmosphere of light, which is observable where the electric arc lights are used, though they are much fewer in number.

PHILADELPHIA derives an annual revenue of £2400 from telegraph, telephone, and electric light companies, for the use of its overhead and underground wires. Each company makes a return annually of the number of poles, &c., and a payment of £1 per annum for each mile of wire used for telegraph or telephone purposes, and £3 per mile per annum for electric lighting purposes is required. There are at present about 10,000 miles of wire in the city.

IT is stated on very good authority that to work the Edison electric plant for lighting the corridors of the House of Commons an American steam engine is to be employed. This is probably quite true, and shows the advantage we give the Americans by importing their engines free of duty, while they charge us a duty of about 40 per cent. We may hope that when the engine does get into the House of Commons, it will answer its purpose better than some of those brought over to this country for the same purpose have done.

THE importation of tin-plates into the United States has increased in a remarkable degree within the last few years. The imports in 1870 were 1,507,000 boxes; in 1875, 1,920,000 boxes; in 1876, 1,800,000 boxes; 1877, 2,140,000 boxes; 1878, 2,160,000 boxes; 1879, 3,120,000 boxes; 1880, 3,380,000 boxes; and in 1881, 3,600,000 boxes. There are about twenty boxes of common tin-plate to the ton. Two of the chief causes of the increased demand for tin in the United States are found in the enormous canning industry and the growth of the tin-roofing business.

M. DEHERAIN, who has been following up Dr. Siemens' experiments on the electric light and vegetation, reports on the result of experiments on plants at the Electric Exhibition at the Palais d'Industrie in 1881, and sums up his conclusions thus:—(1) The electric arc light emits radiations which are injurious to vegetation. (2) Most of these radiations are arrested by colourless glass. (3) The electric light emits radiations powerful enough to maintain plants in vegetation for two months and a-half. (4) The beneficial radiations are not sufficiently powerful to cause the growth of germinating seeds or to allow of the maturation of fruit in older plants.

ACCORDING to the Registrar-General's weekly return for the week ending February 10th, the annual rate of mortality in twenty-eight great towns of England and Wales averaged 23·5 per 1000. The six places in which the death rate was lowest were Derby, Cardiff, Huddersfield, Norwich, Brighton, and Plymouth. In London 2888 births and 1631 deaths were registered, or 17·1 and 9·7 respectively per hour. The annual rate of mortality from all causes, which had been equal to 20·4 and 21·7 per 1000 in the two preceding weeks, was 21·5 last week. During the first six weeks of the current quarter the death rate averaged only 21·1 per 1000, against 31·0, 24·5, and 26·6 in the corresponding periods of the three years 1880, 1881, and 1882.

DURING the past three years ivory has risen at least 100 per cent. in value, and pearl, which is also largely used in hafting cutlery and other goods, has advanced very materially in the same period. The Manila shells, which are the chief sources of supply, could be bought for £8 5s. per cwt. last May, but in December they realised from £11 15s. to £12 10s. per cwt. During the past ten months the value has increased from £160 to £240 and £250 per ton. At the London sale, which has just been held, the quotations were rather lower, but the pearl shells were again in great demand, and the high rates charged by cutters will be maintained. Cutters occasionally come across valuable pearls in the shells. A very large and finely-shaped pearl was recently found by a Sheffield workman. A substitute for ivory is yet wanted; none of those tried will take the polish of the natural ivory.

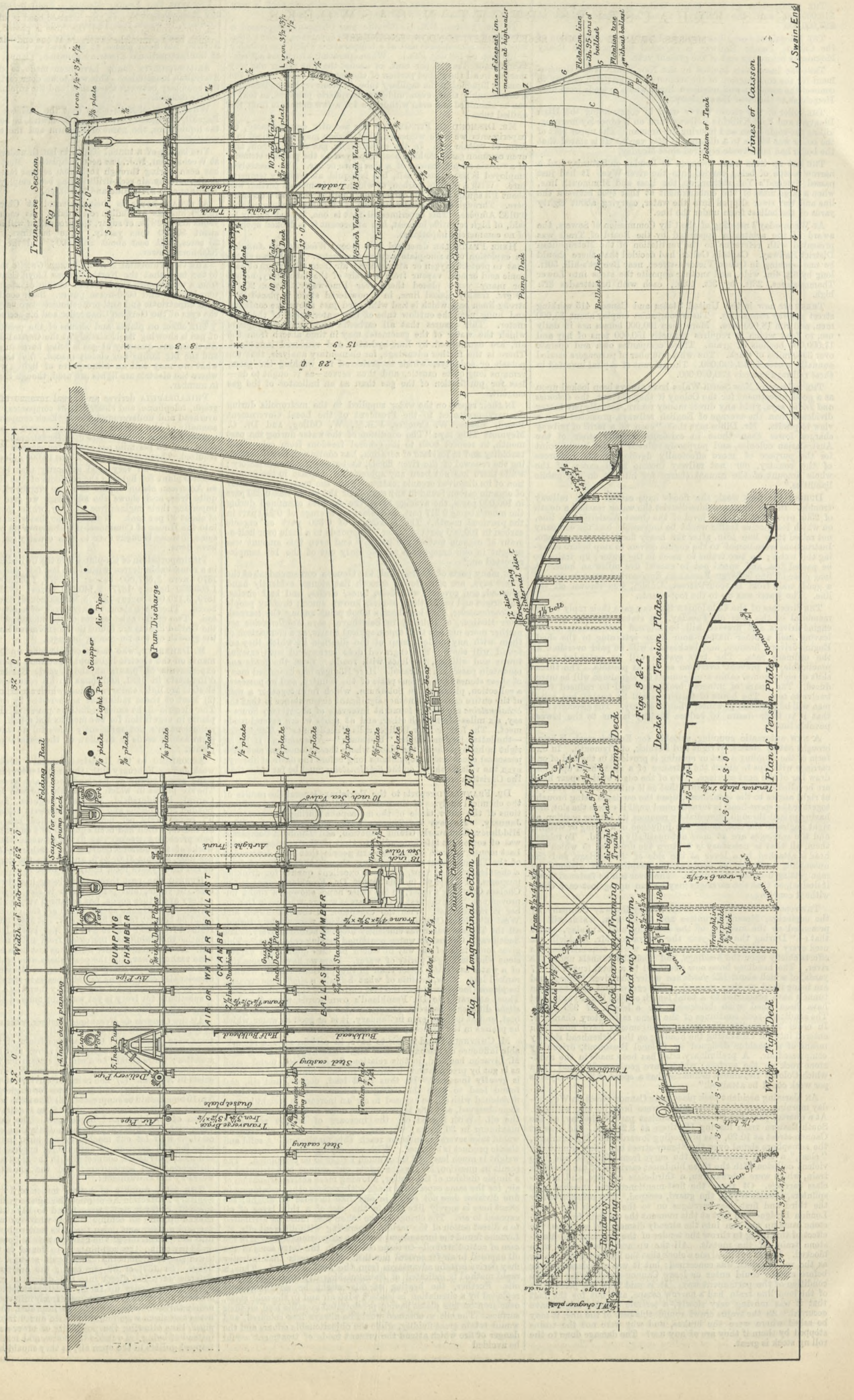
AT the *Congrès de Mécanique Agricole*, which was held in Paris in connection with the annual cattle show, the following resolutions were passed:—(1) Comparative trials of implements should be made at the district agricultural shows and by the agricultural societies; there should be a central station for trials calculated to determine the absolute value of implements, similar to that which exists in Austria. (2) The rates for carriage of agricultural implements need revising; and extra rates for single parts weighing from 5 to 10 tons should be suppressed. (3) The state is petitioned to grant special subsidies to societies which form syndicates for the generalisation of machines and implements. The Congress also passed votes with the object of securing a diminution of the tax imposed on those who let out machinery for hire; uniformity in railway rates for the carriage of agricultural implements; a fostering of technical instruction connected with the application of mechanical engineering and agriculture; and the undertaking of irrigation works by the Government.

THE total number of houses inspected by the officers of the Sanitary Protection Association during the year 1882 was 362. Of these 21, or 6 per cent., were found to have their drains entirely choked up, and no communication whatever with the sewer; all the foul matter sent down the sinks and soil-pipes simply soaking into the ground under the basement of the houses. In 117 houses, or 32 per cent., the soil-pipes were found to be leaky, allowing sewer gas, and in many cases liquid sewage, to escape into the house. In 137, or 37 per cent., the overflow pipes from the cisterns were led direct into the drains or soil pipes, allowing sewer gas to pass up them, and contaminate the water in the cisterns, and in most cases to pass freely into the house. In 263, or nearly three-fourths of the houses inspected, the waste pipes from baths and sinks were found to be led direct into the drain or soil-pipes, thus allowing the possibility of sewer gas passing up them instead of being led outside the house, and made to discharge over trapped gullies in the open air, as they should be.

CAISSON FOR NEW GRAVING DOCK, LYTTELTON, NEW ZEALAND.

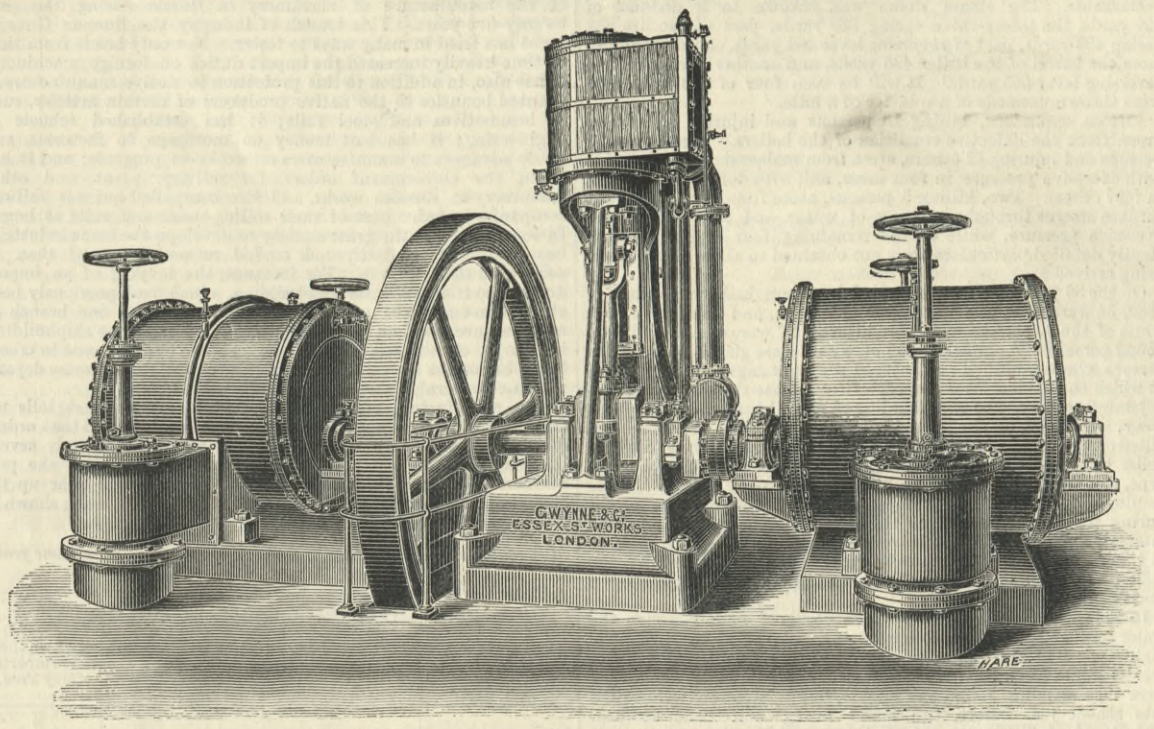
MESSRS. BELL AND MILLER, MM.I.C.E., WESTMINSTER, ENGINEERS.

(For description see page 140.)



GAS EXHAUSTERS, BECKTON GASWORKS.

MESSRS. GWYNNE AND CO., ESSEX STREET, LONDON, ENGINEERS.

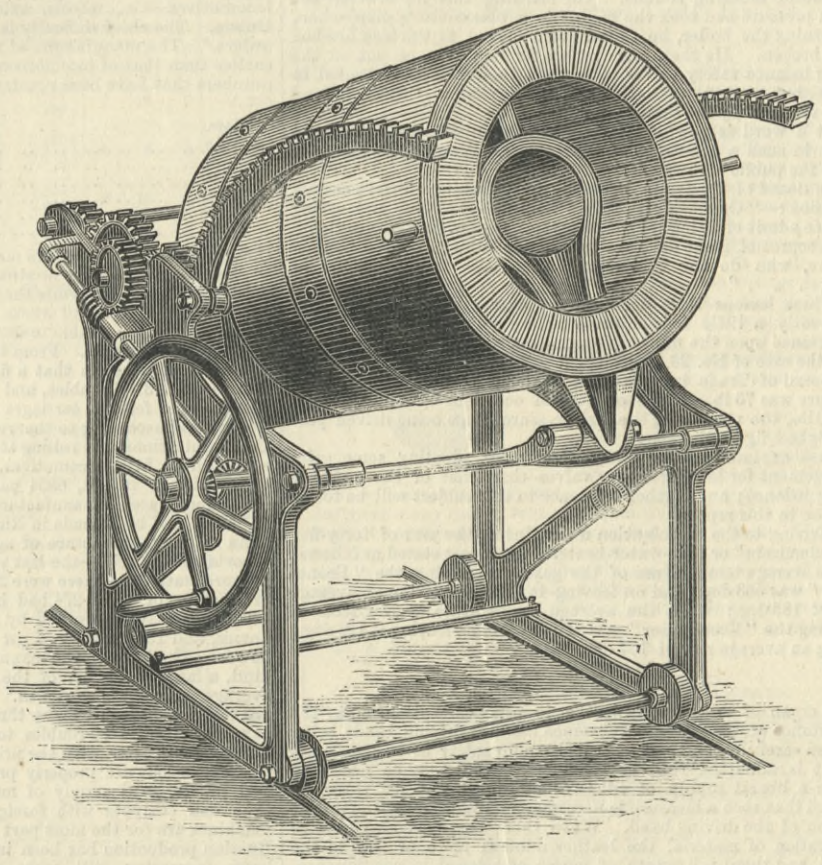


THE system of concentrating the manufacture of gas in one locality is not without its drawbacks. Necessarily the gas has to be transmitted to great distances, and for this purpose machinery is required. The gasworks at Beckton now supply an enormous area, and it has been found desirable to supplement the action of the gas exhausters at the works—which vertically pump gas into the mains—with exhausters at the distant points to which the gas is supplied. The accompanying engraving illustrates exhausters recently supplied by Messrs. Gwynne and Co. to the gasworks at Bromley-by-Bow and Fulham. The engines are made of large size, so as to be capable of working with a very low pressure of steam, and with as much expansion as is possible with the steam pressure available; the degree of expansion is made variable by sliding the excentric on the shaft, which can be done very quickly by slackening two nuts. The exhausters are intended to pass 200,000 cubic feet of gas per hour each, and have been found to pass considerably more at their normal velocity of sixty revolutions per minute. They are made with Gwynne's patent long steel pins, which have a bearing through nearly the whole length of the slides, and are for the purpose of connecting the slides with the segments; other improvements in lubrication, &c., have been recently introduced.

This machinery is employed for pumping up the gas from Beckton in order to relieve the pressure on the new large main which has been laid down between Fulham and Beckton, at which last-named point the gas is forced into the main. The new exhausters are used for pumping either into the gasholders, or when working during the hours of consumption for pumping direct into the mains.

PIAT'S CRUCIBLE MELTING FURNACE.

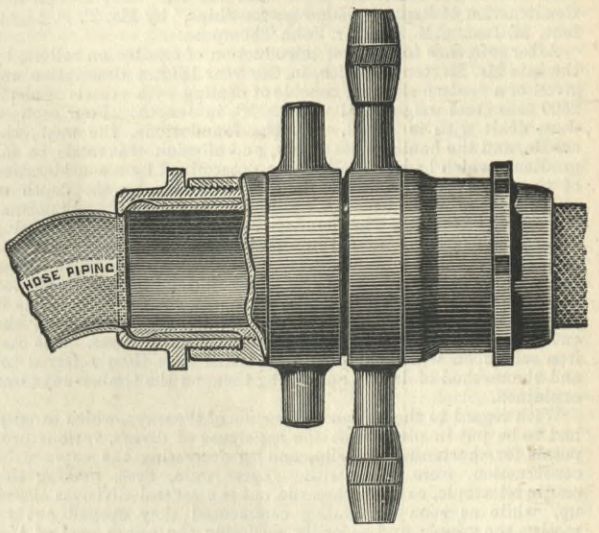
AMONGST other improvements adopted at the Royal Mint is the modified form of the Piat melting furnace which we illustrate below. This arrangement has been made at the instigation of Mr. R. A. Hill, superintendent of the operative department of the mint, the chief object being to dispense with the crane previously employed with Piat's furnaces for removing them from the base of the chimney or flue, and suspending them over the moulds to be poured. For the various forms and sizes of moulds in a general foundry this older form will be required, but in foundries or casting houses where repetition work is done, and considerable quantities of moulds in boxes more or less nearly of the same size have to be poured, the new form offers the advantages of a saving of time, facile manipulation, and renders a crane unnecessary. At the Mint the moulds are all of one kind, and the furnace can there be used with every advantage, beside that of economy in fuel, which belongs to it in the ordinary as well as the new form, the latter being the result of experience with the original form at the Mint and a consideration of the special requirements of that and of similar establishments.



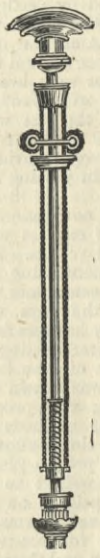
It will be seen that the furnace is suspended by a pivotted lip and by a pair of arc racks, which gear into and rest on a pair of pinions operated by worm and spur hand gearing. As shown in our engraving, the frame carrying the furnace and this manipulating gear is mounted on wheels which run on rails extending from the pouring benches to the base of the chimney, into the lower part of which the flue-piece of the furnace is inserted. It is also shown in the position assumed when the crucible has been emptied, the furnace being, it need hardly be said, vertical during the melting operation, when it is covered by a closely fitting cap. We recently saw one of these furnaces in operation in the works of the Morgan Crucible Company, Battersea, and witnessed the ease and rapidity with which it is removed from the chimney and raised and lowered in pouring moulds. The furnace is lined with fire-bricks, the crucible standing upon a plumbago resting block and fixed by means of a plumbago wedge, at a height which places its lip level with the furnace spout. At the time of our visit the furnace was worked with a natural draught, the chimney being about 40ft. in height. With this the furnace melted 68 lb. of brass, which was in three lumpy ingots, in seventy-nine minutes, the coke used being 16 lb., the quantity of coke in the furnace at the end of the operation being, as near as the eye could judge, the same as before feeding commenced. The coke used was thus 0·235 lb. per pound of lump brass, or 4·25 lb. of brass per pound of coke. With a fan draught as commonly employed the time occupied would have been less than the above. This, it will be seen, is a very satisfactory result, and when this with other advantages are considered, as well as the greater life of the crucible, owing to the avoidance of lifting the crucible at every melting, it will be seen that the furnace now being introduced by the Morgan Crucible Company, has very strong claims when compared with the ordinary system of melting.

HUNT AND MITTON'S HOSE PIPE COUPLING.

A NEW method of attaching hose pipe to couplings, as illustrated by the accompanying engraving, is being made by Messrs. Hunt and Mitton, of Oozell-street North, Birmingham. They are chiefly applying its use to canvas hose for fire brigade purposes; but its range of application is, of course, not confined to this. The advantages claimed for it by the patentees are that the hose is as firmly fixed to the coupling as if it were a part of the hose itself, and that pressure will split the hose before it could be liberated. The coupling is made so that it cannot cut the hose at the end of the unions when dropped upon the ground; the hose being encased in the external collar, the hose pipe can be disconnected at will, shortened and re-connected by any inexperienced person, and in case of fires, where hose is constantly splitting and requires to be re-connected without any loss of time, this union is considered to be specially valuable. From the engraving it will be seen that a raised bead is affixed at each end of the coupling, over which the hose is passed, and the collar—which has a diminished aperture at one end—is first pushed back



over the hose and then drawn forward to the coupling and screwed into it, binding the hose over the raised bead and through the diminished hole in the collar, which renders it perfectly water-tight and securely fixes it. All points of contact with the pipe are so rounded as not to cut or damage the hose.



HEPTON'S GAS CHANDELIER STEM.

THE accompanying engraving illustrates an improvement in gas chandeliers which are now being introduced by Messrs. W. Hepton and Sons, of Leeds. It will be seen that the balance weights have been got rid of. The stem of the chandelier is made a little bolder or larger than usual about half way down from the top. Inside this tube, it will be seen, work the chains on which the chandelier slides, these are regulated by a spiral spring, which so regulates the chain that it will stop anywhere, just the same as the ordinary water slide with weights. To make up for any additional ornament the weights give, there is a fancy ornament put on the stem. We are told by the makers that these chandeliers require no regulating, and that there is no risk of escape of gas through absence of water in the cup.

EXPORTS OF PIG IRON TO GERMANY AND RUSSIA.

THE following statement shows the proportion per cent. of exports to Germany of pig iron and all other descriptions of finished and manufactured iron and steel, distinguishing the changes in the position of raw and finished iron :—

	Per cent. of pig iron.	Per cent. all other sorts.	Total.
1873	65·3	34·7	100
1874	77·1	22·9	100
1875	82·6	17·4	100
1876	80·0	20·0	100
1877	80·0	20·7	100
1878	76·3	23·7	100
1879	86·9	13·6	100
1880	89·0	11	100
1881	86·5	13·5	100
1882	87·5	12·5	100

The following statement shows the relative percentage of exports to Russia in pig iron, and all other descriptions of finished and manufactured iron :—

	Per cent. of pig iron.	Per cent. all other kinds.	Total.
1873	13·5	86·5	100
1874	15·6	88·4	100
1875	16 0	84·0	100
1876	14·0	86·0	100
1877	29 6	79·4	100
1878	45·0	55·0	100
1879	63·3	36·7	100
1880	65·4	34·6	100
1881	74·7	27·3	100
1882	67·8	32·2	100

NAVAL ENGINEER APPOINTMENTS.—The following appointments have been made at the Admiralty:—George T. Craddock, engineer, to the Indus, additional, for the Rapid; and Alexander Wilson, engineer, additional, to the Cambridge, vice Turner.

MR. CAPELL'S FAN.—In our account of the performance of Mr. Capell's fan, given in our last impression, we mentioned that the fan, with the outer case removed, lifted 2in. of water. This should have been 7in., the 2in. referring to the lift when the small test-pipe was simply placed within the inlet, the latter being uncovered.

THE ELECTRICIANS' DIRECTORY.—We have received a copy of this directory and diary, which is published at the office of the *Electrician*. Its publication is much later than was intended, owing to the unexpected difficulties to be encountered in a first compilation of the kind, but in subsequent editions publication is, it is promised, to take place at the beginning of the year. It contains information not to be found in any other directory of the kind, and its special purpose as a directory has been adhered to, and no attempt has been made to supply that sort of information which should be looked for in text-books on electrical matters. The several parts comprise the following:—Directory of electricians, electric light engineers, and all persons connected with electricity and its applications. This is divided into two parts, namely, an alphabetical list of names and a classified alphabetical list of manufactures, trades, or business—as, for instance, the names of makers of dynamo-electric machines, carbons, engines; names of publishers and electrical publications; electrical schools and colleges, telegraph materials, &c. Electrical work will henceforward occupy the attention of local authorities and officials, railway companies and their officials, and lists of the names of these are therefore given, as well as those of postal telegraph officials. The telegraph tariffs are also given, and lists of applications for Provisional Orders, electric light companies, and notes on the Electric Lighting Act, and some hints on taking out a patent

THE INSTITUTION OF CIVIL ENGINEERS.

THE DESIGN AND CONSTRUCTION OF REPAIRING-SLIPWAYS FOR SHIPS.

AT the ordinary meeting on the 13th of February, Mr. Brunlees, president, in the chair, the paper read was on "The Design and Construction of Repairing-slipways for Ships," by Mr. T. B. Lightfoot, M. Inst. C.E., and Mr. John Thompson.

After reference to the first introduction of cradles on rollers, by the late Mr. Morton, of Leith, in the year 1819, a description was given of a modern slipway, capable of dealing with vessels of about 2500 tons gross weight, and up to 300ft. in length. Four sections were dealt with in detail, viz., the foundations, the ways, the cradle, and the hauling machinery, and allusion was made to the gradient, which had generally to be determined by a consideration of the amount and value of land at disposal, by the depth of water to be provided over the cradle, and sometimes by the natural slope of the ground. The foundations were described as not being difficult or expensive, except in special cases, as the weight of the vessel and cradle was spread over such a large area as to reduce the pressure per unit to a very small amount. Piling was objected to unless the whole length of the way was thus supported, as it was important to obtain uniformity of bearing throughout the entire length, in order to avoid excessive local stresses. The cast iron rails upon which the cradle travelled were then referred to, and the method of laying and fixing them on the timber-ways was explained.

With regard to the submerged portion of the ways, which usually had to be put in place with the assistance of divers, various proposals for shortening the slip, and so decreasing the expense of construction, were dealt with. These were, first, making the cradle telescopic, so that when run out the several divisions closed up, while as soon as hauling commenced they opened out to receive the vessel; and secondly, enclosing the upper part of the slip within water-tight walls, provided at the bottom with a pair of gates. Both these systems had been adopted by the authors, but the latter was only applicable in cases where there was a sufficient rise and fall of tide. When diving had to be resorted to, the submerged portion of the ways was first of all framed together on land, and the rails laid. It was then floated out over its final position, and sunk by laying on a sufficient weight of stones, the ground having been previously prepared by dredging and levelling up with ballast. The construction of the cradle was next mentioned. The timber used was generally American oak, put together in the form of three ribs, one at the centre and two at the sides, over the outer lines of rails. The ribs were braced together and mounted on strong cast iron wheels with wrought tion axles running in cast iron carriages. Across the ribs were beams of wood or iron carrying sliding bilge-blocks worked from the vessel itself. Ploughs, stays, and pawl-gear were provided, as well as wrought iron guides, for convenience in placing the vessel.

The hauling-up machinery was described as being now generally actuated by water-pressure, though in some cases engines with gearing were used, especially in slipways for small vessels. The authors then detailed the working of a slipway, mentioning the preparation and running down of the cradle, which sometimes was permitted to project 30ft. to 40ft. over the end of the ways, and the floating on of the vessel, which was guided by hawsers from the quay or jetty, and by the cradle guides. After hauling-up had commenced, the ship gradually settled down on the keel-blocks, and the sliding bilge-pieces being run in, it was drawn out of the water seated on the cradle. In launching this process was reversed. Two instances were then given of methods by which more than one vessel could be taken on a single slipway at one time. The first was by means of hydraulic presses placed under the keel of the ship, which enabled the weight to be transferred from the cradle to blocks supported entirely on the ground, so that, by providing the cradle with swinging arms, it could be run down out of the way and prepared for receiving another vessels. In the second method—Thompson and Cooper's—two cradles travelled on distinct sets of rails, with slightly different inclinations, so that the vessel might be transferred from one to the other, according as the two cradles were simultaneously hauled up or lowered down.

Morton's hydraulic hauling gear, in which the links had to be disconnected at the end of each upward stroke, in order to take out a length, and permit the ram to travel back and be reconnected, was then described; and after pointing out the serious loss of time occasioned by this operation, the authors proceeded to show how, by improved gear, loss of time was avoided. With this apparatus there was no disconnecting of links, which merely travelled up and down the ways according as the rams were on their outward or inward stroke, connection with the cradle being made by pawls attached thereto, which geared with the links on their upward stroke, and slipped so soon as they were reversed. During the short time the links were stationary in reversal at top and bottom, water was accumulated under pressure, and given out when the rams travelled in one direction or the other.

Reference was made to Messrs. Hayward Tyler and Co's hauling gear, also to that introduced by Messrs. Day and Summers, the former being objected to on account of its cost, and the latter from the difficulty in obtaining wire ropes sufficiently durable to work under the heavy strains to which they would be subjected in a large slipway. Formulas were given for calculating the practical dimensions of the hauling gear, and the expense of working a slipway was stated, both for Morton's system and for that of the authors. The average cost of construction of a slipway was very difficult to determine, but it was stated that a slipway to haul up vessels weighing 2500 tons, with 850ft. of ways, hauling machinery, links, and one timber side-jetty, would probably come to £25,000 without the land. In conclusion, the authors said they did not advocate the indiscriminate use of slipways, but the choice of their adoption or otherwise must be left to the engineer,, after a survey of the ground, and a careful consideration of his resources. They thought, however, that in many situations the slipway possessed advantages in regard to first cost and facility in execution which should specially recommend it to the capitalist; while from a shipowner's point of view, the better ventilation around the vessel when it was withdrawn from the water, the opportunity afforded for inspection, and the short time occupied in hauling up and launching, were very important features.

The paper dealt with only such methods as were generally in use, and did not attempt to describe arrangements and modifications which might be desirable in special cases. Reference was, however, made to be combined floating dock and slips as first carried out in 1851 at Philadelphia, the total cost of which was about £163,000.

THE MANCHESTER STEAM USERS' ASSOCIATION.

AT the last ordinary monthly meeting of the executive committee of this Association, held at the offices, 9, Mount-street, Albert-square, Manchester, on Tuesday, February 6th, 1883, Mr. Thos. Schofield, Manchester, in the chair, Mr. Lavington E. Fletcher, Chief Engineer, presented his report, which gave particulars of visits of inspection from November 25th to December 31st inclusive, and also a summary of the explosions for the whole year. Of this report the following is an abstract:—

No explosion arose during the past year from any boiler enrolled with the Manchester Steam Users' Association, but outside its ranks 33 steam boiler explosions occurred, killing 36 persons and injuring 40 others, while there also occurred 13 "minor" explosions, killing 11 persons and injuring 15 others, making a total of 47 persons killed and 55 persons injured.

The average pressure of all the boilers that burst throughout the year was 55 lb., the three highest pressures being 140 lb., 135 lb., and 100 lb., while the three lowest were 20 lb., 20 lb., and 25 lb.

The distances to which the fragments were thrown in the case of an explosion which arose from a locomotive boiler at Dunbar are remarkable. The steam dome was thrown to a distance of 325 yards, the safety-valve spring 368 yards, part of the fire-box casing 480 yards, part of reversing lever 484 yards, one of the plates from the barrel of the boiler 485 yards, and another portion of the reversing lever 563 yards. It will be seen four of the fragments were thrown upwards of a quarter of a mile.

Fifteen explosions, killing 13 persons and injuring 25 others, arose from the defective condition of the boilers. Ten, killing 11 persons and injuring 12 others, arose from malconstruction, coupled with excessive pressure in four cases, and with defective condition in four others. Two, killing 5 persons, arose from overheating the furnace crowns through shortness of water, and two others from excessive pressure, while of the remaining four explosions sufficiently detailed particulars were not obtained to allow of the cause being arrived at.

Of the 36 persons who were killed by steam boiler explosions in 1882, 34 were men, one was a young woman, and one was a boy; while of the 40 persons who were injured, 27 were men and 13 were young persons and children, two of whom were girls. Some of the persons who were killed and injured were not engaged on the works at which the explosions occurred. In one case the manager of an adjoining colliery, who was standing on the pit bank about 100 yards away, was struck on the head with a brick shot from the boiler, and killed on the spot. In another case, four children playing near the boiler were injured. In this instance the boiler was of the portable type, and appears to have been accessible to the public. It was employed temporarily to compress hay for shipment to Egypt during the late war, and as the operation excited considerable interest, a number of persons were attracted to the spot from time to time. In a third case a boy ten years of age, who was near the boiler, was killed, and six others, ranging from twelve to sixteen years of age, injured.

In the case of an explosion which occurred near Norwich the boiler formed part of a traction engine, and burst on the public highway. Had the explosion occurred a few minutes earlier the results would have been most disastrous, as a number of children were then standing round the engine, but fortunately were called into school just before the boiler burst, and thus escaped. The Board of Trade Report on this explosion gives some startling facts adduced from examination of witnesses. The driver deposed that before the engine was under his charge he remembered on one occasion to have seen the pressure so high that the pointer of the steam gauge was driven round hard against the stop pin at zero. Another witness said that within a day or two of the explosion he had on two occasions seen the pointer of the pressure gauge driven right past the last figure, which was 100 lb., and standing between that and the stop pin. Even then the steam was not blowing off, so that the valve must have been loaded to a higher pressure still, if not locked fast. The owner stated that he bought the boiler and engine second-hand about twelve years ago. He believed it to be about twenty years old on the day of the explosion. He had not had it inspected. He worked it at a pressure of 100 lb. on the inch. About seven years ago he went into the field and found the safety valve screwed down and the pointer of the spring balance at the bottom of the slot, so that the valve was locked fast and inoperative. On seeing this he eased the valve, when it took about fifteen minutes to reduce the pressure to 100 lb., with the engine standing at the time. On looking at the boiler he saw that the stays had begun to leak, when the driver told him that about twenty minutes before, while taking the engine up the field, he had heard cracking sounds. On learning this he lowered the steam pressure and took the engine to a blacksmith's shop, when, on opening the boiler, he found from eleven to thirteen fire-box stays broken. He then gave orders for ferules to be put on the spring balance safety valves to prevent their being overloaded in future, but made the startling statement that he "always found them removed by the drivers."

Not a word is needed to point out the injustice of allowing a boiler in such a condition and with such an equipment to travel along the public highway.

The Board of Trade report makes the following remarks on this explosion:—"Open safety valves loaded by a lever and spring balance admit of being too readily tampered with, and are therefore a source of great danger in the hands of such men as engine-drivers, who do not understand the risks they incur by so doing . . ."

"These lessons have been taught over and over again, and apparently a little official pressure is required to impress their importance upon the minds of engine makers and steam users."

In the case of No. 23 explosion, it was stated in evidence before the Board of Trade inspector that though the ordinary working pressure was 70 lb., it had on several occasions been seen as high as 100 lb., the pointer on the dial pressure gauge being driven past the highest figure thereon.

These explosions show the necessity for adopting some safer arrangement for loading safety valves than that of the ordinary spring balance; and further reference to this subject will be found later on in this report.

Referring to the examination made during the year of forty-five "Economisers" or feed-water-heaters, the report stated as follows:—The average temperature of the gases on entering the "Economiser" was 568 deg., and on leaving it 383 deg., giving an average fall of 185 deg.; while the average temperature of the feed on entering the "Economiser" was 94 deg., and on leaving it 198 deg., giving an average rise of 104 deg.

AN organ of the German leather industry calls attention to the importance of the adhesive substance used for driving bands being applied carefully, and not used in such quantity as it sometimes is. It is admitted that in some instances it may be necessary to use a liberal supply of adhesive substance, but the theory is refuted that such a measure is necessary for maintaining the proper tension of the driving band. When there has been an excessive application of material the leather adheres more or less to the metal, and there is a waste of power occasioned in consequence. This fact, it is remarked, also causes the bands to run crooked.

THE METEOROLOGICAL SOCIETY.—The usual monthly meeting of this Society was held on Wednesday evening, the 21st inst., at the Institution of Civil Engineers; Mr. J. K. Laughton, F.R.A.S., president, in the chair. Rev. W. R. C. Adamson, R. P. Coltman, W. F. Gwinnell, Captain C. S. Hudson, T. Mann, F. G. Treharne, and W. Tyson were ballotted for and elected Fellows. The following papers were read:—(1) "Notice of a Remarkable Land Fog-bank, the 'Larry,' that occurred at Teignmouth on October 9th, 1882," by G. W. Ormerod, M.A., F.M.S. The "Larry" is a dense mass of rolling white land fog, and is confined to the bottom of the Teign valley, differing therein from the sea fog, which rises above the tops of the hills. It appears about daybreak, and has an undulating, but well-defined, upper edge, which leaves the higher part of the hill-sides perfectly clear. The author gives an account, illustrated by photographs, of the remarkable fog-bank that occurred at Teignmouth on October 9th. (2) "Barometric Depressions between the Azores and the Continent of Europe," by Captain J. C. de Brito Capello, Hon. Memb. M.S. The author gives the tracks of several depressions from the Azores to Europe, and shows that if there had been a telegraphic cable nearly every one of them could have been foretold in England. (3) "Weather Forecasts and Storm Warnings on the Coast of South Africa," by Captain C. M. Hepworth, F.M.S. (4) "Note on the Reduction of Barometric Readings to the Gravity of Latitude 45 deg., and its Effect on Secular Gradients, and the Calculated Height of the Neutral Plane of Pressure in the Tropics," by Prof. E. D. Archibald, M.A., F.M.S.

THE MECHANICAL INDUSTRIES OF RUSSIA.

INCLUDED in a volume of commercial reports recently issued by our Foreign Office is an interesting review of Mr. Herbert, one of the secretaries to our Embassy at St. Petersburg, of the progress of the manufacture of machinery in Russia during the past twenty-five years. This branch of industry the Russian Government has tried in many ways to foster. Not only has it from time to time heavily increased the import duties on foreign machinery, it has also, in addition to this protection to native manufacturers, granted bounties to the native producers of certain articles, such as locomotives and steel rails; it has established schools of engineering; it has lent money on mortgage to factories, and made advances to manufacturers on works in progress; and it has given the Government orders for railway plant and other machinery to Russian works, and also compelled private railway companies to order part of their rolling-stock and rails at home. In some respects, the great anxiety to develope the home industries has over-reached itself, and tended rather to retard than to accelerate their growth. For instance, the levying of an import duty upon iron plates for shipbuilding, which had previously been allowed to enter free, while intended to encourage one branch of manufacture, has had a decidedly bad effect upon the shipbuilding industry. At the same time, however, the efforts made to create home industries have not been without results, and in some departments considerable progress has been realised.

The manufacture of locomotive engines, Mr. Herbert tells us, may be said to have begun in 1866, when it was decreed that orders for plant should be given to home factories. In 1869 only seventeen engines were constructed in Russia, but since then the production has increased rapidly, the out-turn of each year up till 1880, and the value of the foreign engines imported, being shown in the following table:—

Manufacture of Locomotives and Foreign Imports of the same from 1869 to 1880.

Year.	Russian Manufacture.		Imported from Abroad.	
	Number.	Value.	Value.	Of which there were Imported Duty Free.
		£	£	£
1880	247	710,000	267,000	10,000
1879	266	725,000	170,000	—
1878	334	910,000	1,067,000	437,000
1877	225	558,000	364,000	145,000
1876	188	477,000	239,000	90,000
1875	176	430,000		
1874	184	414,000		
1873	139	304,000		
1872	86	202,000	4,800,000	2,800,000
1871	63	150,000		
1870	38	98,000		
1869	17	41,000		
	1963	5,019,000	6,907,000	3,482,000

Thus, excepting in 1878, when the war with Turkey compelled the Russian Government to import large quantities of all descriptions of rolling stock, the Russian purchases of foreign engines have of late years been declining, the decrease having latterly become more rapid, owing to the curtailment of the privilege of importing free of duty. Between 1869 and 1875 fully 68 per cent. of the imports were duty free, but in 1879 duty had to be paid on the whole of the imports, and in 1880, less than 4 per cent. of them escaped duty. As to the power of Russia to supply her own engines, Mr. Herbert states that "everything necessary for making locomotives—*i.e.*, wheels, axles, springs, &c., can be made in Russia. The chief difficulty is to keep up the constant supply of orders." The manufacture of railway carriages was begun rather earlier than that of locomotives, and the following figures show the numbers that have been constructed in recent years:—

Year.	Passenger.	Luggage and Trucks.
1880	20	5930
1879	163	5593
1878	232	10,692
1875	201	4686
1870	112	5774
1867	99	1092

Complaints, it is stated, are made of the obstinacy of the managers of the Russian railways in still ordering rolling stock abroad; but it would appear that while the Russian factories are able to turn out luggage wagons and trucks in sufficient quantities to meet the demand, they are unable to do the same with regard to first and second-class carriages. From the official figures which Mr. Herbert quotes, it would seem that a first-class carriage of Russian manufacture costs 3104 roubles, and a second-class carriage 1244 roubles; whereas the foreign carriages cost 2942 and 1262 roubles respectively; and according to the report of the Minister of Ways and Communications, the rolling stock of the Russian railways in 1879 consisted of 5190 locomotives, of which about 37 per cent. had been built in Russia, 6334 passenger carriages, of which 34 per cent. were Russian manufacture, and 102,494 trucks, 58½ per cent. of which had been made in Russia.

As to the manufacture of agricultural machinery, Mr. Herbert reports that in 1879—the last year for which he had been able to procure statistics—there were 329 works engaged in this branch of production, of which 274 had been founded since 1860. Of these, 100 factories were worked by steam, 6 by water power, 38 by horses, and 196, or fully 57 per cent. of the total, by purely manual power. The bulk of the manufacture is thus of a very primitive kind, a large proportion of the so-called factories supplying, on an average, only three workmen. In the government of Riazan we are told the peasants make thrashing machines of 4-horse power at a cost of from 80 roubles to 160 roubles—£8 to £16—but the quality is on a par with the price, and it is only the comparatively few works that are properly provided with mechanical appliances and have a good supply of materials, especially seasoned wood, that can compete with foreign makers. Mowing and reaping machines are for the most part made at Warsaw; but although the Russian production has been increasing, the foreign imports have been increasing still more rapidly. "Steam engines," Mr. Herbert writes, "are the chief articles imported, and notwithstanding the import duty imposed in 1881, they still continue to be introduced, as likewise are reaping, sowing, and mowing machines, and likewise thrashing, and all the more complicated sorts of machinery. Traction engines form a large part of the imports, the duty of 30 copecks a pood not preventing large proprietors, nor even the peasants, from buying them. The 1880 tariff, by making the raw material dearer, raised the cost of agricultural machines, and has not improved the position of the Russian manufacturers." From other sources, also, we know that the Russian agriculturists are fully aware of the superiority of the imported over the home-made machinery, and are ready to pay for the latter the higher price that the extremely impolitic import duty causes to be charged; and evidence to the same effect is borne by the following statement of the value of the home production and imports respectively during the past five years:—

Agricultural Machinery.

Year.	Value of Home Manufactures. £	Value of Imports. £
1880	Not ascertained	550,000
1879	398,000	400,000
1878	320,000	364,000
1877	276,000	123,000
1876	237,000	163,000

The figures of the value of the Russian manufactures are disputed, some authorities considering them too high.—*Economist.*

LETTERS TO THE EDITOR.

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

PATENT LAW AMENDMENT.

SIR,—It is proposed by the Society of Arts to examine inventions as to novelty by properly qualified examiners. If this is carried out it would necessitate some alteration in the present mode of procedure in obtaining patents. If it is the provisional specification which is to be examined as to whether it is anticipated by former patents, great difficulty would ensue on account of the ideas being generally in such a crude state. An objection might be raised by the examiners to a provisional specification on account of its resemblance, in its general terms, to a previous patent, when perhaps the applicant, according to his "complete" or "final" specification, subsequently filed, really shows or describes important details which entitle him to take his patent in spite of the former invention. On the other hand, if it is the final specification which is to be examined as to novelty, then the "sealing" fees should not be made payable until after the examination has been completed; otherwise an applicant might stand a chance on being refused his patent by the examiner, through some cause, after he has incurred the expense of stamp, &c., on the provisional specification, the fees on sealing his patent, and the stamp, &c., on his complete or final specification. This would be a great hardship to the inventor, who would not only lose his property and the various fees above mentioned, but also a great deal of time, because the examination would not commence till he had filed his final specification, six months having already elapsed. The great importance of the Bill being as complete as possible is generally admitted, and will, I hope, excuse my trespassing on your valuable space.

C. A. GROSSETETE.

166, Fleet-street, E.C.

GOSLING'S FUEL ECONOMISER.

SIR,—I enclose you copies of the reports of two trials with our economiser, illustrated in THE ENGINEER for Jan. 26th, 1883, and which are signed by the manager of the Beckton Gasworks. It is almost needless for me to say that these trials were prepared and carried out entirely by the engineers of the Beckton Gasworks to their entire satisfaction. You are at liberty to make what use of the enclosed you choose, and we shall be pleased to supply you with any other information you may require.

I may say that the compound Cornish multitubular boiler was a special case of very bad draught and an insufficiency of steam before our economiser was applied, but that after our economiser was applied there was ample of both.

GOSLING AND THOMAS.

New Beckton, North Woolwich, E., February 13th.

(Copy of the Report of a Trial with the "Gosling" Patent Boiler Fuel Economiser at the Beckton Gasworks, Beckton, North Woolwich, E., December, 1882.)

This trial was made with two Lancashire boilers of the same size, whose main steam pipes were connected, and both working together on the same set of pumping engines. The trial lasted for five days, working day and night. The fuel used was a mixture of coke, composed of second and third-rate quality of coke in equal parts. All the fuel and feed-water used during the trial were accurately weighed and measured. The draught of the boiler with the economiser was greatly improved.

The irregularity of the quantities of fuel and feed-water on the different days is accounted for by the irregular working of the engines, as the latter are worked fast or slow, as circumstances require, and also by the want of uniformity in the fuel.

Boiler with Economiser.

	Twelve hours.				Twenty-four hours.			
	Fuel.			Feed-water.	Fuel.			Feed-water.
Dec. 11, 1882.	tons.	cwt.	qr.	gallons.	tons.	cwt.	qr.	gallons.
Day	2	1	0	2,850	3	14	0	5,475
Night	1	13	0	2,625				
Dec. 12, 1882.								
Day	1	18	0	3,075	3	12	2	6,225
Night	1	14	2	3,150				
Dec. 13, 1882.								
Day	2	0	0	3,150	3	6	2	5,925
Night	1	6	2	2,775				
Dec. 14, 1882.								
Day	1	7	0	2,850	2	16	2	5,775
Night	1	9	2	2,925				
Dec. 15, 1882.								
Day	1	14	2	2,850	3	7	0	5,850
Night	1	12	2	3,000				
Total for the five days	16	16	2	29,250	16	16	2	29,250

Feed-water.

	Gallons.
Boiler with economiser	29,250
Boiler without economiser	24,000
	5,250

5250 gallons is rather more than 21¾ per cent. more water generated into steam by the boiler with the economiser.

Boiler without Economiser.

	Twelve hours.				Twenty-four hours.			
	Fuel.			Feed-water.	Fuel.			Feed-water.
Dec. 11, 1882.	tons.	cwt.	qr.	gallons.	tons.	cwt.	qr.	gallons.
Day	2	3	0	2,250	4	5	2	4,575
Night	2	2	2	2,325				
Dec. 12, 1882.								
Day	2	2	2	2,925	3	17	2	5,775
Night	1	15	0	2,850				
Dec. 13, 1882.								
Day	2	2	2	2,400	3	16	0	4,650
Night	1	13	2	2,250				
Dec. 14, 1882.								
Day	1	16	2	2,325	3	9	2	4,500
Night	1	13	0	2,175				
Dec. 15, 1882.								
Day	2	1	0	2,400	4	0	2	4,500
Night	1	19	2	2,100				
Total for the five days	19	9	0	24,000	19	9	0	24,000

Fuel.

	tons.	cwt.	qr.
Boiler without economiser	19	9	0
Boiler with economiser	16	16	2
	2	12	2

2 tons 12 cwt. 2 qr. is rather more than 13¼ per cent. less fuel consumed by the boiler with the economiser.

(Signed) G. C. TREWBY, M.I.C.E.

February 12th, 1883.

(Copy of the Report of a Trial with the "Gosling" Patent Boiler Fuel Economiser at the Beckton Gasworks, Beckton, North Woolwich, E., February, 1883.)

This trial was made with two compound Cornish multitubular boilers of the same size and the following dimensions:—

Length of boiler	19ft.
Diameter of boiler	5ft. 6in.
Diameter of flue	3ft. 1in.
Length of furnace	6ft.
Length of flue—containing two Galloway tubes—between the bridge and the front of the multitubular portion of the flue	6ft.
Length of multitubular portion of flue	7ft.

The main steam pipes of these boilers were connected and both working together on the same set of engines. The trial lasted for twenty-four hours. The fuel used was coke. All the fuel and feed-water used during the trial was accurately weighed and measured. The draught of the boiler was greatly improved by the economiser.

Boiler with Economiser.

	Twelve hours.				Twenty-four hours.			
	Fuel.			Feed-water.	Fuel.			Feed-water.
Feb. 2, 1883.	tons.	cwt.	qr.	gallons.	tons.	cwt.	qr.	gallons.
Day	0	10	0	900	0	19	0	1650
Night	0	9	0	750				
Total for 24 hours	0	19	0	1650	0	19	0	1650

Feed-water.

	Gallons.
Boiler with economiser	1650
Boiler without economiser	1200
	450

450 gallons is just 37½ per cent. more water converted into steam by the boiler with the economiser.

Boiler without Economiser.

	Twelve hours.				Twenty-four hours.			
	Fuel.			Feed-water.	Fuel.			Feed-water.
Feb. 2, 1883.	tons.	cwt.	qr.	gallons.	tons.	cwt.	qr.	gallons.
Day	0	8	2	600	0	17	2	1200
Night	0	9	0	600				
Total for 24 hours	0	17	2	1200	0	17	2	1200

Fuel.

	tons.	cwt.	qr.
Boiler with economiser	0	19	0
Boiler without economiser	0	17	2

0 ton 1 cwt. 2 qr. is rather less than 8½ per cent. more fuel consumed by the boiler with the economiser.

(Signed) G. C. TREWBY, M.I.C.E.

February 12th, 1883.

THE CAUSES OF GLACIER MOTION.

SIR,—In Mr. Browne's very interesting paper on the above subject, in the number of your journal of February 9th last, a point occurs on which I should be glad of further information.

I have always believed—and reference to reliable text-books appears to bear out the belief—that from about 39 deg. Fah. down water and ice *expand* as the temperature decreases; but in Mr. Browne's paper I find the following words:—"When a mass of ice, such as a glacier, suffers a *rise in temperature*, it will *expand*," and in another place, "when the sun is shining this radiant energy is always very large, although the temperature of the air may be low. In such cases the glacier does not melt; it is perfectly clear that it must expand as any other solid must *expand under the action of heat*." Further on there is another clear statement to the same effect, quoted from Dr. Rae.

Evidently the precise period of expansion and contraction under increase of heat or otherwise will not vitiate the theory of the forward and downward motion of the glacier which Mr. Browne illustrates; but the passages I have quoted, and in which the italics are mine, seem to be at variance with generally accepted ideas as to the behaviour of ice under varying degrees of temperature.

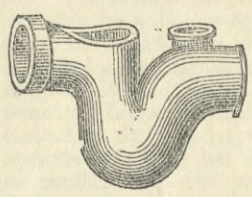
Mr. Browne has studied the subject closely, and he quotes from high authority, so that I write with some diffidence; but shall be obliged if you can find room for these few lines in your next issue, that I may be put right if the apparent discrepancy I have pointed out does not exist.

W. S. LOCKHART.

Fenchurch House, Fenchurch-street, London, Feb. 19th.

CAST IRON OPEN DRAIN TRAP.

SIR,—On the fly-sheet I send you a sketch of a new trap, which I make to use with cast iron drains, now acknowledged to be the best for many reasons, especially in clubs, hotels, and other large establishments where boiler blow-off pipes are often attached to them, causing sudden expansion to the earthenware pipes, and consequent leakage of sewer gas and soil. Not so with iron. This trap, it will be seen, is cut off at the top; this allows the fresh air to enter it, as already explained by you on August 18th, 1882. Besides this it allows better access to the trap than any other at present in use. It is also possible to see that the sewage is passing freely away, and also it is possible to see straight through the drain, and in the event of stoppage, to pass rods through without obstruction, and being of cast iron is not liable to breakage.



It is generally stated that the cost of iron drains is greater than earthenware, but, when taking into consideration that when once fixed no leakage is likely ever to take place, that there are not nearly so many joints, and consequently less liability to stoppage, it will be apparent that in the long run iron is best. These traps are very clean and inexpensive, as well as forming a good ventilation from the sewer, better than the road gratings; and if everyone used a ventilator to the drain, better and sweeter sewers would be the result, when taking into consideration the enormous addition from the suburbs all round.

F. BOTTING.

29, Mount-street, W., February 18th.

MECHANICAL TRACTION ON TRAMWAYS.

SIR,—The question of steam on tramways is revived again, as shown by the interesting questions brought forward lately in THE ENGINEER. I should be glad if you would kindly favour me with some space for a few remarks on the subject. I am surprised to find the opinion still prevailing that steam cannot hold its own against horses, and that the effort of replacing the horse service by steam does not meet with the encouragement it deserves. That horses are actually and, I am sorry to say, cruelly overworked, is a well-known fact. There are managers who have their horses and cars overworked to the utmost, regardless of the detriment to their employers, their aim being to work up the shares to produce a fictitious rise of the dividends a short time before the half yearly meeting, while they disregard the suffering and overwork of the horses and the damage to the rolling stock, leading to the unavoidable ruin of the company. Fifty years ago steam locomotives met with the same opposition as the steam tramways do at present; yet it is a recognised fact that since the introduction of railways horse traffic has increased considerably, as also their dividends. Steam tramway services hold their place favourably in foreign countries. Why should they not do so here? To connect the centres of commercial and manufacturing towns, they are undoubtedly a public boon, as they afford a cheap means of transport for passengers and light goods, so absolutely necessary for the workman, artisan, and tradesman. If townspeople object to steam tramways, because they are not aware of their benefits, the best remedy is to use them at the beginning only, in the suburbs, to the gates of the town, and to employ horse service by the same company for the interior traffic. The company will satisfy the varying requirements of the public, and bring the service into favour. The public will gradually get accustomed to the steam service, and desire it. The causes of the failure of steam until now must not be judged so superficially as one of your correspondents has done, and say that all the engines tried in Paris failed. There were many causes besides that brought about these failures, viz., inexperience of the required strength of permanent way and engines—varying interests in horse service—the company's want of capital to defray the working expenses of the line, and the proper maintenance of permanent way and rolling stock. Such capital was wanted to accrue from the profits first to be realised from the cheaper steam over the horse traction. It would occupy too much of your valuable space to enter minutely into all these details, but I maintain that by the haulage of two cars a clear profit of 2½d. to 3d. per car per mile can be obtained if the well-frequented road be carefully worked and properly managed. The Board of Trade's stringent regulations in regard to the engines show that they were not aware of the great mechanical difficulties to be complied with, and that they did not understand the requirements of such tramway service for the public benefit. It is stated that the steam frightens the horses. According to my experience, it is not the steam which does so, it is the huge and ugly chimneys of the engines, and the excessive height of the cars. In regard to the engines, we have before us Merryweather's, Hughes's, Brown's, Kitson's, and Wilkinson's engines some of which I have worked, and all of which I have seen at work, having lately visited the Darlington, Stockton, Wigan, and Birmingham-Aston line. In neatness, correct proportions, shortness of wheel-base necessary for the existing sharp curves, there are only Wilkinson's and Hughes's Paris-type engine which correspond to the requirements of such a service. The aforesaid engines, with the exception of the Wilkinson engine, are generally built on the principle of the tank-locomotive type, and all show some similarity in the main points of the condensing arrangement, in the discharge and cooling of the condensing tank, and in the application of the condenser, whether placed on the boiler or on the roof. I do not omit the particularity of Kitson's engine in its dispensing with excentrics, and its application of the Joy's valve gear. The marked improvement of Wilkinson's engine consists in the application of wheel-gearing to overcome more easily steep-gradients, and in the superheating of the steam, instead of its condensation. This arrangement has the advantage of making the engine lighter, as she does not carry a heavy load of water, otherwise needed for the condensing arrangements. I found on my visit to the Wigan works that the material, workmanship, and manufacture were in every respect first-class, and that the builder had benefited by former experience of others as to the absolute necessity of having strong and well-built engines, as otherwise no good service of such heavy traffic could be properly carried out. I will not enter into detailed remarks on the gearing and superheating arrangement, the main features of the largely improved principle of Wilkinson's engine. I am informed that the firm continues steadily its improvements. The engine being substantially well built, and therefore comparatively not heavy, the service on the Wigan line being light, I quite understand the working expenses there to be 4d. per mile, as stated. It speaks the more so in favour of the engine, as I found the line, like the Birmingham-Aston line, in very bad and neglected condition. Under heavy service, however, steam traction cannot be properly carried out under 5d. to 6d. per mile. The working expenses to be only 2½d. per mile, as stated by one of the writers, must undoubtedly be, even for a short level road, a great mistake. That my estimation of 5d. to 6d. per mile on the average seems correct I find confirmed by a note on tramways in the metallurgical paper *Iron*, 26th January, 1883, where it is stated that the working expenses of the North Staffordshire Steam Tram Line, with the engines there in use, weighing 13 to 15 tons, is 1s. 2d. per mile; but that the cost of the Wilkinson's engine, which weighs only 8 tons, is under 8d. per mile, including all charges. The heavy engines, I think, are those of Messrs. Manning and Wardle, and others, and will, according to the same statement, be replaced by fifteen Wilkinson engines. It is further stated that the line has been laid too weak for the heavy traffic, and that it will be necessary to strengthen it, which I think should have been foreseen. Even if the working expenses of steam traction are 6d. per mile, steam will still have superiority over the horse traffic for all the tram companies in Paris spend on level roads 6¾d. to 7d., and very often more, per mile. Moreover, the haulage of an extra car does not increase the consumption of fuel nor the general working expenses of the engine by a sensible figure. Thus, the beforementioned benefit of 2d. to 3d. per mile per second car can easily be realised.

That the Board of Trade regulations, as regards the employment of steam, as well as some other similar measures, are unnecessary and complicate only the mechanical appliances for the use of steam, is a fact already generally known, and it is only a matter of a short time that they will be repealed, when the Board of Trade will better understand the real requirements of steam tramways as a public service and will be prepared to assist in favour of its progress.

H. CONRADI.

18, Golden-square, London, February 14th.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending Feb. 17th, 1883:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 11,989; mercantile marine, Indian section, and other collections, 3068. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. to 4 p.m., Museum, 1523; mercantile marine, Indian section, and other collections, 182. Total, 16,762. Average of corresponding week in former years, 13,445. Total from the opening of the Museum, 21,711,116.

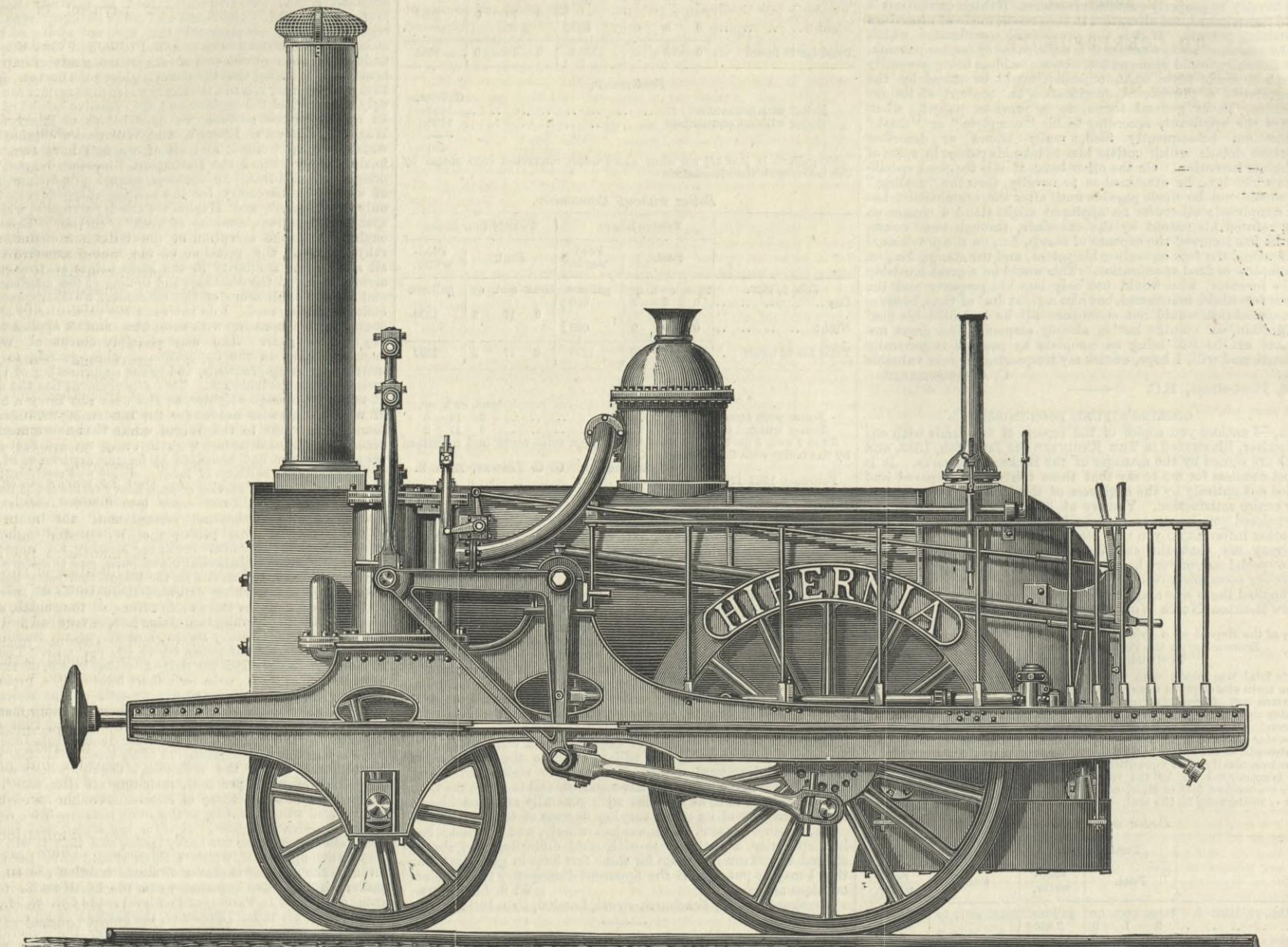
EXTENSIVE preparations are being made for the Marine and Mechanical Engineering and Metal Trades Exhibition, which is to be held in the Agricultural Hall, London, in July. The exhibition is being organised by Mr. Samson Barnett, jun., of 4, Westminster-chambers, Victoria-street, Westminster, who so successfully carried out the Naval Engineering Exhibition at the same place in April last, and who has secured the co-operation of Mr. D. K. Clark, M.I.C.E. This time the exhibition takes a somewhat wider scope, in that it is to be a Marine and Mechanical Engineering and Metal Trades Exhibition. This affords the opportunity for the display of steam engines, machinery, and shop tools in an endless variety of detail.

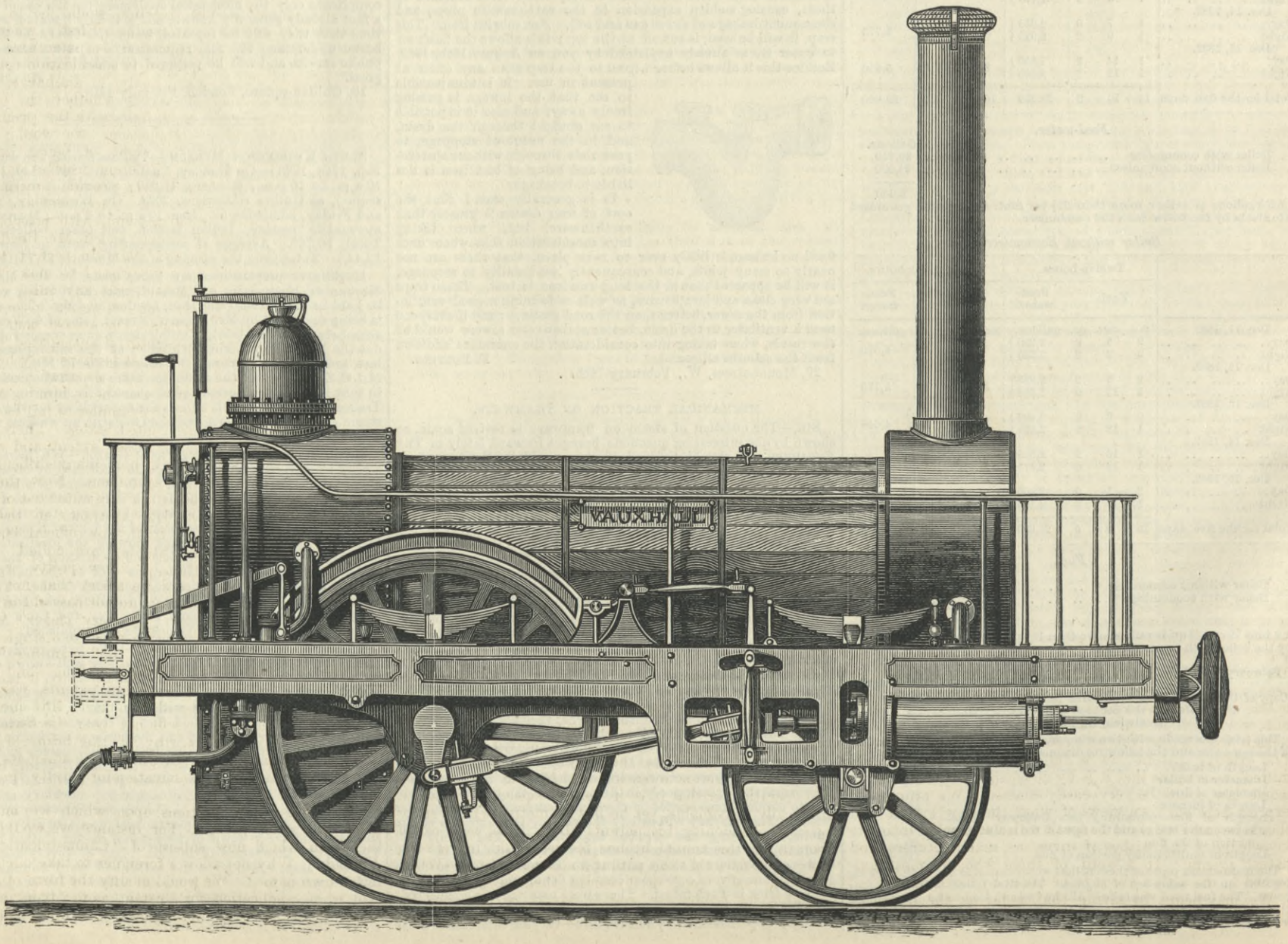
MAY'S BRITISH AND IRISH PRESS GUIDE.—We have received a copy of this now well-known guide published by Messrs. F. L. May and Co., of 159, Piccadilly. It is published in a handy form, 8vo, contains 342 pages, and is not only valuable as a complete guide, but affords a source of very interesting statistical information relating to the periodical press of the United Kingdom. It is furnished with a series of maps showing the localisation of the newspaper press, the guide giving the population of the towns in which newspapers are published, as well as the names of the papers, where published, price, and publisher's name. The lists of London periodicals, journals, magazines, almanacks, and guides, is longer than ever, and Messrs. F. L. May and Co.'s Guide has increased year by year, and is now the best published.

THE CITY OF LONDON DIRECTORY.—We have received a copy of the thirteenth annual issue of this now well-known directory. Although known as the City of London Directory, it is one which is almost equally useful to those who, though not in London, have intimate business relations with the City. Although so well known, it may be mentioned that it contains a Street List, in which every house, occupier, and the business carried on, is given, and the floor occupied. Alphabetical List, name, address, and business of everybody in the City of London. Banking, Insurance, and Public Companies' List, which gives particulars of all the banks, life and fire insurance companies, monetary and finance companies. A Trades List. A Conveyance Directory or reference guide for the despatch of parcels and goods to all parts of the suburbs, and every town of importance in the United Kingdom. The Livery Companies of London. List of Liverymen, a large Coloured Map, which gives the parish and ward bounbaries, and improvements to date of issue, and a List of Bankrupts, and of traders who have compounded with their creditors during the year. It is published by W. H. and L. Collingridge, at the *City Press* office, and is as usual, well got up.

LOCOMOTIVES FOR THE LIVERPOOL & MANCHESTER, AND DUBLIN & KINGSTOWN RAILWAY, 1834.

(*For description see page* 150.)





FOREIGN AGENTS FOR THE SALE OF THE ENGINEER.

PARIS.—Madame BOYVEAU, *Rue de la Banque.*
BERLIN.—ASHER and Co., 5, *Unter den Linden.*
VIENNA.—Messrs. GEROLD and Co., *Booksellers.*
LEIPSIC.—A. TWIETMEYER, *Bookseller.*
NEW YORK.—THE WILLMER and ROGERS NEWS COMPANY, 31, *Beekman-street.*

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.*

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

BOMBAZEEN.—*Use a galvanised iron tank. It will last for many years.*

A. F. AND CO.—*We do not know "Allen's Price List." Try Messrs W. H Allen and Co.,* 13, *Waterloo-place, S. W.*

E. P. M.—*Because air is a very bad conductor of heat, and absorbs and gives it out slowly. The actual quantity of heat in a pound of air is only* ·23 *as compared with the quantity in a pound of water, and the latter occupies a space of* $\frac{1}{14}$ *of a cubic foot, while the other takes up* 13 *cubic feet. Thus a powerful current of hot air would be needed to supply as much heat as can be had from a small quantity of hot water. If you will try the effect of a hot blast at* 400 *deg. you will understand what we mean.*

ENGINEERING IN AUSTRALIA.

(*To the Editor of The Engineer.*)

SIR,—Can any of your readers tell me where I could obtain any pamphlet or work containing general information respecting the condition of mechanics in Australia? TURNER.

Thames Ditton, February 19th.

SUBSCRIPTIONS.

THE ENGINEER *can be had, by order, from any newsagent in town or country at the various railway stations; or it can, if preferred, be supplied direct from the office on the following terms (paid in advance):—*

Half-yearly (including double numbers) .. .. .. £0 14s. 6d.
Yearly (including two double numbers) .. .. .. £1 9s. 0d.

If credit occur, an extra charge of two shillings and sixpence per annum will be made. THE ENGINEER *is registered for transmission abroad.*

Cloth cases for binding THE ENGINEER *Volume, price* 2s. 6d. *each.*

A complete set of THE ENGINEER *can be had on application.*

Foreign Subscriptions for Thin Paper Copies will, until further notice, be received at the rates given below:—Foreign Subscribers paying in advance at the published rates will receive THE ENGINEER *weekly and post-free. Subscriptions sent by Post-office order must be accompanied by letter of advice to the Publisher. Thick Paper Copies may be had, if preferred, at increased rates.*

Remittance by Post-office Order.—Australia, Belgium, Brazil, British Columbia, British Guiana, Canada, Cape of Good Hope, Denmark, Egypt, France, Germany, Gibraltar, Italy, Malta, Natal, Netherlands, New Brunswick, Newfoundland, New South Wales, New Zealand, Portugal, Roumania, Switzerland, Tasmania, Turkey, United States, West Coast of Africa, West Indies, Cyprus, £1 16s. China, Japan, India, £2 0s. 6d.

Remittance by Bill in London.—Austria, Buenos Ayres and Algeria, Greece. Ionian Islands, Norway, Panama, Peru, Russia, Spain, Sweden, Chili, £1 16s. Borneo, Ceylon, Java, and Singapore, £2 0s. 6d. Manilla, Mauritius, Sandwich Isles, £2 5s.

ADVERTISEMENTS.

*** *The charge for Advertisements of four lines and under is three shillings; for every two lines afterwards one shilling and sixpence; odd lines are charged one shilling. The line averages seven words. When an advertisement measures an inch or more the charge is ten shillings per inch. All single advertisements from the country must be accompanied by a post-office order in payment. Alternate advertisements will be inserted with all practical regularity, but regularity cannot be guaranteed in any such case. All except weekly advertisements are taken subject to this condition.*

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, Feb. 27th, at 8 p.m.: Ordinary meeting. Paper to be discussed, "Covered Service Reservoirs," by Mr. William Morris, M. Inst. C.E., Deptford. Thursday, March 1st, at 8 p.m.: Special meeting. Second lecture on the "Applications of Electricity"—"Telephones"—by Sir Frederick Bramwell, F.R.S., V.P. Inst. C.E.

CHEMICAL SOCIETY.—Thursday, March 1st, at 8 p.m.: Ballot for election of Fellows. Paper to be read, "On Some Derivatives of the Isomeric $C_{10}H_{14}O$ Phenols," by Messrs. H. E. Armstrong, Ph.D., F.R.S., and E. H. Rennie, M.A., D.Sc.

SOCIETY OF ARTS.—Monday, Feb. 26th, at 8 p.m.: Cantor Lectures, "Solid and Liquid Illuminating Agents," by Mr. Leopold Field, F.C.S., A.S.T.E. Lecture V.—Paraffin. History and sources. Outlines of the chief processes of manufacture. Coal-tar products. Paraffin oil. Naphtha. Petroleum. Tuesday, Feb. 27th, at 8 p.m.: Foreign and Colonial Section, "Egypt, Present and to Come," by Mr. Robert W. Felkin. Wednesday, Feb. 28th, at 8 p.m.: Thirteenth ordinary meeting, "The Increasing Destruction of Life and Property by Fire. What is the Remedy?" by Mr. Cornelius Walford. Friday, March 2nd, at 8 p.m.: Indian Section, "Agriculture in Lower Bengal; with some Notice of Tenant Right, &c.," by Mr. W. S. Seton-Karr. The Hon. Sir Ashley Eden, K.C.S.I., will preside.

THE ENGINEER.

FEBRUARY 23, 1883.

PATENT LAW AMENDMENT.

THERE is at last a certainty that Government will bring in a Bill to amend the existing law of patents. Such a Bill has been heard of every session for some years. But Irish affairs have sufficed to exclude Bills of far more urgent importance. All reasonable cause for further procrastination is, however, absent just now. The Queen's Speech has promised the introduction of a Patent Bill, and so it is not improbable that before the present year has expired, changes of very great importance will have been wrought in the legal relations of inventors and the public. While a thoroughly good Bill will, beyond question, work well and give satisfaction, it is at least equally certain that a bad Bill will prove extremely mischievous. The existing patent law is full of defects; but it is admitted on all hands that it is by no means so bad but that a worse law could be very easily enacted. We propose to express here our own views of what the new Patent Bill should be; and we claim to speak with a somewhat intimate knowledge of the wishes of inventors, manufacturers, and patent agents. In a word, of those who are most concerned in the action about to be taken by Government.

We may begin by saying that, as far as the maturity and old age of a patent are concerned, there is little change needed, or even desirable. It is in the youth of a patent that it is most exposed to adverse influences, and to paraphrase a well-known maxim, if we take care of the baby patents, we may leave the full-grown patents to take care of themselves. Let us consider, then, what are the first steps to be taken by the inventor who wishes under the existing law to obtain a patent. In the ordinary course of events, he applies for a patent, and obtains provisional protection, which he gets in return for a fee of £5. Some misapprehension exists concerning a provisional protection which it is well to clear away. Before the passing of the Patent Law Amendment Act of 1852 an inventor was permitted to lodge an application for a patent on simply depositing the title of his invention. In other words, he had only to say that he wanted a patent for improvements in something, without giving the Government or anyone else the smallest information concerning the proposed improvements. The utmost laxity was courted by such a system. The complete specification filed six months subsequently often bore but a grotesque connection with the title of the patent. For example, one inventor obtained a patent for "Improvements in Coverings for the Human Body," and the final specification described hats, caps, and coffins! The "provisional specification' did away with this abuse, and its object is to give the Government a fair idea of what it is the inventor seeks to obtain a patent for. It is not intended for the perusal of the general public, and it is, as we have said, nothing more or less than a tolerably definite statement of what the inventor desires to protect. Having received a certificate of allowance, which is virtually a promise that a patent will be granted, the inventor gives "notice to proceed," and this notice must be lodged at the Patent-office before the expiration of four months from the day on which the application for a patent was lodged. With this notice a further fee of five pounds must be paid. Finally, the warrant and seal are granted, and another ten pounds must be paid, and on filing the specification a further fee of five pounds, the total Patent-office fees amounting to £25; and this sum must be paid within the first six months.

We have here ample matter for consideration; indeed, it is not too much to say that on the changes introduced in the mode of carrying out these preliminary operations the whole success of the new Bill will hang; and the points which most earnestly demand our attention are the object, import, and scope of the provisional protection, and the price to be paid for it. Now, let it be clearly understood that, as matters now stand, the Government grants a patent for an invention the precise nature of which is not stated, because the patent is issued before the inventor has handed in, or, to use technical language, filed that complete and fully illustrated description of his invention which is known as his "complete specification." It appears to us that a modification is wanted in the law in this respect, and that no patent should issue until something more complete than the existing provisional specification is filed. The object had in view by the framers of the Act of 1852 was very good. They acted on the assumption that the inventor could not perfect his invention unless he had some protection for it, which would obviate the necessity of working in secret; and, furthermore, the temporary protection enabled him, at small cost, to take his invention to manufacturers and capitalists and get them to help him with funds.

It is so well known that inventors do in nine cases out of ten require the assistance of manufacturers and capitalists to bring their ideas to a good end, that it is unnecessary to insist on this point. The provisional protection is then a step in the right direction, but it is not a sufficiently long step. Experience has proved that the four working months available for selling or divulging an invention are not sufficient, and in addition it seems to be almost universally held that a reduction in the cost of protection is imperatively needed. Bearing these two points in mind, we suggest the remedy. Let provisional protection last for twelve months instead of six, and let the Patent-office fee in the first instance be not £5 but £1. The advantage which would be conferred on the inventor by this alteration is too obvious to need enforcing. We suppose that there is not an inventor in the kingdom who will dissent from our proposition. Before the expiration of a year the inventor would have to determine whether to go on or not. If he decided on the former course, then not less than two months before the expiration of the year for which the provisional protection would last, he should deposit a complete specification, with all the requisite drawings, and before the year expired he should obtain, on payment of £3 or £4 more, a complete patent. This patent should hold good for thirteen years from the day on which it is granted; and here we propose a distinct departure from existing forms; the patent should be liable to forfeiture at the end of every year unless a certain renewal fee were paid. These fees should increase progressively in such a way as that the total sum paid in fees should not be less than, say, £200 to £250 for the fourteen years' patent. Thus, the fee at the beginning of the third year might be £5, at the beginning of the fourth year £7 10s., at the beginning of the fifth year £10, and so on, for as the patent advanced in years it would, if worth anything, obviously augment in value, and should readily bear the increased tax, although the most valuable patent might not be able to bear a charge of £25 during the first six months of its existence. A moment's consideration will make apparent another great advantage which would result from the adoption of the annual fee. At present an inventor, after paying £25 for his patent, is not called upon until the end of the third year, and after that not until the seventh, for any further payment. It may be, nevertheless, that he very shortly discovers that he has no means or intention of bringing his invention into operation, or that it is in some respect deficient and practically unavailable, yet he has no motive whatever for publicly abandoning his patent. But if he were called upon to pay this annual licence fee he would, by refusing to do so, declare that the patent no longer existed. Whatever was really good in it would then be immediately available for public use, and it would be left open for other, possibly more skilled, inventors without hindrance, to improve upon it. We do not think that any objection would be made to our proposal on the score of increased work which it would throw upon officials; that would be merely a matter of detail which would be scarcely comparable with the duty undertaken every year by any one of our large fire insurance companies, which send out notices and receive payment of premiums annually.

But to return to cost. The primary objection will be that if patents in their first stage are made cheap, manufacturing operations will be hampered by the taking out of a multitude of small, and even vexatious, patents. To this we reply that the argument is based on presumption, and that not a fact can be adduced to prove its soundness. On the other hand we may cite the United States, wherein about 25,000 patents are granted every year; but we never hear any complaint that trade is injured thereby. A secondary and much more interesting point is this: Provisional specifications are now kept secret, and, as a consequence, the intending inventor, no matter how careful a search he may make, can never ascertain what is being done during the six months immediately antecedent to the date of his application; consequently, taking a patent is, to a large extent, gambling. The inventor stakes his Patent-office fees on the chance that he has not been anticipated by another, possibly the very day before. Now, it is clear that if a provisional protection ran the twelve months, this difficulty would be doubled, and we propose that to dispose of it altogether the inventor under the new rule should lodge a provisional specification, much less general than the existing provisional, but that he shall have power to amend, disclaim, modify, or expand this in preparing his complete specification, always provided that he works *strictly within the bounds of his provisional specification*; and, furthermore, that while the provisional shall not be printed or sold until the end of twelve months, it shall nevertheless be available for inspection, on payment of a fee, by those interested. This last is but an amplification of the existing regulation, by which any final specification not yet printed, can be seen on payment of a fee of one shilling. This would enable complete searches to be made, and, inasmuch as the provisional protection would be absolute, nothing contained in the provisional, or, as we should term it, the preliminary specification, could be stolen and worked into "a complete specification."

At this point an important question suggests itself, namely, the preliminary examination of specifications for *novelty*. In this country a body of theorists urge that such an examination is not only desirable but necessary. We are flatly opposed to any scheme of the kind, and we do not hesitate to assert that we have the weight of influential opinion on our side. It is quite out of the question that anything like a proper examination should be made by Government officials. There are at this moment in our own Patent-office no fewer than 130,000 specifications; are these all to be read? How is it possible that Government officials should be able to do that which a judge and a jury, aided by the ablest counsel at the bar, men who have made a study of patent law a speciality, find it next to impossible to do? What, for example, could examiners do with such a case as that of Otto *v.* Linford; or the telephone case, yet fresh, no doubt, in the minds of our readers? The utmost we would urge upon the Government in this direction would be to appoint competent examiners to determine: Firstly, whether the subject matter of an application is patentable or not. Secondly, whether the preliminary specification is properly and sufficiently drawn; and lastly, to discharge the still more important duty of saying whether the complete specification is or is not on all fours with the preliminary; and even from these examinations we would give a power of appeal, and the right of being heard by counsel; but all this is very different from examining for *novelty*. If the Government will provide proper facility for making search in the way of a convenient and suitably situated library and patent museum, with possibly a provision for the deposit of models, and if Mr. Reader Lack is empowered to provide and maintain perfect indices of patents, the inventor may be trusted to make his own search. We fail to see, indeed, that any valid objection can be raised to the practice of letting an inventor take out a patent at his own risk. The utmost that we have heard urged is that the inventor, if anticipated, loses his Patent-office fees, &c., but he has perhaps only himself to thank for this, and we do not see that Government examination would in any way help him. We have fortunately in this connection examples to fall back upon. Let us take the case of the United States. There, examination is carried out to the fullest extent, and would-be patentees in the States know how many difficulties are thrown in their way by the examiners. Now the Washington Patent-office publishes an illustrated list of patents granted week by week, with abstracts of the claims and specifications. It is from this official book that our "Selected American Patents" are culled. We are thus placed in a position to know pretty well what takes place in the States, and we assert that not a week elapses in which the examiners do not pass old inventions as though they were new. A very clever American writer some time since devoted a paper to a single subject, namely, the incompetence of the examiners in one department alone—clock and watch-making—and he published a stupendous list of American patents, every one of which had been anticipated. In fact, this question of examination for novelty will not bear discussion. The whole notion is only worthy of the brain of a pure theorist—of a man, in short, who has no adequate conception of what the term "examination for novelty" practically means.

There are other questions upon which we might say much did space permit. For instance, we would abolish the form which now subsists of "Communications from Abroad." Why not allow a foreigner to take out a patent in his own name? We would modify the form of declaration upon application for a patent as to "true" inventorship. It is perfectly well known that, often enough, an

inventor joins with a capitalist or employer in the application for a patent, and each has to declare himself the inventor. Another, and a very important matter to consider is, whether a patentee should not be bound to grant licences to users upon fairly reasonable terms. We see that the Associated Chambers of Commerce this very week demand this power. The difficulty is to discover how "reasonable terms" could be satisfactorily settled. It is altogether a very difficult question, which seems to infringe very suspiciously the principle of freedom of contract. We must now stop, contenting ourselves with repeating that the most important requirement is cheap and complete protection in the early stages of the life of a patent. An invention may be compared, indeed, to a young tree which, while yet a seedling, needs constant nurture and care; after a couple of years it may be planted out; but it will still need fencing from envious cattle and shelter from unfriendly blasts. Given this, and provided the sapling has a good constitution, it will grow into a giant, or, at the least, serve a useful, though possibly humble purpose. In like manner, if a patent be conferred for an invention which has intrinsic merit, that invention will live and prosper; but only on condition that, like the young tree, it is in its infancy dealt with tenderly. Much remains to be said concerning patent law. We have, however, said enough perhaps for the present to set our readers thinking. What will they say?

BRIGHTON BEACH.

The late severe gales experienced on our southern coast have afforded an excellent test of the efficiency of the works which have been erected at Hove, and we regret to say that the results have been such as we have all along expressed a fear were to be anticipated. We find that the action induced by the inclined groynes, and to which we have previously alluded, has been so intensified by the sea driven in from the southward that it has almost completely removed the slight amount of shingle which had accumulated on their windward faces; and has, besides, greatly reduced that which, owing to the reversed action we have before named, had settled on their lee side. As the consequence of the first-named action, the waves have had a clean run right up to the earthen embankment of the lower esplanade; and the whole width of this, adjacent to the inclined groynes has been torn away, the sea having even lapped over the greens themselves in more than one place. This destructive action has been more strongly apparent as the groynes diverged in a greater degree from the right angle; but it was very slightly perceptible in the case of the groynes which have been built at the angle which we on a previous occasion instanced as that which appeared to us to be the best suited to the retention of beach, viz., 15 deg. or thereabouts from the perpendicular line. The higher the groynes, also, the more the tearing effect of the water has been manifested. At the boundary groyne, *i.e.*, that nearest to the Brighton district, and which has been built almost in exact conformity with the suggestions made in our earlier remarks on this subject, no harm has been done, the beach remaining in the same condition as it was previous to the storm; and we hold that strong confirmation has thus been afforded of the correctness of the view we have expressed as to the leading considerations to be observed in the construction of beach groynes. We may, as of importance here, briefly recapitulate them. They are: First, that only retention of the existing beach line be sought. Secondly, that the height of the groynes should be but little in excess of the present beach level, so as to allow free travel of the shingle to leeward. Thirdly, that they should extend but very slightly beyond the normal beach line; and, Fourthly, that a slight curve in the direction of the current should be given them at their terminal points. To these considerations we have more recently added our conviction, as the result of Mr. Ellice Clark's experiment, that a slight angle in the direction of the set of the prevailing currents may with advantage be adopted.

Wherever at these Hove works such considerations have received development, we failed to find any of the bad consequences which were noticeable in the cases of groynes where other principles had been adopted, and so far Mr. Ellice-Clark's experiments have afforded a useful lesson in this important branch of engineering. But, acknowleging that this is so, we fear we must express concurrence in the now generally held opinion that the endeavour to resist the action of the sea by accumulating beach has proved to be a failure; and this conclusion brings us back at once to one of our original starting points in the discussion. We all along deprecated the want of connecting protective work between some of these groynes, and in our article of April 14th of last year we wrote:—"Firstly, granting for the sake of argument that protective works of the extensive character Mr. Ellice-Clark has adopted are a necessity, we believe that a permanent sea-wall, such as has stood in many other parts of England, could have been constructed at a less cost than has now been, and will have to be, incurred for the purpose of retaining protective shingle. Better altogether, we should have said, to reject so treacherous an ally in the struggle with the sea, and have trusted to solid work." And to this alternative it is now decided resort must be had; not that we in the least underrate Mr. Ellice-Clark's intelligent struggles to cope with his insidious enemy. We have all along expressed the greatest sympathy for him, and shared on many points the theories which have been the base for his practice. Indeed, we believed until recently that, after all, he had gained the mastery in the fight, and it is with regret that we are forced to the conclusion that he has been beaten. Only very lately we wrote that, in our opinion, there had not been sufficient time to justify the conclusion that his valuable experiments had failed to perform what was hoped of them; and we feel sure that Mr. Ellice-Clark will acknowledge that in our criticism of his works as they have proceeded, we have expressed the utmost sympathy with him in the difficulties and disappointments he has skilfully endeavoured to meet and overcome.

It is evident, however, that the Hove Commissioners can no longer proceed on an experimental course, and we are pleased to learn that the result of the reconsideration of Sir John Coode's proposal for a sea-wall—to which we alluded in our latest article—has been its final adoption. On one point Sir John Coode's recommendations and those of Mr. Ellice-Clark differ; this point being, as before named by us, the line which this sea-wall should take. On a recent visit we found the two alternative lines staked out; Mr. Ellice-Clark's line being 40ft. more to seaward than Sir John Coode's. We gave much attention to an examination of these divergent proposals, and we think there is much to be said for both. As regards Sir John Coode's design, it is more fully in accordance with our original postulate that it is the wiser course to secure what exists rather than attempt recovery of what has been lost. On the other hand, Mr. Ellice-Clark's line secures a much finer esplanade, and is not so far seaward as not to have still a considerable and probably sufficient berm of shingle for covering the footings of the proposed wall. It will, further, be in continuation of those sections of walling which were constructed in connection with the more westward of the groynes, where, it is to be observed, there is strong evidence of shingle accumulating. In fact, it is in the great deposit at these points that a considerable surplus has been carried over the esplanade, and even into the private gardens of the residences facing the sea; this excess accumulation being, we think, due to the unnecessary height of some of these westernmost groynes, which has prevented its travel to the bare spots to the eastward. But this matter is still *sub judice* with the Commission, and Mr. Ellice-Clark is confident that he can hold his additional ground over Sir John Coode without risk and without increased expense in the construction of the wall; the latter, he says, being dependent more on the land water to be met with than any possible incursion of the sea whilst the wall is in hand.

Here, for the present, we must leave the Hove works, and turn once more to the dual feature of our subject, which we have always held to bear to it important relation, and that being in the adjacent beach in the Brighton parish. Those of our readers who have followed our previous remarks closely will recollect that from the first we have warned the Brighton authorities of what they had to expect. Will it be believed that, in spite of warnings strong and reiterated, and insisted upon by many members in their own Town Council, we the other day found labourers carting away beach from the threatened point as energetically as ever! Beach, did we say? There is none now, in the proper sense of the word, that remains for removal. All that now exists at the point of danger, where until within the last year or so there was a fine heavy beach, is a composition only of sand, mud, and gravel, and the general level at this point is fully from three to four feet below that of but only a few months back. It was evident, indeed, to our eye, that the general height of the beach for more than half a mile to the eastward has been sensibly reduced, and our impression was fully confirmed by boatmen and others with whom we spoke relative to it. In our article of April 14th, 1882, we also further wrote: "What we have detailed as now occurring at Hove, will, when the protection of that shore is complete, be experienced most infallibly at Brighton; and the length of beach to be protected by its authorities so far exceeds that under the responsible control of those at Hove, that an expenditure will have to be faced which will alarm the ratepayers." In our latest comment we stated that a sum of £7000 had already been asked and granted for the formation of gardens at the most threatened point behind a protective sea-wall to be constructed, and this may be regarded as only the first instalment of the expenditure which we foresee will be forced on Brighton if the reckless denudation of the beach by voluntary forces, independent of those resulting from nature's action, be permitted. The gales, the destructive results of which at Hove we have above detailed, have already made their mark at the east end of the town by the partial destruction of the work known as the "Duke's Mound." In this we have a warning which most people alive to the interests of their town would assuredly not neglect, although the locality is too remote to quote it as an exemplification of our prophecies of evil results from the Hove works for the neighbouring beach. Still, unless the removal of shingle is at once stopped, the decrease of beach we have already noticed will proceed until the evils we predict will become only too clearly and expensively apparent.

CONTINUOUS BRAKES.

Mr. Moon, the Chairman of the London and North-Western Railway Company, made a strange statement at the half-yearly meeting of the Company on Saturday. Mr. Moon has persistently maintained that the Clark-Webb brake in use on the London and North-Western Railway left nothing to be desired, and this in the face of reports which he continually received from the Board of Trade announcing failure after failure, and accident after accident, which would have been prevented had the brake been even moderately trustworthy. It seems, however, that at last even Mr. Moon's faith in the Clark-Webb, or never-ready-when-wanted brake has been shaken. It has been stated that the Company is about to adopt a totally new brake, possessing unheard-of advantages over all other continuous brakes, and the novelty has been looked for with considerable interest. If there be such a brake Mr. Moon knows nothing about it, for on Saturday he told his audience that "He had often alluded to their brake as a satisfactory one, but latterly the directors had had interviews with the chairmen of several of the neighbouring lines of the Great Northern, Midland, Great Western, Lancashire and Yorkshire, and the North Staffordshire—with which they interchanged a large amount of traffic—and they found that those companies used the vacuum brake. They had, therefore, resolved to adapt that brake to the North-Western stock as regarded all their through trains. They also intended to adopt the universal coupling which had been invented by the carriage superintendent of the Midland Company. Their local trains would remain as they were, but they would take care to have, in addition to one big brake, as hitherto, sufficient steam brakes. These changes must take some time to carry out; but within a a little while there could, he thought, be no doubt that all the companies in the country would adopt the vacuum brake." Now, of the neighbouring lines mentioned by Mr. Moon, three use an automatic and two a non-automatic vacuum brake. Mr. Moon has apparently forgotten that it is impossible to work these two types of brake in the same train without a duplication of apparatus which no one is foolhardy enough to suggest. But this being the case, it seems to be clear that the London and North-Western stock will be nearly as far as ever from finality in the matter of interchangeability. The adoption of the so-called universal coupling means next to nothing. The whole statement is possibly a decent excuse for despatching the chain brake. If other companies who run their coaches over London and North-Western lines use the vacuum brake, why then the London and North-Western must follow suit. It might easily be gathered from Mr. Moon's words, that he was, in the first place, ignorant of the existence of anything but the vacuum brake, and that, in the second, he had never heard of the Board of Trade. So far as can be seen at present, there is not the smallest chance that the vacuum brake will be universally adopted. The more minutely we study Mr. Moon's statements, the more extravagant do they appear. The assertion that the vacuum brake will ultimately be universally adopted has not a scrap of foundation to rest on. If his dreams were realised, no fewer than ten Boards of Directors, including the boards of seven of the principal railways in the kingdom, would have to abandon the continuous brake, which is now fitted to a carriage stock of over 11,000 vehicles, and nearly 1400 passenger engines. The lines thus equipped have 5300 miles open. Is all this to be abandoned? We commend the following figures to Mr. Moon. They have been prepared from the Board of Trade return ending June 30th, 1882. Of the total stock fitted in Great Britain and Ireland, 41 per cent. is provided with continuous, and 29 per cent. with automatic brakes. Of continuous brakes, 70 per cent. are automatic; of automatic brakes, 65 per cent. are Westinghouse. We may add further that on the 30th of December there were, in Europe and America, in all 8864 engines and 39,347 vehicles fitted with the automatic Westinghouse brake.

But apart from the consideration that other lines have rejected the vacuum system, we have certain facts which Mr. Moon may ignore, but which none the less remain facts. In the first place, the Board of Trade demand an automatic brake, and they will have it too. Domestic legislation bids fair to be thought of at last; and it would not require much stimulus to induce the Government to deal with this brake question with a high hand. Railway directors know that the simple vacuum brake will not do, and desperate efforts have been made to invent an automatic vacuum brake; but the best that it seems can be accomplished in this direction is the "two-minute brake" on the Midland Railway—a brake which has generally been pronounced a mechanical abortion, and which is now kept alive only by the pertinacity of those who have charge of it. Let it once be decided that brakes must be automatic, and the vacuum system is doomed, and the reason is easily stated. Automaticity in any fluid brake depends absolutely on the maintenance in some vessel or reservoir beneath each vehicle of either a plenum or a vacuum. There is no possible escape from this, for the brake depends for its action on either a plenum or a vacuum previously prepared by the pump or the ejector on the engine. It is the essence of automaticity that the brake shall act the moment the train is separated from the engine—the original source of the brake power, and of course the power must be stored up while the engine is still coupled to the train throughout. Now it is not difficult to maintain pressure in reservoirs under the coaches, but it is extremely difficult to maintain a vacuum. It is well known that to keep joints, for example, tight under a pressure of air is much easier than to keep them tight against—if we may use the word—a vacuum. But apart altogether from this we have another and important factor to deal with. The volume of the vessel required to store vacuum power must be enormous as compared with the size of the vessel required to store power in the shape of compressed air. Thus one cubic foot of air under a pressure of 7·5 atmospheres, or 108 lb. on the square inch, will weigh nearly three-quarters of a pound, and will represent no less energy than 35,000 foot-pounds, and assuming that but one-half of this is rendered available, we shall have a force of, say, 15,000 foot-pounds, after a deduction has been made for losses by friction, available for putting on a brake. In other words, it would suffice to force out a piston for a discance of a foot, with a pressure of over six tons. If a vacuum of 10 lb. could be maintained, it is evident that a piston to give a pull of 15,000 lb. must have an effective area of 1500in., and consequently must be 44in. in diameter; and assuming that it had a stroke of 1ft., then the cubic capacity of the cylinder would be not less than 10 cubic feet, instead of one, which would, as we have seen, suffice with compressed air. For these reasons it has been found essential to keep a small ejector continually at work on the engine, to maintain the vacuum in the pipes, and this ejector, it is well known, cannot perform its duty even under ordinary circumstances, but must be supplemented by the main ejector, with the result that an enormous quantity of steam is wasted. The circumstance that after the Midland, or two-minute, brake has leaked itself off, it cannot be put on again until a vacuum has again been made throughout the train, is quite sufficient to condemn it if it had no other defect. Why, under the circumstances, Mr. Moon should imagine that all the railway companies in the country are going to adopt the vacuum brake, passes our comprehension. It is, of course, possible that a vacuum brake may yet enjoy universal favour; but it is certain that such a brake has to be invented.

It is very difficult to understand the precise grounds which have induced some companies to adopt the vacuum in preference to the pressure brake. It may be urged that

the vacuum brake in its non-automatic form is much simpler than the Westinghouse brake. This no one will dispute—an automatic brake must be more complex than a non-automatic brake. But then the Board of Trade has decided that automatic brakes must be used, and the admirable manner in which the Westinghouse brake has acted on several occasions—notably, during an accident last summer on the Great Eastern Railway—and the notorious and repeated failures of the vacuum brake, practically put the non-automatic system out of court. We do not think that any engineer holds that an automatic vacuum brake can be made as efficient as the Westinghouse brake; but there is a feeling extant that such brakes as that now being tried on the Midland Railway are good enough for practical purposes. This is a mischievous delusion. When the lives of passengers are in question, nothing is good enough but the best. As to the arguments which have been urged against the pressure brake on the score of failure, it need hardly be said that when proper care—not undue care—is taken of it, it practically never breaks down; for example, it has made 140,000 miles on the Brighton line, with a detention of train of one minute only, due to the splitting of an india-rubber pipe. Can anything like this be claimed for any automatic vacuum brake?

Mr. Moon's statement of intentions must be received with regret and dissatisfaction. It is the duty of every railway company to serve the public as well as it can be served, and this is in the long run the wisest policy. A great company like that of which Mr. Moon is chairman ought to set an example in this respect. It seems pitiable that years should be wasted in endeavouring to do what is impossible. The chain brake has had a full trial, and has been condemned at last. This is something gained. But it is not encouraging to find that at least as bad a brake is going to take the place of the discarded chain. In all this there is more than meets the eye. The true history of the introduction of continuous brakes will never be written; but it is no secret that the likes and dislikes that have been manifest in this connection have not invariably been evoked by the merits or demerits of a particular brake. In all such matters, however, the welfare of the public should be the paramount consideration. But it is sometimes difficult to get railway men to see this.

TILBURY NEW DOCKS.

THE constructors for this great undertaking, namely, Messrs. Kirk and Randall, are actively at work upon it, and the visitor to Tilbury now sees, on landing at the station, the level surface of the marsh land, almost as far as the eye can reach on the London side, alive with volumes of steam, jibs of cranes, banks of clay, and swarming labourers. The whole of the work includes an area of 450 acres, and nearly all this amount has to be excavated to a depth of about 25ft., and dumped in banks forming the margin of the docks and tidal basin, the level of which will be some 2ft. above that of the river bank or dyke, which for ages past has protected the low-lying marsh lands on the Essex shore. The work is interesting to engineers in that the major part of the labour is performed by machinery, and that the material excavated will be employed in forming the surrounding and impounding wall and wharfage ground. There are at the present stage three of Dunbar and Ruston's steam excavators in operation, and a fourth awaiting erection, which, in the uniform character of the clay met with, are giving every satisfaction, and thirty locomotives do all the haulage and tipping, with no assistance from horses, of which there are but six on the workings. These locomotives are mostly by Manning, Wardle, and Co., of Leeds, with a few of the geared slow speed type, made by Messrs. Aveling and Porter, of Rochester, which take eight loaded tip wagons at a time. Twenty-one steam cranes are employed hoisting from the excavations by hand-labour, and delivering to tip wagons. A number of these cranes are of an improved type, made by Jessop and Co., of Leicester, and are working with great ease and smoothness, though doing their full capacity of work. The crane has no centre post proper, its duty being performed by a 4in. bolt, which passes through the swivelling bed plate of the crane into the framework of the carriage below. The wrought iron stays from the jib end are brought past the centre line of the bolt, and take hold of the bed plate at some distance behind it. The weight of the bed plate and crane is carried by four rollers below, two forward and two behind; bearing not upon the carriage below but on the upper edge of the geared turning circle, which is usually fastened to the carriage. In these cranes it is not so fastened, and is free to revolve, but being pressed against the carriage surface by the weight of the crane on the rollers on its upper edge, it is held by friction dependent for its intensity on the weight of the crane and its load. Thus, when the pinion moved by the engine is set in motion, the turning circle gives a little while the jib is getting into rotary motion, but its friction is sufficient to hold it when once started. This valuable detail saves those many vexatious breakages of gear teeth which are unavoidable in the rough duty of contract work. The driving engines are horizontal, and lie back towards the boiler, thus giving their dead weight where most useful as a balance. A deep pump has been sunk near the centre of the workings for drainage, and two 24in. bucket pumps, 5ft. stroke, are at work, keeping under at present all water with ease. It is contemplated, however, that a second and larger pump will be necessary before the completion of the work. A 25-horse power compound portable engine, by Marshall and Sons, is driving these pumps in the temporary disarrangement of a 40-horse power horizontal, by Clayton and Shuttleworth, which is to take steam from Cornish boilers. This portable presents a very fine appearance, and possesses all the newest features of design introduced by its well-known makers. The whole of the machinery occupies the attention of 150 hands, while between 800 and 900 labourers are now at work, a number which will be doubled by next summer time. The present contract for the dock work is, we understand, £700,000, and it is expected to occupy three years in execution. The projected railway connecting the new docks with London is to be a four line one throughout, and is in the hands of Messrs. Kirk and Parry, a kindred firm.

THE ACTION OF FURNACE GASES ON VEGETATION.

AN interesting paper has recently been published in one of the German scientific magazines by M. Freytag on "The Damage Done to Plants by Furnace Gases." It has been attributed by Stöckhardt to sulphurous anhydride and to the metallic particles, especially those of lead oxide, which are present. It is not the opinion, however, of Freytag, who considers that the principal damage is due to sulphuric acid and soluble sulphates, and that the action of sulphurous anhydride is indirect, the gas being absorbed by the moist leaves and oxidised to sulphuric acid by oxygen under the influence of sunlight. No direct damage is done to the soil by the floating metallic particles, but settling as these do on the leaves of fodder plants, they induce disease in the animals feeding on those plants. The leaves damaged by gases appear spotted and bear stripes traversing them, and if the damage is very severe they curl together and die; the plant then continues to throw out fresh leaves, which are likewise killed, and exhaustion follows. Again, as assimilation is checked the plant dies from above downwards and the roots throw forth fresh shoots. The stage of blossoming, if it be arrived at, cannot proceed to the production of seed; young and soft leaves are more readily affected than those with a hard epidermis. Moisture, direction of winds, temperature of the atmosphere, intensity of light, and configuration of land determine the area of country affected; the chief damage is done in the mornings and nights, when the fumes descend on the bedewed plants. False diagnosis must be guarded against, as the damage done by gases closely resembles that caused by frost and the ever-acting parasites. The action of sulphuric acid fumes on the soil is not harmful, as gypsum is generally formed; but although the dust of copper, zinc, &c., works does no direct damage to the plants, yet by preserving the dead leaves the formation of humus is hindered. In dead plants the percentage of sulphates is three times what is found in healthy plants of the same kind. The Glover and Gay-Lussac towers being insufficient to keep back all the gases which work harm to vegetation, it is recommended to pass the mixed gases into lead chambers, into which a spray of concentrated sulphuric acid is introduced. This will remove 96·7 per cent. of sulphuric acid and 66 per cent. of sulphurous anhydride. Should this be found insufficient, the gases must next be passed through a chamber containing diluted sulphuric acid—of chamber acid strength.

LIFE-SAVING APPARATUS ON THE THAMES EMBANKMENT.

IF the Metropolitan Board of Works much longer delays the provision of simple meane of saving life along the walls of the Thames Embankment, and if the arguments against such a work continue to be as silly as they have hitherto been, the question will have to be taken up by a higher authority, and the Metropolitan Board of Works classed with the City of London Corporation with respect to new works. At the meeting of the Board on Friday last, the Works Committee stated that, having considered the resolution of the Board referring it to the committee to consider the best means of providing for safety of life from drowning in case of accident on the river, so far as the Victoria and Albert Embankments are concerned, they are of opinion that any means which could be provided with this view must necessarily be a disfigurement and a probable injury to the Embankment, and that it does not appear to them that any sufficient reason exists for the adoption of the course indicated by the reference. In reply to this absurd report, Mr. Jones complained that the committee had violated their instructions, which were "to find the best means" of saving life on the Thames. Whether these means were good or bad, it was the duty of the committee to state them, and not merely to say that none were good enough for their acceptance. Mr. Jones produced a number of letters which he had received, with suggestions on the subject; and as a proof of the need which existed, he said he had been informed that, during the past year, no less than thirty-six youths were drowned between Blackfriars and Waterloo Bridges. He concluded by moving that the matter should be referred back, but not to that "condemnable committee" which had had the matter to deal with before. He wished the matter to be referred to the engineer, to report to the Board. Mr. Jones's amendment, on being put to the meeting, was lost, and the recommendation of the committee was adopted. The Thames Embankments are thus to remain like well walls, up which no being unfortunate enough to drop into the water can ever hope to escape from drowning. Can anyone who has had the misfortune to belong to the "condemnable committee" say why festoon chains should not be suspended from the Embankment walls from rings about 15ft. apart, provision being made for imposing a heavy fine upon any boat owners who made illegitimate use of these chains.

SYNTHESIS OF URIC ACID.

AT the end of last year we noted the fact, which had been telegraphed from Vienna, that a chemist had at last succeeded in accomplishing what many chemists had vainly endeavoured to do during the last half century, that uric acid had been formed synthetically. The honour is due to Johann Horbaczewski, and the plan by which he succeeded in preparing uric acid is now published. Pure finely powdered glycocoll, prepared from hippuric acid, is mixed with ten times the quantity of pure urea prepared from ammonium cyanate, and quickly heated from 200 deg. to 230 deg. C. in a flask in a metal bath until the clear melted liquid, originally colourless, has become brownish yellow, muddy and thicker in consistency. The mixture is then allowed to cool and the melted mass dissolved in dilute solution of potash, the liquid saturated with ammonium chloride, and then treated with a mixture of ammoniacal silver solution, and "magnesium mixture." The precipitate, containing the uric acid, is well washed out with ammonia water, and decomposed with potassium sulphide. After removing the precipitate by filtration, the filtrate is to be saturated with hydrochloric acid. The crude product, which separated on cooling, is again to be dissolved in dilute potash, and at least twice more subjected to the same style of treatment. Finally a yellowish coloured crystalline powder is obtained, which is first to be washed out with alcohol, then to be dried, then to be washed out with carbon disulphide, to remove the sulphur which may be present, and at last to be washed with ether. The substance then purified has all the properties and shows all the reaction of uric acid:—(1) Under the microscope it shows all the forms which characterise uric acid—leaves, or whetstone-like crystals, according to the degree of purity. (2) It reduces an alkaline copper solution, when warmed with it, and silver solution already in the cold. (3) It dissolves in concentrated nitric acid in the warm with the development of nitrous vapours, and the onion-red coloured residue left on evaporation is coloured purple red by ammonia, and violet with potash solution. (4) It is very slightly soluble in water, acids, alcohol and ether, but is easily taken up by potash solution. The elementary analysis gave the following numbers:—

	Calculated.	Found.
Carbon	35·72	35·68 per cent.
Hydrogen	2·38	4·02 ,,
Nitrogen	33·33	33·49 ,,

The author states that he intends to make further inquiries into the question of the manner of its formation.

THE ACCIDENT IN THE VRIOG CUTTING.

COLONEL RICH'S report on the accident that occurred on the 1st ult. in the Vriog cutting, on the Cambrian Railways, has been published. In this case the 5.30 p.m. passenger train from Glandovery Junction to Barmouth left the rails, and the driver and firemen were killed. The engine and tender fell over the cliff on to the sea beach, a distance of about 86ft., and a perperpendicular height of about 50ft. The engine appears to have turned a complete summersault, to have become detached while falling, and it came to rest on the beach, in an oblique position to the direction in which it had been travelling. The tender came to rest on its side nearly at right angles to the engine. The tender fortunately became separated from the third-class coach next to it by the front draw-bar hook of that coach breaking. The coach was thrown on its side over the cliff, and remained hanging by the couplings to the composite carriage behind it. There were no passengers in this front coach. The composite carriage fell over on its left side, on a small plateau at the sea side of the line, where the cutting at the sea side ends. The third-class coach and the brake van next behind the composite carriage remained upright, but the leading wheels of the third-class coach were off the rails. Engines and tenders will stand a good deal of knocking about, but in this case they were so damaged as to be of no further service. The train ran off while on the descending gradient of 1 in 103, and on the inside of a 12-chain curve, the curve close behind it being a reverse curve of the same radius. The railway, 50ft. 7in. above high water at the spot where the accident happened, is formed along the face of the cliff, which descends towards the sea at an angle of about 45 deg. The cliff or edge of the mountain, round which the railway runs at this place, consists of a bastard shaly rock, which disintegrates on the surface. A great part of it is overlaid with a peaty loam. The road above the railway, at the place of the accident, was fenced with a stone wall about 2ft. 6in. thick. About 30ft. of this wall, and the peaty loam between it and the railway, fell on the night in question and caused the accident. Colonel Rich is of opinion that the only way of securing the railway from such accidents would be to tunnel through the mountain, which would be very expensive; and if Parliament had not sanctioned the line being made round the headland, it is probable that it never would have been made at all, as the traffic is small, does not meet the cost of the railway in its present form, and would do so in a less degree if more capital had been expended. There is little doubt, however, that it would add to the security of the railway if the highway, which runs 68ft. above it, was better drained and maintained.

RAILWAY RUNNING EXPENSES.

SOME months ago we gave an analysis in THE ENGINEER of the running expenses of one of the great railways. In the present instance, we have figures before us officially furnished to the shareholders of the Great Northern Railway, which show in a tabulated form the expenses of that railway over a period of ten years ending with 1882. In the first half of these years the working expenses were 54·84 per cent. of the earnings; and in the first half of the year 1874 they rose to 56·86, fluctuating considerably for several periods. The highest proportion was reached in the first half of 1877, when the proportion was 59·28, and from that time to the present, though there have been several variations, there has been a general downward movement. For the past year the proportions have been for the first half 56·88, and for the second half 54·40 per cent. If we look at the working expenses per train mile we shall find that there has been a great fluctuation. In the first half of the year 1873 the working expenses were 2·87s. per train mile, and the highest proportion was reached in the first half of 1874, when the sum was over three shillings—3·04s. to be exact. But it fell thence, and with a little more regularity than that of the proportion to the gross earnings, and in the first half of 1882 it was 2·44s. per train mile, whilst for the last half it was 2·46s., so that the working expenses per train mile are now, if not at the lowest point, still far below the rate of a few years ago. It is first of all in the reduction of the working expenses on the train miles run, and then in the reduction of their proportion to the gross earnings of the railway, that there is a probability of larger return to the shareholders. But these reductions cannot be effected beyond a given degree, and hence it is rather to the enlargement of the gross receipts per train mile that there is the best hope for an increase of the dividends of railway companies. Expenses can only be kept down in a certain degree, but there is practically no limit to the work that may be done by the railways or to the amount of the traffic that may be brought upon them if there is an extension of the facilities that companies offer, and if cheapness of travelling is fostered. This is then the aim that the directors of railways should keep in view—increased facilities and larger traffic.

MIDLAND RAILWAY WORKS.

FOR years the expenditure of the Midland Railway on capital account, on new lines, and on improvements and on additions to old works, has been at the rate of fully two millions sterling; and down to the latest date there is no indication of any slackening in this respect. In the past six months it has expended on capital account £1,112,985. Out of this the large sum of £452,000 was for expenditure on lines that are already open for traffic; and close upon a quarter of a million was on lines and works in course of construction; whilst £345,000 was spent on new rolling stock—an expenditure that must be pronounced very large, even for so progressive a company. On works in course of construction, the largest sums in the past half year have been spent on the Belsize second tunnel; on the Rushton and Bedford branch; and on the Bootle goods branch, the London Dock Works being now removed into the list of the lines that are open for traffic. In the half year that is now entered upon the Midland contemplates the expenditure of a similar sum to that in the past—a sum estimated at £1,150,000. Of this just about half is to be spent on the lines and works that are open for traffic; £284,000 is the estimated amount of the expenditure on lines and works in course of construction, including the working stock; and the balance is in subscriptions to other companies, in joint lines expenditure, &c. After this there will still remain an estimated expenditure of close upon three millions sterling, so that the Midland has still before it a large amount of work, and this it proposes to increase by the Bills now before Parliament. It is apparent, then, that it is intended to continue that progress which, up to the present time, has been in the past few years so remarkable, and which has induced a very great growth of the revenue. Three of the recent lines of the Midland Railway are now open for traffic, and it may be fairly believed that there ought to be a considerable accession to the receipts of the company as these tap fresh streams of traffic, so that the general outlook of the company should be promising.

THE PROPOSED GENERAL RESTRICTION OF THE OUTPUT OF COAL.

THE question of how best to restrict the output of coal throughout the United Kingdom is to be considered at a general conference of miners, to be held on Tuesday next at the old Town Hall, King-street, Manchester. From the instructions issued by Mr. Thos. Ashton, of Manchester, the secretary of the Leeds Conference, to the miners throughout the United Kingdom, it appears that short reports are expected from all districts in order

to show how far they have been able to carry out the resolutions passed at the Leeds Conference. The promoters state that they believe nearly all the leading districts in the county will send representatives, and those districts, such as South Wales, which did not attend the Leeds conference are especially urged to send delegates. The whole of Yorkshire is pledged to carry out restriction if all other districts agree to do the same. Derbyshire, at its recent conference, empowered their delegates to vote in its favour, as done in other coal mining centres. It is, however, a most unfortunate thing for the promoters to find that the mild weather has greatly damped the house coal trade, and there are now a large number of collieries which are only making three and four days per week, and are unable to pay any dividends to their shareholders.

LITERATURE.

A Treatise on Shoring and Underpinning, and Generally Dealing with Ruinous and Dangerous Structures. By CECIL H. STOCK. London: T. B. Batsford. 1882. 8vo. 54 pp.

ONE need not walk far in some of the older parts of London and other towns to find a building which, though not quite, perhaps, of the sort described by Dickens as having left off being a house and not quite begun to be a barn, are, as he said, ready to fall in all directions, but have not quite decided which direction to take. More often, however, these unsafe buildings have a decided leaning towards one direction, and to prevent this taking effect a good deal of timber may occasionally be seen employed as raking or flying shores. The question must often occur to architects and surveyors who are, or may be, called upon to carry out this shoring, what are the strains thrown on the timber thus employed to support buildings of different kinds, and what are the most suitable and usual methods adopted to shore and underpin such buildings and others, as arches and steeples supported in churches by columns. These questions will be found ably dealt with in Mr. Stock's book, which is one of the few works on a special subject that does not wander into others. The subject is dealt with under the following heads:—Raking shores; principles, varieties, and uses of raking shores; horizontal or flying shores; needle shoring and underpinning; the shoring and underpinning of mediæval buildings; and on the mechanics of raking shores. These subjects are well and concisely treated, and examples of the calculations of strains are numerous, so as to give the fullest assistance to the young architect; they are well illustrated, and the book is one which will save a great deal of time in hunting up the hitherto scattered examples of work of the kind carried out and the principles upon which it should be done. A sufficient number of illustrative specimens of shoring are described, and we may add one of special interest, namely, that employed during the restoration of the St. Albans Abbey, carried out under Sir G. Scott by Mr. G. Chapple, and described in THE ENGINEER of the 21st of September, 1877.

Pumps and Pumping Machinery. By FREDERICK COLYER, M.I.C.E. London: E. and F. N. Spon. 1882. 102 pp. 23 plates. 8vo.

DESCRIPTIONS of well tested and successful types of machinery of any kind, if accompanied by well executed engravings with dimensions or to scale, are always useful, especially to young engineers, and to those engineers who are called upon to specify machinery of a class with which they have not had intimate experience. Mr. Colyer's book is one of this class. It describes pumps of various kinds, ranging from the smaller well pumps to those employed in waterworks, drainage works, mines, and breweries, his examples being all from his own practice and experience, or from the practice of well-known constructors, of whose machinery he has practical knowledge. These pumps and pumping machinery he tersely describes, supplying, as he goes, useful hints on details of design, erection, and working. He also gives full dimensions of those he illustrates, and figures showing the efficiency of the different forms of pumps and pumping engines. The illustrations, many of which are wholly or partly in section, are clearly executed lithographs, and are all to scale or fully dimensioned. In a second edition the author might add to the value of the book by giving a few larger detail engravings of pump valves. In many cases he states where the machinery of which he gives the working figures are in operation, and gives the makers' names. The book does not pretend to deal with the hydrodynamics of pumping machinery, but with the results of their practical application as exemplified in well pumps, "Cornish" pumps, direct-acting pumps, spiral pumps, beam, Bull, and Cornish pumps, differential pumps, air pumps, air compressors, and blowing engines. The book is provided with a list of contents and of drawings and an index, but the latter needs amplification. From what we have said, it will be seen that it is a book which will be useful to many engineers.

BOOKS RECEIVED.

Die Gasmaschine. Versuch der Darstellung ihrer Entwickelung und ihres Kreisprocesses. Von R. Schoettler. Braunschweig und Leipsig: Verlag von Goeritz und zu Putlitz. 1882.

The Gas Engineers' Text Book and Gas Companies' Directory for 1883. Edited by G. E. Wright and W. S. Mason. Fourth annual publication. Birmingham: J. Wright and Co. 1883.

Report of the Smoke Abatement Committee 1882, *with Reports of the Jurors of the Exhibition at South Kensington, and Reports of the Testing Engineer.* London: Smith, Elder, and Co. 1883.

Hydraulic Manual, consisting of Working Tables and Explanatory Text intended as a Guide in Hydraulic Calculations and Field Operations. By Lowis D'A Jackson. Fourth edition. London: Crosby Lockwood and Co. 1883.

Equilibro interno delle Pile Metalliche secondo de leggi della deformazione elastica. Per L. Allievi. Roma: Ermanus Loescher and Co. 1882. Text and plates.

Scuola d'Applicazione per Gl'Ingegneri Annuario per l'Anno Geolastico 1882-3. Roma: Coi Tipi Del Salvincci. 1882.

Misure de Velocitanel Tevere. Memoria dell'ing Ildebrando Nazzini, Professo d'idraulica. Roma: Tip E. Lit Del Genio Civile. 1882. R. Scuola d'Applicazione. Per Gl'Ingegneri in Roma.

James Nasmyth, Engineer: An Autobiography. Edited by Samuel Smiles, LL.D. London: John Murray. 1883.

Van Nostrand's Science Series: House Drainage and Plumbing. By W. P. Gerhard. London: Trübner and Co. 1882.

Details of Machinery, comprising Instruction for the Execution of Various Works in Iron in the Fitting Shop, Foundry, and Boiler-yard. By Francis Campin, C.E. London: Crosby Lockwood and Co. 1883. Weale's Series.

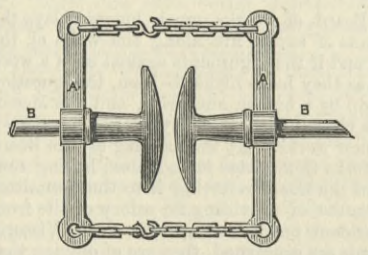
Berly's British, American, and Continental Electrical Directory and Advertiser. London: Dawson and Sons. 1883.

Chemical Percentage Tables and Laboratory Calculation. By C. H. Ridsdale, F.C.S. London: Crosby Lockwood and Co.

LINKS IN THE HISTORY OF THE LOCOMOTIVE.

No. XIII.*

AT an early period in the history of the locomotive a return was made to the vertical cylinders of the first railway engines, modifications being introduced with the object of making them act better. The first engines employed in working the Dublin and Kingstown Railway were constructed on this plan. The line in question is about seven miles long, and skirts the southern shore of Dublin Bay for almost the whole distance. It is very nearly a dead level throughout, and involved no works of importance save a very heavy sea wall to protect it from the waves in north-easterly gales; and one very short tunnel under Sir Harcourt Lee's park, near Blackrock station. This was the first railway opened in Ireland, and it was laid to the English or 4ft. 8½in. gauge, and was subsequently widened some five-and-twenty years ago. The traffic on it was worked entirely by small tank engines with inside cylinders. All the rolling stock had central buffers and the carriages were coupled by yokes, consisting of an iron bar at the back of each buffer head, and two chains as in the annexed diagram. The yokes are shown at A A,



and they could turn round on the buffer rods B. The carriage axle-boxes had no keeps underneath. The speed was moderate, twenty-five minutes being allowed for the run of seven miles, including four stops. The line is now merged in the Dublin, Wicklow, and Wexford Railway, and all the old engines have long since gone to the scrap heap. In 1853 the only engine with a link motion on the line was the Comet, all the others worked with four gabs and four excentrics in a way too well known to need description. The Comet was known as the "Royal" engine, for it ran the train which conveyed the Queen and Prince Albert to and from Dublin when the Queen visited Ireland to open the Exhibition in 1853, and it was afterwards always employed to work the Viceregal trains. All these engines had outside cranks on the driving axles, and the valve chests were on the top of the cylinders, the valve spindles being driven by rocking shafts with tongues playing in mortices in the valve spindles.

Mr. Alex. Allan, of Scarborough, the well-known inventor of the straight link and many other improvements in the locomotive, has favoured us with a good deal of valuable information concerning the types of engine first used on the Dublin and Kingstown Railway, and he has also enabled us to illustrate three engines possessing much interest, and so far as we are aware, never before illustrated in any publication.

Mr. Allan calls our attention to a slight error in "Links in the History of the Locomotive Engine," No. X., which will be found in THE ENGINEER for March 18th, 1881. There is a table therein giving the dates when the early locomotives of the Liverpool and Manchester Railway were made. The construction of the Swiftsure, No. 36, is dated in the table 1835. Now, the Swiftsure was the first locomotive turned out by Messrs. George Forrester and Co., of Liverpool, for the Liverpool and Manchester Railway, and was built early in 1834, and was worked that year from the Liverpool end of the line. In 1835 it may have gone into the hands of Mr. Fyfe at the Manchester end of the line. Mr. Allan attended to it when first put on the line during certain days and trial trips, &c.

Late in the summer of 1834 Mr. Allan went for Messrs. George Forrester and Co., to Dublin with three locomotives for the Dublin and Kingstown Railway. These engines were of the same size and design as the Swiftsure, concerning which we shall have more to say, and with four fixed eccentrics and rods to work the valves. They had also a vibrating pillar parallel motion, as shown in our engraving of the Vauxhall, page 146. Mr. Allan had the care of them during Messrs. Forrester's year of maintenance contract. In the following year, 1835, three more engines were supplied for the Dublin and Kingstown Railway by Messrs. Forrester. These were without the parallel motion, and had the usual guide bars. They were without tenders, having three water tanks under the boiler, and within the frames, which carried water for the journey between Dublin and Kingstown. These engines were probably the earliest tank locomotives. Some of the same size and class, with tanks, were supplied for the London and Greenwich Railway in 1836 or 1837. Messrs. Sharp and Roberts also made some locomotives for the opening of the Dublin and Kingstown Railway in 1834, which were of the size and design of the Experiment, working on the Liverpool and Manchester Railway in 1833, as described by Mr. D. K. Clark in his work on Locomotives. These had no eccentrics to actuate the valves, a short lever on the bell crank giving the throw by a long rod to rocking gear on the foot-plate. The valves were tubular, without lap or lead. The pistons had not the usual elastic packing rings, but were made nearly frictionless by exactly fitting the vertical cylinders, and having a white metal surface.

The cylinders of the engines made by Messrs. Sharp and Roberts for the Dublin and Kingstown Railway were vertical, as shown in the Hibernia, page 146.

* No. XII. will be found in our impression for June 16th, 1882. It deals with Great Western broad gauge engines.

ON THE RELATIVE CORROSION OF CAST IRON STEEL, AND WROUGHT IRON.

DURING last month Herr Gruner published a paper on this subject in the *Comptes Rendus.* He points out that during the last year he has been occupied with experiments on the oxidation of various kinds of iron, as regards their use for rails, and hulls of ships, especially when exposed to the action of sea-water. Certain engineers have thought that it was possible to determine the relative oxidation of the different kinds of iron by submitting them to the action of acidulated water; but it would be necessary to prove first that acidulated water acts in the same way as moist air or sea-water, for the identity of the action is not evident *a priori.* It is the study of this relation which he has undertaken, and his note to the *Comptes Rendus* contains the salient points of the fuller paper which goes to the *Annales des Mines.* He refers at the outset to the earlier labours of Mr. Robert Mallet, and the more recent ones (1881) of Philipps, and Parker, of London. The question, it appeared to him, should be examined from a more general point of view, and, above all, with the aim of knowing whether acidulated water agrees or not in its mode of action on the different kinds of iron with that of moist air and sea-water. He submitted to a series of identical experiments eighteen polished plates of steel and hard and soft iron, pure and impure, of various kinds. They were all one decimetre (3·93in.) square, and in order to submit them to precisely similar experiments, they were fixed in a wooden frame. The plates were suspended by their four corners, 15mm. apart, and could all be plunged simultaneously into a trough containing either acidulated water containing 5 per cent. of sulphuric acid, or sea-water; or it was possible to place them in moist air on a terrace exposed to all the winds. The first experiments were made last winter at a factory at St. Montant, near De Beauvoir; others during the spring and autumn in Paris, and a much greater number during the course of the summer on the seashore at Villervilles, in Normandy, but always with the same series of plates and the same apparatus. These plates are weighed before and after each experiment, and carefully brushed and dried. These are the chief results arrived at: The experiments in moist air were not continued a sufficiently long time to enable one to determine whether the degree of carburation of the steel, and the moistening of the plate, had any influence or not upon the intensity of the corrosion by rust. These experiments are still in course of execution. There are, however, certain definite results arrived at. In twenty days the steel lost at least from three to four grammes per plate, that is to say, per 0·02mq. of surface, the two faces of the plate being equally corroded. Chromium steel was more oxidised, and Wolfram steel less, than steel which was simply carburetted. Cast iron, even that which contains manganese, oxidises less than steel or wrought iron, and amongst them the white specular cast iron (spiegel), containing 20 per cent. of manganese, less than the grey cast iron. The loss is about the half of that which steel suffers. Sea-water attacks iron like acidulated water by dissolving it; but the conditions are entirely different. At the end of a very short time one recognises the presence of iron chloride in the trough. Unlike the action in moist air, the sea-water more strongly attacks the cast iron than the steel, and, above all others, most energetically the white specular cast iron (spiegel). Thus, in nine days the steels had only lost for 0·02mq. of surface from 1 to 2 grammes, according to their nature, while the white manganese cast iron had lost 7 grammes, the black cast iron of St. Montant, from the Bessemer Works, 3·50 grammes, and the phosphatic cast iron, for pottery purposes, 5 grammes. Soft steels are less attacked than the same steels annealed; soft steels less than chromic or manganesian; Wolfram steel less than ordinary steel, with the same percentage of combined carbon. It follows from this that it is necessary to avoid the employment of manganese sheet steel in the hulls of ships, and according to the experience of English constructors, corrosion is much more active along the line of flotation than where the metal is always in the air or always under water. Acidulated water, like sea water, dissolves more rapidly the grey cast irons than steel, but not the white specular cast iron—spiegel. It is the impure grey cast iron which is the most readily attacked. Thus in three days, water containing one-half per cent. of sulphuric acid, renewed each morning, dissolved the following quantities:—

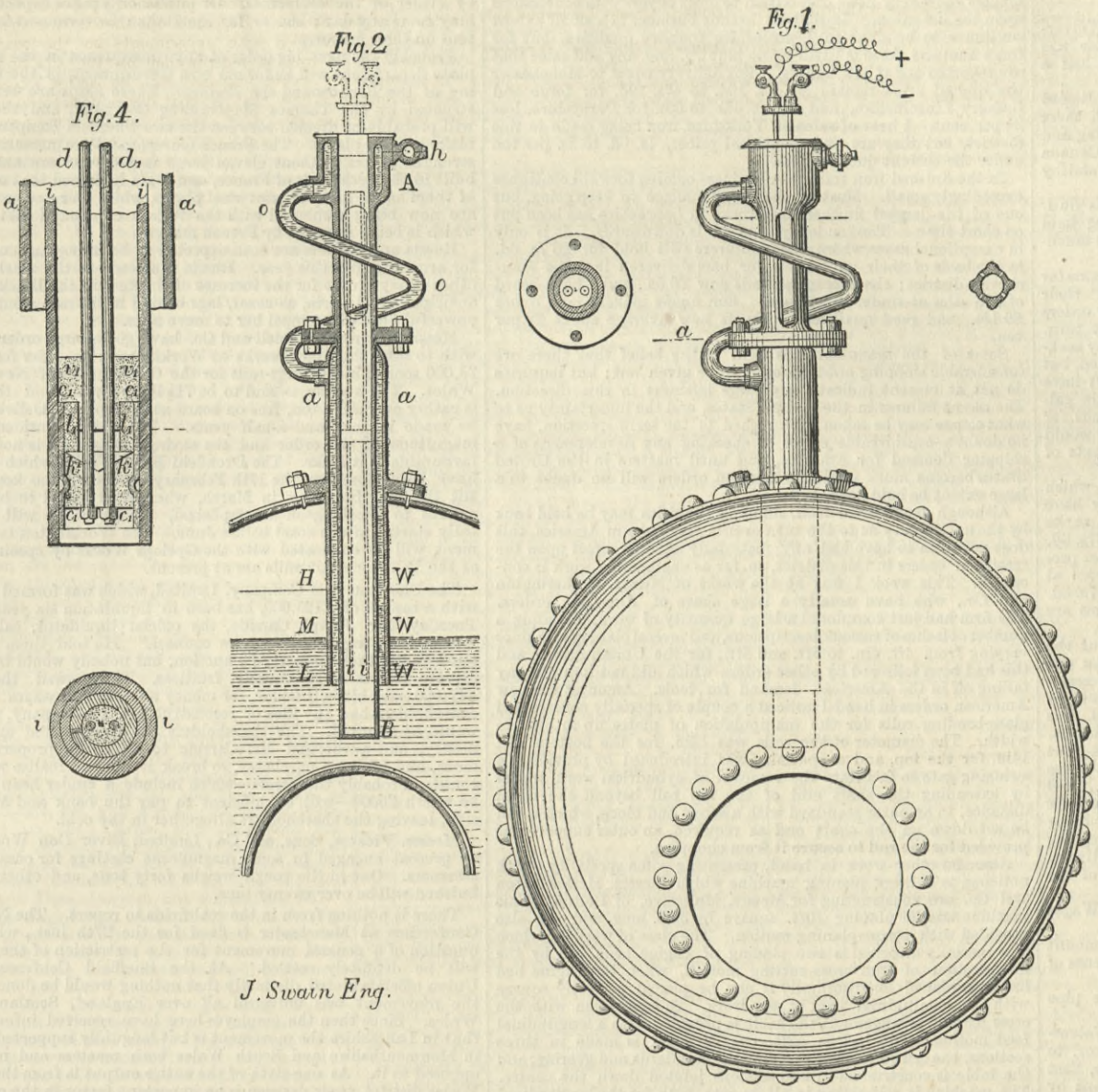
	Grammes.
Black cast iron for the Bessemer furnace, containing 3 to 4 per cent. of manganese, and 1 to 2 per cent. of silicium	15·9
Phosphatic grey cast for pottery	8·9
White specular cast	1·5
The same as above, smelted with charcoal	0·8
Soft steels, under the same circumstances, only lose	0·4
Soft steels simply carburetted	1·1
Manganesian steel, and hard tempered	1·6
The same soft steel	4·1

That is to say, much more than the white specular cast and the cast iron obtained with charcoal. It is found by these experiments that acidulated water, like sea-water, attacks more energetically chromic steel than pure steel, and rather less Wolfram steel. We see, finally, that if in respect to chromium, manganese, and tungsten, the action of acidulated water is rather less than that of sea-water, it is quite different in other respects, and altogether different to the action of moist air. From the experiments with acidulated water, we are not able to obtain any knowledge of the relative resistance of different sorts of iron in moist air or sea-water.

LIVERPOOL ENGINEERING SOCIETY.—The third meeting of the session was held on Wednesday, the 14th instant, at the Royal Institution, Colquitt-street. Mr. R. R. Bevis, jun., in the chair, when a paper entitled "Notes on the Steam Engine Indicator" was read by Mr. W. C. Pagan. After a few introductory remarks upon the instrument itself, the author proceeded to trace its gradual development from its invention by the great James Watt to the instruments used at the present day. Taking the leading types for comparison, he pointed out their respective advantages, and gave some general hints as to the fixing of the instrument, remarking, in conclusion, that though the diagrams produced by the indicator might be accepted as a delineation of the pressure, and its position as existing in any vessel, it should not be relied on as an absolutely correct measurer of the power developed by an engine.

THE MIDLAND INSTITUTE OF MINING ENGINEERS.—On Tuesday last a well-attended meeting of the members of the Midland Institute of Mining Engineers was held at the Queen's Hotel, Leeds. Mr. T. Carrington, president of the Institute and manager of the Kiverton Park Collieries, presided. A discussion took place on the new method of getting coal by the lime process, the representative of the patentees being present. In the absence of expected reports on the subject the discussion was again adjourned. A brief discussion ensued on a paper submitted some time ago by Mr. T. W. Embleton, mining engineer, "On Atmospheric Pressure in Relation to Colliery Explosions in Coal Mines." The conclusion which seemed to be arrived at was that the gas in the pit was in some instances a safer guide than to trust to the barometer, but great value was put upon the latter. A discussion also took place with respect to safety lamps and their utility in the safe working of coal mines. The discussion was ultimately adjourned in order to obtain particulars relating to two new Welsh lamps.

SCHWARTZKOPFF'S SAFETY BOILER APPARATUS.



THE apparatus which we illustrate above is the invention of a German, Herr Schwartzkopff. It is intended to give warning of the approaching danger of explosion of steam boilers by an acoustic and optical signal near the boiler, as well as at any desired distance in the following cases: (1) if the highest admissible steam pressure is reached or exceeded, thus controlling the steam gauge and the safety valve. (2) If the water in the boiler has sunk below the lowest admissible level, thus controlling all apparatuses for recognising the water level. (3) If the water in the boiler should have reached a temperature which exceeds the one corresponding with the pressure shown by the steam gauge, *i.e.*, in case of a retardation of the ebullition. (4) If the boiler is being heated without containing any water at all; in this case the signal will be given long before the boiler plates have been heated to any injurious degree. The Schwartzkopff apparatus is based on this principle: The heat of the steam or water in the boilers (or in the case of dry heating, the radiating heat of the boiler plates), acts on certain hermetically enclosed alloy rings, which melt as soon as the highest admissible temperature is passed, and the molten metal brings two, otherwise insulated copper rods into metallic contact, thereby closing an electric current, which puts an alarm bell into operation.

The apparatus consists, as will be seen from Figs. 1 and 2, of two concentric metal tubes, *a* and *i*, the inner one of which is closed at the bottom and open at the top, and which, by means of a flange, is hermetically fixed to the outer tube. The latter is screwed or rivetted by means of a flange at a convenient place on the top of the boiler, is open at the bottom, and reaches down into the boiler to the lowest admissible water level, while the inner tube projects still lower—down to about ½in. from the highest fire-touched surface of the fire-box or fire-tubes. There remains an open annular space of about ½in. all round between the two tubes. The same arrangement of concentric tubes with an open annular space between them is repeated at the head of the apparatus A, the latter and the lower part being connected by means of a winding tube *o*; the annular space in the upper and the lower part of the apparatus is interrupted and re-united in this way for the sole purpose of cooling the head of the system below the temperature of the boiler, which object, by the radiation of heat through the winding pipe, is fully attained. The apparatus being fixed, as shown in Figs. 1 and 2, closes the boiler entirely, thus allowing the former to be controlled, to work, or to be re-adjusted after having worked, without the escape of steam or water, or without the necessity of interrupting the working of the boiler in the least. The inner tube, which, for better conducting the heat, is made of brass, is traversed from end to end by two strong nickel-plated copper rods, *d* and d_1, which are fixed into, and insulated by, several serpentine plugs, the top and bottom one of which, *k* and k_1 (Figs. 3 and 4), are conically bored and enclosed in thin copper cases, which, on their part, fit closely into the inner tube.

These rods project, as shown in Fig. 1, out of the same, and are provided with holdfasts for the connection with the alarm bell, electric battery and signboard, and, together with the serpentine cups and cases, form a system, Fig. 5, which can easily be inserted into and withdrawn from the inner tube. Into the two copper cases, *c* and c_1, there are fitted two slotted alloy rings, *l* and l_1, which, by their elasticity, adjust themselves closely, fitting in the cases, and two suitable serpentine plugs, *v* and v_1, sliding on the rods, will, if pushed down, hermetically close the cases which contain the alloy rings, thereby preventing any outside influence of steam, water, and air. The alloy rings referred to are adjusted so as to melt at certain degrees of temperature, viz., the upper ring will melt at the boiling point of water, the lower one at a temperature slightly exceeding that one which corresponds with the highest steam pressure with which the boiler may be safely worked. At the head of the outer tube a small cock, *h*, is fixed, by which the air contained in the annular space at the time of raising steam can be allowed to escape; the annular space should always be filled with water at the top; as this water does not circulate, but is in a state of stagnation, and as the winding pipe allows sufficient heat to radiate, the head of the apparatus, as long as filled with water, will always be kept comparatively cool; any air in the same, although not preventing the action of the apparatus, is sometimes apt to delay it. The apparatus is now put into operation, under the following conditions: The alloy of the top ring will melt and ring the bell as soon as the water in the boiler sinks slightly below the lowest admissible water level, as then the water contained in the annular space will no longer be kept therein, but will fall into the boiler and will be replaced by steam, which at once heats the head of the apparatus beyond the melting point of the upper ring.

The alloy of the lower ring will melt as soon as the temperature corresponding with the highest admissible pressure is reached or just surpassed; this will take place:—(1) By the heat of the water in two cases: (*a*) If the pressure of the steam exceeds the fixed limit; (*b*) if the water gets heated to a dangerous degree without the pressure increasing correspondingly (retardation of ebullition). (2) By the radiating heat of the boiler plates, in case of the fire being got up without the boiler being filled with water. In all these cases the molten metal flows into the serpentine cups, and produces a metallic contact between the two rods, by which the electric bell or bells connected with the same are put into operation. As stated before, the apparatus gives the signal without the escape of steam or water, and after having done its duty, the rods can easily be withdrawn, the molten metal is poured out, and a new ring is fitted in without any interruption in the working of the boiler. It will be seen that the apparatus depends for its efficiency on the alloy rings. We are told that the apparatus enjoys considerable favour on the Continent, being used by Herr Borsig at his works in Upper Silesia, Messrs. Siemens and Halske, of Berlin, the Berlin Manufacturing Company, and others.

EMPLOYERS' LIABILITY IN THE MERCANTILE MARINE.

IN the Southwark County Court on Monday, Mr. H. J. Stoner gave judgment in the case of "Grace *v.* Cawthorn." The particulars of the case are fully stated in his Honour's remarks. He said—The question involved in this action—whether the numerous persons engaged in the Mercantile Marine and, possibly, in the Royal Navy, who are not seamen in the ordinary and natural signification of the term, are within the operation of the Employers' Liability Act, 1880—is one of importance and difficulty, and has been argued with great ability by counsel for both parties. According to the evidence, the plaintiff was a fireman on board a merchant steamer called the Ransome, belonging to the defendant, and through the negligence of the chief engineer, whose duty it was to see that a passage by the side of the crank pit of the engine was properly protected, fell, whilst executing the chief engineer's orders, into the crank pit and received serious injuries, for which he has recovered in this action £50 damages, subject to leave reserved to enter a nonsuit, on the ground that a seaman is not within the operation of the Employers' Liability Act, 1880, and that the plaintiff is a seaman. By the 8th section of that Act it is provided that in the construction of the Act the expression "workman" shall mean any person to whom "The Employers' and Workmen's Act, 1875," applies. By the 10th section of the latter Act it is provided that the expression "workman" should not include "a domestic or menial servant," but, save as aforesaid, should mean any person "engaged in manual labour" who should enter into or work under a contract with an employer; but by the 13th section of the same Act it is provided that it "shall not apply to seamen or to apprentices to the sea service." There is nothing in the latter Act to extend the ordinary and natural meaning of the expression "seamen" used in the 13th section, nor, I may mention, to exclude the Royal Navy, and it therefore follows that this expression "seamen," when employed in either of those Acts, has only its natural and ordinary signification. An argument was raised on the part of the defendant, founded on the Interpretation Clause of the Merchant Shipping Act, 1854, which enacts—"That in the construction and for the purposes of that Act, the word 'seamen' shall include every person—except masters, pilots, and apprentices—employed or engaged in any capacity on board any ship;" but it appears to me that the operation of this section must clearly be restricted, according to its own terms, to the construction and purposes of the Act in which it is contained, and further, that it affords a strong argument against the extension of the expression "seamen" to any other person than those to whom it applies in its ordinary and natural signification, inasmuch as it was thought necessary by the Legislature expressly to include in such expression by this section the other persons referred to. It therefore appears to me that the only questions in the present case are, what is the ordinary and natural signification of the word "seaman," and is the plaintiff, according to such signification, a "seaman?" In Webster's dictionary the following definition is given of the word "seaman":—(1) "A sailor, a mariner, a man whose occupation is to assist in the management of ships at sea;" (2) "By way of distinction a skilful mariner, one well versed in the art of navigating ships at sea, in which sense it is applied both to officers and to common seamen." Now, I take it to be clear that any person employed or engaged in any capacity on board any ship who does not fall within the first of the above definitions—upon the true significance of which much light is thrown by the second—is not a "seaman," and that a person who is not employed and occupied in the management of the sails, the steering of the vessel, or otherwise directly assisting in the management and navigation of the ship, with skilled knowledge relating to the same, is not a "seaman." This interpretation of the word "seaman" is strengthened by evidence in this present action, as both the plaintiff and the second engineer employed in the same ship, who were the only skilled witnesses called, both deposed that they and others similarly employed were not considered or termed "seamen," and were not so in fact. The exact circumstances of the plaintiff's employment were as follows: He had been a coal porter and a corn porter ashore until about a year previously to the 29th June last. During such year he had been employed as a coal trimmer on board ship, off and on, under written agreements, and on the 29th June last the chief engineer of the ship Ransome engaged him as a fireman at weekly wages of 30s., without any written agreement; and he went on board at ten o'clock at night. He was at first employed in passing word from the deck to the engine-room, but about eleven he was sent down to the engine-room to attend to the fires, when the accident in question happened. His duties appear to have been simply to attend to the fires of the engine, to pass the orders from deck to the engineer and similar duties connected with the engine, and which were evidently the same, whether performed on land or at sea, and certainly required no skilled knowledge relating to the management or navigation of a ship. Upon these facts I am of opinion that the plaintiff was not at the time of the accident a "seaman" in the ordinary and natural signification of the term, and that judgment ought to be entered in his favour. The defendant is at liberty to appeal either by motion or by case; and in the event of an appeal I shall, under the County Court Act, 1882, allow costs on a higher scale above £100, being of opinion that the question involved is one "of general and public interest;" but in the event of there being no appeal, I shall allow the costs only on the amount recovered.

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

(*From our own Correspondent.*)

On 'Change in Birmingham to-day—Thursday—and in Wolverhampton on Wednesday, business was quiet; yet the tone was stronger and prices were upheld. The improved weather had a distinctly favourable influence.

Bars were variously quoted at from £8 2s. 6d. for the "Round Oak" brand, down to £6 5s. for common Staffordshire, and there was a steady business in the better qualities for cable making and for export. On export account the demand is growing, Canada and the Australias being better customers; but the home smithy branch is quiet.

Hoop and strip orders were sought, but the inquiry was dull. Orders upon United States account were announced as being held back merely till some definite conclusion has been arrived at touching the duty to be hereafter levied.

Best stamping sheets sold in fair quantities on makers' terms for export through merchants. Messrs. Baldwin quoted their "Severn" brand at £11, and they are receiving enough new orders to enable them to start their works with the Monday night turn. The makers of galvanising sheets were to-day and yesterday seeking specifications in fulfilment of orders some time ago booked, but they were not generally successful. New business might have been done at £9 for trebles, but that figure, which certain galvanisers offered, makers would not accept. They held out for prices varying from £9 10s. to £9 5s.; and for doubles they would not take less than from £8 7s. 6d. to £8 5s. Braziery sheets of these gauges were, however, to be had at less money.

Pigs were fairly strong. Throughout the period during which galvanising sheets have gone down from 20s. to 25s. they have dropped only about 2s. 6d. Derbyshire pigs, which were 50s. at the earlier time, were not this afternoon to be had at less than 47s. 6d. All-mine Staffordshire pigs, which had been 67s. 6d., were not procurable at under 65s.; and the Spring Vale make was quoted at £2 2s., £2 12s. 6d., and £3, according to brand; £3 5s. to £3 7s. 6d. was asked for hematites, but without business. Steel blooms are selling. Makers quote £7 10s. per ton.

Gas coke was in demand to-day and yesterday at 12s., but the supply was restricted. One quality of South Wales oven coke was to be had at 14s. 6d., but 15s. 6d. was required for a better description; 15s. 6d. was also the general price for Derbyshire, yet a high-class description was quoted at 17s.; and for Wigan 15s. 6d. was required, delivered, as in the other cases, on to customers' sidings.

Furnace coal of the best description was 11s. and 10s. 6d., but the figure was got but rarely and with difficulty. Before these prices the colliers' wages are fixed at "per day," 3s. 8d., and 2s. 10d. for thick and thin coal-workers respectively; yet the bulk of the coal for furnace and forge and mill uses, which is now being sold, is realising prices much lower than warrants the foregoing rates. The colliery proprietors, who can this week get hardly 7s. per ton for their forge fuel, were to-day loudly complaining of the high wages to which they are committed.

To-day the usual annual meeting of the Mill and Forge Wages Board was held in Birmingham.

The chief engineering firms are receiving an encouraging amount of work, in satisfaction mainly of the rolling stock requirements of foreign railway companies.

Structure building engineers are well engaged, but the pipe founders are mostly short of work.

The Home Secretary has appointed Mr. W. B. Scott, of Wolverhampton, who for ten years acted as assistant mines inspector, to the chief inspectorship of mines for the South Staffordshire, East Worcestershire, and Cannock Chase districts, rendered vacant by the death of Mr. J. P. Baker. The appointment has given general satisfaction.

Mr. Thomas Lucas, of Hanley, has this week been elected president for the ensuing year of the North Staffordshire Mining Institute, and Messrs. W. Heath, F. Silvester, and T. E. Storey vice-presidents. The Institute now numbers 262 members, which is a slight decrease on the year.

The Birmingham Corporation have made a net profit during the past year upon their gas undertaking of £50,946. This amount has been appropriated as follows:—£25,000 to the borough improvement rate of 1882, and £25,946 to the sinking fund for the redemption of loans and annuities. In the last four years the manufacture of gas has increased by 539 million cubic feet. The illuminating power during the past year was an average of 17·23 sperm candles.

The Birmingham Gas Committee have accepted the tender of Messrs. S. Cutler and Sons for the construction of two three-lift gasholders at Windsor-street, at a cost of £53,850. They have also authorised the expenditure of £6000 upon two pairs of West's stoking machines for the retort house at Saltley, by the adoption of which they expect to effect considerable saving.

In his address at the sixth annual meeting of gas managers in Birmingham on Friday, Mr. H. Woodhall, of Leeds, the president, said that notwithstanding the competition of the electric light, almost everything tended to increase their faith in the future of gas supply. Gas engineers were, in his opinion, on the eve of an advance into new domains of usefulness and profit, whose proportions would dwarf those they occupied at present, namely, in the use of gas as a heating agent. Enlarging upon the value of gas for motive purposes, Mr. Woodhall remarked that with gas at 1s. per 1000ft., a 5-horse power gas engine could be worked at 1d. an hour, and taking into account the saving in labour, insurance, &c., he asked was not gas at such a price cheaper than steam as a gift.

It has just been made known in Birmingham, on what appears to be very good authority, that further proceedings as to the electric lighting schemes now before Parliament are held in abeyance pending the issue of a model order which the Board of Trade have decided to frame in the form which they think it should take in the interests of manufacturers and companies alike. The department are understood to be in a position to draw up such an order, since they have now before them the views of the electric lighting companies as indicated by their "orders," and those of the Corporations as expressed in their objections.

The engine builders are receiving inquiries for tenders for the supply of compound condensing and beam engines for water companies' use, together with sets of three-throw pumps and the like.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—An extraordinary feature in connection with the iron trade at the present time is that although money is cheap, with an abundance of capital waiting for investment in any enterprise that can show a fair return, and although raw material is now at an extremely low point so far as price is concerned, business does not come forward. A general want of confidence prevails throughout the market, and consumers of iron only cover their requirements from hand to mouth. A few offers are made at prices under current rates, and no doubt a little giving way on the part of makers would lead to a moderate business being done; but there is little or no evidence of any great weight of business in the background, and so far as lower prices are concerned, they seem already to have got to a point so low that there is practically no margin for further concessions. Pig iron makers declare their inability to come lower, and in the finished iron trade the closing of works is talked of rather than follow any further the downward course of the market.

The business doing at the Manchester market on Tuesday was again of an exceedingly limited character, and the weight of orders booked during the week has been very small. Lancashire pig iron makers still quoted 46s. to 47s. less 2½ for forge and foundry qualities delivered equal to Manchester, but at those figures they are not able to get orders. At about 1s. less offers have been made, and at little under the quoted rates one or two special sales have been made; but although stocks are now beginning to accumulate, local makers show very little disposition to meet buyers with concessions upon the list rates. In district brands business to a small extent continues to be done in Lincolnshire foundry qualities, but for forge numbers there is little or no inquiry, and any odd sales that are reported are at low figures. For delivery equal to Manchester the quoted rates remain at 45s. 10d. to 47s. 10d. for forge and foundry Lincolnshire, and about 48s. to 50s. for Derbyshire, less 2½ per cent. I hear of sales of Yorkshire iron being made in this district, but they are at exceptional prices, 1s. 6d. to 2s. per ton under the current quoted rates.

In the finished iron trade the business coming forward continues exceedingly small. Most of the forges manage to keep going, but one of the largest finished ironworks in Lancashire has been put on short time. The tendency of prices is downwards. It is only in exceptional cases where manufacturers still hold for £6 7s. 6d. as the basis of their quotations for bars delivered into the Manchester district; the average price is now £6 5s., and I have heard of odd sales at under this figure. For hoops makers now quote £6 15s., and good qualities of sheets now average about £8 per ton.

Some of the manufacturers hold to the belief that there are considerable shipping orders shortly to be given out; but inquiries do not at present indicate any large business in this direction. The recent failures in the United States, and the uncertainty as to what course may be taken with regard to the tariff question, have no doubt a considerable effect in checking any development of a shipping demand for America, and until matters in the United States become more settled, American orders will no doubt to a large extent be held back.

Although for finished iron, shipping inquiries may be held back by the uncertainty as to the turn events may take in America, this does not seem to have had any materially adverse effect upon the receipt of orders in this district, so far as engineering work is concerned. This week I was at the works of Messrs. Hetherington and Co., who have usually a large share of American orders. The firm had just completed a large quantity of work, including a number of lathes of various descriptions, and several planing machines varying from 4ft. 6in. to 5ft. and 6ft., for the United States, and this had been followed by other orders which did not indicate any falling off in the American demand for tools. Amongst the new American orders in hand I noticed a couple of specially constructed plate-bending rolls for the manipulation of plates up to 10ft. in width. The diameter of the rolls was 12in. for the bottom and 14in. for the top, and a specialty was introduced by providing a swinging gate to facilitate the removal of cylindrical work, whilst by extending the shaft end of the top roll beyond the usual distance, to an outer standard with a screw and block, which could be set down on the shaft end as required, an outer support was provided for the roll to secure it from chopping.

Amongst other work in hand, presenting some speciality worth noticing, is a large planing machine which Messrs. Hetherington and Co. are constructing for Messrs. Musgrave, of Bolton. This machine was for planing 10ft. square by 30ft. long, and was also provided with a cross-planing motion. The class of work for which it is specially designed is the planing of engine beds, and by the introduction of the cross-cutting motion, when the engine bed has been planed longitudinally it can be planed perfectly square with the longitudinal part of the work. In connection with the cross planing arrangement the table is provided with a longitudinal feed motion. The bed is 52ft. over all, and is made in three sections, the centre portion carrying the standards and gearing, and the table is constructed in two sections jointed down the centre. The machine is self-acting in all its cuts, both for the longitudinal and cross planing, and when complete will weigh about 100 tons. Other special machines in hand included a 12in. shafting lathe, arranged with two duplex carriages, the front rest carrying two tools and the back rest one tool in each case. The bed of this machine is 36ft. long, and is provided with an 18in. headstock on the outer end, so that when both the carriages are not in use for sliding the shafting, one can be employed in conjunction with the headstock as a face lathe. The same firm has in hand a drilling and tapping machine for pipe sockets up to 4½in. diameter, in which double guide screws with the same pitch as the taps are introduced on the top frames to ensure accuracy in the tapping, whilst a foot treadle is provided to assist the workmen in lifting the taps out of the sockets; also a milling machine for grooving locomotive coupling rods, constructed for operating upon two rods simultaneously, each cutter removing 3in. by $\frac{9}{16}$in. at one operation. In this machine the cutters are brought down to the required depth, then a longitudinal feed motion is put on which traverses to the length required, leaving the groove ends with a good radial finish. This motion is also adapted for general purposes, and the machine, which is powerfully geared, is 10ft. long and 3ft. between the standards.

With regard to the engineering trades generally throughout Lancashire, the reports from the various districts connected with the Amalgamated Society of Engineers show that, although the year has opened with activity in nearly every department, there has, so far, been a slight falling off in employment. In the Manchester and Salford district the percentage of out-of-work members on the books has risen from about 2½ per cent. before the close of last year to about 3 per cent. at the present time. This is, however, chiefly accounted for by the lessened activity in some of the machinists' shops, and to the fact that in one or two large engineering firms who have been working overtime the night shifts have been discontinued. Locomotive builders are still exceedingly busy, and the large firms are not only working overtime continuously, but in some cases are running all night through once during each week. Toolmakers have also plenty of work in hand; boilermakers and stationary engine builders are kept fairly well employed, and where there is any noticeable slackness it is chiefly amongst some of the cotton machine-making firms; but even in this branch the large well-known makers are in most cases fairly off for work.

The coal trade keeps fairly steady both as regards prices and demand. At the pit mouth the average rates remain at about 9s. 6d. to 10s. for best coal, 7s. 6d. to 8s. for seconds, 6s. 6d. to 7s. for common house coal, 5s. 9d. to 6s. 3d. for steam and forge coal, 4s. 9d. to 5s. for burgy, and 3s. 6d. to 4s. for ordinary qualities of slack.

For shipment there is a moderately good demand, with prices for delivery at the high level, Liverpool, or the Garston Docks, averaging about 7s. 9d. to 8s. for steam coal, and 9s. to 9s. 6d. for house fire qualities. Coke moves off fairly well at old rates.

The balance-sheets and reports of the large Lancashire coal and iron companies show little variation in the unsatisfactory results upon the operation of last year. Last week I gave an abstract from the report of Messrs. Andrew Knowles and Sons, Limited, Manchester, this week I have been furnished with the half-yearly report of the Wigan Coal and Iron Company, the paid-up share capital of which amounts to £1,809,725, in addition to which there is £158,705 owing in debentures. The directors state that the output and sales have increased, and for iron prices had been somewhat higher, but the net results of the company's operations in coal and iron has only been a profit of £23,978, out of which it is proposed to pay a dividend of 2½ per cent., leaving £1968 to be carried forward. The company had seven furnaces in work during the half-year, and the further application of Whitwell stoves, which had been previously introduced with successful results, has continued.

THE SHEFFIELD DISTRICT

(*From Our Own Correspondent.*)

A statement has been freely circulated in the provincial press that Messrs. John Brown and Co. and Messrs. Charles Cammell and Co. have each received an order for £100,000 worth of armour-plates for "a foreign Government." This was held to refer to Italy, and to be the outcome of the Spezzia trials. After inquiry, I am able to state that no such orders have as yet been received by either of the companies. Of course orders are expected, and may come any day; but so far the Italian Government have not sent on their favours.

Probably the next big order of any consequence in the armour-plate department will be for our own Government, in the armouring of the Benbow and the Rodney. These ships are being constructed by the Thames Shipbuilding Company, and the plates will probably be divided between the two Sheffield companies who make armour-plates. The French Government are increasing their strength at sea. About eleven large men-of-war are now being built in the dockyards of France, and I am informed that only two of them are to have Creusot steel plates, while four or five at least are now being armoured with the Wilson compound plate, all of which is being supplied by French makers.

Russia and Austria are both expected to be important customers for armour-plates this year. Russia is already in the market, and other heavy orders for the increase of the fleet in the Black Sea are anticipated. Austria, as usual, lags behind in the race; but Italy's powerful fleet will compel her to move soon.

Messrs. Charles Cammell and Co. have got a large order wherewith to start their new works at Workington; an order for nearly 73,000 tons of steel flange-rails for the Government of New South Wales. The section is said to be 71½ lb. per yard, and the price is rather over £5 a ton, free on board at Liverpoo . Delivery is to be made in four and a-half years. The price, considering the magnitude of the order and the saving of carriage, is not so unfavourable as it looks. The Dronfield Steel Works, which were to have been closed on the 17th February, are now to be kept open till the first Saturday in March, when it is hoped to have the exodus to Workington accomplished, though work will not be fully started at the coast before June. The Workington establishment will be connected with the Cyclops Works by special wire, as the Penistone rail mills are at present.

The Charlton Iron Company, Limited, which was formed in 1872 with a capital of £125,000, has been in liquidation six years. On Tuesday, Mr. Joseph Carside, the official liquidator, called the shareholders together "to take counsel." He told them he had tried to sell their property by auction, but nobody would buy, and private efforts were equally fruitless. They owed the bank £17,000, and himself £4000, for money advanced in wages. If the shareholders had any idea of reconstructing the company, £22,000 would be required. The shareholders declined to find any more money, and authorised Mr. Carside to offer the property once more, and failing a purchaser, to break it up and realise what he could. Probably the assets—which include a cinder heap said to be worth £6000—will be sufficient to pay the bank and Mr. Carside, leaving the shareholders altogether in the cold.

Messrs. Vickers, Sons, and Co., Limited, River Don Works, are at present engaged in some magnificent castings for ocean-going steamers. One in the rough weighs forty tons, and others when finished will be over twenty tons.

There is nothing fresh in the coal-fields to report. The National Conference at Manchester is fixed for the 27th inst., when the question of a general movement for the restriction of the output will be definitely settled. At the Sheffield Conference the Union officials stated distinctly that nothing would be done unless the movement was universal all over England, Scotland, and Wales. Since then the employés here have received information that in Lancashire the movement is but languidly supported, while in Monmouthshire and South Wales both masters and men are opposed to it. As one-sixth of the entire output is from the South Wales district, their decision is an important factor in the case.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

The Cleveland iron trade continues in a dull and spiritless condition, especially as regards pig iron. At the market held at Middlesbrough on Tuesday last merchants and makers were both very anxious to sell, but did not find consumers ready to buy, though 3d. to 6d. per ton less was asked than on the previous Tuesday. No. 3 g.m.b. was offered by merchants at 40s. 9d. per ton, makers for the most part were asking 41s., but some were willing to take a trifle less. The shipments have been very poor so far this month, and there is every probability that a large addition will be made to stocks by the end thereof. Buyers, no doubt, bear this in mind, and refrain from purchasing, in the hope that lower prices will prevail.

The stock of Cleveland iron in Messrs. Connal and Co.'s Middlesbrough stores continues to decrease. This is satisfactory as tending, so far as it goes, to prevent a still more serious increase of stocks. On Monday night the quantity in store was 85,672 tons, being 1531 tons less than a week ago.

Only 30,809 tons of pig iron had been shipped from the Tees, this month, up to Monday night. Last month, in the corresponding period, the quantity was 39,815 tons, and in February last year 41,912 tons.

There is nothing new to report with regard to the finished iron trade. Some of the manufacturers are anxious to secure further orders to keep their mills going; but few are being given out, and these at ruinous prices. If there is no change for the better soon, it may be found necessary to close some of the works. Prices are about the same as quoted last week, viz., ship plates £6 2s. 6d. to £6 5s. per ton; shipbuilding angles, £5 5s. to £5 7s. 6d.; and common bars, £5 10s. to £5 15s., all f.o.t. at makers' works, less 2½ per cent. discount. Puddled bars are £3 15s. per ton net. The steel rail trade is very quiet.

The electric light was put into operation at the Lambton Coal Drops at Sunderland Docks last week, and so far it has been found to answer well the purpose for which it was intended. Eight Gulcher arc lamps of 1000-candle power each have been placed along the side of the quay, so as to illuminate the whole of the dock side and the railway sidings. Vessels are now being loaded during the night without the slightest difficulty. Besides the arc lamps already erected, it is intended to put up several of Crooke's 20-candle power incandescent lamps at certain other important points.

The first annual meeting of the Clay-lane Iron Company, Limited, was held at Leeds on Friday, the 16th inst. A dividend was declared at the rate of 5 per cent. per annum, free of income-tax, after taking off 7½ per cent. for depreciation, and carrying forward £7065 to the next account. This company was formed in April, 1882, to work the furnaces and mines which formerly belonged to Messrs. T. Vaughan and Co. They have now been at work about ten months, and are obviously doing well.

Messrs. Hawks, Crawshay, and Co., of Gateshead, have just completed the construction of a large girder bridge for the Canadian Pacific Railway, British Columbia. The largest span is 315ft. long, and there are two smaller ones about 105ft. each. The bridge will cross the Fraser River 150 miles eastward of Port Moody. Mr. C. C. Schreiber, of New York, is the engineer.

An adjourned meeting of the Board of Conciliation and Arbitration for the manufactured iron trade was held at Darlington on Friday, February 16th; Mr. W. Whitwell presided. It was decided to hold a meeting of the Standing Committee once a month, unless it were notified by the secretaries that there was no business requiring attention. The principal business of the meeting was to elect a referee. A letter from Mr. Dodds was read in which he said he had not the time nor the special knowledge requisite to do justice to the matter, and that he would not like to be put in competition with Mr. Dale under any circumstances. Mr. Dodd's name was therefore withdrawn, and the proposal that Mr. Dale be referee for the ensuing year was carried unanimously.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

THE improvement which showed itself in the warrant market this week has unfortunately not been maintained. The prices have been on the decline this week, owing mainly to the transactions of brokers, although it must be admitted that the shipments of pig iron have not been good enough to inspire confidence in the change for the better which was believed to have set in last week. The demand from the United States has been comparatively good, it being a noticeable circumstance that of the total shipment of 8887 tons, no less than 3870 tons were despatched to America. For home consumption there has been a steady demand, and the prospects of this department of the trade could not well be more satisfactory, but the inquiry from the Continent is not coming away as was expected. A large decrease has taken place in the course of the week in the stocks in Messrs. Connal and Co.'s stores, but the general opinion in the trade is that makers must now be adding considerably to their holdings. Since last report one furnace has been relighted at Lugan Ironworks, giving a total of 111 in blast, as compared with 106 at the same date last year. The arrivals of Cleveland pig iron in Scotland are very poor, the past week's imports amounting to only 995 tons, as compared with 8057 in the same week of 1882, and there is a decrease of 15,256 tons on these arrivals since Christmas.

Business was done on Friday at from 47s. 10d. to 47s. 8d. cash, the transactions being limited. The market was easier on Monday, with business between 47s. 8d. and 47s. 6½d. cash, while on Tuesday the quotations were 47s. 4d. down to 47s. 4½d. On Wednesday there were transactions between 47s. 4½d. and 47s. 1½d. cash. To-day—Thursday—business was done at 47s. 4d. to 47s. 5½d. cash, and 47s. 7½d. one month.

The quotations of makers' iron are as follows:—Gartsherrie, f.o.b., at Glasgow per ton, No. 1, 62s.; No. 3, 53s. 6d.; Coltness, 65s. and 55s.; Langloan, 65s. and 55s. 6d.; Summerlee, 62s. and 52s.; Chapelhall, 61s. and 52s.; Calder, 62s. 6d. and 51s.; Carnbroe, 56s. and 50s.; Clyde, 52s. 6d. and 50s. 6d.; Monkland, 49s. 3d. and 47s. 9d.; Quarter, 48s. 9d. and 47s.; Govan, at Broomielaw, 49s. and 47s. 6d.; Shotts, at Leith, 64s. 6d. and 56s.; Carron, at Grangemouth, 53s. (specially selected, 57s. 6d.) and 52s.; Kinneil, at Bo'ness, 48s. 6d. and 47s. 6d.; Glengarnock, at Ardrossan, 55s. and 49s. 6d.; Eglinton, 50s. and 48s.; and Dalmellington, 50s. 6d. and 49s. 6d.

In the engineering trades of the West of Scotland great activity prevails, and there are numerous inquiries for a variety of work, which indicates that the present year will continue a busy, if not also a profitable one, with engineers. In the marine engineering department especially, fresh orders of importance are being placed almost daily. For different kinds of machinery the demand is also good, as well as for ship and boiler plates, although in the case of plates the quotations are kept rather low by keen competition on the part of English firms. There is much activity, too, in the foundries, large castings being particularly in request. The shipments of iron manufactures in the past week from the Clyde embraced £7241 worth of machinery, £4667 sewing machines, £4100 steel articles, and £22,500 various kinds of iron manufactures, most of the consignments being to Mediterranean ports, to India, and Australia.

The coal trade continues fairly active in Lanark and Ayrshire, the inland consumption being brisk both in households and works. Dealers report that they have good orders in hand for shipment, and indeed they are unable to execute these as promptly as they could wish, on account of the detention of vessels by stormy weather, and the insufficient arrangements provided by the railway companies for the conveyance of the coals to their destinations. There has been rather more doing in the shipment of coals at Leith, but at Grangemouth there has been scarcely anything doing in the course of the week. Business has also been exceedingly slack at the Fife ports, so much so, that much against their will the colliery owners were obliged about three weeks ago to give notice of a reduction in the miners' wages. This "break" amounted to about 4½d. per day, and was to come into operation from Monday last. The representatives of masters and men held a conference on the subject, but the former could see no other way out of their difficulties than a curtailment of the men's pay.

An idle day was held on Monday throughout the Fife mining districts to consider the position of affairs, and from the speeches made at a meeting attended by about 3000 men, it would seem as if they were resolved to adopt a policy of restriction. This, however, can do them little or no good in the circumstances, because a plentiful supply of coals can be had at other places at moderate rates, so that prices are not likely to be enhanced by curtailing the output in any one locality.

The colliers are talking about shortening their hours all over the country, but there appears small prospect of any united movement in this direction in the West, where the men are practically without a combination, and have had no leader since the death of Mr. Alex. Macdonald, M.P., whom they were prepared to follow in very great numbers.

Colonel Majendie has been in Glasgow a second time inspecting the gasholder that exploded at the Tradeston Gasworks, and he has given it as his opinion that the occurrence was the result of the external application of dynamite or nitro-glycerine. The municipal authorities have accordingly increased the reward offered for the detection of the person or persons who caused the explosion from £100 to £500. Curiously enough, although the gas officials adopted the dynamite theory from the first, neither the police nor the public have much faith in it. The gasholder has for a long time been liable to serious leakage, and it is alleged that there has existed much ill-feeling among the employés at the gasworks.

By a landslip which occurred on Sunday on the Girvan and Portpatrick Railway, between Girvan and Pinecherry, the traffic on this railway has been completely suspended throughout the week.

WALES & ADJOINING COUNTIES.

(From our own Correspondent.)

COMPETITION amongst skilled men in the Welsh industries is every year becoming keener. A large employer of labour told me some time ago that he had over thirty mining engineers on his list for probable vacancies. Even this is eclipsed by a recent competition. For the post of deputy inspector of mines, South Wales, the position held by Mr. Traherne Rees, there were no less than 120 candidates. The selection fell to Mr. Randall, of the Great Western Colliery, Rhondda Valley.

The dock war at Cardiff still continues to rage. How some of the Barry promoters reconcile their action with the opinion of Mr. Riches, that the Welsh coal-field has had its day, is a mystery to me. I do not go to the length Mr. Riches did, but a few years must show a decline. There is a rapid working now of the best marketable coals in the Rhondda. The output has reached 4,720,899 tons annually against Aberdare Valley 2,208,205 tons, and there is not very much difference in the acreage of the two places, certainly not double. If it is true that the quantity from the Aberdare Valley is falling off, and that the seams are being worked out, the Rhondda will, with the increased quantity worked, sooner arrive at the same period of exhaustion. Hunt's figures are well worthy of consideration, and it will be well to carefully consider the relative outputs of the two valleys, and be guided by the inference which the figures give. By all means the extension of the Bute Docks should be supported, though I question if the capital expended already by his lordship returns anything like adequate interest. He has overlooked this, most generously, in conceding new docks, and it is sheer ingratitude on the part of Cardiff Corporation to ignore this.

There was a stormy meeting at Cardiff on Tuesday—the Mayor in the chair—when the proposition to oppose the Barry Docks was negatived.

The whole of the plant at Penydarran Ironworks was sold by auction this week. Boilers, accumulators, engines, many parts of good wrought iron, went for the price of old iron—some as little as 10s. per ton. It is estimated that there were 3000 tons wrought and cast iron on the place, and previous to the sale offers were made for the whole. Many purchasers were there from Bristol, the Midlands, and North of England.

Trade generally is tolerably good, especially coal; house and steam of best quality are in strong demand, and prices are maintained. The stormy weather continues to interfere somewhat with shipping, or the totals of the week would have been considerably increased. As it was, over 200,000 tons were shipped, foreign and coastwise.

Satisfactory progress is reported with the Penarth Harbour, Dock, and Railway; and the new dock is in an advanced state. A dividend of £5 5s. has been recommended by the directors.

Prospects of a busy session foreshadowing a busy year for contractors are now before me. I see that Bills will be brought in for Bute Docks, Barry Docks, Rhondda and Swansea Bay extension; Newport Docks, Swansea Harbour; Pontypridd, Caerphilly, and Newport Railway; Oystermouth Railway; Milford Docks; Cambrian Railway; Cardiff and Monmouthshire Railways; Central Wales and Carmarthen Junction Railway; Great Western and Llynvi and Ogmore Companies; Taff Vale; Great Western; London and North-Western additional powers and new Railways; Midland Railway; all connected with Wales.

Patent fuel is in good demand, and the pitwood industry is thriving. Iron ore is flagging and prices low. This is a tolerably good indication that the iron is not very brisk. Most of the works are busy, but new orders are slowly coming in. A good proof of the iron trade being sluggish was shown this week by the fact that a commission agent who applied to many of the leading iron houses for a commission to buy iron at Penydarran Works failed in each case, the market being too dull to justify purchase. Pig iron was quoted this week at Swansea at 45s.

THE IRON AND ENGINEERING INDUSTRIES in the Coatbridge and Airdrie districts are now merging into substantial activity, as is evinced by the fact that one firm who newly entered the field as marine engine builders have already in hand four sets of compound marine engines, the smallest of which is over 500-horse power indicated; whilst enlargement of their premises and appliances is being carried out in view of enabling them to undertake similar engines of the heaviest class. Other of the engineering and boiler-making firms have their power heavily taxed in the rapid construction of machine and iron buildings connected with the new process of iron smelting, already successfully inaugurated and now being adopted throughout the whole smelting furnaces at the Gartsherrie Ironworks, and others belonging to the same firm. Part of the old site of the once famous Dundyvan Ironworks has also been set apart on which to carry out iron and steel bar rolling by a company embracing amongst its number at least one of the oldest ironmasters of the district. To the extreme west of Langloan, adjoining the Baillieston branch of the Caledonian Railway, workmen are busily levelling out several acres of ground, and digging foundation pits preparatory to the reception of heavy steel and iron plate and sheet rolling mill trains and connections, to be worked under a new firm, styled "The Woodside Steel and Iron Company." Important additional engines, hammers, and mills, are also in course of completion, both at the Waverley Iron and Steel and the North British Ironworks; and it is flattering to the district to record that the contracts for the new erections have to the larger extent fallen to Coatbridge and Airdrie engineers, who in some instances are now more than fully employed. It may be worthy of special note that these contracts embrace the renewed construction of the Stevenson frictional reversing system for the new plate mills, which formed a chief subject of inspection and discussion, and subsequent controversy by the members of the Iron and Steel Institute at Monkland and Blochairn during their meetings at Glasgow in 1872; which system, during the following year, was uprooted at immense sacrifice at the latter named work.

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.

13th February, 1883.

779. LUBRICATING APPARATUS for SPINDLE, &c., BEARINGS, W. Cunningham, Dundee.
780. POTATO STEAMER, C. F. Bower, London.
781. GAS MOTOR ENGINES, H. Townsend and E. and E. C. Davis, Bradford.
782. CANS for MEAT, &c., T. G. F. Dolby, Dulwich.
783. PICKERS for LOOMS, R. and T. Fielden, Walsden.
784. GOVERNING STEAM ENGINES, W. Knowles, Bolton.
785. FEED-WATER PURIFIERS for BOILERS, W. P. Thompson.—(*C. Elliot, San Francisco, U.S.*)
786. CLEANSING TUBES of BABIES' FEEDING BOTTLES, &c., J. P. Bark, Bootle.
787. BREAKING PIG IRON, &c., J. Evans, Gaythorne, and S. Mason, Leicester.
788. RAILWAY BRAKES, A. M. Clark.—(*J. V. D. Reed, New York, U.S.*)
789. MALTING, E. de Pass.—(*C. Golay, Paris.*)
790. CORRUGATED BOX-IRONS, J. Gautherin, Paris.
791. SECONDARY or STORAGE BATTERIES, T. Rowan, London.
792. DYNAMO-ELECTRIC MACHINES, T. Rowan, and S. Williams, Newport.
793. VALVES, W. Branford, Dennington.
794. SHEARING SHEEP, &c., W. R. Lake.—(*C. Carpentier, Paris.*)
795. FASTENINGS for PURSES, &c., F., H., and F. Dowler, jun., Birmingham.
796. CONSTRUCTING PARTS of VELOCIPEDES, W. J. Spurrier, Birmingham.
797. DYNAMO-ELECTRIC, &c., MACHINERY, F. Wynne, London.

14th February, 1883.

798. SECURING KNOBS to HANDLES, W. B. Shorland, Manchester.
799. SMUTTING, &c., BLACKENED LEATHER, W. Morgan-Brown.—(*C. B. Bryant, Woburn, Massachusetts, U.S.*)
800. PLANING MACHINES, W. Morgan-Brown.—(*H. F. Campbell, Concord Merrimac, New Hampshire, U.S.*)
801. SEWING MACHINES, W. Morgan-Brown.—(*O. R. van Vechten, New York.*)
802. BUTTER WORKERS, T. Bradford, Manchester.
803. CONSTRUCTING WALLS for BUILDINGS, W. Mullett, Stafford.
804. DYNAMO-ELECTRIC MACHINES, H. T. Barnett, London.
805. ORDNANCE, G. A. Cassagnes, Paris.
806. MAKING KNITTED LOOPED FABRICS, H. Kiddier, Nottingham.
807. A NEW PLASTIC COMPOUND, O. Schreiber, London.
808. FELT HATS, J. Isherwood, Denton.
809. REAPING and MOWING MACHINES, H. and J. Armour, Linlithgow, N.B.
810. GAS-COOKING STOVES, J. Russell, Reading.
811. NICKEL and COBALT, &c., F. Lotter, Germany.
812. DOMESTIC STOVES and GRATES, H. Thompson. London.
813. FASTENINGS for BOOTS, &c., F. J. Brougham.—(*G. Klotz, Dresden.*)
814. LOCKS and LATCHES, J. Kaye, London.
815. RAIL SCREWS, T. Matthews, London, and W. Bayliss, Wolverhampton.
816. STEAM, &c., ENGINES, P. B. Elwell and T. Parker, Wolverhampton.
817. BRASS BOBBIN WINDING ENGINES, J. Mosley, Nottingham.
818. MAKING SPOKED WHEELS, E. Dearden, Darnall.
819. SLEEPING BERTHS of RAILWAY CARRIAGES, &c., T. F. Craven, Sheffield.
820. DRESSING TEXTILE FABRICS, W. R. Lake.—(*M. Luthringer, France.*)
821. CALENDAR RING, A. E. Maudslay, Southampton.
822. COUPLING APPARATUS, W. R. Lake.—(*C. C. Mark, Flint, Michigan, U.S.*)
823. FIRE-ARMS, F. Beesley, London.
824. EXTENSIBLE FIRE-ESCAPE LADDERS, A. M. Clark.—(*D. D. Hayes, San Francisco, U.S.*)
825. IRRIGATING GARDENS with WASTE WATER from HOUSEHOLDS, W. Blakely, Bournemouth.
826. PREVENTING TRANSMISSION of HEAT THROUGH the ROOFS of HOUSES, W. Blakely, Bournemouth.

15th February, 1883.

827. GOVERNORS, J. Whitley, Leeds.
828. COMPRESSED AIR MOTORS, R. Bolton.—(*C. W. Potter, New York, U.S.*)
829. WATER TAPS, W. J. Dunderdale, Huddersfield.
830. TREATING CERTAIN WASTE or BYE PRODUCTS, L. Howell, Glamorganshire.
831. FUSIBLE PLUGS, J. Graham, East Greenwich.
832. MACHINERY for RAISING WEIGHTS, &c., W. R. Lake.—(*A. S. de la Pena and L. Drumen, Madrid.*)
833. GALVANIC BATTERIES, F. Walker, Camberwell.
834. MATCHES and BOXES, G. W. von Nawrocki.—(*F. Gerken and G. Goliasch and Company, Berlin.*)
835. TOBACCO PIPES, J. R. S. Backhouse, Scarcroft.
836. GAS MOTOR ENGINES, J. Imray.—(*J. Schweizer, Paris.*)
837. COFFEE CUPS, C. D. Abel.—(*M. D. Pasvouri, Smyrna, Asia Minor.*)
838. BEATING, &c., CARPETS, C. Hinksman, London.
839. DESTROYING INSECT VERMIN, A. A. Akerman, London.
840. BENDING or FORMING LEAD, &c., T. Drake, Huddersfield.
841. STOPPERS for DRAWING OFF LIQUIDS in BOTTLES, E. Wright, Essex.
842. WORKING GRABS, &c., J. H. Wild, Leeds.
843. HOLDING DRY PLATES or FILMS after EXPOSURE, and for CHANGING them in the PHOTOGRAPIC CAMERA, T. Samuels, London.
844. TREATING SULPHURETTED HYDROGEN, P. J. Worsley, Bristol.
845. PIPES for SANITARY, &c., PURPOSES, H. Tugby, Woodville.
846. SADDLE BAR, M. Macleod, Malmesbury.
847. TREATING STEEL INGOTS, J. Gjers, Middlesbrough-on-Tees.

16th February, 1883.

848. LAWN TENNIS BATS, F. H. Ayres, London.
849. QUICKLY REDUCING the SPEED of a SHIP, W. B. Tully, Chowdean.
850. ELECTRICAL SELF-REGISTERING MONEY TILLS, B. W. Webb, London.
851. FASTENINGS for BOOTS, &c., C. Crowther.—(*E. A. Quincke, Ludenscheid, Germany.*)
852. STOPPERING BOTTLES, J. C. Schultz, London.
853. ROCK DRILLS, J. W. Larmuth and R. B. Howarth, Pendleton.
854. SCREW PROPELLERS, R. M. Steele, London.
855. MARKING, &c., DISTANCES, H. Smith, London.
856. REGISTERING FARES, W. Taylor, Tottenham.
857. DECORATING PASTRY, E. Raths, Switzerland.
858. COLLECTING RAIN WATER, C. Roberts, Haslemere.
859. INDELIBLE INK, H. A. Dufrené.—(*Messrs. Fonseca et Compagnie, Paris.*)
860. ADJUSTABLE RISING and FALLING PIANO STOOLS, &c., W. Hemingway, Northgate, and W. Bottomley, Brighouse.
861. PILLAR, &c., BOXES, H. Devine, Manchester.
862. FIRE-LIGHTERS, G. W. von Nawrocki.—(*C. Mohr, Berlin.*)
863. MORTICE LOCKS, A. W. Pocock, Wandsworth.
864. DRYING, &c., WHITE LEAD, J. Martin, Richmond.
865. METALLIC DOWELS, W. D. Player, Birmingham.
866. HAT-PRESSING MACHINES, H. C. Birley.—(*G. Yule Newark, New Jersey, U.S.*)
867. GENERATING, &c., ELECTRICITY, F. M. Newton, Belfast.
868. PADS, &c., for BATHS, C. Jack, London.
869. BREAKING, &c., TEXTILE PLANTS, B. J. B. Mills.—(*N. de Landtsheer, Paris.*)
870. PIANOFORTES, C. Camin, Berlin.
871. INCANDESCENT LAMPS, O. E. Woodhouse, F. L. Rawson, and W. H. Coffin, London.
872. SOFTENING, &c., HIDES and SKINS, A. M. Clark.—(*J. L. Moret, Paris.*)

17th February, 1883.

873. HOLDING ROPES USED in the NAVIGATION of SMALL SAILING BOATS, &c., A. E. Maudslay, Littlebourne.
874. PREVENTING CANDLES from GUTTERING, &c., J. B. Goodwin, London.
875. REDUCING METALS from their ORES, &c., J. Clark, London.
876. LOCK-STITCH SEWING MACHINES, L. Silverman London.
877. BILLIARD TABLES, J. Reap, Grove Park, Surrey.
878. VENTILATING SHIPS, D. Gilchrist, Pollockshields, and J. Barr, Kilmarnock.
879. BEDS or BERTHS for SHIPS, J. Hamilton, jun., and R. McIntyre, Glasgow.
880. WORKING CLOCKS or TIME-KEEPERS, J. A. McFerran, Manchester.
881. CRICKETERS' BATTING GLOVES, J. G. Heap, Manchester.
882. BOOT and SHOE TIPS, J. Foster, Kettering.
883. GIVING MEDICINE to ANIMALS, A. Patchett, Lincolnshire.
884. PRESERVING SMOKED FISH, H. J. Haddan.—(*O. Sylwasschy, Leipzig.*)
885. PLAYING ACCOMPANIMENTS on ORGANS, &c., H. J. Haddan.—(*M. van Goch, Breda, Holland.*)
886. DATING, &c., HAND STAMPS, G. K. Cooke, London.
887. MEASURING, &c., ARTICLES of CLOTHING, E. Edwards.—(*P. Guiyonnet, Paris.*)
888. LOOMS for WEAVING, J. Almond, Blackburn.
889. COOKING STOVES, &c., T. Fletcher, Warrington.
890. MAINTAINING the LEVEL of WATER in STEAM BOILERS, H. H. Lake.—(*The Automatic Safety Boiler and Engine Company (Incorporated) New Haven, U.S.*)
891. CONSTRUCTING TOBACCO PIPES, M. Perl, London.
892. PREVENTING FLUCTUATION of GAS in MAINS, &c., C. G. Beechey, Liverpool.
893. FURNACES, &c., J. C. Mewburn.—(*L. C. Voorheez, New York, U.S.*)
894. CLIPPING HORSES, J. C. Mewburn.—(*Messrs. F. Guillaume et Compagnie, Paris.*)

19th February, 1883.

895. STARCHING COLLARS, S. Barrett, Keighley.
896. PRINTING PLATES, &c., by PHOTOGRAPHIC MEANS, J. R. Meihe.—(*J. Allgeyer and C. Bolhoevener, Munich.*)
897. PRODUCING PHOSPHORIC ACID, &c., T. Twynam, Hampstead.
898. STEAMSHIP MACHINERY, J. Tweedy, Walker.
899. JOINT, &c., for ELECTRIC FITTINGS, W. Defries, London.
900. WATER HEATER, W. Carrington, Openshaw, and W. H. Bowers, Gorton.
901. PRINTING CALICO, &c., C. Hindle, Rawtenstall, and J. H. Canavan, Salford.
902. VELOCIPEDES, G. P. Smith, Tunbridge Wells.
903. FLOWER-POTS for ARTIFICIAL FLOWERS, B. Lowy, Berlin.
904. WASTE-PREVENTING CISTERNS, B. C. Cross, Leeds.
905. FIRE-GRATES, I. Dunbar, Coalbrookdale.
906. LOOMS for WEAVING, J. Williams and H. Barnes, Burnley.
907. STEEPING GRAIN, C. D. Abel.—(*Dr. L. M. R. von Markhof, Vienna.*)
908. LENSES for SIGNAL LAMPS, &c., J. Rogers, London.
909. BRICKS, &c., J. C. Bloomfield and J. McGurn, Ireland.
910. CONCENTRATING, &c., WINES, S. Pitt.—(*The Compagnie Industrielle des procédés Raoul Pictet, Paris.*)
911. MOTORS WORKED by AIR, &c., G. M. Capell, Northampton.
912. DAVITS for RAISING SHIPS' BOATS, D. Pattison, Limehouse.
913. ELECTRICAL FUSES, S. J. Mackie and J. S. Warburton, London.
914. KEYLESS WATCHES, C. Lange, London.

Inventions Protected for Six Months on Deposit of Complete Specifications.

742. COMPRESSING AIR by SUCCESSIVE EXPLOSIONS of COMBUSTIBLE GASEOUS MIXTURE, J. Imray, Southampton-buildings, London.—A communication from J. Schweizer, Paris.—*10th February*, 1883.
785. FEED-WATER PURIFIERS for BOILERS, W. P. Thompson, Lord-street, Liverpool.—A communication from C. Elliot, San Francisco, U.S.—*13th February*, 1883.
836. GAS MOTOR ENGINES, J. Imray, Southampton-buildings, London.—A communication from J. Schweizer, Paris.—*15th February*, 1883.

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

618. TREATING RAILROAD RAILS, S. P. Wilding, London.—*12th February*, 1880.
626. POINTING, &c., WIRE-CARDS, G. and E. Ashworth, Manchester.—*13th February*, 1880.
690. MAKING TILES, &c., I. B. Shaw, Tunstall.—*17th February*, 1880.
639. FILTERING, &c., FEED-WATER, A. Bell, Manchester.—*13th February*, 1880.
849. DYNAMO-ELECTRIC MACHINES, H. J. Haddan, London.—*26th February*, 1880.
652. CLEANING, &c., CARDS, J. Webster, jun., Wortley.—*14th February*, 1880.
704. TREATING WORTS, H. Daniel, Burton-on-Trent.—*17th February*, 1880.
681. LAMPS, &c., E. A. Rippingille, London.—*16th February*, 1880.
686. RIBBED PILE FABRICS, J. R. Hutchinson, Bury.—*17th February*, 1880.
718. GOVERNORS, &c., J. D. and R. D. Napier, Glasgow.—*18th February*, 1880.
727. PURIFYING MIDDLINGS, &c., W. R. Lake, London.—*18th February*, 1880.
1193. HAIR RESTORERS, S. W. Rich, Croydon.—*19th March*, 1880.
1210. SHAPING, &c., METAL BARS, W. R. Lake, London.—*20th March*, 1880.
670. ROTARY MOTOR, E. A. Brydges, Berlin.—*16th February*, 1880.
723. TOOTH BRUSHES, A. M. Clark, London.—*18th February*, 1880.
730. WHITELEAD PIGMENT, W. R. Lake, London.—*18th February*, 1880.
744. HEATING and PURIFYING WATER, J. Wright, Tipton.—*19th February*, 1880.
685. HOARDINGS, F. Sage, London.—*17th February*, 1880.
725. DISTRIBUTING CURRENTS for ELECTRIC LAMPS, J. Imray, London.—*18th February*, 1880.
761. CASTING STEEL INGOTS, J. H. Rogers, Llanelly.—*20th February*, 1880.
824. SCREW HOOKS, &c., W. H. Richards, Birmingham, and H. Skerrett, Kings Norton.—*25th February*, 1880.

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

902. MACHINERY for MOVING LAND, D. Greig and M. Eyth, Leeds.—*2nd March*, 1876.
1095. TELEGRAPHIC APPARATUS, Sir W. Thomson, Glasgow, and F. Jenkin, Edinburgh.—*13th March*, 1880.

1255. Setting and Distributing Types, B. Hunt, London.—24*th March*, 1880.
2026. Steam Pumps, J. W. Blake, Manchester.—2*nd June*, 1875.
2044. Producing Soluble Gun-cotton, F. Greening, Essex.—3*rd June*, 1875.
3867. Steam Pumps, M. Neuhaus and J. E. Hodgkin, London.—6*th November*, 1875.
651. Breech-loading Small-arms, T. Woodward, Birmingham.—17*th February*, 1876.
669. Motors for Tramway Cars, A. M. Clark, London.—17*th February*, 1876.
712. Making Retorts, W. P. Ingham and A. C. Hill, Redcar.—19*th February*, 1876.
749. Steam Engines, E. Wood, Bolton.—23*rd February*, 1876.
893. Lamp Burners, W. Morgan-Brown, London.—2*nd March*, 1876.

Notices of Intention to Proceed with Applications.

(*Last day for filing opposition*, 9*th March*, 1883.)

4817. Producing Clear Ice, T. Dowrie, London.—10*th October*, 1882.
4825. Extracting Precious Metals from Silicious, &c., Substances, J. P. Kagenbusch, London.—11*th October*, 1882.
4847. Velocipedes, J. Rettie, London.—12*th October*, 1882.
4851. Foot Rugs, W. W. Smith, London.—12*th October*, 1882.
4865. Spring Mattresses, D. E. Gardner, Glasgow.—13*th October*, 1882.
4869. Electric Lighting, W. Strickland, Woodford.—13*th October*, 1882.
4871. Range Finding, C. McG. Bate, Woolwich.—13*th October*, 1882.
4875. Preventing the Opening of Doors, &c., E. Guattari, London.—13*th October*, 1882.
4877. Stall-divisions, &c., for Stables, J. A. Hanna, and T. F. Shillington, London.—13*th October*, 1882.
4878. Galvanic Batteries, G. C. V. Holmes and S. H. Emmens, London.—13*th October*, 1882.
4882. Looms, W. Youngjohns, Kidderminster.—14*th October*, 1882.
4895. Horseshoes, E. E. Hewett, Sheffield.—A communication from A. Gauer.—14*th October*, 1882.
4898. Tricycles, &c., J. P. Dalby, Leeds.—14*th October*, 1882.
4905. Driving Pulleys &c., G. E. Sherwin, Aston.—14*th October*, 1882.
4927. Treating Silk Yarns, A. M. Clark, London.—A communication from G. Teissonnière and J. Auroy-Deslongchamps.—16*th October*, 1882.
4935. Making Paper Pulp, H. A. Dufrené, Paris.—A com. from H. da C. C. Leite.—17*th October*, 1882.
4947. Casting Pig Metal, J. T. King, Liverpool.—A com. from G. A. Leishman.—18*th October*, 1882.
4968. Razor-blades, W. R. Lake, London.—A communication from J. D. Frary.—18*th October*, 1882.
5014. Regulating Electric Currents, L. Campbell, Glasgow.—21*st October*, 1882.
5036. Water Purifiers, G. F. Redfern, London.—A communication from D. Hanna.—23*rd October*, 1882.
5057. Serving Rope with Yarn, J. H. Nute, New Glasgow, Canada.—24*th October*, 1882.
5130. Carburetting Air, H. H. Lake, London.—A communication from L. Lascols.—27*th October*, 1882.
5179. Sewing Machines, G. Browning, Glasgow.—31*st October*, 1882.
5295. Furnaces, W. Mowat, Slateford, N.B.—6*th November*, 1882.
5385. Raising Sunken Vessels, A. M. Clark, London.—A com. from P. Oriolle.—11*th November*, 1882.
5516. Handles for Carving Meat, H. H. Lake, London.—A com. from P. Carmien.—20*th November*, 1882.
5517. Ornamental Nails, &c., A. J. Boult, London.—A communication from C. E. Bailey and W. R. Talbot.—20*th November*, 1882.
5589. Apparatus for Measuring Liquids, H. H. Lake, London.—A communication from P. J. Carmien.—21*st November*, 1882.
5716. Wagons, &c., W. P. Wilson, Brockley.—30*th November*, 1882.
5939. Removing Impurities from Feed-water. A. M. Clark, London.—A communication from D. D. Wass, S. Stuart, J. C. Henderson, and T. Motley.—12*th December*, 1882.
6032. Shielding Velocipedists from Inclemency of Weather, A. Tomkins, London.—18*th December*, 1882.
6047. Bichromates, J. H. Johnson, London.—A communication from O., Adolf, and Albert Neuhaus.—18*th December*, 1882.
69. Welding Boilers, &c., S. Alley, Glasgow.—5*th January*, 1883.
246. Preserving Alimentary Substances, C. M. Pielsticker, London.—16*th January*, 1883.
259. Drilling Rocks, &c., H. H. Lake, London.—A com. from A. Cantin.—16*th January*, 1883.
315. Cylinders for Breaking Up Fibrous Materials, J. Tomlinson, Rochdale.—19*th January*, 1883.
332. Treating Sewage, J. Young, Kelly.—20*th January*, 1883.
339. Telephonic Apparatus, J. Graham, London.—20*th January*, 1883.
347. Appliances for the Game of Cricket, G. G. Bussey, London.—20*th January*, 1883.
408. Pistons, A. MacLaine, Belfast.—25*th January*, 1883.
502. Vices, A. W. L. Reddie, London.—A communication from W. H. Schofield.—30*th January*, 1883.
503. Spinning, &c., Fibrous Materials, J. Tatham, Rochdale.—30*th January*, 1883.

(*Last day for filing opposition*, 13*th March*, 1883.)

4891. Gas Stoves, G. E. Webster, Nottingham.—14*th October*, 1882.
4894. Apparatus for Heating, &c., J. Wadsworth, Manchester.—14*th October*, 1882.
4902. Compound Welded Steel Plates, &c., A. L. S. Leighs, London.—14*th October*, 1882.
4904. Washing Bottles, &c., W. W. Horner, Dulwich.—14*th October*, 1882.
4906. Steam Engines, W. Crook, Preston.—A communication from W. and H. Monk.—16*th October*, 1882.
4913. Boilers, W. H. Thompson, L. Hardacre, and J. M. Porter, Leeds.—16*th October*, 1882.
4916. Looms, J. Bywater, C. Bedford, and T. Kershaw, Birstall.—16*th October*, 1882.
4919. Synchronising Clocks, J. A. Lund, London.—16*th October*, 1882.
4920. Fastening Neckties, P. Amjorn, Comte de Sparre, Paris.—16*th October*, 1882.
4921. Voltaic Batteries, J. L. Henderson, Selhurst.—A com. from A. Blondin.—16*th October*, 1882.
4923. Velocipedes, E. H. Hodgkinson, London.—16*th October*, 1882.
4924. Fountain Pens, R. Enright, Kingsland.—16*th October*, 1882.
4932. Clogs, &c., D. Pickles, Halifax.—17*th October*, 1882.
4933. Buckles, F. J. Candy, Highfield Fen Ditton.—17*th October*, 1882.
4939. Sewing Machines, &c., W. P. Thompson, London.—A communication from the Morley Sewing Machine Company.—17*th October*, 1882.
4943. Writing Slates, J. and W. Williams, Llanfair.—17*th October*, 1882.
4954. Utilising Balloons for Photography, &c., J. Templer, London.—A communication from H. Elsdale.—18*th October*, 1882.
4958. Coverings for Locks, H. Fleming, Halifax.—18*th October*, 1882.
4959. Combing Machinery, P. Kelly, Bradford.—18*th October*, 1882.
4963. Grinding Mills, H. J. Haddan, London.—A com. from E. Schmeja.—18*th October*, 1882.
4973. Paper-cutting Machines, &c., W. Crosland, Newton Heath.—19*th October*, 1882.
4984. Chloride of Lime, G. W. von Nawrocki, Berlin.—A com. from C. Opl.—19*th October*, 1882.
5000. Making Confectionery, C. F. Müller, Magdeburg.—20*th October*, 1882.
5044. Cleaning Fats, F. C. Glaser, Berlin.—A communication from H. Schlinck.—23*rd October*, 1882.
5064. Parallel Vices, H. F. Read, Brooklyn, U.S.—24*th October*, 1882.
5106. Window-sashes, W. H. Lindsay, London.—26*th October*, 1882.
5115. Manhole Doors, &c., T. H. Collins, Winchester.—27*th October*, 1882.
5316. Silicious Copper, J. C. Mewburn, London.—A com. from E. Weiller.—7*th November*, 1882.
5355. Stays, &c., M. G. Totterdell, Landport.—9*th November*, 1882.
5382. Making Lace, L. Marceuil, Paris.—11*th November*, 1882.
5404. Winding Paper, G. W. Osborn and W. Yates, London.—13*th November*, 1882.
5406. Punching, &c., Machines, J. D. Morrison, Gateshead.—13*th November*, 1882.
5428. Steam Packing, H. W. Johns, New York.—14*th November*, 1882.
5441. Lithographic Stones, P. Stuart, Edinburgh.—15*th November*, 1882.
5617. Sharpening, &c., Saws, W. R. Lake, London.—A com. from L. Martinier.—25*th November*, 1882.
5658. Securing Buttons on Leather, W. R. Lake, London.—A communication from J. Mathison.—28*th November*, 1882.
5709. Fastening Buttons, A. J. Boult, London.—A communication from J. Wiedenmann and C. de Quillfeldt.—30*th November*, 1882.
6057. Drying Salt, S. Pitt, Sutton.—A communication from R. G. Starke.—19*th December*, 1882.
6071. Axles, &c., J. Dakers, Aberdeen.—20*th December*, 1882.
176. Lubricating Steam Cylinders, W. P. Thompson, London.—A communication from C. H. Parshall.—11*th January*, 1883.
342. Couplings of Vehicles, F. Attock, Manchester.—20*th January*, 1883.
368. Condensers, W. A. Miles, New York.—23*rd January*, 1883.
392. Friction Clutches, A. M. Clark, London.—A com. from G. N. Schœnberg.—24*th January*, 1883.
434. Treating Sewage Water, &c., J. Young, Kelly.—26*th January*, 1883.
441. Substitute for Ivory, &c., A. M. Clark, London.—A communication from S. Barbier and C. H. Coiffier.—26*th January*, 1883.
443. Steering Apparatus, J. Donaldson, Chiswick.—27*th January*, 1883.
491. Metallic Tubes, T. B. Sharp, Smethwick.—30*th January*, 1883.
493. Winding Thread upon Spools, &c., J. P. Kerr and T. Law, Paisley.—30*th January*, 1883.
508. Primary Voltaic Batteries, G. G. André, Dorking.—30*th January*, 1883.
516. Building Arches, &c., W. R. Lake, London.—A com. from T. J. Lovegrove.—30*th January*, 1883.
530. Lubricating parts of Machinery, E. B. Petrie and W. A. Entwistle, Rochdale.—31*st January*, 1883.
566. Projectiles, A. Longsdon, London.—A communication from A. Krupp.—1*st February*, 1883.
742. Compressing Air, J. Imray, London.—A communication from J. Schweizer.—10*th February*, 1882.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the* 16*th February*, 1883.)

3939. Chineeing Textiles, W. A. Barlow, London.—17*th August*, 1882.
3946. Receiving, &c., Signals, B. H. Chameroy, Maisons Lafitte (Seine-et-Oise).—17*th August*, 1882.
3951. Watermotors, S. S. Allin, Bedford Park.—18*th August*, 1882.
3958. Casting, &c., Metals, J. A. B. Bennett, King's Heath, and B. P. Walker, B'ham.—18*th August*, 1882.
3971. Insulating Compositions, C. J. Allport, London, and R. Punshon, Brighton.—19*th August*, 1882.
3979. Driving Mechanism of Tricycles, W. S. Lewis, Wolverhampton.—19*th August*, 1882.
3984. Tailors' Marking Instruments, H. Searle, London, & T. Ironside, Forest Hill.—19*th August*, 1882.
3990. Facilitating the Lighting of Fires, E. Tomlinson, London.—19*th August*, 1882.
4005. Non-conducting Tubes, J. C. Marsh and R. J. Smith, London.—21*st August*, 1882.
4009. Making Barrels, &c., W. R. Lake, London.—21*st August*, 1882.
4015. Working Gates at Crossings, C. H. Lea, Stafford.—22*nd August*, 1882.
4022. Rowlocks, S. S. Hazeland, St. Sampson's.—22*nd August*, 1882.
4033. Carburetting Gas, C. Crozat, London.—22*nd August*, 1882.
4053. Sleeper Chairs, J. MacL. Blair, Glasgow.—24*th August*, 1882.
4055. Motor Machines, T. Charlton and J. Wright, London.—24*th August*, 1882.
4061. Covers for Cans, H. J. Haddan, London.—24*th August*, 1882.
4062. Sewing Machines, H. J. Haddan, London.—24*th August*, 1882.
4081. Friction Couplings, F. C. Glaser, Berlin.—26*th August*, 1882.
4111. Dynamo-electric Machines, H. H. Lake, London.—28*th August*, 1882.
4117. Washing Tennis Balls, &c., A. S. Openshaw, Birmingham.—29*th August*, 1882.
4127. Electric Controller, &c., T. Wright, Malta.—29*th August*, 1882.
4130. Making Boxes, H. J. Haddan, London.—29*th August*, 1882.
4160. Telephonic Instruments, J. D. Husbands, London.—31*st August*, 1882.
4167. Boat-disengaging Apparatus, C. Mace and J. Brewster, Sunderland.—1*st September*, 1882.
4172. Frames of Bags, &c., V. Huppe, Offenbach-on-the-Main, Germany.—1*st September*, 1882.
4203. Drying Animal and other Matter, J. F. Johnstone, London.—4*th September*, 1882.
4212. Treating Carbonised Material, J. H. Johnson, London.—5*th September*, 1882.
4227. Fire-escapes, A. M. Clark, London.—5*th September*, 1882.
4233. Machines for Packing Flour, &c., J. Joyce, Edmonton.—6*th September*, 1882.
4250. Dynamo-magnetic Electric Machines, T. Donnithorne, London.—6*th September*, 1882.
4270. Generating Electricity, W. R. Lake, London.—7*th September*, 1882.
4328. Cock or Tap, W. Bright, Exeter.—12*th September*, 1882.
4346. Mechanical Pianofortes, &c., W. R. Lake, London.—12*th September*, 1882.
4372. Cleaning Grain, J. and R. M. Davidson, Newcastle-upon-Tyne, and A. Miller, Gateshead.—14*th September*, 1882.
4496. Making Wire Nets, M. A. F. Mennons, Paris.—20*th September*, 1882.
4548. Transporting Goods, &c., by Electricity, F. Jenkin, Edinburgh.—23*rd September*, 1882.
4601. Apparatus for Hauling Vehicles by Cables, W. R. Lake, London.—27*th September*, 1882.
4602. Vessels for Liquids, G. A. J. Schott, Bradford.—28*th September*, 1882.
4659. Treating Sewage, J. Young, Kelly.—30*th September*, 1882.
4713. Elevators, W. Clark, London.—3*rd October*, 1882.
4789. Typefounding, A. J. Boult, London.—7*th October*, 1882.
5559. Ordnance, J. Vavasseur, London.—22*nd November*, 1882.
5671. Obtaining Colouring Matters, C. D. Ekman, London.—29*th November*, 1882.
5927. Making Bichromate of Potash, F. C. Glaser, Berlin.—12*th December*, 1882.
5989. Bichromate of Soda, C. D. Abel, London.—15*th December*, 1882.
6055. Car-couplings, A. J. Boult, London.—19*th December*, 1882.

(*List of Letters Patent which passed the Great Seal on the* 20*th February*, 1883.)

3476. Carpets, J. H. Braithwaite, Kendal.—21*st July*, 1882.
3564. Furnaces for Kilns, &c., B. Finch, London.—27*th July*, 1882.
4002. Kitchen Ranges, R. W. Crabtree, Leeds.—21*st August*, 1882.
4018. Cleaning Tin-plate, B. Williams, Cardiff.—22*nd August*, 1882.
4023. Preparing Book Covers, R. Birdsall, Northampton.—22*nd August*, 1882.
4026. Skates, C. G. Beddoe, London—22*nd August*, 1882.
4032. Making Glass Bottles, T. Pyke, South Shields.—22*nd August*, 1882.
4034. Generation, &c., of Electricity, J. S. Williams, London.—22*nd August*, 1882.
4035. Metal Cans, J. A. Lloyd, London.—23*rd August*, 1882.
4040. Mechanical Stokers, J. Proctor, Burnley.—23*rd August*, 1882.
4042. Steel for Corsets, J. S. W. Whitehead, Halifax.—23*rd August*, 1882.
4045. Signalling Apparatus, H. Diggins and A. Glück, London.—23*rd August*, 1882.
4048. Dye Stuff, F. Wirth, Frankfort-on-the-Main.—23*rd August*, 1882.
4052. Carriage, H. Lloyd, Liverpool.—24*th August*, 1882.
4058. Spinning Fibres, H. Illingworth, Bradford.—24*th August*, 1882.
4069. Getting Coal, C. G. Robinson, Barnsley.—25*th August*, 1882.
4120. Self-indicating Urn, &c., R. W. Raphael, Ballymoney.—29*th August*, 1882.
4135. Valve Motions, &c., A. C. Kirk, Glasgow.—30*th August*, 1882.
4137. Flanging Holes in Metal Plates, A. C. Kirk, Glasgow.—30*th August*, 1882.
4147. Galvanic Batteries, S. H. Emmens, London.—30*th August*, 1882.
4176. Printing Machines, W. S. Hope, London.—1*st September*, 1882.
4187. Breech-loading Small-arms, E. James, Birmingham.—2*nd September*, 1882.
4225. Pitch Chains, &c., S. Pitt, Sutton.—5*th September*, 1882.
4275. Making White Lead, W. V. Wilson, London.—8*th September*, 1882.
4281. Treating Peat, &c., S. Heimann, London.—8*th September*, 1882.
4497. Gas Lamps, I. Spielmann, London.—21*st September*, 1882.
4977. Shives, &c., W. Rose, Halesowen.—19*th October*, 1882.
5048. Fastening Umbrellas, H. H. Lake, London.—23*rd October*, 1882.
5225. Axles, &c., of Vehicles, H. Weatherill, Manchester,—2*nd November*, 1882.
5267. Couplings for Vehicles, W. Wright and J. Pethick, Plymouth.—4*th November*, 1882.
5922. Brushes, S. Pitt, Sutton.—12*th December*, 1882.
5949. Safety Apparatus for Ships' Holds, R. C. Scott, Liverpool.—13*th December*, 1882.
17. Electric Lighting Systems, S. Pitt, Sutton.—1*st January*, 1883.

List of Specifications published during the week ending February 17th, 1883.

3725*, 4d.; 2773, 2d.; 2819, 2d.; 2961, 6d.; 2971, 6d.; 2980, 6d.; 3007, 6d; 3011, 2d; 3021, 6d.; 3032, 6d.; 3049, 4d.; 3057, 6d.; 3075, 6d.; 3080, 6d.; 3081, 4d.; 3094, 6d.; 3095, 6d.; 3098, 2d.; 3103, 4d.; 3115, 6d.; 3120, 6d.; 3128, 6d.; 3140, 6d.; 3141, 2d.; 3142, 6d.; 3143, 6d.; 3144, 6d.; 3148, 6d.; 3149, 6d.; 3151, 6d.; 3153, 10d.; 3154, 3s. 6d.; 3155, 2s. 2d.; 3157, 6d.; 3159, 6d.; 3162, 6d.; 3165, 2d.; 3167, 6d.; 3170, 4d.; 3177, 8d.; 3179, 2d.; 3180, 2d.; 3183, 6d.; 3185, 4d.; 3189, 2d.; 3194, 6d.; 3196, 6d.; 3200, 4d.; 3206, 2d.; 3207, 4d.; 3210, 8d.; 3211, 4d.; 3217, 2d.; 3219, 2d.; 3223, 6d.; 3225, 6d.; 3228, 4d.; 3241, 2d.; 3243, 2d.; 3248, 6d.; 3251, 6d.; 3252, 6d.; 3256, 6d.; 3259, 6d; 3281, 6d.; 3293, 1s.; 3313, 6d.; 3323, 4d.; 3367, 6d.; 5340, 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.*

2773. Setting out Lawn Tennis Courts, *A. R. Cobbett, Pall Mall.*—13*th July*, 1882.—(*Provisional protection not allowed.*) 2*d.*

This relates to apparatus for correctly marking out lawn tennis courts.

2819. Giving Publicity to Advertisements, &c., *P. M. Justice, London.*—15*th July*, 1882.—(*A communication from E. Brenta, Brussels.*)—(*Provisional protection not allowed.*) 2*d.*

This relates to an arrangement of mirrors so as to reproduce any advertisement a number of times.

2823. Generating and Storing Electric Energy, &c., *C. Westphal, Berlin.*—15*th June*, 1882. 8*d.*

The object of this invention is to produce electric currents from the gaseous compounds of coal, and so avoid the roundabout method of producing them by means of a steam engine and dynamo machine. The principle of the invention consists in producing a constant current of electricity by means of water gas or generator gas and oxygen—that is to say, by using these gases for artificially producing on plates the state assumed by electrodes during the electrolytical decomposition of water, which state is the cause of the production of polarisation currents. The patent describes the apparatus employed by the inventor to accomplish his object.

2990. Apparatus or Machinery for Generating, Controlling, and Utilising Electric Currents, *J. H. Johnson, Lincoln's-inn-fields.*—23*rd June*, 1882.—(*A communication from La Compagnie Electrique, Paris.*) 6*d.*

This relates, First, to improvements in dynamo machines, having Gramme ring armatures and electro-magnets provided with multiple armatures which completely surround the apparatus, so as to render them fit for use as generators and motors for the transmission of power; Secondly, to the regulation of the speed of the motors in this respect, the invention claims "the combination of electric generators of feeble residual magnetism sending a current to motors possessing great residual magnetism, and their application to electrical purposes as described."

2961. Flushing Water-closets, Traps, and Urinals, *J. Harsant, Wandsworth.*—22*nd June*, 1882. 6*d.*

A tank to hold the water for each flushing is supplied by a ball valve, and through its bottom ascends a discharge pipe, the mouth of which is above the water level. The pipe is surrounded by a tube closed at top, and the bottom of which descends to near the bottom of the tank, thus forming a syphon. A displacer actuated by a pull descends into the tank and fills the upper part of the tube, thus setting up a syphon action. The discharge pipe divides into two branches, one leading to the overflow trap of the basin, and the other to the safe trap on the discharge pipe below the basin.

2971. Furnaces for Melting Glass, *E. Potter, Stairfoot, York.*—22*nd June*, 1882. 6*d.*

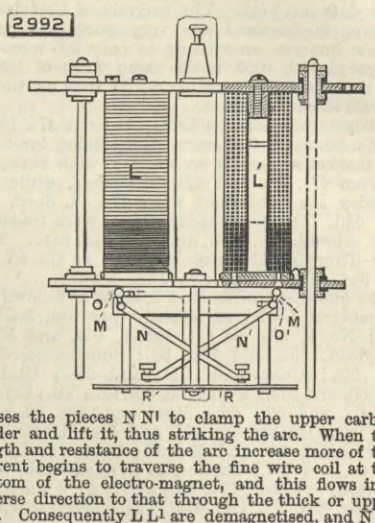
This relates to an arrangement of regenerative gas tank furnace and mode of charging the same, and also to keeping the bottom of the tank cool. It consists, First, in forming the regenerative gas furnace with an offshoot or wing portion for melting purposes; Secondly, in forming a charging hole in the crown of the furnace, so that the raw material is charged through the same, a fixed or portable hopper being provided; and Thirdly, in constructing tank furnaces with sloped or stepped bottoms, or bottoms deepest at the working-out end, the block forming the bottoms being supported on iron pillars and cold air caused to circulate in the space below the blocks.

2980. Horseshoes, &c., *J. C. Mewburn, London.*—23*rd June*, 1882.—(*A communication from L. G. Claude, New York.*) 6*d.*

This relates to the manufacture of horseshoes of iron with a steel centre or core at one heat. A composite pile, consisting of two bars of iron with a groove in the face of each to receive a bar of steel, is heated and passed through rolls to reduce it to the proper shape and size. Other rolls form the toe and heel calks, and the creases and holes to receive the nails in the bar, which is then cut in lengths forming blanks, which by an endless chain are delivered to a bending clip forming machine of special construction.

2992. Regulating the Action of Electric Arc Lamps, *W. R. Lake, London.*—23*rd June*, 1882.—(*A communication from J. M. A. Gérard Lescuyer, Paris.*) 8*d.*

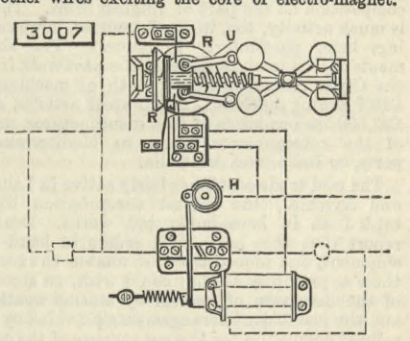
The illustration shows the method of regulation adopted. The action of the apparatus is as follows:—The carbons being in contact, the current circulates around cores L L¹, and draws them up. In rising they lift cross-bar M, which by means of small links O O¹



causes the pieces N N¹ to clamp the upper carbon holder and lift it, thus striking the arc. When the length and resistance of the arc increase more of the current begins to traverse the fine wire coil at the bottom of the electro-magnet, and this flows in a reverse direction to that through the thick or upper coil. Consequently L L¹ are demagnetised, and N N¹ descend until they come into contact with disc R, when they release the carbon holder.

3007. Machinery for the Regulation of Speed in Machinery Driven by Electricity, &c., *Fleeming Jenkins, Edinburgh.*—24*th June*, 1883. 6*d.*

The invention is illustrated in the accompanying engraving, which represents an arrangement of governor and governing relay. Suppose the speed of the machine to which the current is being transmitted exceeds the limit; spring V has been so adjusted that slider U will bring springs 2 and 3 into contact, pressing them together by spring 1, which is insulated from the other two. Spring 2 is connected by wire with terminal H, and therefore a current instantly traverses the other wires exciting the core of electro-magnet.



The resistance of the electro-magnet coils is such that only a suitable portion of the main current is diverted through the magnet. The armature and lever are instantly pulled over, breaking the current through the machine and making contact. Part of the current is now flowing through to the frame, and part through the resistance coil to frame. If the speed of the machine should be such as to bring the slider of the governor into contact with spring 4, the circuit of the receiver will be closed.

3010. Improvements in Electric Lamps with Incandescent Conductors, *W. E. Debenham, London.*—26*th June*, 1882. 4*d.*

To obviate the evil caused by the unequal expansion of the glass and platinum conductors of incandescent lamps, the inventor takes two samples of glass, one having a higher the other a lower coefficiency of expansion than the platinum, and mixes these two samples together, to render the resultant as near as possible of the same coefficiency of expansion as the platinum. The carbons he makes of sewing cotton soaked in a solution of gluten dissolved in alcohol. Other improvements are described.

3021. Detaching Hooks, *J. King, Derby.*—27*th June*, 1882. 6*d.*

This relates to improvements on patent No. 1105, A.D. 1879, and consists in forming in each outer plate of the hooks described a vertical slot, the inner plates having each a corresponding slot, but made wider at bottom than at top. These slots are between the slots which release or hold the shackle pin and the upper hole for the axle pin. When the hauling chain is carried away by overwinding, the axle pin is removed and inserted in the upper hole, and upon the shackle being brought back the shackle pin is taken out and passed through one hole in the shackle and through the upper slots in the four plates, then through the other hole in the shackle, thus enabling the engine to lift the cage.

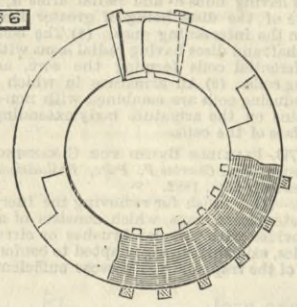
3032. Safety Lamps, *W. Jenkins and D. Morgan, Glamorgan.*—27*th June*, 1882. 6*d.*

This consists, First, in the employment of a tube arranged in the interior of the lower part of the ordinary wire gauze of safety lamps of the Davy type, such tube having a cup or cover of wire gauze; Secondly, in safety lamps of the Cluny type, the employment of a tube arranged in the lower part of the wire gauze in combination with passages above or below the glass for the admission of only sufficient air to the burner to support combustion.

3036. Dynamo-electric Machines, *W. E. Ayrton, F.R.S., and J. Perry, Finsbury.*—27*th June*, 1682. 6*d.*

The First part of the invention consists in the use of field magnets made of steel and iron combined; either a steel tube enclosing an iron core, or *vice versa*, or alternate plates of the two metals. The inventors find that with this arrangement a dynamo will behave like a combination magneto and dynamo machine, and that great constancy is the result. The Second part relates to the winding of any ring armature. The ring is made of two pieces joined together, so that the screws are flush with the ordinary sur-

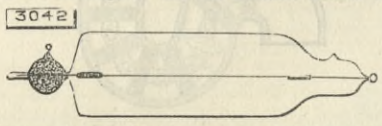
faces of the ring. The coils are slipped on these halves, and between every two is also slipped a ring of wrought iron, out of which a small portion is cut at one place, so that the ring is incomplete, as shown in the figure. This is to prevent induction currents. Other parts of the invention relate to a method of connecting up when any even number of



pairs of field magnets are used near the armature, and to the use of an armature core of phosphor bronze, or brass or steel, with a great many rivets of soft iron passing through it.

3042. INCANDESCENT ELECTRIC LAMPS, *F. L. Willard, London.*—28*th June*, 1882. 6*d.*

The invention relates to a method of avoiding fracture of the filaments of incandescent lamps through being rigidly connected to the leading-in wires, and so allow for a certain amount of contraction and expansion. To accomplish this the inventor inserts the



platinum wires into the two ends of a cylindrical glass bulb, as shown in the figure, in which he places the filament. This bulb has at its base a small bulb containing mercury. The filament is made from a species of veneer called "white lines," carbonised. One end of it is cemented with a mixture of coal-tar and coke-dust to one leading-in wire, and the other end to another piece of platinum wire, which dips into the mercury, the other leading-in wire being fused into the small end of the bulb and in contact with the mercury.

3047. TELEPHONIC RECEIVERS, *W. Spence, Chancery-lane.*—28*th June*, 1882.—(*A communication from M. Kotgra, Paris.*) 6*d.*

The chief peculiarity in this invention is the construction of the compound magnet and the soft iron armature. The magnets are composed of multiple bars separately magnetised and solidly bound together. The polar extremities carry the soft iron cases of the bobbins, and the whole forms a magnet which is a sort of interrupted frame.

3049. ARTIFICIAL STONE, *R. Searle, Hackney.*—28*th June*, 1882. 4*d.*

This relates to the manufacture of artificial stone, the cementitious portion of which is Portland cement, and which is mixed with artificially heated water, the air being withdrawn from the materials by any known mode of exhaustion during the mixing.

3054. REGULATING THE PRODUCTION OF ELECTRICITY, *J. C. Mewburn, London.*—28*th June*, 1882.—(*A communication from F. Rigaud, Paris.*)—(*Not proceeded with.*) 2*d.*

This consists in modifying the speed of the electric generator according to the state of the current, so as to keep constant the difference of potential without changing the speed of the engine.

3057. CHUCKS FOR TURNING LATHES, *H. H. Lake, London.*—28*th June*, 1882.—(*A communication from L. Frobeen, Berlin.*) 6*d.*

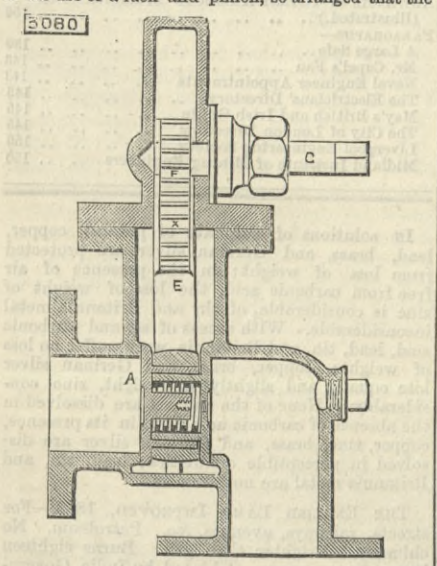
A head or block is formed with three or more recesses to receive guide pins. A ring on the block has a cylindrical recess to receive a worm which gears with teeth on the side of the block, and can be turned by a handle. The ring has near its periphery vertical grooves opposite the guide pins. A suitable number of lever plates have near one end a hole fitting the pins, and near their opposite ends a projection to fit the groove in the ring. The lever plates with their holes are slid alternately over the guide pins, so that they are fulcrumed at the pins, their opposite ends resting in the grooves of the ring, so that they will be rotated by the latter. A cover is screwed down upon the lever plates and also bears on the upper part of the ring. The article to be held is inserted in a central aperture, and by turning the worm the lever plates will be caused to grip or release the same.

3075. FURNACES OF STEAM BOILERS, *W. Bell, Lancaster.*—29*th June*, 1882. 6*d.*

This consists, First, in providing the flues of steam boilers with an arch, which leaves a small space between itself and the inner side of the flue, the arch forming a return flue closed at the end nearest the fire; Secondly, combining with such arch a division, so as to form with the same parallel flues or passages; and Thirdly, combining with the arch air tubes to conduct air to the products of combustion as they pass into the space above the arch.

3080. STOP VALVES, *J. A. and J. Hopkinson, Huddersfield.*—30*th June*, 1882. 6*d.*

The object is to increase the efficiency of the valves described in patent No. 4586, A.D. 1881, and it consists in the use of a rack and pinion, so arranged that the



valve may be fully opened and closed by slightly turning the pinion. The valve spindle E, which carries the valve A, has a rack X formed on its upper end, and with it the pinion F engages, such pinion being mounted on the spindle G, which is turned by a key, lever, or wheel.

3081. SWIVEL FOR MANUFACTURE OF JEWELLERY ORNAMENTS, *W. Skelhorn, Hatton Garden.*—30*th June*, 1882. 4*d.*

This relates to the construction of a ball-and-socket joint, for connecting different portions of articles of jewellery.

3094. WASHING OR CLEANSING WOOL, *J. and F. W. Petrie, Rochdale.*—30*th June*, 1882. 6*d.*

This relates to the transferring of the wool from the washing trough to the squeezing rollers by means of sliding bars, which are situated and suitably carried and actuated from the outside of the trough. The squeezing rollers are formed of loose wool compressed into discs, and mounted on a suitable spindle.

3095. OVERFLOW OF VALVE CLOSETS, *H. Conolly, Hampstead-road, and A. E. Hubert, Chelsea.*—30*th June*, 1882. 6*d.*

The object is to provide an overflow which shall always be sealed while there is water in the basin, which cannot be stopped up or choked, and the water therein will always be completely changed when the closet is used. A pipe is made outside and in one piece with the basin, and opens into the inside near the bottom. This pipe rises outside the basin to the height the water is required to stand inside, and is then bent over and carried to the discharge pipe of the closet. The opening into the basin is smaller than the overflow pipe, which will thus be prevented from choking, and if any material is washed into it when the bottom basin is opened the material will be drawn down the pipe back to the basin and be discharged through the valve.

3097. SECONDARY BATTERIES, *A. Watt, Liverpool.*—30*th June*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to the construction of plates by pouring an alloy of lead and zinc in a molten state into water. It thus assumes a granulated form, and is afterwards pressed into cohering masses or slabs.

3098. PENCILS, *J. D. Sprague, Upper Norwood.*—30*th June*, 1882.—(*Provisional protection not allowed.*) 2*d.*

The object is to enable pencils to draw either fine or thick lines without sharpening the same, and it consists in forming the leads in flat strips and fitting them in a suitable case. The edge of the pencil will make a fine line, while by holding it obliquely or using the width of the leads, the lines formed can be regulated in width.

3101. AN IMPROVED ARC ELECTRIC LAMP, *R. H. Courtenay, Southampton-buildings.*—30*th June*, 1882. 6*d.*

This relates to a peculiar gripping arrangement for regulating the carbons. One or more solenoids are so arranged that each shall draw up cores, which lift a small slotted plate, the sides of the slots being of a taper or wedge shape. In each of the slots are placed movable blocks, which grip the upper carbon when the current energises the solenoids, thus lifting the rod and striking the arc. The blocks are retained in position by springs.

3103. BRICKS AND TILES, *W. A. McJ. Valon, Ramsgate.*—1*st July*, 1882. 4*d.*

The bricks are rabbeted on at least four sides, and when fitted together with each joint broken a more efficient and gas and air-tight structure can be built than hitherto.

3108. SECONDARY BATTERIES OR MAGAZINES OF ELECTRICITY, &c., *H. J. Haddan, Kensington.*—1*st July*, 1882.—(*A communication from C. F. Brush, Cleveland, Ohio, U.S.*) 2*s.* 4*d.*

To form the plates the inventor takes two ordinary lead plates in dilute sulphuric acid, and charges them in such a manner that a coating of peroxide of lead of sufficient thickness is formed on both of them; these plates are then associated together in the usual manner, and charged so that one of the plates remains uncharged, and constitutes the oxygen element of the battery, while the other has its charge reversed, and constitutes the hydrogen element. According to another part of this invention, the plates before the process of forming are coated electrolytically with a deposit of coherent lead, with grooved plates. The inventor employs special means to make the deposit of coherent lead thick in the grooves. Another part relates to the covering of plates with porous metal, reduced from oxides by reducing gases. Another part relates to the construction of plates of masses of finely-pulverised metallic lead and lead oxide in an intimately mixed condition, pressed hydraulically together into a compact mass. Other methods of forming plates are also described, as well as methods for charging batteries.

3115. STEAM GENERATORS, *S. P. Martin, Vienna.*—1*st July*, 1882. 6*d.*

This relates to a method of heating the surface of water for the production of steam, and based on the principle that the pressure of steam depends on its temperature. A hermetically-closed furnace has the upper part lined with refractory material, and the lower part forms the boiler. On the furnace is mounted the valve-box of an engine, the piston of which is propelled from the back, the front part acting as an air compressor. A tube conducts the air compressed into an envelope, and by dampers on to and under the grate. Concentrically above the grate is a feed hopper with double closing arrangements, and its lower collar is provided with a thread to serve as an obturator between the furnace and the chimney, the same being raised or lowered by suitable handles.

3120. IMPROVEMENTS IN GALVANIC BATTERIES, *J. H. Davies, Ipswich.*—1*st July*, 1882. 6*d.*

This relates to the production of currents by the combination with oxygen of carbon or carbon compounds. The inventor claims the use of batteries in which a mixture of coke and coal is employed as the positive element, and is consumed by, or enters into, combination with the oxygen of a liquid substance forming the electrolyte. The use as the negative element of conductors of perforated metal, or a metal netting, these conductors having gas or vapour passed in contact with them, &c. &c.

3128. ELECTRIC LOGS OR APPARATUS FOR ASCERTAINING THE SPEED OF SHIPS, &c., *R. M. Lowne, Finchley.*—3*rd July*, 1882. 6*d.*

The inventor employs a rotator similar to an ordinary mechanical ship's log, the cable attached to which contains two insulated wires, which are connected respectively to a recording apparatus on the ship and to the rotator under water. The rotator is made to make and break an electrical circuit at every given number of revolutions so as to operate the recording apparatus on board ship, and thereby record the number of revolutions of the rotator. The inventor claims the machinery required to carry out the invention, and also novel methods of establishing connection between the battery poles and the rotator.

3129. MACHINES FOR GENERATING ELECTRICITY, *T. Varley, Walthamstow, and H. B. Greenwood, Monmouth-road.*—3*rd July*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to a novel construction and arrangement of the field magnets and of the parts in connection therewith.

3140. LADDER TAPES FOR VENETIAN BLINDS, *T. French and J. Monks, Manchester.*—4*th July*, 1882. 6*d.*

This relates to improvements in machines for weaving ladder tapes all in one piece, and it consists—instead of mounting four sets of jacks consisting of four each at different levels, whereby the fulcrums are arranged one behind the other—in arranging two sets of jacks of eight each at two different levels, whereby such jacks are capable of being balanced, or nearly so, on their fulcrums, and thus require the minimum power to work them. By this arrangement the jacquard mechanism for operating the healds can be simplified, and instead of using at least ninety-six hooks as hitherto, only sixteen hooks are used, and are elongated so as to obtain the desired extra lift.

3142. SUBMARINE TELEGRAPH CABLES, *G. E. Vaughan, Chancery-lane.*—4*th July*, 1882.—(*A communication from S. Trott and F. A. Hamilton, Halifax, Nova Scotia.*) 6*d.*

The object of this invention is to prevent any twisting asunder of the cable when being made or laid, and the consequent breakages often engendered thereby. The inventors obviate this by winding the insulated core with alternate left and right-handed layers of yarn, one over the other.

3141. FRAMES FOR LOOKING-GLASSES, &c., *B. M. Simmons, D. A. Lowthime, and J. H. Tree, London.*—4*th July*, 1882.—(*Provisional protection not allowed.*) 2*d.*

This relates to covering frames of looking-glasses, &c., with embossed velvet, plush cloth, and leather.

3143. GRAPNELS, *G. E. Vaughan, London.*—4*th July*, 1882.—(*A communication from S. Trott and H. Kingsford, Canada.*) 6*d.*

This relates to grapnels for submarine telegraph cable and torpedo work, or other operations of a like nature, such grapnels being so constructed and fitted that the presence of the cable on the same will be indicated by electrical means at any desired distance, the pressure of the cable causing such indication. Through the stem of the grapnel passes an insulated wire, which forks out at the bottom and enters a hole drilled through each prong of the grapnel, and is embedded in an elastic insulating material, the end of the wire terminating in a conducting surface. A plunger works in the top of the hole in each prong, and when forced inwards by the cable a pin attached to it comes in contact with the end of the wire, and so completes the circuit.

3144. BARB WIRE FOR FENCES, *F. C. Glaser, Berlin.*—4*th July*, 1882.—(*A communication from A. Schniewindt, Westphalia.*) 6*d.*

The wire passes in an oblique direction through two excentric stamps, which cut a splint off the wire, such splints being bent downwards or upwards by means of an oblique guide piece attached to the cutter.

3148. VENTILATION OF WATERPOOF RAIN-CLOAKS, &c., *A. Sachs, Berlin.*—4*th July*, 1882. 6*d.*

This relates to the use of various forms of ventilators preferably in connection with the buttons of waterproof garments, and serving to establish communication between the outer atmosphere and the space enclosed by the garment.

3149. PLOUGHS FOR CUTTING OPEN DITCHES OR GUTTERS, *T. T. Mallett, Somerset.*—4*th July*, 1882. 6*d.*

This consists of an ordinary long-framed iron plough fitted with a flat sole, in front of which is a wide point or share, one side of which slopes away under the mouldboard, and the other, after similarly sloping for a short distance, is notched into the width of the sole, this share being raised or lowered by being pivotted on a pin, and having a continuation of it running back and adjusted by a screw and lock nuts. On the top of the share is the delivery board, which rises in a curve and runs back and to one side, by which means the sod as it is cut is lifted out of and laid parallel with the gutter and unturned. On the side of the delivery board is the mouldboard, adjusted laterally by a screw stay. Two disc coulters are carried by the plough beam, and can be adjusted to regulate the depth and width of the gutter.

3151. SEWING MACHINES, *F. Wirth, Germany.*—4*th July*, 1882.—(*A communication from Junker and Ruh, Germany.*) 6*d.*

Under the plate is a block with three arms connected with a ring, which carries the guide for the feed-bar and a cheek and a hollow boss, in which a pin is fitted. Close to the block is an excentric on the main shaft, and a driver is connected therewith. There is a groove in the ring and also an opening at the top, within which a shuttle rotates, being actuated by the driver. The excentric actuates a bent rod guide at one end by means of sliding pieces on the pin, whilst the other end transmits motion by a bolt to a link piece connected to the feed-bar. The motion of the feeder secured to the feed-bar is regulated by a stitch-regulating lever. The needle is set by means of a wedge-shaped piece, which is pressed against the needle by a set screw.

3153. GENERATING AND USING GAS FOR FURNACES, *W. F. Browne, London.*—4*th July*, 1882—(*Complete.*) 10*d.*

This relates to a process for generating heating or illuminating gases in furnaces, wherein a portion thereof is discharged into the furnace for combustion, and the heat of which generates the gas, while the surplus heat is utilised for other purposes. The generator consists of a pipe bent into a coil, into one end of which water or steam and combustible liquids are forced by a pump or injector, and when the pipe is highly heated gas or a gaseous fuel will be discharged from the other end, which is connected to a hollow grate, provided with outlets for the discharge of the gas into the furnace where it is burned.

3154. MANUFACTURING AND STORING GAS, *W. F. Browne, London.*—4*th July*, 1882. 3*s.* 6*d.*

This relates to a process and to the means for generating gases under high or low pressure, for motive power, heating, and illuminating purposes; and it consists in the general construction and arrangement of the apparatus employed, there being twenty-four sheets of drawings and fifty-eight claims. In the generating apparatus a coil is employed, into which steam and carbon liquids are injected, and by becoming heated in their passage through the are converted into gas.

3155. EVAPORATING LIQUIDS, *W. F. Browne, London.*—4*th July*, 1882. 2*s.* 2*d.*

This relates to a process and to apparatus, which can be made stationary or portable, for the manufacture of syrups and sugar from saccharine juices, and also to the mode of evaporating liquids from organic or inorganic matter, which may be held in solution or suspension in said liquids. A great feature is the portable character of the machinery and appliances. The saccharine juices are forced through a series of coiled pipes, and in circulating through which it is gradually heated. There are fourteen sheets of drawings and forty-nine claims.

3157. HYDRAULIC MOTOR, *G. W. von Nawrocki, Berlin.*—4*th July*, 1882.—(*A communication from F. K. Theiss, A. Meckel, and L. A. Simons, Germany.*) 6*d.*

This consists in connecting with a water supply tank a series of syphons, in such a manner that the first syphon draws water from the tank, and discharges it through a bend into the inlet pipe of the second syphon, and so on to the last syphon, which discharges the water into a tank, each syphon containing a turbine, which is driven by the water passing through. A portion of the power obtained may be used to drive a pump to lift the water back into the supply tank.

3159. EXTRACTING GREASE FROM BONES, &c., *G. W. von Nawrocki, Berlin.*—4*th July*, 1882.—(*A communication from J. Wellstein, Germany.*) 6*d.*

This relates to a method of extracting grease from bones by means of solvents capable of being evaporated, and consists in producing a vacuum in the extractor, drawing in the solvent by suction, extracting grease by heating the extractor after having been hermetically closed, separating or recovering the solvent in the extractor itself after the extraction of grease, evaporating the solvent remaining in the extractor, and drawing off the recovered fat into a purifier. The apparatus to carry on the operation is also claimed.

3160. REGULATING THE CURRENTS IN DYNAMO ELECTRIC MACHINES, *W. R. Lake, London.*—4*th July*, 1882.—(*A communication from J. Carpentier, Paris.*)—(*Not proceeded with.*) 4*d.*

This relates to a method of graduating the inducing current by periodical interruptions.

3162. DRESSING OR PREPARING ORES, *F. Wirth, Germany.*—4*th July*, 1882.—(*A communication from H. Hockstrate, Germany.*) 6*d.*

This relates to a method and apparatus for dressing or preparing ores, in which the lighter particles are winnowed out by an air current, and the heavier particles dressed or separated by means of water. The crushed ore is delivered by a revolving screen and falls into hoppers, from each of which it is delivered to winnowing and dressing apparatus, by which it is subjected to a current of air, and the lighter particles carried to a dust chamber. The ore is then fed to a vertical spout in which there is an ascending current of water, by which the lighter parts are carried off while the heavier parts sink to the bottom.

3161. INCANDESCENT LAMPS, *A. R Leask, Holborn Viaduct.*—4*th July*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to the construction of the globes of incandescent lamps, and to a method of fitting the carbon filaments and a conducting wire.

3165. EDUCATIONAL GAMES, &c., *A. J. Boult, London.*—4*th July*, 1882.—(*A communication from J. Froin, Paris.*)—(*Provisional protection not allowed.*) 2*d.*

This relates to a game by means of which geography can be learned in a manner interesting to the player.

3167. RAILWAY SIGNALLING APPARATUS, *D. Knight, Cambridge.*—5*th July*, 1882. 6*d.*

This relates to apparatus for signalling, being especially useful in dark or foggy weather, and consists in an arrangement for automatically manipulating a hammer or trigger for exploding detonating signals or striking a gong, in such manner that the trigger is put in gear ready for exploding or striking from the signal cabin as the semaphore arm is raised or lowered, at the same time that a rod carrying the signal lights is revolved by the detonating apparatus.

3170. PAVEMENT AND SHIP DECK LIGHTS, *T. G. Webb, Manchester.*—5*th July*, 1882. 4*d.*

This consists in constructing glass blocks with the underside in the form of a half or smaller segment of a plane-convex lens, the plane surface being uppermost and towards the light, whilst the convex surface is downwards and turned towards the place to be lighted.

3175. ELECTRIC INSULATING APPARATUS, &c., *W. F. Bottomley, Wood Green, J. H. Barry, Rendlesham-road, and J. J. Lundy, Upper Thames-street, London.*—5*th July*, 1882. 4*d.*

To obtain an improved covering material for the preservation of electric apparatus, the inventors dissolve leather with dilute muriatic and chloride or sesquichloride of iron, or with caustic soda or other suitable solvents, which solvents may be expressed therefrom or neutralised therein as convenient. The inventors also claim the use of animal, mineral, or vegetable pitch combined with raw or boiled linseed or other drying oil, and either with or without dissolved leather, osseine, glues, gutta-percha or gum, as an insulating material.

3176. INSULATING COMPOUNDS, *M. Mackay, Mansion-street.*—5*th July*, 1882. 4*d.*

The inventor combines by heat at from 100 to 212 deg. Fah. mineral wax, such as paraffine or ozokerit wax, vegetable tar (wood tar), shellac, and asbestos, in the proportions of—wax, 1; wood tar, 24; shellac, 32; asbestos, 32. This composition may also be employed for forming moulds for electro-plating purposes.

3177. HORSESHOES, *W. R. Lake, London.*—3*rd July*, 1882.—(*A communication from F. A. Roe, New York.*) 8*d.*

This relates to the manufacture of spring horseshoes and the machinery therefor, and comprises the use of novel dies. The blank cut from a bar of metal is heated and subjected to the action of dies having their curved surfaces grooved, one groove having a recess to form the heel calk, other grooves receive the blanks edgewise. Only one half of the length of the blank is pressed into shape at a time. Other dies cut the ends of the blank to form the rear of the spring, which is made on an incline or bevelled so as to rest against the heel of the shoe proper. The crease is formed by other dies, and the blank is then bent.

3179. SUGAR, *E. T. Hughes, London.*—5*th July*, 1882.—(*A communication from E. Wernickenck, Moscow.*)—(*Not proceeded with.*) 2*d.*

A mould in the form of a rectangular box is divided into compartments by divisions or diaphragms, so as to produce plates, slabs, or strips of sugar ready to be broken up into cubes. A pump is employed to exhaust the air, and a hydraulic press forces the sugar from the mould.

3180. PROPELLING SHIPS, *A. Ricarby, Newcastle-upon-Tyne.*—5*th July*, 1882.—(*Not proceeded with.*) 2*d.*

A tube fixed in the bottom of the ship is closed at its inner end, and its mouth opening out at the stern, and in this tube a plunger works. At the side of the tube are two tubes, each preferably of half the area of the central tube and forming a U, the loop of which joins the central tube, with their outer ends opening out of the after "run" of the ship. The plunger on the back stroke forces water out, and so propels the vessel, while water rushes through the side tubes and fills the front of the centre tube, from which the plunger in its forward stroke drives it out again through the side tubes.

3181. DYNAMO-ELECTRIC MACHINES, *A. Lévy, Goswell-road.*—5*th July*, 1882.—(*A communication from D. Lachaussée, Liège, Belgium.*)—(*Not proceeded with.*) 2*d.*

This invention consists in such an arrangement of electro-magnets that all the points of the magnets are utilised, and form as many subsequent points.

3183. PREPARING COTTON FOR SPINNING, *A. M. Clark, London.*—5*th July*, 1882.—(*A communication from G. A. Risler, Haute Alsace.*) 6*d.*

This relates to apparatus for preparing cotton for spinning, and it comprises, First, a novel system of drawing, whereby thick laps of cotton of considerable breadth may be drawn whose filaments are entangled, as are in fact the laps coming from opening batting machines. The drawing rollers have similarly fluted or toothed surfaces, and are driven at different speeds. The beaters of machines for batting long stapled cotton consist of toothed pivotted beaters and intermediate toothed segments of a drum.

3185. VENTILATING DRYING ROOMS, *J. G. Tongue, London.*—5*th July*, 1882.—(*A communication from H. Wattel, France.*)—(*Not proceeded with.*) 4*d.*

A fan forces air through a pipe from openings, in which it escapes and passes up through the drying floor, which is perforated. In the centre of the drying room is the funnel-shaped mouth of an exhaust pipe leading to the fan.

3189. SEPARATING AND COLLECTING AMMONIACAL AND OTHER PRODUCTS FROM BLAST FURNACE GASES, &c., *W. Ferrie, Lanark.*—6*th July*, 1882.—(*Void.*) 2*d.*

The object is to separate and collect ammoniacal and other products from blast furnace gases, and when necessary to recharge the residue of the said gases with tar and other hydrocarbons from which some of the tars and the hydrocarbons have become separated with the ammoniacal products, so as to restore the heating value of the gases. A series of scrubbers effect the separating, and the gases, if necessary, are led through chambers containing tars or hydrocarbons before being utilised for heating purposes.

3196. PLACING WOOL, &c., UPON SHADE, SAMPLE, OR PATTERN CARDS, *W. Greenwood, Halifax.*—6*th July*, 1882. 6*d.*

The object is to greatly facilitate the manufacture of sample cards used to exhibit colours or qualities of wool or other fibrous substances. The card is gummed at proper intervals apart and placed on a table, from which any length is wound on to a roller, to which the ends of the threads are secured, and which thus become secured to the paper at the gummed parts.

3194. RIVER AND OTHER WEIRS AND SLUICE GATES, *F. Wiswall and W. H. Collier, Manchester.*—6*th July*, 1882. 6*d.*

The object is to construct weirs and sluice gates so that they will open automatically when the water rises above a certain line, and thereby allow the water to escape in case of floods, and at the same time means

are provided for opening the gates from the banks when desired. A series of rectangular sluice gates extend in a line across the river, and are capable of turning on a common horizontal axis. When the water rises and exerts pressure on the part of the gates above the axis the gates will be turned thereon, and so allow the water to escape. Each gate is also capable of being raised from the bank by means of chains and crabs.

3200. WHEEL TIRES, *A. C. Guerrier, Fulham.*—6th *July*, 1882. 4d.
This consists in cutting tires from plates of metal of the thickness required to form the width of the tire, so that they shall be in one continuous length and not require welding.

3206. FACILITATING THE VENTILATION AND DRYING OF CROPS IN THE STACK, *J. L. Norton, Piccadilly.*—6th *July*, 1882.—(*Not proceeded with.*) 2d.
This consists in constructing a number of openwork or perforated tubes open at both ends, and in placing these tubes in juxtaposition in the stack of crops, so as to form flues communicating with each other, and with the body of the stack, in such manner as to carry off heat and vapour before a dangerous amount is generated.

3207. CULTIVATION, STORAGE, PACKING, AND CONVEYANCE OF OYSTERS, &c., *W. H. Thompson and C. W. Kitto, London.*—6th *July*, 1882.—(*Not proceeded with.*) 4d.
The object is to avoid the great loss of oysters which now occurs during transport, and it consists in packing them in cases with porous partitions to which water is supplied. For the cultivation of oysters a raft is employed, and provided with partitions of wire, so as to allow water to pass over the oysters and yet prevent them rubbing against each other.

3210. LOOMS FOR WEAVING, *W. Buckley and J. Hollingworth, Yorkshire.*—6th *July*, 1882. 8d.
This relates, First, to the jacquard or peg lag apparatus, and the object is to avoid having to change the lags when necessary to alter the pattern. This is effected by employing two, three, or more cylinders, each carrying a chain of lags provided with pegs, all of which represent a different design, such cylinders being carried by a swinging frame, and actuated by suitable means, so as to bring the desired cylinder into the working position, with its lags opposite the jacquard needles. The invention relates, Secondly, to means for removing the pressure of the finger from the shuttle-box swell just before the shuttle is sent out of the box, so as to reduce the power required to send the shuttle therefrom.

3211. REGENERATIVE GAS HEATING ARRANGEMENTS FOR HEATING WATER OR AIR, &c., *E. A. Brydges, Berlin.*—6th *July*, 1882.—(*A communication from D. Grove, Berlin.*—(*Not proceeded with.*) 4d.
The gases pass from the generator to a flue or channel, whence they pass through the narrow orifices of a burner into a combustion chamber, where they come in contact with warm air, and are ignited, the burning gases then streaming through cast iron flues in a serpentine direction from one pipe to another, and then pass to the chimney. The air for combustion is heated in suitable chambers.

3217. MACHINERY OR APPARATUS FOR APPLYING ANTI-INDUCTION COVERINGS TO INSULATED ELECTRICAL CONDUCTING WIRES, *G. S. Page, Stanley, Morris County, Jersey State, U.S., and American Exchange, Strand, London.*—7th *July*, 1882.—(*A communication J. M. Stearns, jun., Brooklyn, New York.*—(*Not proceeded with.*) 2d.
This relates to machinery or apparatus for bending a thin sheet of metal backwards and forwards so as to form longitudinal corrugations or loops, into which insulated conductors are introduced, the object being to prevent induction, as described in the inventor's patent, No. 5468 (14th December, 1881), taken out in the name of Imray.

3219. SUPPORTS FOR UNDERGROUND ELECTRICAL CONDUCTORS, &c., *G. S. Page, Stanley, Morris County, Jersey State, U.S.*—7th *July*, 1882.—(*A communication from J. N. Stearns, jun., Brooklyn, New York.*) —(*Not proceeded with*) 2d.
A continuous trough-shaped receptacle is provided within the conduit, within which the conductor or cable is placed so as to have its metal sheathing in electrical connection with the metal of the support, which in turn is in electrical connection with the conduit, and consequently, earth.

3221. SECONDARY BATTERIES OR ACCUMULATORS, *R. H. Woodley, Limehouse, and H. F. Joel, Dalston.*—7th *July*, 1882.—(*Not proceeded with.*) 2d.
This relates to the construction, charging, and regulation of secondary batteries.

3222. OMNIBUSES, TRAM-CARS, &c., *H. W. Hart, London.*—7th *July*, 1882.—(*Not proceeded with.*) 4d.
This relates, First, to the arrangement of the seats; Secondly, to means for checking the amounts received; Thirdly, to the arrangement of an apron on the outside; Fourthly, to means for causing the vehicle to ride smoothly.

3223. FILTRATION OF WATER, *J. H. Topham, Manchester.*—7th *July*, 1882. 6d.
A brass tube has conical ends terminating in screwed nozzles, one of which takes into a boss turning on a hollow pivot secured to the supply tap. The tube has a piece of sponge in each end, and the remainder is filled in with asbestos, cloth, and coarse-grained charcoal.

3224. COMBINED TACK-MAKING AND LASTING MACHINE, *R. H. Brandon, Paris.*—7th *July*, 1882.—(*A communication from F. Hurd, Paris.*) 6d.
This consists in a machine in which the upper is held upon a last whilst it is being tacked; the tack is made in the machine and driven into the upper.

3225. CABS, &c., *J. Abbot, Bideford.*—7th *July*, 1882. 6d.
This relates to a two-wheeled cab for carrying more than two passengers. The coachman's seat and the entrance is at the rear of the vehicle, and the inside seats are arranged either longitudinally, or one seat is placed in each corner of the vehicle.

3227. BEARINGS FOR ROLLING STOCK, &c., SUBJECT TO GREAT WEAR THROUGH GRIT, *J. V. Hope, Wednesbury, and J. Dickson, jun., Seaforth.*—7th *July*, 1882.—(*Not proceeded with.*) 2d.
The bearings are made of wood, compressed fibre, and other ligneous matters, thoroughly saturated with oil and lubricated with graphite, steatite, and other like lubricants.

3228. CARTRIDGES, *F. Wirth, Germany.*—7th *July*, 1882.—(*A communication from Pulverfabrik Rottweil, Hamburg, Germany.*) 4d.
This relates to metal gun cartridges containing small shot, the object being to provide a firm and water-tight covering or wad to hold the shot in position, and it consists in placing a thin disc of cardboard over the shot and further closing the cartridge by a thin brass disc held in position by longitudinal ribs formed in the walls of the cartridge.

3238. TURRET CLOCKS, *W. H. Bailey, Salford.*—7th *July*, 1882.—(*Not proceeded with.*) 2d.
This consists, First, in the arrangement of the frame; and Secondly, in the arrangement of the fly or flyer governing the striking mechanism.

3240. PLATES FOR ELECTRIC ACCUMULATORS, *T. S. Sarney, Camberwell, and J. M. Alprovidge, Herne Hill.*—8th *July*, 1882. 4d.
The inventors make their plates of thin laminated metallic sheets, in or with which are intimately commingled amalgamated or impregnated lead or other suitable metallic oxides, peroxides, or sulphates.

3241. RULING MUSIC LINES, *E. Barnett, London.*—8th *July*, 1882.—(*Not proceeded with.*) 2d.
A metal cylinder is formed with five equidistant lines on its periphery, and ink is supplied thereto so that by revolving the cylinder over a sheet of paper the five lines will be marked thereon.

3243. PREPARATIONS FOR PRINTING OR DECORATING TO OBTAIN METALLIC EFFECTS, *J. Gibson, Manchester.*—8th *July*, 1882.—(*Not proceeded with.*) 2d.
Caoutchouc is dissolved in carbonised disulphide or sulphide of carbon and mineral naphtha or other solvent added thereto, and to the solution is added gold, silver, or bronze powders, whereby a preparation is formed which may be used for decorating woven or other material.

3248. CRANES FOR QUARRYING AND MINING PURPOSES, *M. J. Brooks and J. H. Spencer, Lancaster.*—8th *July*, 1882. 6d.
This relates to jib or derrick cranes with vertical uprights, and which are driven by power derived from a separate motor, the object being to enable them to be swung round without interfering with the driving mechanism.

3251. OVENS FOR BAKING BREAD, &c., *A. M. Clark, London.*—8th *July*, 1882.—(*A communication from J. E. J. L. Mounié, Paris.*) 6d.
This relates to a continuous oven with a travelling sole for baking bread, biscuits, and other products, the sole consisting of an endless chain of fire-clay slabs.

3252. BOTTLES FOR AERATED LIQUIDS, *H. Codd, London, and D. Rylands, Barnsley, Yorks.*—8th *July*, 1882. 6d.
The object is to enable bottles with internal stoppers to be opened without touching the stoppers, and it consists in forming in the neck of such bottles a small hole closed by an internal elastic valve, the stem of which projects to the outside, so that by forcing the valve inwards the gas can escape from the inside of the bottle, and the pressure thus being reduced the stopper will fall from its seat in the neck and so open the bottle.

3256. ROLLING MILLS, *C. A. Snow, Washington, U.S.*—10th *July*, 1882.—(*A communication from C. B. Sill, Youngstown, U.S.*) 6d.
This relates to rolling mills adapted for rolling, finishing and reducing pipes and other cylindrical articles. The principle of the invention consists in the arrangement in a common frame of a set of two or more rolls arranged with their axes at an angle to each other and to the axis of the article to be rolled, whereby such article receives not only a rotary but a progressive movement while passing between the rolls so as to be in this manner reduced to the proper dimensions and to a true cylindrical shape. These rolls are adjustably mounted in the supporting frame and are arranged spirally as it were around a central axis so that the axes of the several rolls shall be in different planes and at an angle to the central axis, which is that of the article to be operated upon.

3259. PICKERS AND PICKING BANDS USED IN LOOMS, *E. Booth, Manchester.*—10th *July*, 1882. 6d.
The object is, First, to increase the durability and reduce the friction of loom pickers, and so dispense with or lessen the lubrication. An open-topped bearing is provided for the spindle on the top of the picker which slides between the spindle and the foot-race or bottom of the box. The band passes through a hole in the body of the picker, or is otherwise secured. Shields of soft iron in some cases are used to enclose the picker body, which is of wood faced with buffalo hide. The invention consists, Secondly, in making the picking bands by braiding or plaiting together a number of yarns or cords, or small braids or strips of material.

3277. STOPPING RUNAWAY HORSES, *B. J. B. Mills, London.*—11th *July*, 1882.—(*A communication from J. Goudet and G. Durozad, Lyons.*) 6d.
This relates to means for stopping runaway horses by a pressure exerted on the nostrils, the apparatus being controlled by the driver.

3281. ELECTRICAL CONDUCTORS, *F. Jacob, Westminster.*—11th *July*, 1882. 6d.
This relates to patent No. 231 (17th Jan., 1882), granted to C. W. Siemens, and communicated to him by the present inventor. That patent related to "improvements in telephonic conductors" only, and the object of this patent is to claim the invention there described as applied to electric conductors generally, whether employed for telegraph, electric light, or other purposes The invention consists in a method of connecting several sets of electrical instruments by employing the double conductors of one set as a single conductor for another set, and multiples of such double lines as single lines.

3293. MACHINES FOR THE MANUFACTURE OF CIGARETTES, *W. R. Lake, London.*—11th *July*, 1882.—(*A communication from C. G. and W. H. Emery, Brooklyn, U.S.*) 1s.
This relates to the general construction of a machine for making a continuous cigarette, cut it into lengths suitable for cigarettes, and deliver them completed at the end of the machine continuously and automatically. There are thirty-seven claims.

3311. DISINFECTING AND PRESERVING HIDES AND SKINS, *J. C. Mewburn, London.*—12th *July*, 1882.—(*A communication from La Société Guillemin et Cie., Paris.*) 4d.
The process is based on the employment of chloride of zinc as a disinfecting product, and is characterised by the use of this product in combination with carbonate of soda and alum.

3316. CONDUITS FOR GAS OR WATER, &c., *W. R. Lake, London.*—(*A communication from A. Knaudt, Essen-on-the-Ruhr.*) 2d.
This consists in the construction of underground conduits, and linings of wells, shafts, galleries, culverts, and the like of corrugated tubes or cylinders.

3318. FOLDING CHAIRS, *L. Field, Birmingham.*—12th *July*, 1882. 6d.
This relates to folding chairs with rigid seats; and it consists in pointing the seat to the tops of the back legs, the front of the seat resting on a cross-bar. The legs are crossed, so as to fold up and lay in a line side by side, and the back is hinged to the top of the back legs, and connected by a pivotted arm to the top of the front legs, so as to fold back when the chair is closed, and the seat folds with it.

3323. WINE, &c., *J. H. Loder, Holland.*—14th *July*, 1882. 4d.
This relates to the manufacture of wine by the fermentation of sugar and glucose mixed with colouring matters.

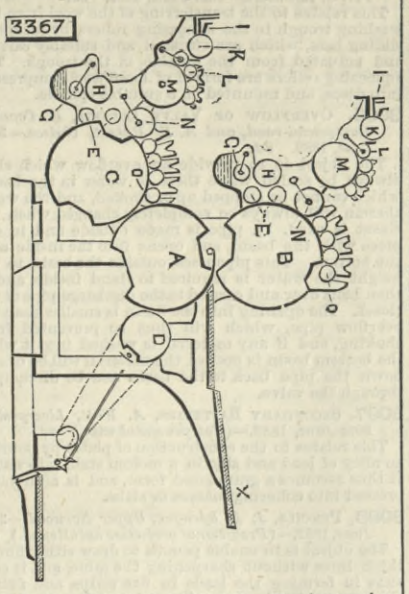
3491. APPARATUS FOR PRODUCING PHOTOGRAPHIC IMAGES, *E. G. Coltin, London.*—22nd *July*, 1882.—(*A communication from W. Kurtz, New York.*) 6d.
This relates to the combination of apparatus for producing photographic images, consisting of a movable main platform, which is rotated on a centre pivot in a socket on the floor (or otherwise suitably pivotted), a rotary platform mounted on one end of the main platform for turning the person or object to be photographed, and a camera at the other end.

3494. RUBBING MECHANISM FOR CARDING MACHINES, *C. A. Day, London.*—22nd *July*, 1882.—(*A communication from J. Barker, Philadelphia.*) 6d.
Two pairs of aprons are used with an intervening space, the strands passing first between one pair of aprons, then across the space, and then between the other pair of aprons.

3818. TYPE AND SPACE HOLDERS, *J. C. Mewburn, London.*—10th *August*, 1882.—(*A communication from A. A. Low and L. K. Johnson, Brooklyn, U.S.*) 8d.
This relates to several improvements in the general combination of the machine.

3367. MACHINES FOR PRINTING SEVERAL COLOURS AT THE SAME TIME, *E. de Pass, London.*—15th *July*, 1882.—(*A communication from J. Krayer, Germany.*) 6d.
In the drawing a machine is shown to print two colours. A is the impression cylinder and B and C two forme cylinders. The sheet is placed upon the feed table X, and the grippers of the impression cylinder seize the same and carry it, the sheet receiving a first impression from cylinder B, and then a second impression from cylinder C, after which it

3367



passes to the taking-off cylinder D. The impression cylinders are covered with zinc, the blank parts of which are kept damp by rollers E, H, and G. The ink is supplied by rollers I, K, L, M, N, and O.

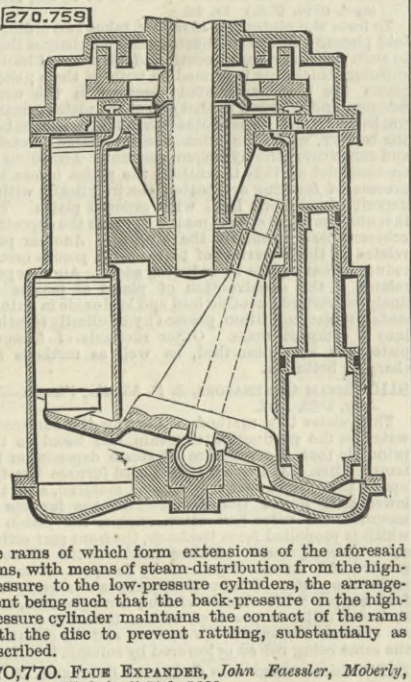
5197. APPARATUS FOR FLUSHING WATER-CLOSETS, &c., *W. R. Lake, London.*—31st *October*, 1882.—(*A communication from J. Cooper, Boston, U.S.*)—(*Complete.*) 4d.
The inventor claims a double-faced valve having two seats, one of which is inverted, and placed above the valve, in combination with a cylinder, plunger, adjusting screw, and air port.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazttee.

270,759. COMPOUND DISC ENGINE, *Frank Darkin, New York, N.Y.*—*Filed June* 19*th*, 1882.
Claim.—In a disc engine, a series of low-pressure cylinders, the rams or pistons of which act directly on the disc, and a series of high-pressure cylinders,

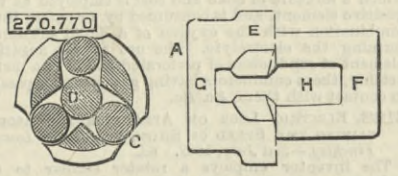
270.759



the rams of which form extensions of the aforesaid rams, with means of steam-distribution from the high-pressure to the low-pressure cylinders, the arrangement being such that the back-pressure on the high-pressure cylinder maintains the contact of the rams with the disc to prevent rattling, substantially as described.

270,770. FLUE EXPANDER, *John Faessler, Moberly, Mo.*—*Filed April* 24*th*, 1882.
Claim.—The roller-box A, provided with the shoulder E, front end F, and back end G, and embracing the three cavities H, and two holes I and J,

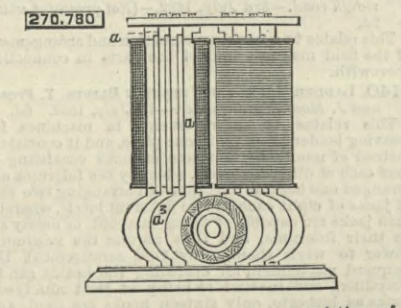
270.770



constructed of one piece of suitable wrought or cast metal, in combination with the double length reversible rollers C and the tapering pin or mandril D, substantially as and for the purpose herein shown and described.

270,780. DYNAMO-ELECTRIC MACHINE, *Warren P. Freeman, New York, N.Y.*—*Filed July* 13*th*, 1882.
Claim.—(1) Field magnets for dynamo-electric machines or electric motors having their cores and poles made of sectional plates parallel with the axis of the armature, and with air spaces between the core portions of the plates. (2) A sectional plate for the

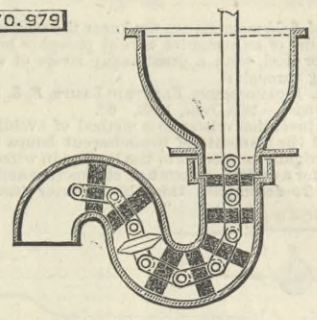
270.780



core and pole of an electro-magnet, consisting of a straight portion *a* and curved end A^3, with off-sets a^1. (3) An armature having its body composed of a shaft and a series of non-magnetic discs, with rediating arms and bosses or hubs d^1. (4) An armature having its body composed of a shaft and a series of non-magnetic discs, with radiating arms and hubs d^1 with notches d^2. (5) The combination of a series of non-magnetic discs forming the body of an armature with a series of circumferential coils of iron wires separated from each other by said discs. (6) The combination of a series of discs forming the body of an armature with a series of circumferential coils of iron wire magnetically insulated from each other. (7) An armature body composed of a shaft and a series of discs having hubs d^1 and radial arms *d*, the arms on some of the discs being of greater length than those on the intervening ones. (8) The combination of the shaft and discs having radial arms with slots E, circumferential coils forming the core, and outer inducing coils. (9) An armature in which the insulated inducing coils are combined with non-magnetic guide-pins on the armature body extending to near the surface of the coils.

270,979. FLEXIBLE BRUSH FOR CLEANSING WATER-CLOSETS, &c., *Charles F. Pike, Philadelphia, Pa.*—*Filed July* 27*th*, 1882.
Claim.—(1) A brush for removing the incrustations from water-closet traps, which consists of a shaft or core provided with circular brushes or circular rows of bristles, said shaft being adapted to conform to the outline of the trap, and yet possess sufficient rigidity

270.979



to cause all of the brushes to simultaneously operate to effect such removal, substantially as set forth. (2) A brush for cleansing water-closet traps, which consists of a shaft or core provided with a series of brushes and a scraper, said shaft being adapted to conform to the outline of the trap, yet having sufficient rigidity to cause the brushes and scraper to simultaneously operate to effect such cleansing, substantially as set forth.

CONTENTS.

THE ENGINEER, Feb. 23rd, 1883. PAGE