ELECTRICAL TRANSMISSION OF POWER.

By Professor Oliver J. Lodge.

No. VI.

Behaviour of an ordinary series dynamo used as a motor and driven by a battery.—If several similar dynamos are employed for convenience they can still be regarded as one.

Let E be the total electro-motive force of the battery, say 2 volts per cell whatever current it is giving; and e the back electro-motive force of the dynamo proportional to the speed.

Let R be the resistance of the battery and connections, say ·004 ohms per cell; and ρ the resistance of the dynamo, armature and magnet together.

Let P be the gross power given by the battery in Watts; and p the useful power obtained from the dynamo, reckoned electrically.

Let C be the current,

And f the total efficiency, $= \frac{p}{P}$.

The armature resistance may be taken as equal to the field magnet resistance, each being $\frac{1}{2}\rho$.

The actual horse-power obtained on a brake will be a trifle less than p, say 10 per cent. less.

The electro-motive force between the terminals of the dynamo will be less than E, by the amount R C which is required to drive the current through the battery; and it will be greater than e, by the amount ρ C which is required to drive the current through the wire on the dynamo; *i.e.*, electro-motive force between terminals $= E - R C$, or $= e + \rho C$.

The gross power is $P = E C$;

The useful power is $p = e C$;

The efficiency is $f = \frac{e}{E}$.

These are the simple fundamental formulæ from which everything follows which is hereafter written down.

For instance, these expressions—

Back electro-motive force $= e = E - (R + \rho) C$

Useful power $= p = E c - (R + \rho) C^2$

or useful power = total power minus the waste.

Efficiency $= f = 1 - (R + \rho)\frac{C}{E}$.

Problem 1.—Given a certain number of cells (E and R given) and required a certain power (p given) with a specified efficiency (f given), What current must be drawn from the battery? And what must be the resistance of the wire on the motor which is to do the work?

Answer to first question—

The necessary current is $C = \frac{p}{f E}$: anything less than this will not give the power, and anything more than this will not give the efficiency.

Answer to second question—

The resistance of the dynamo is $\rho = (f - f^2)\frac{E^2}{p} - R$

or $$\rho = (1 - f)\frac{E}{C} - R,$$

nothing greater than this will do.

Now if this value of ρ comes out 0, or negative, it means that no series dynamo can be got to satisfy the given conditions at any price. If ρ comes out very small, the motor would have to run at a great speed in order to give the necessary back electro-motive force, viz., $e = fE$. Whether the motor can give this electro-motive force, and at what speed it must be run to do it, depends on the carcass of the machine, and must be determined by experiment, *i.e.*, by the characteristic curve.

Thus: Let the carcass of the machine be already wound with any wire of resistance ρ^1, and then use it as a generator, turning it at an observed speed n^1, and measuring the current C^1 and the electro-motive force between the terminals, which call ϵ^1. The electro-motive force in the armature is greater than ϵ^1 by the amount $\rho^1 C^1$, which is necessary to force the current through the wire of the machine; so the real electro-motive force is $e^1 = \epsilon^1 + \rho^1 C^1$. Drive it till the current C^1 is equal to the C required, that is, to $\frac{p}{f E}$; then measure ϵ^1 and calculate e^1. Then, if the machine were wound with a wire of resistance ρ and were driven at a speed n, the electro-motive force in the armature would be $e = \frac{n \rho}{n^1 \rho^1} e^1$; and this is wanted to equal $f E$.

So the necessary speed is $n = \frac{n^1 \rho^1 f E}{\rho e^1}$.

This is not so complicated as it appears. Put it shorter.

It is required to find out at what speed a dynamo must run, if wound with a resistance ρ and excited with a battery of electro-motive force E and resistance R, in order to give the power p with the efficiency f. We have found that the current must be $\frac{p}{f E} = C$, and the resistance of the wire must be $(f - f^2)\frac{E^2}{p} - R = \rho$. This being settled, take the dynamo wound as it is with any wire of resistance ρ^1, use it as a generator, and spin it until it gives the above current C; then measure the speed n^1 and the electro-motive force between the terminals ϵ^1. These are the data required. For to satisfy the above conditions, the back electro-motive force must be fE, and the electro-motive force is approximately simply proportional to the speed and to the resistance of the wire on the machine (the current round the magnet being the same); therefore the necessary electro-motive force will be given and the above conditions satisfied by letting the machine run at a speed

$$n = \frac{n^1 \rho^1}{\epsilon^1 + \frac{\rho^1 p}{f E}} \cdot \frac{f E}{(f - f^2)\frac{E^2}{p} - R} = \frac{n^1 \rho^1 e}{e^1 \rho}$$

$$= \frac{n^1 p \rho^1 f^2 E^2}{\left\{\epsilon^1 f E + p \rho^1\right\}\left\{(f - f^2) E^2 - p R\right\}}$$

If this speed is greater than reasonable, a larger carcass must be taken.

Problem 2.—Given a battery and a wound dynamo and required a certain power (E R ρ p given), what current must be used and what efficiency will be attained?

Answer—

The necessary current is $C = \frac{E - \sqrt{E^2 - 4 p (R + \rho)}}{2 (R + \rho)}$

The efficiency is $f = \frac{1}{2} + \sqrt{\frac{1}{4} - \frac{p (R + \rho)}{E^2}}$

So the bigger E is the better.

N.B.—Unless E has a certain value it is impossible to satisfy the given conditions. The smallest allowable value for E is $\sqrt[2]{p (R + \rho)}$. It must be a little greater than this, and the more the better.

Problem 3.—Given a battery and a wound dynamo, required the conditions that the maximum power possible may be obtained. Also what is this maximum power? and what is the efficiency when it is got?

Answer:—The maximum power will be obtained by running at such low speed that the current strength is $C = \frac{E}{2 (R + \rho)}$; that is, just half what it would be if the machine were stationary.

The efficiency will be only $\frac{1}{2}$, or 50 per cent., and the maximum power will be $\frac{E^2}{4 (R + \rho)}$ or $(R + \rho) C^2$.

Problem 4.—Given a wound dynamo and required a certain power at a specified efficiency, how many cells—of given construction—must be used?

Let each cell have the electro-motive force e and the resistance r } so that { $E = N e$ and $R = N r$

(then ρ p f e r are given), and we have to find N.

Answer:—The number of cells needful is—

$$N = \frac{p r}{2 e^2 (f - f^2)}\left\{1 + \sqrt{1 + \frac{4 \rho e^2 (f - f^2)}{p r^2}}\right\}$$

It may be useful to illustrate the applicability of these solutions, which very easily follow from the simple equations at the beginning of this article, by taking a few numerical examples; and I am indebted to the Electrical Power Storage Company for some numbers relating to their experimental tramcar at Shepherd's Bush. For instance, the number of boxes and the resistance of the motor used by them in some of their series of runs.

Numerical example of problem 2—

Actual tram car case, where 50 1-H.P. hour cells in good order are used to exert 5-H.P. on the car by means of a Siemens D_2 machine. { let E = 100, R = ·2, ρ = ·3, p = 3730 = 5-H.P.

The necessary current is $\frac{100 - \sqrt{10000 - 7460}}{1}$

$= 100 - \sqrt{2540} = 100 - 50{\cdot}4 = 4{\cdot}96$ ampères.

The efficiency is $\frac{1}{2} + \sqrt{\frac{1}{4} - \frac{1865}{10000}} = \frac{1}{2} + \sqrt{{\cdot}25 - {\cdot}1865}$;

$= \frac{1}{2} + \sqrt{{\cdot}0635}$; $= {\cdot}5 + {\cdot}2529 = {\cdot}752$; $= 75$ per cent.

The back electro-motive force is $100 - \frac{1}{2} 50 = 75$ volts; the electro-motive force between the terminals is 90 volts; the power expended by the cells is 4960 watts $= 6\frac{2}{3}$-horse power.

The smallest allowable value of E is $2\sqrt{1865} = 86{\cdot}37$ volts; and if this were used, it would necessitate the use of a current of 100 ampères, and would only give 50 per cent. efficiency. Consequently, a slight diminution in the electro-motive force of the cells would necessitate the use of a much stronger current, and a corresponding loss of efficiency.

Numerical example of problem 3—

Tram car case. Given { E = 100, ρ = ·3, R = ·2

the maximum power* will be obtained when $C = 100$ ampères; and this maximum power is 5000 watts, or $6\frac{2}{3}$-horse power; but the cells are then expending power at the rate of 10,000 watts, or $13\frac{1}{3}$-horse power.

Numerical examples of problem 1—

First, let 50 boxes be used in good condition, let the power required by 5-horse power, and let the efficiency aimed at be 50 per cent., *i.e.*, let { E = 100, R = ·2, p = 3730, f = ·5

then $C = \frac{3730}{50} = 74{\cdot}6$ ampères,

and $\rho = \frac{10{,}000}{14{,}920} - {\cdot}2 = {\cdot}67 - {\cdot}2 = {\cdot}47$ ohms.

Let the efficiency arrived at be 75 per cent.,

then $C = \frac{3730}{75} = 49{\cdot}7$ ampères,

and $\rho = {\cdot}5 - {\cdot}2 = {\cdot}3$.

Next let the efficiency be 80 per cent.—

$C = \frac{3730}{80} = 46{\cdot}6$ ampères,

and $\rho = {\cdot}43 - {\cdot}2 = {\cdot}23$ ohms.

For this to be possible the speed must be increased above that necessary in the case next above, in the ratio of $\frac{30}{23}$.

Second, let 100 boxes be used, and let the efficiency aimed at be 50 per cent., { E = 200, R = ·4, p = 3730, f = ·5

then C = 37·3 ampères,

$\rho = 2{\cdot}68 - {\cdot}4 = 2{\cdot}28$ ohms; very unnecessarily high, for by above second case ·6 ohms should be sufficient at same speed.

Let 75 per cent. be aimed at—

C = 24·8 ampères,

$\rho = 2 - {\cdot}4 = 1{\cdot}6$; still needlessly high.

* N.B.—This does not mean the maximum statical pull at starting. The statical pull increases rapidly with the current, and is greatest when the current is greatest, viz., before the dynamo begins to move. Supposing no extra resistance to be purposely thrown into the circuit, the current would then be 200 ampères, and would exert a tremendous starting force. But the wires would heat, the brushes get burnt, and the cells would rapidly run down if such a current as this were long demanded. In practice, therefore, such violent currents are avoided.

Let 80 per cent. be aimed at—

C = 23·3 ampères,

$\rho = 1{\cdot}72 - {\cdot}4 = 1{\cdot}32$; perfectly practicable.

Let 90 per cent. be aimed at—

C = 20·7 ampères,

$\rho = {\cdot}966 - {\cdot}4 = {\cdot}566$; nearly practicable, not quite, except at a higher speed.

Example of problems 2 *and* 3 *with* 100 *boexs and a given machine*—

Let E = 200

R = ·4

Let ρ = ·6, which ought to do if the ·3 machine does for 50 boxes; then to give $p = 3730$,

the necessary current is $\frac{200 - 2\sqrt{10{,}000 - 3730}}{2}$

$C = 100 - \sqrt{6270} = 100 - 79{\cdot}18 = 20{\cdot}82$ ampères, and the efficiency is $f = \frac{1}{2} + \frac{1}{2}\sqrt{-{\cdot}3730}$

$= \frac{1}{2} + \frac{1}{2}\sqrt{{\cdot}6270}$

$= {\cdot}5 + {\cdot}396 = {\cdot}896$

$= 89{\cdot}6$ per cent.

The maximum power obtainable is $\frac{40{,}000}{4} = 10{,}000$ watts,

$= 13\frac{1}{3}$-H.P.,

the current then being 100 ampères, and the efficiency only $\frac{1}{2}$.

Example of problem 4—

Given ρ = ·3, p = 3730, f = ·8, or 80 per cent.

Find number of cells necessary if each has resistance ·004 and electro-motive force 2 volts—

$$N = \frac{3{\cdot}73}{{\cdot}32}\left\{1 + \sqrt{1 + \frac{4 \times {\cdot}3 \times {\cdot}16}{3{\cdot}73 \times {\cdot}004}}\right\}$$

$= 11{\cdot}65\ (1 + \sqrt{13{\cdot}85})$

$= 11{\cdot}65 \times 4{\cdot}72 = 54$ cells.

If each has fallen off somewhat so as to have electro-motive force 1·8 volts, the number necessary will be—

$14{\cdot}4\left\{1 + \sqrt{1 + 14{\cdot}2}\right\}$

$= 14{\cdot}4 \times 4{\cdot}9 = 70{\cdot}5$ cells.

If each had the electro-motive force of $2\frac{1}{2}$ volts, the number necessary would be—

$7{\cdot}5\left\{1 + \sqrt{1 + 20}\right\}$

$7{\cdot}5 \times 5{\cdot}58 = 42$ cells.

ARC LAMPS AT THE VIENNA EXHIBITION.

No. I.

The name "incandescent" is not a particularly fortunate one by which to distinguish the class of lamps which we have described in our last articles on this Exhibition from the other class termed "arc" lamps. The name "arc" is exactly descriptive of the specialty of this species of lamp, which is that there is a break in the solid conductor of the current where an arc is formed and where the resistance rises so high as to cause the necessary localisation of the absorption of electric energy and of its transformation into heat and light. But the electric arc itself furnishes only a very small proportion of the light given by an arc lamp. It is the high local resistance of the arc that is of use. The large amount of heat generated in consequence of this resistance is spent in raising the temperature of the carbon points to incandescence. It is from the incandescent surfaces of the carbon points that the great bulk of the light is radiated, a certain portion also coming from the incandescent particles of carbon which fly in a stream across the arc from the positive to the negative pole. Thus, arc lamps are, properly speaking, incandescent lamps to an almost equal degree with those that have received that special name. The proper distinction between the two is that the so-called "incandescent" lamps have no break in the continuity of the solid conductor and have, therefore, no arc.

This essential distinction between them is brought forcibly to mind in considering the Soleil or Sun lamp. The Art Gallery at the Vienna Exhibition is lighted by these lamps in the latest form they have assumed. This gallery consists of two small halls, in which pictures by living Viennese artists are exhibited along with a few pieces of sculpture. With the character of the pictures we have nothing to do. Sufficient to say that they are nearly as well seen by the electric light as they could be by daylight, and would be so quite as well if the supply of electric light were about one and a-half times what it is.

The Sun lamp has recently undergone great change in design; the modification being in the direction of simplicity and of securing greater steadiness and efficiency of light-producing power. This is an arc and also an incandescent lamp, as all the others are; but it is distinguished from all others in the fact that the solid, which is raised to incandescence and radiates light, forms no part of the conducting circuit. This is so at any rate according to the intentions and belief of the makers; but, as we find below, there is considerable room for doubt as to the accuracy of this belief. The current, as in ordinary arc lamps, passes between poles formed by the ends of sticks of hard carbon. These and the arc passage are surrounded by a block of marble. The carbon points are, as usual, raised to a high temperature; but, as they are completely surrounded by the marble, this intercepts all light coming from them. The carbons and the arc impart heat to the marble block until it is raised to an intense yellowish white glow of incandescence, and it is the marble, which is considered an almost perfect non-conductor of the current, that furnishes nearly the whole light of the lamp.

In the old Soleil lamp the carbons were both nearly vertical, lying in almost parallel holes drilled in the marble and descending to the bottoms of these by their own weight as they were consumed. The length of the arc between their ends was thus somewhat indefinite to the extent of about half the breadth of the carbon point. They are now placed in line with each other, with the points fairly facing each other and projecting into holes of $\frac{3}{4}$in. diameter drilled in opposite ends of the rectangular block of marble. This arrangement is shown in Fig. 1, of the accompanying

four engravings. The ends of these holes are rounded to a spherical form, and each carbon is pressed home by a spiral spring precisely similar to that used in coach candles. Co-axially with these larger holes, and connecting them, is drilled a small straight hole ¼in. in diameter. This forms the passage for the electric arc through the marble. The length of the arc is slightly in excess of the length of the small hole in consequence of the ends of the carbons burning away in the hollowed form indicated by the lines in Fig. 1. This excess of length remains very nearly constant after the carbons have been lit for a few minutes. The length of the arc is thus found to be 5 mm. longer than that of the small hole.

The block of marble for a 1000-candle lamp is 2in. long, 1⅝in. wide, and 1¼in. deep. In the one face of this is scooped or drilled out a trumpet-shaped recess, forming a sort of crater, from which the light streams forth. The bottom of this crater and the small hole forming the arc passage are connected by a longitudinal slot, which in the above size of lamp is about ⅜in. long; the upper edge of the crater being about 1⅛in. in diameter, and the length of the small arc passage 1in. These lamps are generally fixed to the ceiling of the room to be lighted, and the crater-side of marble is placed downwards. Sometimes this position has been reversed, the light issuing upwards, and being thrown down again by the ceiling or by special reflectors. The marble is encased in a stout iron framework, made of several pieces. As shown in Fig. 2, the central piece of iron is in the shape of a rectangular box, with the top and one side removed, and with ⅜in. holes bored through the ends. The marble is slipped in from the side, and a stout iron cover plate then screwed on this side. Over the crater-face of the marble rests a thin plate-iron cover, in two pieces, with a round hole cut out over the crater mouth, half the hole being in each half-plate. The whole is hinged at one side of the centre for convenience in opening up the lamp for replacing the marbles. On each side of this central block of the frame is a strip of iron, ½in. thick, and insulated by asbestos packing from the central and from the end portions. The end portions are strong iron tubes, with widened butt ends. Through these tubes the carbons are pushed up.

Fig. 2

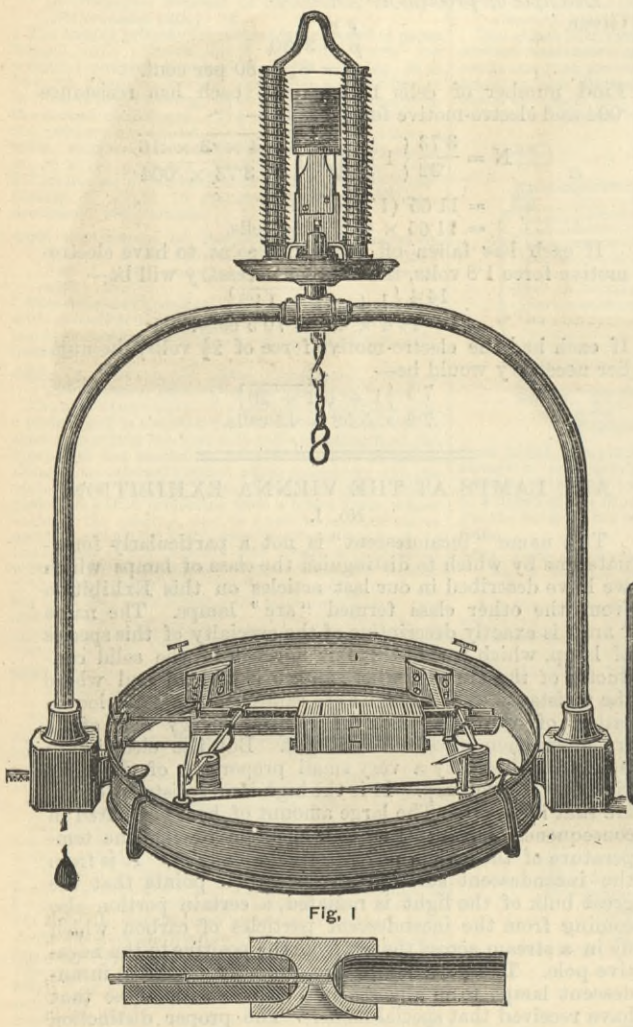


Fig. 1

One of the carbon sticks is solid; the other is hollow, the core being rather less than ¼in. in diameter. Through this core is inserted a small carbon rod of the same size. This can be pushed forward or drawn back at pleasure, either by means of a cord or by a small electro-magnet sucking in an iron core attached to the small carbon. To start the current through the lamp, and thus light it, the small carbon is pushed through the passage in the marble until it touches the solid carbon stick at the opposite end. Then carbon contact being thus made, the current is established through the carbons, and, as soon as the small carbon is drawn back, the arc is kindled. To provide for the cutting out of any single lamp from a series, without interfering with the supply of current to the others, the automatic short-circuiting safety-switch shown in Figs. 3 and 4 is used. This is of use in case the lamp be extinguished by accident, and also permits the carbons on marbles of one lamp being renewed without extinguishing the others. In the lamp circuit is placed a small electro-magnet coil. When the current is established by this path, this coil sucks up an iron core, which carries a copper fork at its lower end. The two fork ends rest in two mercury cups until they are thus drawn up, and until then make contact for the short circuit. When the lamp is extinguished, the fork drops, and makes this short circuit contact once more. One disadvantage of this mercury switch is that it can only be used in the vertical position shown in the drawing.

The lamp may be fed by either a continuous or an alternating current. The alternating current is advantageous so far as the quality of the rates of consumption of the two carbons is concerned, but this appears to us to be of small importance. When the continuous current is used, the hollow carbon is used connected with the negative pole; so that the positive carbon, which is the more rapidly consumed, has the larger section. The rate of consumption of the carbon sticks is about ½in. each per hour, with a current averaging ranging from 7 to 9 ampères, and averaging 8. Each stick is 4in. long by ⅜in. diameter, and lasts from twenty-four to thirty hours. The short "ends" are not wasted. The new stick is simply placed behind the remnant of the old one, and pushes it forward until it is entirely consumed. This saving of short ends is an item of economy by no means to be despised. It is curious to notice that a similar ingenious device has been in use among the Japanese for many generations. Their common candles are made with a conical recess in the base, and when one is nearly burnt down it is simply stuck upon the top of a new one, which fits this conical hole, and is thus completely "used up." The marble of the Sun lamp lasts from fifteen to fifty hours, according to the current used. For the 1000-candle lamp it lasts about thirty hours. The cost to the company of each marble is 3d., and the cost in carbon consumption is about the same as that of the marble. It is said that almost any kind of common white marble will answer. The carbonic acid is rapidly burnt out after the lamp is kindled, and the stone becomes harder and more resistant after this expulsion of the acid is complete. The small hole forming the passage for the arc becomes burnt out to a slightly larger size than its original ¼in. diameter. The lamp is made in various sizes, arcs varying from ½in. to 4in. in length, corresponding to candle-powers from 500 to 50,000.

Fig 3

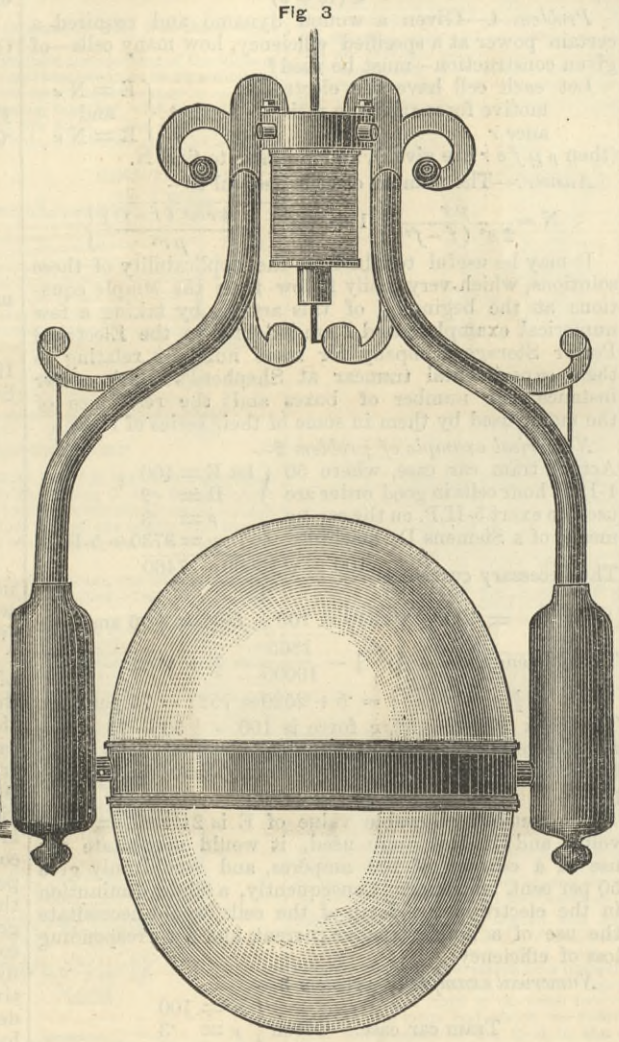
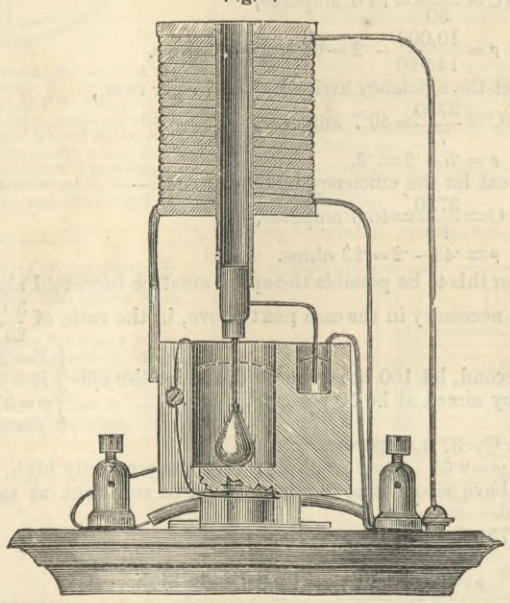


Fig. 4



The following figures are given us by the London engineer to the company. They have been very slightly altered by us, as the electrical horse-power as given us did not exactly agree with the other figures given:—

Normal candle-power.	Length of arc as measured by length of small hole in marble.	Resistance. Ohms.	Current. Ampères.	E.M.F. Volts.	Volt-ampères.	Electrical horse-power.	Volt-ampères per candle-power.
	in.						
500	¼	10	8	80	640	·86	1·23
1,200	1	16 55	8	132	1,060	1·42	0·88
2,000	1	10	12	120	1,440	1·93	0·72
About 50,000	4	20·7	30	620	18,600	25	0·37

The figures in the lowest line are professedly only approximate, the data supplied to us being the candle-power, the current, and the horse-power, from which we have calculated the other figures. It is to be noticed, firstly, that the carbon sticks have about double the diameter, and therfore four times the sectional area, that is common in arc lamps. Such carbons would be very rapidly burned away if the points were openly exposed. The slow consumption of the points is, of course, due to their being completely and closely surrounded by the marble, except over one small spot. The marble also acts as a reservoir of heat, preventing proportionate fluctuations of light, following variations of resistance and of current. Comparing the two first lines of the above table, it may be seen that the resistance is, for the same current, exactly proportional to the length of the arc, because the arc-lengths are not those stated in the second column, but these plus rather less than ¼in. The second and third lines represent the same lamp worked with different currents. Comparing the number stated, we find the paradoxical result that a larger current is obtained in the same lamp with a smaller electro-motive force. It must be understood that we give the numbers on the authority of the makers of the lamp, and that we have not received from them any explanation sufficient in our opinion to account for the paradoxical nature of this phenomenon. We are assured, however, that the law of variation of the lamp resistance stated below has been deduced from the results of over 200 experiments. It is well known that the resistance diminishes with increase of current, but that it should decrease at so rapid a rate that a smaller electro-motive force should generate a larger current is hard to understand, because although not at all physically impossible under proper conditions, still it would indicate a condition of unstable equilibrium, in which we should imagine it impossible by any means to keep the lamp burning steadily. Call the resistance R, the current C, and the length, in mm., of the small hole through the marble l. The length of the arc in mm. is then $l+5$, and the law referred to is—

$$R=\frac{45+14{\cdot}4\,(l+5)}{C^{\frac{3}{2}}}=\frac{117+14{\cdot}4\,l}{C^{\frac{3}{2}}}$$

This equation does not agree exactly with the figures given in the second and third lines of the table, the three-halves power of the ratio $\frac{1}{8}^{\frac{3}{2}}$ being 1·84 and not 1·65; also $\frac{117+14{\cdot}4\times 25{\cdot}4}{12^{\frac{3}{2}}}=11{\cdot}4$, and not 10. But the approximation is sufficiently near to support the general accuracy of the law given, because the currents are presumably not measured—or at least stated—to the small fraction of an ampère. The explanation of this rapid decrease of resistance, suggested to us by the company's engineer, is that "the facility with which the two carbons disintegrate increases very much with the current intensity, which reduces the resistance." No doubt the tearing away of the particles of carbon which are carried from positive to negative carbon—*i.e.*, the overcoming of their molecular adhesion to the mass of the carbon point—forms a very considerable portion of the "work done" in the arc, and certainly the amount of this work may rapidly decrease with the rise of temperature of the points. But we doubt whether this is sufficient to account for the above extraordinary diminution of resistance. We would suggest that a more probable explanation of a large decrease of resistance following an increase of current, and therefore a rise of temperature, is that at the high temperature of the marble its insulating power is greatly diminished, and that in reality a considerable proportion of the current actually passes through the marble. The rapidly increasing conductivity of so-called "insulators" at high temperatures is a well-known fact. If this suggestion be a correct one—and its correctness seems supported by the results of independent experiments made last year upon the Soleil lamp—this lamp would furnish an example of a combined arc and incandescent lamp, in the sense that the light-producing current is divided in two branches, one forming an arc, and the other flowing through a continuous solid conductor; the conductor, however, being of so-called insulating material, and therefore offering exceptionally high resistance.

On the supposition that the above equation for the resistance in terms of the current is correct, we find the following expressions for the elements of this class of lamps. In these E represents the electro-motive force—

$$R=(117+14{\cdot}4\,l)\,C^{-\frac{3}{2}}=(117+14{\cdot}4\,l)^{-2}\,E^{3}.$$

$$C=(117+14{\cdot}4\,l)^{2}\,E^{-2}.$$

$$E=(117+14{\cdot}4\,l)\,C^{-\frac{1}{2}}.$$

$$\text{Volt-ampères}=E\,C=(117+14{\cdot}4\,l)\,C^{\frac{1}{2}}=(117+14{\cdot}4\,l)^{2}\,E^{-1}.$$

An advantage claimed for this lamp is the yellowness of its rays, which certainly penetrate fog better than the pure white rays do. For ship and lighthouse purposes this may be a solid advantage; but for indoor illumination it is within the range of everyone's experience that yellow light is the most hurtful to the eyesight. Forty of these lamps may now be seen burning at the South Kensington Museum.

Fig. 3 of our illustrations shows the lantern in which the lamp is fixed.

THE SOCIETY OF ENGINEERS.

DESIGNS, SPECIFICATIONS, AND INSPECTION OF IRONWORK.

At the ordinary general meeting of the Society, held on Monday, the 1st inst., a paper on the above subject by Mr. Hamilton W. Pendred, C.E., was read.

Although engineers and contractors now approach each other more nearly in knowledge of the respective branches of business more peculiarly pursued by each in his own speciality than was the case in the earlier days of constructive engineering, the engineer, on the one part, possessing more practical knowledge of what can and what cannot be done in a girder yard, and the contractor having more complete technical knowledge, each has still something to learn of the other; and if both the parties to contracts for ironwork could be brought yet more near each other, the one in practical and the other in theoretical knowledge, contracts would be carried out with less friction and more satisfaction to both parties than is the case at present. Illustrations of this may often be found in the designs prepared in the office of the engineer, whose first object is to secure durable work—a lasting structure. After that he seeks economy of cost and inexpensive work. The contractor reverses this order, seeking first cheapness of production, and after that durability of work; and so far as the author's experience extends, he ventures to think that designers have more to learn from makers than makers have from engineers. Many specifications are drawn and designs prepared which, if exactly carried out, might produce excellent theoretical results, but which would and do cost half as much again as they would if the designer possessed sufficient girder-yard experience; and the author can instance a case in illustration of this, wherein a contractor for an iron roof of very moderate size was called on to polish and machine to the most accurate fit every part of every joint of every king rod and tie and shoe and bolt of that roof. It is a regrettable matter, also, that the suggestions of contractors to engineers in relation to work in hand, are so frequently and so indignantly rejected without any consideration of their value. Nothing conduces more to the speedy and amicable execution of a contract than good drawings, wherein all the details are separately shown to a large scale; they save much letter writing, &c., prevent many disputes, and obviate trouble to all concerned. Another point is the advisability of making the design complete at once, leaving nothing to be subsequently added. This cannot always be done, but, whenever possible, it ought to be done. Contractors have a strong and natural objection to any hindrance or delay of their work while in progress, not of their own causing, and pending the preparation of the design of some detail; and a piece of work thus put off is liable to be done in a hurry, and done badly. With regard to details, some points about their design are ill calculated to facilitate ease of manufacture or sound workmanship. This is particularly noticeable about the disposition of angle irons. These are often bent without the smallest necessity for it, and such angle irons are always weakened and suffer in their fibres, even when shaped by pressure and at one heat; far more so if bent by hand and subjected to repeated heating and hammering till much of the nature is taken out of the iron. In fact, the author is strongly of opinion that the less heating or working iron receives from the time it leaves the rolls till it is rivetted up the better, whether as regards its own soundness or from an economic point of view. Fig. 1 illustrates an example of three different methods of fitting a gusset in a girder. A shows the angle iron needlessly bent; B shows it straight in two modes of fitting, one with packing at back. Straight work is much the easiest to fit and rivet soundly, whether as regards true holes or closing up the rivets. If single cranks or bends in angle irons are bad, double ones, or those which become necessary where one angle iron has to overlap two others at right angles to each other, as shown in Fig. 2, are far worse. Another thing constantly done by designers is introducing joint covers where all the parts are in compression. The author never could see reason for their employment where they are not required to resist either tensile or lateral strain, when the plates in compression are properly planed and butted.

Joint covers.—Of all the parts of an iron structure, perhaps there is none more troublesome to fit properly, or more seldom so fitted, than angle iron joint covers. They would almost demand a paragraph in a specification all to themselves, as may be seen in Fig. 3, where A shows the manner in which such covers are usually put on, while B illustrates how they should be fitted. The cause of bad fitting here is due to neglect on the part of the designer, who overlooks the fact that the inside corner of the main angle iron is rounded, while the outside corner of the angle joint cover is sharply square, and the specification should state that the outside corner of the joint cover is to be rounded either by planing or swaging to fit corner of main angle iron; or, which is much better, a special section should be rolled for the purpose. Such sections are now supplied by most firms at very little over ordinary rates. The rivet holes in the main angle iron should be pierced nearer the edge than those not covered, in order to suit the narrower angle iron used in the joint cover, and thus allow these particular rivets to be properly snapped down.

Drilling and oiling.—Contractors often read specifications with contempt on account of the unpractical nature of some of their clauses, such, for example, as that stipulating that all rivet holes are to be drilled while the parts are in the position they are to occupy in the girder, bridge, roof, &c.—a perfectly absurd demand. Another clause demands that the plates and angle irons are to be dipped in oil immediately after leaving the rolls, and while so many degrees of temperature. This is alike unpractical and unwise; no rolling mill with which the author is acquainted has an oil tank or any other means of oiling plates. He has himself caused plates after delivery to the contractor to be heated in an annealing oven and then gone over with a coarse brush dipped in oil. The theory is, of course, to prevent rust, but this will not come in any case during handling and fitting, because, for one thing, the mill scale is on, and for another, because most girder yards are now either in part or altogether covered in, and the iron is kept dry. The oil, too, is, with much reason, hated by workmen, as it makes a dirty mess of everything—hands, clothes, and tools; it makes the plates slippery and dangerous to handle; it picks up dust, and by the time that the erection stage is reached the surfaces which ought to be clean have a thick coat of dirty scum over them, which is difficult and costly to remove, and which, indeed, is seldom perfectly scraped off; consequently a double coating of this stuff is sandwiched between each pair of plates, rendering tight or sound rivetting almost impossible.

Delivery of iron.—Another, at least useless clause is that stipulating that the iron shall be delivered in lots of not less than so many tons. The author has always seen it in specifications; but he has never seen it acted upon, and indeed it is of little consequence, the engineer or his representative having tested the first or second lot of iron delivered and passed it, may, as a rule, feel confident that the whole will equal that tested. Very large web plates are almost certain to be up to standard, if for no other reason, simply because it is difficult to roll bad poor iron out into such plates, and besides this, any inspecting engineer who knows his business can, by the simple process of bending a cold plate corner by hammering, judge pretty accurately of the quality of the iron. The punchings on examination will also give a good idea, even with close fitting dies, for hard crystalline iron will show deep cracks with a crystalline fracture on the die side of the punchings or buttons cut out.

Methods of work.—As nearly every girder-maker has his own method of work, it is generally advisable for the engineer to refrain from specifying any special plan of manufacture or method of doing the work; such a point is best settled by consultation between the engineer and the contractor after the contract is let.

Holes.—The author is of opinion that drilling the holes out of the solid is not essentially necessary; he has seen first-class work done as follows:—After all the plates, &c., were planed on their edges, one plate had all the hole centres very carefully and accurately marked out on it. These were then drilled; a centre punch was then made, the body of which was turned to fit the holes exactly. The plate was used as a template, and, being laid down successively over all the others, the holes were marked with the punch. The plates were then punched with holes $\frac{1}{8}$in. smaller than finished size, and were finally drilled. A special punch was made for the work, having a stud or projection on its centre, and the man at the machine shifted his plate till the punch dropped this stud into the mark made by the centre punch; he then put the punch in gear and pierced the hole. The system is employed largely at Messrs. Cockerill's works, Liége. Another mode is to cramp the flange plates together in sets and to drill the holes through the set. Yet another method is to lay down an entire length or complete flange on a bed between a pair of rails on which a carriage travels, carrying a multiple drilling machine, the machine as a whole being driven by a belt from a long barrel drum running by a wall. Men attending drills of this kind need careful supervision, as sometimes a drill will break or sustain injury, and its chain of holes consequently becomes defective owing to the neglect of the attendant to replace the faulty drill by a good one.

Securing cross to main girders.—There are various methods of securing cross to main girders. A very usual plan is to rest cross girder ends upon the angle irons of the lower flange of the main girders, as shown in Fig. 4, rivetting them both to the bottom projection and to the side web of the main girder, which is here stiffened with a gusset-plate A. Some engineers seem to consider this gusset as being equivalent to continuing the cross girder itself into body of main ditto. The author dissents from this view. In his opinion the only function the gusset fulfils is that of stiffening the side webs of the main girders; and at best this mode of securing cross girders is not, in the author's opinion, a very desirable one. Indeed, in one respect it is decidedly faulty—viz., that the whole load of, and borne by, the cross girders is sustained by one side of the main girders, thus tending to turn over the latter out of plumb. The author in his own practice has caused the bearing plates on abutments to be bedded with a slight inclination from the roadway or centre, so that, when the main girder is in its place and loaded, the bearing plate will be able to settle on its most loaded side more than on its less loaded one, till it comes dead level, and the girder may finally remain plumb. Cross girders thus fitted are generally ill-designed in one particular, as shown in Fig. 4. The fault of this arrangement consists in carrying the top flange round the ends in one piece, with a more or less sharp bend—see A. It is exceedingly troublesome and difficult to bend such flanges so accurately that a series of girders will be all as identical in length as is requisite when they have to be rivetted between main girders.

Turning flanges over thus is unadvisable also, because it is difficult to rivet the bent corner tightly to its own angle-irons. Besides, this plan is by no means necessary. Fig. 5 shows a simpler and more convenient arrangement. In it the end plate is separate; bending, and the other faults mentioned above, are obviated. All the support the top flange could give to the cross girder as fastened to the main one, if only bent round, is equally attained by making the top flange overlap the end plate; and besides this a close fit to the web of the main girder at the corner C is obtained.

Underhung girders. — Underhung girders are very common, especially in railway work, and make excellent and safe work, but need most especial attention on the part of the engineer superintending the erection of the bridge. Dummy rivets here might lead to disastrous results, and the heads of the bolts should be most carefully put on. One method of doing this is to make a head and punch a taper hole through it. The end of the bolt, being raised to a moderate white heat—less than welding temperature—is put into this hole, entering it at the small end, and it is then to be upset in the hole till it fills it tightly. Some people then heat and weld the whole, but the author is opposed to this, having no faith in welds of almost any kind. Another method is to simply screw on the head and rivet the bolt end over. The rod ought not to be threaded further than will allow the nut down enough to let the bolt so far through as will give material sufficient for rivetting over. The head must be a fixture, because it is required to hold the bolt from turning when the other nut is being screwed on. As the tensile strength of a nut and screw are pretty well known, the strength of the head, if thus fitted, is the same as that of the nut; and neither of these things can be said of any method of securing the head by heating and hammering, processes so injurious to the fibre of the bolt. The author has seen cross girders united to open-bottomed main girders by a sort of compound method, shown in Fig. 6. This makes an excellent and secure job, and is, like mere underhung girders, free from the faulty tendency of side-fastened girders to tilt main girders over. The author fails to perceive

FIG. 2

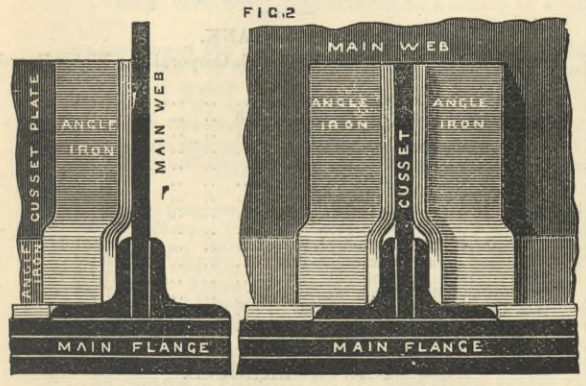


FIG. 1

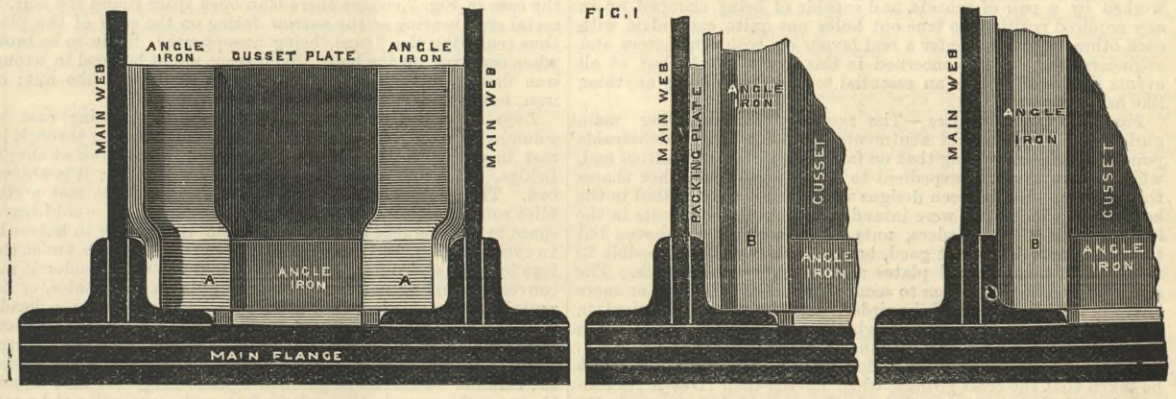


FIG. 5

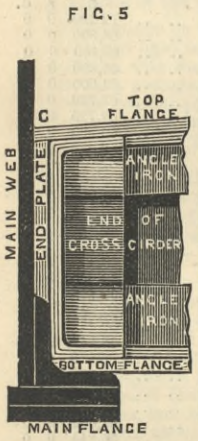


FIG. 6

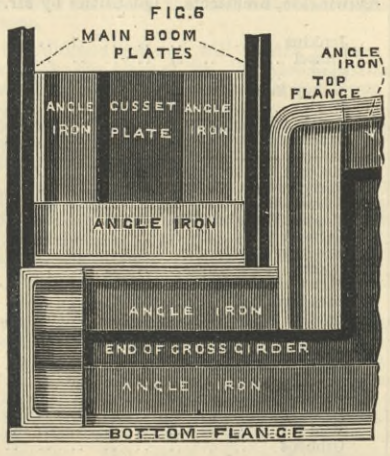


FIG. 3

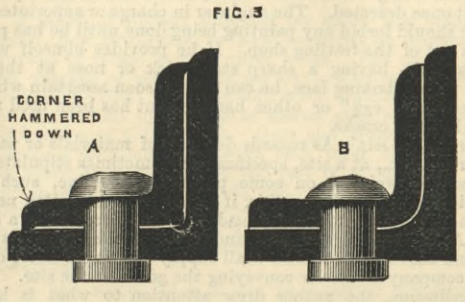
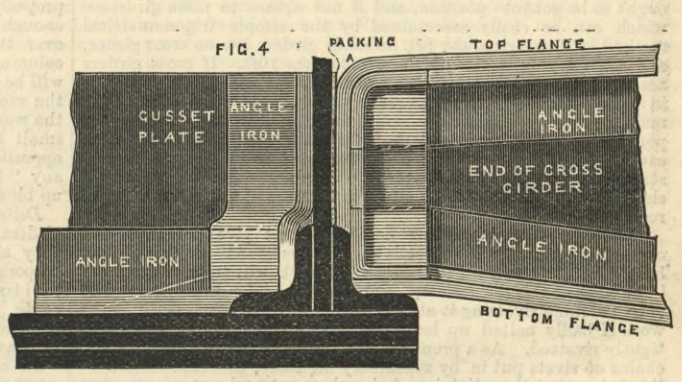


FIG. 4



END SECTION OF MAIN GIRDER

FIG. 7

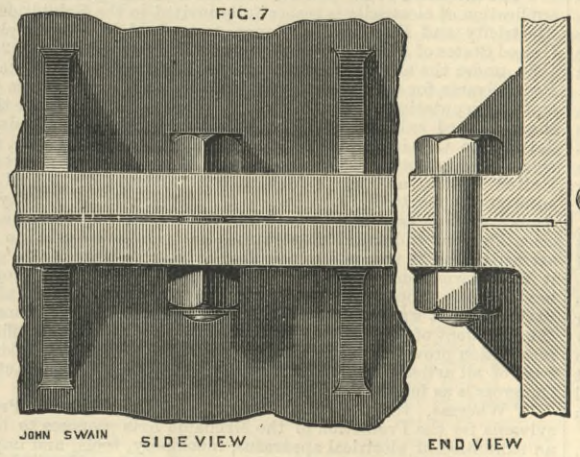
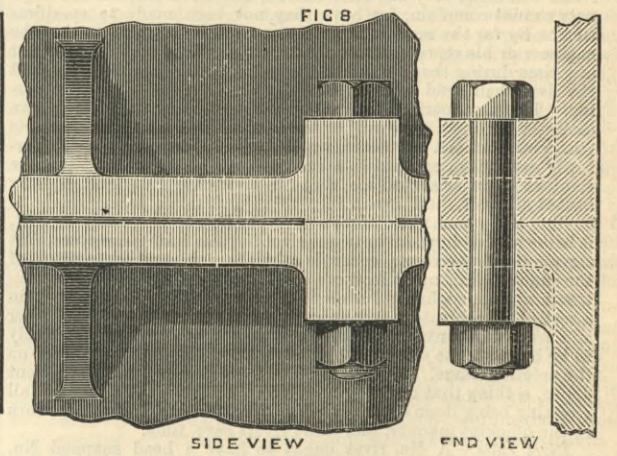


FIG. 8



much utility in making cross girders fish-bellied. True, theory may recommend such a shape, but the reduction of weight is more than counterbalanced by the extra expense and trouble involved in bending, shaping, and fitting both the plates and the angle-irons. The angle-iron stiffeners also have to be made of different lengths. It is true that, with regard to road bridges, cross girders which are arched on their upper flanges help to give the requisite convexity to the road surface; but this does not apply to the bottom flanges.

Floor plates.—Although for one obvious reason floor plates should be laid so as to have their joints over cross girders, yet as this arrangement greatly obstructs the rivetting of their joint covers, it is better to have the joints situate at some point between the cross girders. Contractors are sometimes called upon to rivet these floors water-tight; a thing which, though it may be effected temporarily by exceptional care in rivetting and by caulking as if it were a steam boiler, never lasts, because the vibration caused by the moving loads on the bridge soon works the joints leaky. Where a good sound floor is well "enamelled" or coated with asphalte brushed all over it, then overlaid with some inches of coarse gravel, saturated with asphalte poured hot over it, and this finally covered with an inch or more of asphalte alone, a floor thus covered will remain water-tight a long time.

Drifting.—The words: "No drifting will be allowed on any account," are constantly inserted in specifications, and are ridiculed both in the yard and at the site during erection; the words are as absurd as is the demand that all plates, &c., are to be drilled in the position they are to occupy in the structure, as already commented upon. If, indeed, the employment of cutting tools to true or clear defective rivet holes was forbidden, it would be well, but even this is difficult to attain.

Machine rimers.—If anyone would invent a good rimer to be worked by a pair of wheels, and capable of being clamped up in any required position, to true out holes not quite concentric with each other, he would confer a real favour on both contractors and engineers, and to all concerned in this sort of work; but at all events the barrel drift is an essential tool in rivetting up anything like heavy girder work.

Fastening main girders.—The necessity for fastening main girders spanning a pair of abutments, at one end is a debateable point; some men arguing that no fastening is needed at either end, while others think it expedient to fasten; and the author shares this opinion. He has seen designs where bolts were placed in the bed plates, which bolts were intended to pass through holes in the bearing ends of the girders, nuts being screwed on above; but their employment is not good, because it is nearly impossible to secure that holes in bed plates and in girders will match. The author's practice has been to secure the omission of two or more rivets in the bearing end of the girder, and then when the girder is in place to have holes drilled through these points into the cast iron bed plate below, and then have pins or stakes driven through all.

Squaring cross girders.—In fixing main girders great care must be taken that the cross girders, when having their rivet holes concentric with their companion holes in the main girder, are perfectly square with the main girders, as if this is not the case the rivet holes in the flooring will be thrown out. Therefore, before ends of main girders are staked at their fixed ends, at least two cross girders ought to be got into position, and if not square to main girders—which can be easily ascertained by the simple trigonometrical method of measuring, say 6ft. on main girder, 8ft. on cross girder, and then trying if the diagonal measures 10ft. If cross girders are not quite square, one of the main girders must be jacked till it is in a position such as will square the cross girders. When both main girders are built at the same time, and in their permanent position, this jacking is seldom requisite if the girders have been carefully laid down at first; but where one is built on a central stage first, and then jacked over into its place, and then the second similarly built and shifted, end adjustment is almost certain to be required.

Rivetting.—The inspecting engineer must give constant and especial attention to the rivetting up of work. All the care he may have taken in the yard to secure good work will be thrown away if he neglect this department, and it is a mistake to suppose that even machine rivetting it always and uniformly trustworthy. The work if badly bolted up before going to the machine cannot be tightly rivetted. As a proof of this, the author has himself found chains of rivets put in by machinery all loose, the explanation of this being that the adjoining chain when put in loosened the first set. This was proved by the fact that the first being cut out and fresh rivets put in, they did not loosen any others. The plates had not been properly bolted up at first, and the first row of rivets merely did what the bolts should have done, and thus the second row loosened them.

Machine rivetting.—Machine rivetting, other things being equal, must be the best if for no other reason, then because the squeeze given by the machine tends to upset the shank of the rivet throughout its entire length, more effectually filling up the hole than is the case with hammered rivets. The hammer only makes a succession of dents on the rivet end, but really does not upset the shank for more than about $\frac{1}{2}$in. of its length; and let anyone cut out a rivet, say, 3in. long and examine it, and he will find this to be the case. Moreover, if the rivet selected happens to be tight and difficult to drive out, the punch used to drive it out will have upset still more than it was. The author is of opinion that specifying that rivets shall be made from iron capable of bearing a certain tensile strain is a mistake. The best iron if overheated while being made into rivets will make very bad ones indeed, but nevertheless the engineer cannot complain, for have they not been made to specification? By far the most satisfactory method is to stipulate that the engineer or his representative shall have power to test the rivets at any time during the progress of the work by cold bending, and that the rivet shall bend down close under the hammer without cracking. This is a perfectly reasonable demand, as such rivets can easily be obtained. The author has himself frequently tested rivets $\frac{5}{8}$in., $\frac{3}{4}$in., and $\frac{7}{8}$in. diameter, which have borne such a trial perfectly even when exposed to a severe frost. During rivetting the resident engineer should see that the rivets are fully and equally heated all over, and concerning this point some better mode of heating them than the common portable hearth is greatly needed, it being almost impossible to get rivet boys to heat more than just the points of the rivets, consequently there is less probability of the shanks being upset in the holes, and the rivets have less contraction when cooling. In some girder yards rivets are heated in a sort of reverberatory furnace; they are heated equally all over and are not in contact with the fuel, and moreover are less likely to be burnt. The same method of heating should be pursued on the erection stage. All rivets should be snapped to a sufficient depth, a thing that can only be obtained by incessant attention, all rivetting being done by piecework. Workmen will do their work in the quickest manner, and short rivets save time.

Rivet ends.—A $\frac{1}{2}$in. rivet ought to have a head snapped $\frac{3}{16}$in. deep; $\frac{5}{8}$in. rivets, $\frac{7}{16}$in. heads; $\frac{3}{4}$in. rivets, $\frac{1}{2}$in. heads; and $\frac{7}{8}$in. rivets, $\frac{9}{16}$in. The author has seen specifications stipulating for $1\frac{1}{4}$in. heads for $\frac{7}{8}$in. work; but he thinks this is excessive. Great care should also be given to see that the snaps used are sufficiently deep and with clean well-ground edges; no workman can do good or nice rivetting with bad snaps. A good rivet should have a smooth, nearly hemispherical head, free from cuts, hammer marks, fraising, or other blemishes, and the plate round the head should not be cut by the edge of the snap.

Tight rivets.—The tightness of rivets can be readily tested by tapping their ends with a light hammer; but where one or two rivets in a group are not perfectly tight, it is better to have the snap put on and the rivets hammered again, than to cut them out and put in fresh rivets, which is sometimes apt to loosen the adjoining rivets. In rivetting the top booms or flanges of girders it is an excellent plan to begin rivetting at each end and work on to the centre. By so doing, the stretching or elongation caused in the plates by the process of rivetting is avoided, and the joints are more effectually closed and tightened up.

Camber of girder.—Care should be taken that the main girders, when built and ready for rivetting, have their proper camber. This will, of course, have been provided for when the work was marked out, made, and erected in the yard; but when laid on the blocks at the site it must be carefully built, otherwise the rivet holes in the top boom, as well as its joints, will never come right if the lower boom is not laid true; and this must be tested either with a theodolite or by means of a boneing bar and spirit level. When the lower boom is true and the work in the yard well done, all the rest of the work will come together without trouble. An excellent rule for an inspecting engineer to lay down for a contractor to follow, is that no rivetting is to be done on any account till he has passed the work, and he himself must take care to examine the work as soon as possible after it is reported as ready.

Cast ironwork.—With respect to cast ironwork, it seems to be falling more and more into desuetude—undeservedly so, the author thinks, in some things—since the Tay Bridge disaster. Various parts of structures hitherto made of cast, are now made of wrought iron; yet if castings are properly designed, made, and fitted, cast iron makes excellent work. Castings, other than ornamental work, should have all their corners well filletted—a thing not by any means invariably done. Feathers, too, are not so often introduced as they, with advantage, might be. Yet they cost but little, and if judiciously placed lend a good deal of additional strength to flanges. Full advantage, however, is not always taken of them by proper placing of bolts, which are usually placed between the feathers, as in Fig. 7. In Fig. 8 will be seen what is, in the author's opinion, a far better arrangement. There a boss or thickening of the flange is made, through which the bolt passes; the boss may be either round and well ribbed into side plate, or a cheaper arrangement would be a simple square block. At the bolt, too, the metal faces bear on each other all round the bolt, which is not the case in Fig. 7, where there is an open space round the bolt, the metal only bearing at the narrow facing on the edge of the plate; thus rendering the flange, being unsupported, liable to be broken when screwing up the bolt. Such space might be good in wrought iron flanges, as the spring of the flanges would lock the nut; cast iron, however, is a very different matter.

Lugs on cast iron columns.—The evil of trussing cast iron columns by wrought iron ties secured by bolts passing through lugs cast in one with the column was disastrously shown at the Tay Bridge. This method of construction is very usual; it is also very bad. The method the author would suggest is to cast a rib or fillet round the column, as far from the capital as would leave a space to be embraced by a wrought iron ring, made in halves like an excentric ring, and to secure the eye ends of the ties between these lugs by bolts and nuts. Exigences of foundry work render it more convenient and economical to cast columns on their sides, or horizontally, and therefore they cannot well be cast under a head of metal; consequently there is a danger of the casting being defective from sponginess, air-blows, &c., as well as from the core floating up while the metal is fluid, causing an inequality in the thickness of the column. This can be guarded against if special care is taken to secure the cores in their place, but such care will not be taken without careful supervision. It is not difficult to ascertain whether the metal of a column is of equal thickness all round by means of a special pipe callipers, several feet long in the legs, and with properly shaped ends. A tool of this kind being opened wide enough to let one leg inside the column, and the other being passed over the flange, can then be closed down on the shaft of the column, and being worked all round it here and there, inequalities will be at once detected. The engineer in charge or superintending the work should forbid any painting being done until he has passed the work out of the fettling shop. If he provides himself with a small hammer, having a sharp steel pick or nose at the end opposite to the striking face, he can with it soon ascertain whether any "beaumont egg" or other hard cement has been used to fill up blow-holes or cracks.

Delivery at the site.—As regards delivery of materials or parts of girders, roofs, &c., at a site, specifications sometimes stipulate that they shall be weighed on some particular machine, such as a corporation public machine; this, if enforced, would often necessitate transporting the things a considerable distance out of a direct route. A much simpler, fairer, and more practical stipulation is to demand that the contractor shall supply the weigh notes of the railway company or carrier conveying the goods to the site.

In conclusion, the author drew attention to what is known as the dispute clause in a specification, the text of which constitutes the engineer who is party to the framing, letting, &c., of the contract, and who is superintendent of its execution, absolute and sole judge and final arbitrator in any dispute which may arise during the progress of the work, between his own client and the contractor. The author invited members to discuss this point, as he had himself heard very contradictory opinions expressed as to its legality.

INTERNATIONAL ELECTRICAL EXHIBITION IN PHILADELPHIA.

We have already stated that an International Electrical Exhibition will be held next year in Philadelphia, under the auspices of the Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts. The following is the text of the programme which has just been issued by the Institute:—

"The attention of all persons interested in the generation and application of electricity is respectfully invited to the Exhibition of Electricity and Electrical Appliances to be held in Philadelphia, United States of America, commencing on Tuesday, September 2nd, 1884, under the auspices of the Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts. From the eminent reputation of this institution, coupled with the fact that the projected exhibition will be the first in America exclusively devoted to this important and progressing branch of science, the above announcement has attracted unusual interest throughout the United States, and the exhibition will undoubtedly afford an admirable opportunity of witnessing a representative display of American discovery and invention in electricity. To increase its scientific and industrial importance, as well as to add to its attractiveness, it was determined shortly after its inception to give it an international character. The importance of the project having been properly represented to the Congress of the United States, an Act was passed which, having received the signature of the President of the United States, is now the law. This official recognition provides for the admission into the United States, duty free, of all articles for exhibition only. The text of this Act of Congress is as follows:

"'Whereas, the Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts proposes to hold an exhibition of electrical apparatus, machinery, tools, and implements, and other articles used in scientific and mechanical and manufacturing business and investigation; and

"'Whereas, it is deemed desirable to promote the success of such an exhibition by all reasonable encouragement, in order that it may be made useful for the promotion of knowledge; therefore, be it

"'*Resolved*, by the Senate and House of Representatives of the United States of America, in Congress assembled: That all articles that shall be imported for the sole purpose of exhibition at the Exhibition to be held by the Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, in the city of Philadelphia, in the years 1883 or 1884, shall be admitted without payment of duty or customs fees or charges, under such regulations as the Secretary of the Treasury shall prescribe; *provided*, that all such articles as shall be sold in the United States, or withdrawn for consumption therein at any time after such importation, shall be subject to the duties, if any, imposed on like articles by the revenue laws in force at the date of importation; *and provided, further*, that in case any article imported under the provisions of this joint resolution shall be withdrawn for consumption, or shall be sold without payment of duty as required by law, all the penalties prescribed by the revenue laws shall be applied and enforced against such articles, and against the persons who may be guilty of such withdrawals or sales.'

"It remains only to add, at the present time, that no effort will be spared by the Franklin Institute to secure a large and important representation of the progress of foreign countries, and that the most liberal provisions will be made to place European and American exhibitors on a fair and equal footing. The subject of electricity and its applications is at present attracting an unusual amount of attention, and the exhibition side by side of the best achievements of Europe and America cannot fail to be in the highest degree instructive. All information required by exhibitors, including the classification of exhibits, regulations for the entry of articles for competition, advices as to the best modes of transportation, custom-house regulations, and all other needful information, will be furnished to parties making application for space for exhibition. Such applications should be made to the Secretary, Franklin Institute, Philadelphia, U.S.A.

"For the Franklin Institute,

"William P. Tatham, *President.*
"William H. Wahl, *Secretary.*"

TENDERS.

For erecting new warehouse for Messrs. Pearson, Uxbridge-street, Notting-hill. Quantities not supplied. Mr. H. H. Hart, architect.

D. D. and A. Brown—accepted.

STORAGE TANK.

For the Stockton and Middlesbrough Corporations Water Board.

	£	s.	d.
S. and W. Pattinson, Ruskington	11,751	4	5
John Johnson and Son, Middlesbrough	13,121	19	0
Kellet and Bentley, London	13,732	16	10
George Smith, Newcastle-on-Tyne	14,708	9	10
Foster and Barry, Radcliffe-on-Trent	14,722	8	0
Thos. D. Ridley, Middlesbrough	14,945	10	0
John T. Dickson, Darlington	15,214	1	4
James Dickson, St. Albans	15,298	4	5
George Marshall, Darlington	16,008	12	6
H. Fotherby and Son, Burnley	16,131	17	5
Whitaker Bros., Stockton-on-Tees	16,430	5	9
Robert Simpson, Barnsfold	17,169	15	0
McCrea and McFarland, Westminster	17,182	3	6
Jas. Cowan Smith, Rotherham	17,806	16	2
Geo. H. Goodhall, Middlesbrough	18,189	9	10

NEW WORKHOUSE.

Wandsworth and Clapham Union. Messrs. Wilson, Son, and Aldwinckle, architects. Quantities by Mr. C. Dowling.

	£	s.	d.
Jenkins	72,290	0	0
Chapel	68,800	0	0
Skiff	67,100	0	0
Sathey Bros.	65,300	0	0
Davis	64,000	0	0
Twitle and Appleton	63,720	0	0
Gibbs and Flew	62,726	0	0
Lucas	62,500	0	0
Mullens	62,436	0	0
Perry and Co.	62,288	0	0
Johnstone	62,168	0	0
Martin, Wells, and Co.	61,720	0	0
Gabbott	60,990	0	0
Shurmur	60,840	0	0
Booth	60,750	0	0
Stevens and Bastow	60,450	0	0
Shepherd	59,920	0	0
Parsons	59,745	0	0
Peto	59,595	0	0
Croaker	59,435	0	0
Greenwood Bros.	58,847	0	0
Nightingale	57,872	0	0
Kirk and Randle	57,615	0	0
Lawrence	57,194	0	0
Wall	57,287	0	0
Gibbons	57,000	0	0
Jerrard	56,244	0	0
Foster and Dicksey	55,888	0	0
D. D. and A. Brown	55,506	0	0
Smith	53,977	0	0

Naval Engineer Appointments.—The following appointment has been made at the Admiralty:—Ferdinand J. Fairclough, engineer, to the Swinger.

M. Joseph Antoine Ferdinand Plateau.—This celebrated Belgian physicist has just died at Ghent at a ripe old age. He was born at Brussels on the 14th of October, 1801, was the son of a painter, and was sent to the University at Liége, where he studied law and science, and afterwards gave himself up entirely to the study of mathematics, physics, and astronomy. In 1829 he returned, as Doctor of Science, to live in Brussels, and was received on the 15th of December, 1836, as member of the Royal Academy of Sciences. At the reorganisation of higher education in Belgium—1835—he was called, at the University of Ghent, to the Chair of Physics and Astronomy. Since 1844 he was made titular member of the Academy of Sciences of Brussels. In 1852 he became correspondent of the Academy of Sciences of France. The works of this scientific man—which have generally, as an object, the phenomena of light, of optics, and of vision, and his researches on the superficial tension of liquids—are to be found in the "Memoirs" of the Academy at Brussels and those of the Institute, in the *Annales de Physique et de Chimie*, the *Philosophical Magazine*, &c. A discussion of his papers—some sixty in number—would recall many interesting investigations in which he took part. Félix Plateau, who has also written on allied subjects, is his son, and an interesting research on the formation of soap-bubbles, coupling their names, is to be found in the *Philosophical Magazine*, xxvi., November, 1863. He, the father, that is to say, was elected a foreign member of the Royal Society in the year 1870.

A Venerable Railway Engineer.—George Jennison, foreman engineer in the employment of the North-Eastern Railway Company, has just retired from that position on full pay. Jennison, who is quite an historical personage, has been in the railway service for sixty years, during fifty of which he was engaged as an engine driver. He entered the service of the Stockton and Darlington Railway Company at fourteen years of age, first going about with Mr. Storey when engaged in surveying, and was afterwards apprenticed to the company under that gentleman, who acted as engineer to the Stockton and Darlington Company. He was next employed under Mr. Timothy Hackworth, a divisional locomotive engineer for the same company, and was variously engaged at that time in the different shops at West Auckland and elsewhere. He fired on the No. 1 Rocket, Royal George, Planet, Sans Pareil, and other engines. He went with the Sans Pareil to the Liverpool and Manchester competition in 1829, and the engine burst a cylinder whilst there. He fired on No. 1 engine for nearly two years, running between Shildon and Stockton. He was afterwards driver on the Planet, and was the first to go over the suspension bridge at Stockton. He also drove the first engine between York and Darlington. Jennison ran the experimental trial between York and Darlington on the Big A engine against the Great Western Company's engine, and went with the three-cylinder engine to London to run against Crampton's patent. During his years of service he has had four ribs broken and his right hand maimed. Mr. Jennison is now totally unfit for any further duty.—*York Herald.*

RAILWAY MATTERS.

RAPID progress is being made on the Great Western Railway with the construction of the extra double line between Slough and Taplow. A fine new station is in course of erection at Slough, to which place the extra railway is already completed.

A LARGE expenditure on public works is proposed by the Tasmanian Government for the current year. Among the items may be mentioned a sum of £719,000 on railways. On roads and bridges a sum of £90,000 is to be expended, and with £59,000 on public buildings and other works, a sum total of £900,000 is proposed for expenditure.

IT is estimated that the world's stock of locomotives consists of 66,000; of passenger cars, 120,000, and of freight cars, 500,000. The capital invested in railways, which are in all 200,000 miles long, is £4,000,000,000. The commerce of the seas is carried by 12,000 steamers and 100,000 sailing vessels, whose tonnage amounts to over 20,000,000 tons.

THE new schedule of passenger fares decided upon by the Californian Railroad Commission came into effect August 19th. It fixes 6 cents per mile as the maximum through desert and mountain districts, and 4 cents per mile as the maximum in the valleys. Lower rates already established by the railways are not allowed to be raised to equalise the revenues, but are left as found.

THE Solent Tunnel, which has been so long a project of Mr. Hamilton Fulton, is now being taken up by a committee formed to promote "The Isle of Wight and Mainland Tunnel;" the proposal being to make use of the machinery employed in the abandoned Channel Tunnel. The arguments in favour of this tunnel have so often been urged that there is no necessity to dwell on them here.

AT a meeting of the St. Luke's Vestry on Tuesday a deputation of the inhabitants of Old-street and neighbourhood attended for the purpose of urging the vestry to support a memorial to the Regent's Canal City and Docks Railway Company to form a railway station in Old-street in connection with the proposed line of rail. Support was promised, and the matter referred to the Parliamentary and Improvement Committee for consideration and report.

MORE rapid progress was made last week than in any previous one with the Mersey Tunnel, the advance having been forty-three yards. Of these, thirty-two were on the Birkenhead side, with the Beaumont and English's machine, and eleven by hand on the Liverpool side. There now remain 520 yards between the two extremities of the headings. The main tunnels are being proceeded with, and are following up the headings rapidly. In the course of about another month they may be expected to reach the points where the main tunnel and the drainage heading meet and become one. By that time, therefore, the two ends of the tunnel will be within 400 yards of each other. At the present rate of progress, the communication under the bed of the river will be accomplished by the end of the year.

PASSENGERS on the Midland Railway will be glad to learn that an efficient light is to take the place of the old flickering irritating oil lamps, with their thick glass globes covered in the lower part with dirty swinging oil. The Midland Company has decided to have its coaches provided with the Pintsch system of compressed oil gas fittings, by the Pintsch's Patent Lighting Company, and large numbers of the coaches will be at once placed in the hands of the workmen of that firm. The Midland Railway Company thus again takes the lead in one of the most desirable railway improvements; but in this case the credit deserved is perhaps not quite so great as for some of the improvements made on the Midland line, inasmuch as this system of lighting by gas costs considerably less per year than the troublesome, sinner-making oil lamp.

ON Saturday the nine a.m. passenger train from Musselburgh to Edinburgh ran at speed into the hydraulic lift at the parcels' office, which is situated in the Waverley Station, Edinburgh, at the terminus of the line. The fireman, upon seeing a collision inevitable, sprang from the engine, but the driver remained at his post. It was found that about a dozen persons received bruises and concussions, but the most serious case is that of a fisherwoman, who was cut about the eye. The engine was badly damaged, and the rails torn up. It has been stated that the Westinghouse brakes, with which the train was fitted, could not be applied, as two fish wagons intervened between the engine and carriages. We have ascertained, however, that the engine, No. 230, is a tank engine not fitted with the Westinghouse brake complete, but only with the pump and driver's valve, and that the train was not fitted at all. The blocks on the engine are worked by two hand brakes, one for the driver and the other for fireman, and has no air cylinder or steam brake attached. The driver's report states that the rails were greasy, and the wheels skidded when he and the fireman put on the brake at the usual place. We have here another example of the evils which result from the want of sufficient brake power.

THE Louisville and Nashville Railway Company has just adopted the Jackson improved self-igniting signals on its whole system. Major Geddes and Mr. Frank Fonda think very highly of these fuses, and say they will obviate what few accidents would otherwise occur on the road by a train running into another which had been delayed through accident. Heretofore the danger in these cases has always resulted from the necessity that the delayed train had to recall the flagman with his red lantern at night before starting off, and where a collision occurs it generally takes place before the forward train was well under way. The rule of the road now requires the flagman to stick the spear point of the Roman candle or fuse in a cross-tie in the track, and then strike the cap on the head of it. For fifteen minutes after the brakeman leaves the fuse it throws out a stream of red fire about 10ft. high, and his train is thus enabled to get under full headway before the train following can run into it. The conductor of a train, upon seeing the red fire issuing from the fuse, stops until the matter is investigated and the candle burns out. This, of course, allows the necessary time for the forward train to get under full headway. The usual plan of placing torpedoes on the track just in the rear of a delayed train is still to be kept up, the torpedoes being placed between the burning fuse and the expected train. We may point out that some years ago we suggested in this journal the use of a very similar device.

THE North-Eastern Railway is about to make an early commencement with two works of some magnitude—the enlargement of Middlesbrough Dock, and the Alnwick and Cornhill Railway. The latter is one the cost of which may be measured by the statement that the share capital authorised by the Act is £375,000, with borrowing powers to the amount of £125,000. It is for the construction of a line about thirty-six miles long, traversing a rather thinly peopled part of Northumberland, diverging at Alnwick from the present North-Eastern line, and passing on to Cornhill, on the Kelso branch of the same company's railway. It is expected that the works may be let in a few weeks, but the period of construction cannot as yet be stated. It will give, in some degree, railway facilities to a part of inner Northumberland that has long felt the want, and will be of special benefit to the agriculture of that district. The first-named project is less costly, but it is one that has been loudly called for by the traders of the capital of Cleveland. They urge that the present dock at Middlesbrough—though enlarged a decade ago—does not furnish accommodation for the growing trade of that district, and especially for the enlarged exports of iron and steel. The export coal trade at Middlesbrough is practically dead, the distance from the mines being so much greater than from the pits to adjacent ports, but from the position of Middlesbrough, there should be a large growth in the exports of iron and steel, and this the enlargement of the dock is aimed to meet. A commencement with the work will be made this year, and conclusion may be hoped for next year.

NOTES AND MEMORANDA.

THE colony of Tasmania has now a population of 122,000.

THERE were twenty-three vessels launched from the Clyde shipbuilding yards in the course of the past month, with an aggregate tonnage of 31,510, as against thirty-five vessels and 38,500 tons in September last year. On the past nine months, however, there is an increase of fully 20,000 tons.

IN a paper read before the Bury meeting of the Association of Engineers and Surveyors, it was stated that wood pavement was being laid in that town at 16s. 7d. per yard, to be kept in repair at 8d. per yard for fifteen years. A second length was laid of beech wood 5in. deep and 3in. wide with $\frac{3}{16}$th joints at an angle of 45 to 60 deg. This has a smooth and regular surface which bids fair to be a successful piece of work at a cost of 11s. 9½d. per yard.

WE have been shown a sample of damp-proof matches, invented and patented by Major E. H. Cameron, R.A. These vestas have been placed in water for many hours, and found to ignite without failure after this severe test. Major Cameron took these matches to India with him in 1881, and found that they stood the damp of the south-west monsoon at sea and in Bombay, and the extreme heat of Mooltan equally well. They are made both in wax and wood; the wooden match will, of course, not stand the test of immersion in water, though equally proof against climatic moisture.

A PATENT has been taken out in Germany for a new process of enamelling ceramic articles. The glass, terra-cotta, stoneware, porcelain, or similar article, is covered with a film capable of conducting electricity, by painting the article with a solution of chloride of platinum or nitrate of silver and burning this in, and then decorating as desired, with enamel. This is burned in, and the article is afterwards covered electrolytically with the metal. The galvanic coating does not adhere to the enamel, and very varied effects can be produced by gilding, silvering, colouring, polishing, platinising, &c., the metallic surfaces of the articles.

THE following is the weight of seasoned timber per cubic foot, in pounds:—Apple tree, 49; ash, 50; bay tree, 50; beech, 51; birch, 48; box, 60; cedar, American, 30; Lebanon, 35; cherry tree, 42; chestnut, 40; cork, 15; ebony, Indian, 70; American, 80; elder, 42; elm, 39; fir, Dantzic, 35; Memel, 38; hazel, 40; hornbeam, 48; larch, 35; lignum-vitæ, 70; logwood, 55; mahogany, Honduras, 40; Spanish, 55; maple, 47; oak, English, 50; American, 47; Baltic, 46; pine, red, 40; yellow, 33; poplar, white Spanish, 32; sycamore, 37; teak, Indian, 41; Moulmein, 45; Johore, 70; African, 60; wainscot, Riga, 38; walnut, American, 35; Spanish, 43; willow, 30; yew, 50.

THE *Maryland Farmer* publishes a letter from a correspondent who has seen the great cotton mills of Fall River, Mass., and gives some statements which are not generally considered when estimating the relative manufacturing importance of the geographical sections of the country. Fall River has a population of 55,000, according to the last census; it has fifty-three mills for the manufacture of cotton goods, covering an investment of 35,000,000 dols. Fall River has over one-seventh of all the spindles in the country, and manufactures over three-fifths of all the print cloths of the country. This manufacturing city employs 18,135 persons, their pay weekly amounting to 113,000 dols., and the capital stock is reckoned at 16,738,000 dols.

A RAFT of timbers intended for spiles was brought from St. John, New Brunswick, to New York city on August 26th, after a voyage by steam tows of three weeks. The distance is 600 miles, an average of sixty miles per day. The raft, if such it can be called, was 800ft. long and 30ft. wide, drawing about 8ft. of water. It was formed by sections of eleven cribs each, containing about 500 spiles of 65ft. length. Over and around the sections great chains were wound. Between each cargo there was a wide space to allow free working of the raft in a rough sea. The cargoes weigh about 250 tons each, and it would have cost about 25,000 dols. to bring them to New York by sailing vessels, as the boats engaged in this kind of transportation demanded extra pay on account of the size of the raft. The raft was towed by two powerful tugs.

IN the course of a lecture on pottery, delivered to the Soc. d'Encour. pour l'Indus. Nat., M. Chas. Lauth, of Sèvres, gave some very interesting general information. With regard to the decoration of porcelain, there are two principal methods. The first consists in mixing the metallic oxide—the usual colouring matter—with a flux, such as silicate or silicoborate of lead, and applying it—made into a paint with spirit—to the article, which is then put into a muffle and raised to from 600 deg. to 1200 deg. The flux melting unites with the glaze of the porcelain, and the incorporated colour thus becomes fixed. In the other method the oxide is applied without the intervention of a flux, and the heat is raised to such a degree that the enamel of the porcelain melts, and the colour becomes more completely than in the other case a part of the glaze itself. The effects obtained in this way far excel the others in depth and brilliancy of colour.

THE Philadelphia *Record* says:—"The brigantine Julia Blake, which was recently detained for nearly two weeks at the Quarantine Station on account of having a case of yellow fever on board, has discharged at Dickinson-street wharf a number of curious old bells which have been cracked in the service of the Catholic Church on the island of Cuba. Every year about this season these old and useless bells, many of them cast hundreds of years ago in Italy and Spain, are collected in Cuba by a gentleman doing business with Philadelphia, and shipped here to be disposed of at the market rates for old bronze. Many of the bells are fine specimens of the best workmanship of Europe's oldest and most celebrated foundries. There for years their music has rung out upon the tropical air from the steeples of the churches of Havana and the smaller chapels scattered here and there throughout the country, until at last they have broken down in the service and have been turned into junk."

THE Zuyder Zee was recently the scene of some interesting experiments with Professor Holme's Siren fog-horn. Two steam vessels, the one the Zwalaw, belonging to the Netherland Royal Steamship Company, the other the Hollandia, were each fitted with one of the fog-horns, which, though well known in our navy, have, up to the present time, been used by the Dutch Government as lighthouse fog-signals only. The object of the experiments was to ascertain if a small apparatus operated by steam could be used advantageously at sea for signalling on the Morse system of dot and dash. The two vessels left Rotterdam at 10 a.m., and, after passing through the sluice gates, and entering the Zuyder Zee, the smaller of the two ships ceased steaming, while the larger one put out to sea. Telegraph clerks were employed to manipulate the apparatus, and although the distance eventually became so great that each vessel was invisible to those on board, yet the signals reached the ear distinctly, and were at once read off and understood. The unusual and unexpected sounds caused the captain of an outward bound steamer, the Willem III., to suppose the Zwalaw was in distress, and to hasten to her assistance. Upon getting alongside, and ascertaining the true cause of the noises, he made no secret of his disgust, and steamed away at full speed. After experimenting for about five hours, at distances varying from one to five miles, the signal "Come to us," was given from the Zwalaw, to which the Hollandia replied "We come," and was soon seen steaming towards her consort. There were present Mr. Reeringh, of the Marine Department; Colonel Steppens, Director of the Navy-yard, and the representatives of the various steamship companies. The results of the trials were considered to be in every way satisfactory, and to demonstrate the possibility of one vessel communicating intelligence to the other at sea although separated by a considerable distance. The experiments were conducted by Messrs. De Wit, engineers of Amsterdam, and Mr. C. Ingrey, C.E., the engineer of the Caloric Engine and Siren Company, of London.

MISCELLANEA.

TEN THOUSAND workmen are employed on the Panama Canal, and the work is being pushed forward with great energy.

AS a supplement to "Society" a coloured portrait of M. Ferdinand de Lesseps is published with the issue for the 29th September.

AMERICAN milling machinists are doing their best to produce a good bran compressing machine. A satisfactory machine for packing bran has not yet been produced.

THE town of Settle and neighbouring village of Giggleswick have recently come into possession of a new excellent water supply. The entire cost of the new works has been £3000.

AT an extraordinary general meeting of the Submarine Continental Railway Company a resolution was confirmed to return to shareholders 2s. of the capital of the company. A sum of money is kept in hand to keep the works in good repair.

THE number of visitors to the Fisheries Exhibition on Saturday was 25,486, making a total for last week of 91,502; the total number from the opening of the Exhibition has been 1,985,050, so that the two millions will have been reached long before the Exhibition closes.

THE Darlington Steel and Iron Company have paid off between seven and eight hundred operatives engaged in the steel rail trade on account of their refusal to accept a reduction of 7½ per cent., which the company state is necessary, owing to the severe depression at present prevailing in the steel trade.

THE Liversedge board has rejected the offer made to them by the Cleckheaton Board with a view to a combined drainage scheme. Notice of motion was given that Cleckheaton should take immediate steps to acquire a site suitable for sewerage disposal works; also that a competent engineer be advertised for to superintend the necessary works.

A REPORT has just been issued by the Committee for Promoting Communication between North and South of the Thames, east of London Bridge. It is claimed that the Committee has done much to direct activity in this matter, and that by its aid the recent decided steps formed have been brought about. The office of the Committee is 79, Mark-lane.

TEN years ago iron rails were manufactured by all rail makers, and steel rails by comparatively few; the lattter now form about 95 per cent. of the total output. The life of a steel rail is estimated equal to that of three iron rails. "Steel lines" already in existence will not thus come in very freely to help makers with orders for "rails necessary for relaying."

IN addition to the scheme for bridging over the Straits of Messina, other projects in connection with the same matter are before the attention of the Italian Government. A large ferry to contain twenty-four railway carriages has been proposed to the Ministry of Public Works by Signor Calabretto. A tunnel is also spoken of, the construction of which is estimated to cost £3,000,000 sterling.

A NEW dock and fish market has been opened at Lowestoft. The new basin, when completed, will occupy an area of between ten and eleven acres. On the west side is a quay 700ft. long for drift-net boats, and the new market runs the whole length of this. There is also an additional quay of 1000ft. where fish can be landed. The dock and market have been constructed by the Great Eastern Railway Company, to meet the demands of the large fishing business at Lowestoft.

ON Tuesday morning five men and a boy were descending the Nelson Pit, Shockerley, near Tyldesley, belonging to Mr. W. Ramsden, by means of a cage, when the rope broke, and the men and boy were precipitated to the bottom of the pit into the dibhole, a depth of 260 yards, all of them being, of course, instantaneously killed. Their shrieks as they descended gave the alarm, the fall occupying about seven seconds, so that they had time to realise the horrors of their situation, but at the velocity of about 220ft. per second, or 2·5 miles per minute, which they reached before arrest probably left them little to feel when the crash came. The breakage of ropes is a failure which ought to be visited with very heavy penalties.

AN accident of a somewhat novel character recently occurred between two of the large sea-going Yarrow torpedo boats while manœuvring in the Bay of Spezzia. The *Times* says they were steaming rapidly round one of the large Italian ironclads in opposite directions, and came suddenly in collision with one another. The bow of one boat not only penetrated the side of the other, but actually passed completely through the hull, projecting a considerable distance out on the other side. After a few seconds the boats were separated, and both steamed safely back into the harbour. This curious accident illustrates how easily these boats can be penetrated by one another, and also how efficient are the means provided with some of them for preventing their sinking in case of accident.

THE *Mexican Financier* gives an account of a new fuel invented by a member of a commercial house in the city of Mexico, and for which a patent was obtained from the Mexican Congress in May last. The article is called "turbato," and consists principally of bog peat, of which there are immense quantities in Mexico, mixed with a proper proportion of bitumen or chapopote. The fuel is made in five different classes: for locomotives, stationary engines, smelting purposes, smiths' fires, and household purposes. It burns freely and without much smoke, giving a higher dynamic equivalent of heat than the same amount of wood, and very nearly as great as the best English coal. It can be manufactured and sold in Mexico at a price considerably below coal or wood, and, looking at the daily increasing demand for fuel, the augmentation in the price of wood, and its growing scarcity, the *Financier* says that it is safe to predict a large and successful market for "turbato." As all the ingredients necessary for its manufacture are found in inexhaustible quantities in Mexico, it will create a new and important industry in the republic. With a good and cheap fuel it does not need a wizard to foresee the immense impetus that will be given to Mexican manufactures of every description. Arrangements are said to be making for the manufacture of "turbato" on a large scale, so that it will be shortly brought before the public.

IN the iron-trade report of Messrs. Bolling and Lowe, it is remarked that the second half of this year shows no improvement in the English iron trade; and we have not far to seek for the reason. The immense exports of the last few years to the United States have gradually dwindled down, tin-plates alone excepted, and it does not seem likely that we shall be called upon for some time to execute any demands which manufacturers there care to meet. It is not a question of the United States being unable to produce the rails and other materials required in the development of their railway system—now about 116,000 miles, as against about 18,700 in Great Britain—but simply whether their railway promotors can find people with well-lined pockets willing to accept "promises to pay" in exchange for the hard cash necessary to carry out their projects. Even before the reduced tariff came into force on 1st July, orders for rails were placed with the American makers at low prices, owing to the reduced requirements, and up to the present the position of affairs has not altered. The following statistics of production in 1882 show how great was the American production of rails last year:—United States: Bessemer steel rails, 1,284,067 tons; iron rails, 205,087 tons; total, 1,489,154 tons. Great Britain: Bessemer steel rails, 1,235,785 tons; iron rails, 60,339 tons; total, 1,296,124 tons. The United States consume all the steel and iron rails they make, whilst Great Britain exported last year—780,451 tons, of which not less than 194,901 tons, say one-fourth of the whole, went to the United States. In the first eight months of this year, however, only 49,827 tons were shipped from England to the United States, and of these the greater portion may be looked upon as for transit only.

DOWSON GAS ENGINE AND PRODUCING PLANT.

MESSRS. DOWSON AND HOLT, MANCHESTER, ENGINEERS.

FIG. 3

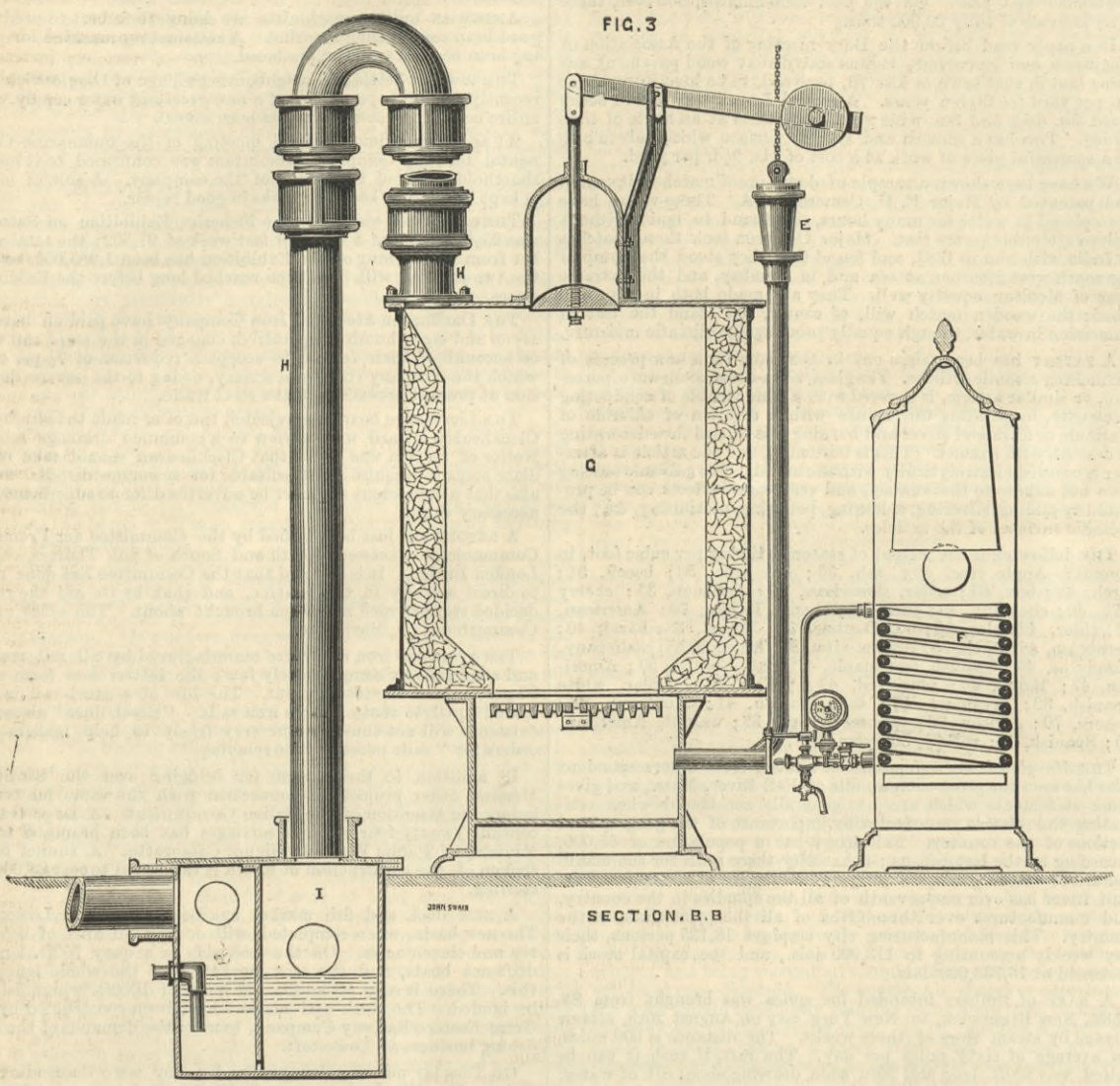
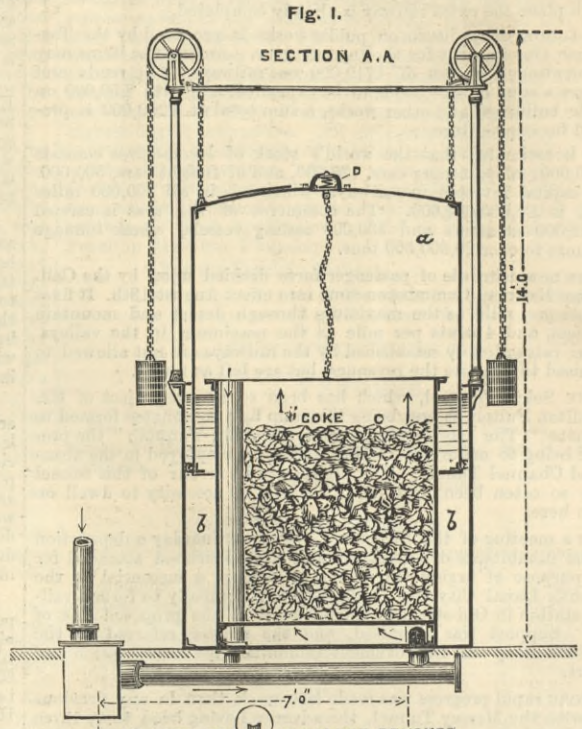


Fig. 1.



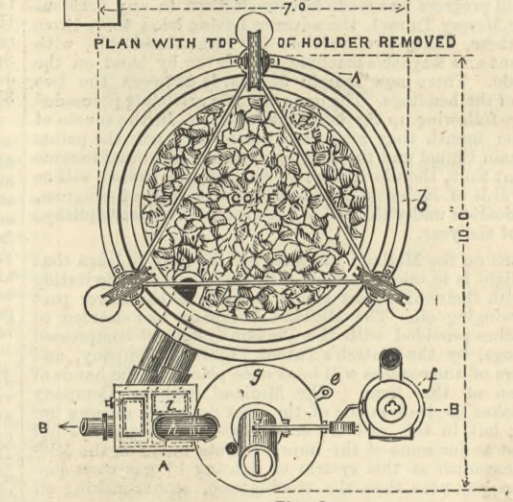
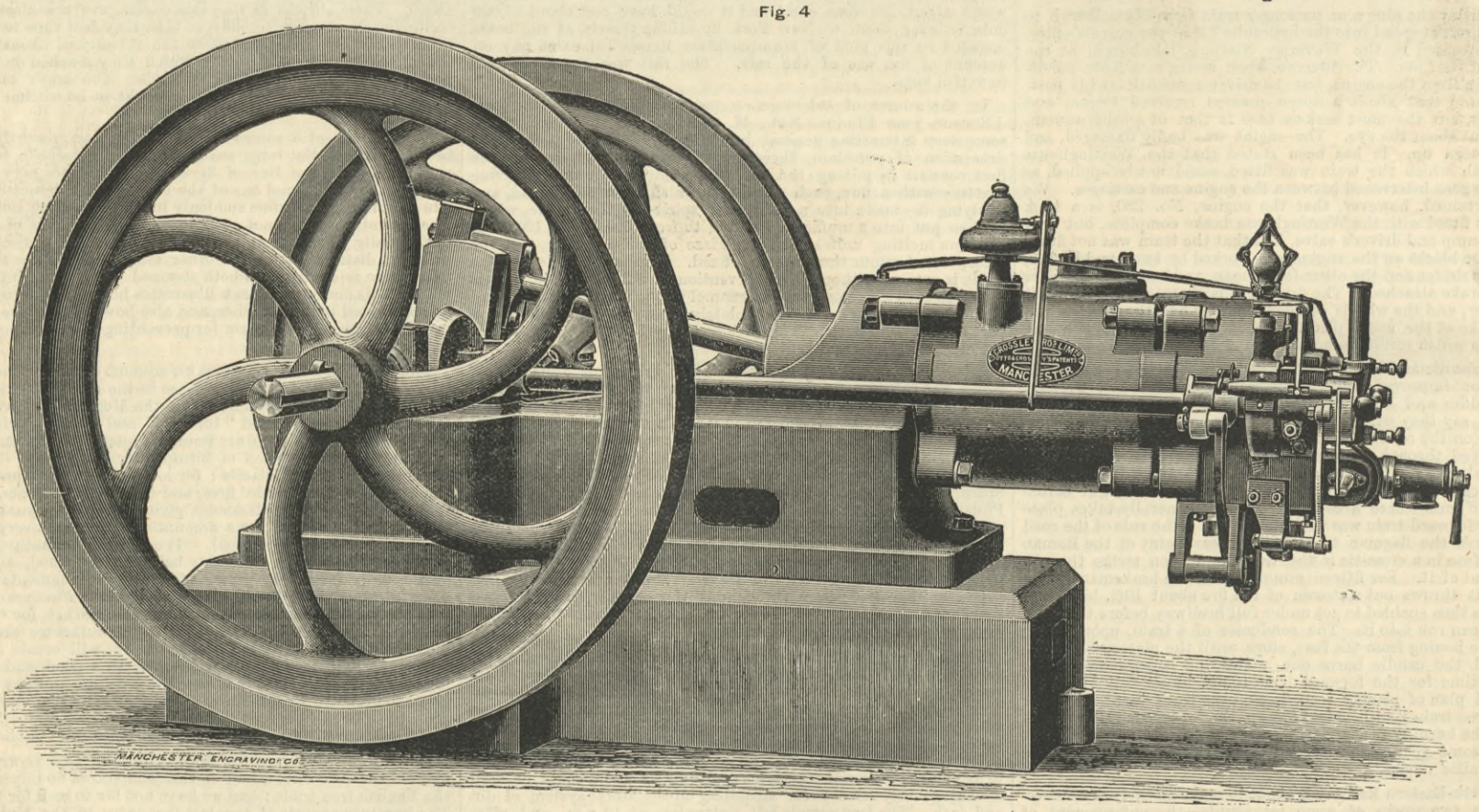


Fig. 2.

Fig. 4



Several Otto engines are now working regularly with Mr. Dowson's cheap gas, but finding that many users of gas engines have little ground space to spare for gas-making apparatus, he has just introduced a complete set of specially compact plant. This requires an area of only 10ft. by 7ft. for a gas engine indicating over 40-horse power, and a very slight increase suffices for double that power. The plant is shown in Figs. 1, 2, and 3, and consists of a small gasholder *a* and tank *b*, with a scrubber *c* placed inside the tank. The scrubber is filled with coke or other suitable material, and the gas is passed through this before it reaches the holder. On the top of the holder is an escape valve *d* to let off gas in the open air or up a waste pipe when the holder is full and when the make of gas exceeds the consumption. This, however, is not much used, for there is also a regulator *e* on the generator—Fig. 3—which, within certain limits, governs the production of gas by the rise or fall of the holder, and this not only avoids waste of fuel, but renders the storage of much gas unnecessary. A sectional view of the gas-making apparatus is shown in Fig. 3, and this consists of a steam superheater F, a gas generator G, an outlet pipe H, and a syphon box I. The gas is made by forcing a continuous current of steam and air through a fire in the generator, so that the high temperature of the fuel is maintained while a constant volume of steam is decomposed. The oxygen of the air and steam combine with the carbon and produce carbonic oxide, which is rendered more inflamable and explosive by the hydrogen from the steam. The gas is of course largely diluted with nitrogen, and for this reason a special type of gas engine is required, which we illustrate above. The total cost of the gas, including wages, &c., and allowing for the increased volume of this gas required to develope the same power as coal gas, is equal to coal gas at 1s. 3d. to 1s. 6d. per 1000 cubic feet, according to the scale of working. Messrs. Crossley Brothers have been using the Dowson gas for some of their ordinary 16-H.P. engines for several months past at their new works, and careful trials have shown, we are told, that with these the fuel consumption is 1·4 lb. per indicated horse-power per hour. They also find that the wages of the fireman for several gas generators are not more than for a set of steam boilers, and that as the gas can be conveyed to any part of the works without condensation, separate engines can be used for different lines of shafting, and this not only effects a saving in the cost of shafting, but any department working overtime can have its engine supplied with gas from a single generator.

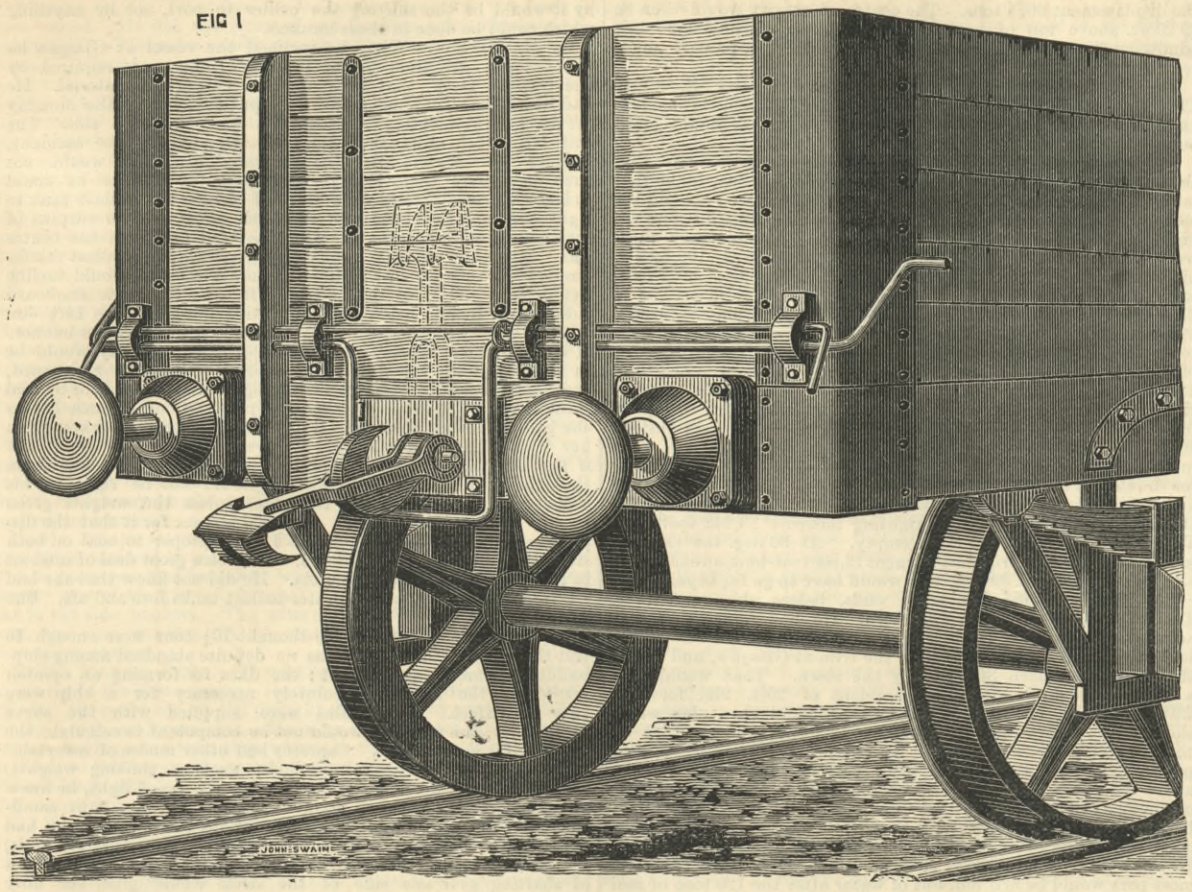
The engine shown in Fig. 4, and taken from a photograph supplied by Messrs. Crossley, is 16-H.P. nominal, and indicates fully 40-H.P. with the Dowson gas. It was specially made for the gas, and was working satisfactorily with it at York show. This engine has some new features in design, and on being tested with the Dowson gas it consumed, we are told, about 15 per cent. less gas per horse-power than the engines previously tested, so that the fuel consumption has now been brought, we are informed, to less than 1·2 lb. per indicated horse-power per hour.

It may be mentioned that the results obtained with this gas have led Messrs. Crossley to construct a special double-cylinder engine to indicate 70-H.P. with the Dowson gas, and this has just been fitted up for regular work.

An American View of the Compound Locomotive.—The indicator cards published from Webb's compound locomotive, concerning which so much has been said of late, do not bear out the assertions of economy made for it. The work in the low-pressure cylinder, at a speed of fifty miles an hour, is a mere trifle, scarcely worth the additional complication and weight entailed. On this point—the multiplication of parts and the crowding necessary to get them in—there is great objection, and it will require much longer trial and impartial judges to determine whether this engine is a good example to be multiplied.—*American Engineer.*

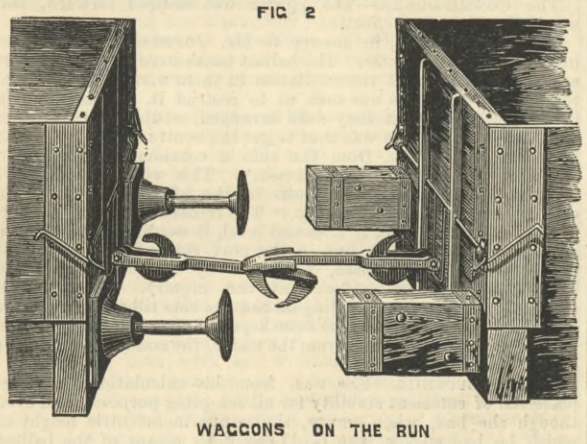
BROCKELBANK'S AUTOMATIC RAILWAY COUPLING.

FIG 1



We illustrate above the latest improvements of Mr. Brockelbank, of Rylett-road, Shepherd's Bush, whose efforts to provide an efficient automatic coupling fulfilling the requirements of the traffic in the United Kingdom are well known. The desirability of securing a cheap and simple coupling capable of being rapidly adopted without interfering with traffic is indisputable, and this Mr. Brockelbank claims to provide in this apparatus. Each wagon is fitted with a coupling iron embracing the draw hook —of the shape and make shown in Fig. 1. On the approach of one wagon one coupling rises from its slanting position, the hooks pass over the other coupling, and dropping by its own weight, makes the connection as in Fig. 2.

FIG 2



WAGGONS ON THE RUN

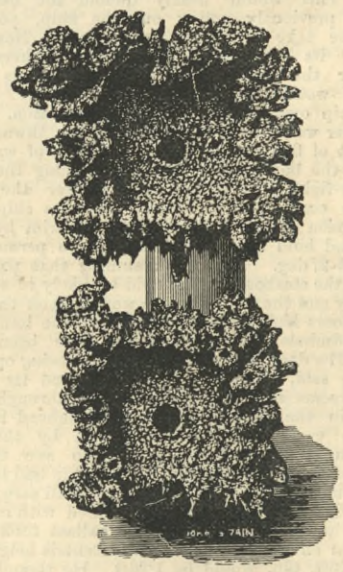
The uncoupling is accomplished by the lever acting as shown by the dotted lines. This lever, which is entirely independent of the coupling, can only come into play when worked from either side of the wagon. This lifting gear can be altered or adjusted to any description of vehicle. This coupling is not affected by any discrepancy in height of vehicles, nor differing lengths of buffers; and is so simple, that once seen at work all further instruction is superfluous.

Cheap as this coupling can be made, the aggregate expenditure necessary to alter 750,000 wagons or more in England would entail some millions of outlay, and in this consists the chief difficulty in substitution of automatic for hand-worked connections. An eminent railway engineer pointed out to the inventor that railway engineers and managers had so hard a task to control working expenditure, that unless such an alteration can be shown to possess elements of economy, it would be a difficult matter to obtain its adoption; and he suggested certain experiments, which were carried out by Mr. Brockelbank with the following results, viz., that as against manual coupling many minutes per train can be saved in the making up and breaking up of trains; that expedition in despatch of traffic can be assured by its adoption, which would realise with some trains a saving stated by Mr. Brockelbank at £10 per journey, in saving in coals, cost of haulage, standing in steam, wages, &c. But putting the saving at one shilling only per goods train journey, over a quarter of a million sterling becomes available towards dividends, and that apart from the increased safety to passengers, there are numerous small savings attendant on the adoption of automatic couplings, which in the aggregate yet further increase their value.

A few instances given by Mr. Brockelbank concerning safety of passengers are deserving of consideration:—"Collisions between trains are usually ascribed to defective points, rolling stock, or bad permanent way, want of brake power or faulty signals; but the reason why that goods train was on the wrong road or in the way at the fatal spot is rarely discovered. Day after day trains timed to be at a certain spot at a given time are many miles away, and not seldom accomplish only one-half their journey by the hour at which their work is by time-table set down as ended." "One train I selected to follow up never for a whole week got near its time-table time after its first stoppage, on some days taking just two hours for every one allotted to that journey. Another train I traced lost fifteen minutes at its first station, owing to delay in making up previous trains; thereupon it lost time at every successive stopping point during its journey of 120 miles, getting shut out at its last signals for two hours and forty minutes, losing altogether five hours and twenty-five minutes that journey. One other train lost four hours per day three days in one week at a certain signal through a few minutes' delay early on its journey." As during any given period of ten years two out of every three train collisions in which passengers have been killed or injured are in goods train collisions, the importance of improved despatch in traffic is fully demonstrated. The annual railway returns, 1870 to 1880, show some 2000 passengers killed or injured during that period, and heavy compensation has been paid, much wagon stock renewed, and permanent way made good. Such facts indisputably show that there is an immense field of saving to be reaped on adoption of automatic couplings.

MAGNETIC INFLUENCE UPON ELECTRO-DEPOSITION.

The accompanying engraving copied from a photograph represents the result of one of a series of experiments by Mr. Frederick H. Varley, to ascertain if it were possible to make magnetism build up a structure from electro-deposited metal, which structure should represent the magnetic lines more accurately than the coarse grains of iron filings. The shadow between the poles merely represents the back of the magnet out of focus. The vertical shadow below one corner of one of the poles bears no relation to the experiment.



Each pole of the horseshoe magnet was 1in. square. The magnet was suspended, poles downwards, in a solution consisting of equal parts by weight of sulphate of magnesia and pure protosulphate of iron dissolved in distilled water, and then diluted down to the specific gravity of 1·26. An iron plate placed at the bottom of the liquid was 1in. wide by 2in. long, and 2in. of liquid were between it and the poles above. A current from two Daniel's cells was used, and the negative or zinc pole connected with the magnet, the positive with the iron electrode. The accumulation represented in the engraving was produced in three days of twenty-four hours.

It will be seen that the result was completely at variance from that which might have been expected from the well-known effects of iron filing experiments. The north and south poles appear to be isolated, and the chief deposition is not between them, the latter being the case when iron filings are used. Moreover, instead of a uniform deposit of metal having a smooth surface, a coral-like aggregation of iron atoms took place, and that almost entirely on the margins of the poles. The philosophical conclusions drawn by Mr. Varley from this are, that the current flowing from the dissolving to the receiving pole is deflected by the action of magnetism; this action practically cuts off the current where the magnetic field is the strongest, and the deposit is thus deflected nearly equally to the margins of the poles. Indeed, the greatest deposit is on the outside margins, where the magnetic action is the weakest.

Another experiment consisted in depositing iron on a mercurial surface, when a uniform film of laminated iron was obtained, having a mirror-like surface. A helix was then placed around the receiving and depositing pole, and the experiment repeated. Instead of the uniform film, fine vertical needles of iron parallel with the magnetic axis grew up from the flat iron plate previously deposited, illustrating in another form Groves' experiment with finely-divided iron suspended in a liquid, in which the liquid became less opaque to light during the passage of the current through the helix, in consequence of the particles of iron arranging themselves in the lines of magnetic force.

The reason why, in the experiment represented in our engraving, the iron assumes coral-like excrescences instead of more regular forms, is, according to Mr. Varley, the virtual reduction of the area of the surface of the receiving poles by what may be termed magnetic insulation.

LEGAL INTELLIGENCE.

WRECK COMMISSIONER'S COURT.

(*Before* Mr. H. C. Rothery, *Wreck Commissioner, with Assessors.*)

THE AUSTRAL.

In our last impression we reported the evidence given down to Wednesday night. The evidence given on the remaining day last week is of small scientific interest, the witnesses, indeed, only repeating one another to a large extent. Thus on Friday Peter Campbell, second mate of the Austral, said that he joined the ship in London, at which time she was nearly coaled. It was not his duty to superintend the trimming of the coals, but the chief engineer's. Upon arriving at Sydney he trimmed the coals, upon instructions. He superintended the opening and closing of the coal ports. There were four certificated engineers. It was the practice to close each port as the coaling was finished. Some time before the casualty the vessel was as nearly as possible upright, with a slight inclination on the port side. He did not hear the coaling commence that evening. He was awoke with the shout, "All hands on deck; the ship is sinking." When he turned out he noticed a considerable list. He got on board one of the colliers. He could hear the sound of water rushing into the vessel. He made no attempt to close the coal ports, the ship being then too far over. Between the time of his coming on deck and the stern disappearing only about ten minutes elapsed. He had nothing to do with the coaling of the vessel at Sydney.

By Mr. Bucknill.—Immediately a list was observed the colliers should go round to the other side of the vessel to coal. There was no lurch, but the vessel went rapidly over. He was not aware that any collier was coming alongside.

To Mr. Commissioner Rothery.—When he came on deck he saw that all the coal ports were under water, and that it had reached some of the side lights, which were about 5ft. from the coal ports. He had previously pumped some of the ballast tanks out, according to order. At that time she had a list to starboard.

John M'Laren, the second engineer, in his evidence, said that he had never superintended the trimming of the vessel when she had been coaling. The chief engineer took upon himself the duty.

William White, the second officer, said that he held a master's certificate of competency. In her two voyages the vessel behaved very well, and there was nothing to indicate she was a "tender" ship. He received no order when the vessel had a list at the Circular Quay. On the evening previous to the casualty he saw that coaling was going on, and went to his cabin on the port side, and turned in. At that time she was perfectly upright. He awoke by the ship turning over. He had great difficulty in opening his door. The ship was lying over about 25 deg. starboard. He looked over the side, and saw most of the crew in the lighter, and after a time he joined them with the aid of a rope.

William Rogers Hayes, the ship's carpenter, said that it was his practice to sound the holds of the vessel night and morning, and her ballast tanks about twice a week. The indicators for the ballast tanks were all in the engine-room. He sounded the pumps night and morning. Previous to the disaster all the water ballast tanks were full. He was present when the vessel was rigged. The masts were of steel. The foremast and mainmast were about 18 tons each in weight. She carried ten boats, five on each side. On the morning that the ship sunk he was awakened by the noise of coaling. The draught of the vessel at that time was about 19ft. 6in. forward, and from 22ft. to 23ft. aft. His cabin was on the upper deck on the port side. When he awoke he found the ship had a list, and he heard the cries from the coal trimmers, believing that something was wrong with the coal. He went on board the collier, and saw that the Austral was going over. He noticed that some of the coal ports were under water in the after end. She was going over pretty quickly. He took no measures to close the coal ports, as it was no part of his duty; but there was no time to do it, even if he had the opportunity, as some coal shoots were attached to the ports. He had not examined the coal shoots since they were fitted. It was the duty of the chief engineer. Some of them might have been stiff in the hinges, but he never saw them in the process of opening or closing. Some of them would not close with their own weight.

The inquiry was adjourned till Monday, when the interest centred in Mr. Elgar's evidence, of which a report, revised himself, will be found further on.

The examination-in-chief of Ransley, the steward, was continued. He said he was on top of the second-class companion on the spar-deck when the second steward said "The ship is sinking." Witness noticed a slight list, but nothing in particular. After that he roused some stewards and felt a list to the starboard. He went back to the after part of the ship and got into one of the ship's boats which was just pushing off. He noticed the lighter on the port side. He could not say whether she was moored to the Austral or not. The first intimation he had of any danger was the second steward saying, "Call all hands, the ship is sinking."

By Mr. Nelson.—He noticed that the coalmen knocked off work during coaling. They were supposed to have a smoke during the night.

By the Court.—He told the stewards the ship was sinking because he was told so, not because he noticed anything.

Wilson, the donkeyman, said it was his duty to keep up steam in the donkey, which was 'tween-decks on the main deck. It was not used in coaling. He having charge of the donkey knew when the tanks were pumped out. At 3.30 a.m., Wednesday, he finished pumping out the sea-water ballast tanks. On the Friday evening he had steam up in the donkey. He turned in a little after ten. He went to sleep. He turned out at midnight, looked to the fire; he could not say whether coaling was going on. He did not hear. He would not necessarily have heard that coaling was going on. Very likely he would have noticed if there was a heavy list; he did not notice any. He turned in at twelve; was out at two again. Every time he turned out he went down to the engine-room and stokehole. There was no one on duty in the engine-room. He did not see a collier alongside. He went on deck once. His cabin was on the spar-deck on the port side. At 2 a.m. he went down through the engine-room, through the stokehole, and sat down in his own room. He was roused by the noise of the coalmen. The ship had a very heavy list, the coalmen were going out of the bunkers, and the water coming in; this was at the midship ports, between the funnels. Previously he had noticed no list. He was not asleep, but lying down on his elbow. He went forward, called the men, and then went over to the lighter. She was fast to the Austral by one rope, a 1¼in. to 2in. Manilla rope. They had to pull the rope tight when he got on. There were over 100 men on the lighter. A very short time elapsed from the time of his hearing the noise till he went into the lighter. Steam was kept up in case of fire. He was roused at about 3.30.

By Mr. Israel Davies.—It was his duty to be on watch at the donkey boiler and in the engine-room at night. He was not on

watch in the day. His room was half-a-minute from the engine-room.

By Mr. Nelson.—He had no duty in the day. He might have said to the Board of Trade officer that when he came on deck there was a collier alongside. He was not on the starboard side all that night. If he had heard coaling going on it would not have been his duty to report it to anybody. There might be a man in the engine-room and he not see him. He was on watch to a certain extent. Alongside the quay he was on watch all night because a main boiler was lit.

By Mr. Batham.—He saw the chief officer that night. It was his duty to keep up steam. He saw the chief officer.

By Mr. Mansell Jones.—His duty was to see that no water accumulated in the engine-room or stokehole. He had never seen anyone besides himself on watch in the engine-room in harbour, except in London. In Simon's Bay he looked after the trimming of the coal, by order of the chief engineer. He had no order from the chief engineer to call him if coaling began. The chief engineer told him to keep steam in the boiler and look after the bilges. There would be no necessity for anyone else to be in the engine-room. He was last down in the engine-room at two.

By the Court.—He had very bad hearing. His duty was to keep steam in the donkey boiler, and to see the water did not accumulate in the bilges. If she made water in the night soon after he had been through the bilges, he would not have known till two hours after.

Mr. William Thomas Mumford said he was principal shipwright surveyor for Lloyd's at Glasgow, including iron and steel vessels. He took up the duty of a colleague who had died in observing the construction of the Austral. She was built to 100A class, under special survey, and he reported that she complied with the requirements, on which the committee granted a certificate.

By Mr. Bucknill.—He had been surveyor to Lloyd's Register for twenty-seven years.

By the Court.—He was satisfied with the ship in every respect.

Mr. Mansel Jones put in by consent the depositions taken before the coroner at Sydney. He observed that the Board of Trade came early to the conclusion that the cause of the casualty was in all probability not want of stability. It was felt, however, that if the question did not directly arise, it should be made an element of the inquiry. They were informed that the owners would call evidence as to stability. They had furnished to the Board a proof of the evidence to be given by Mr. Elgar, and the Board, knowing it would be before the Court, had determined to watch the evidence, and if the Court then required further evidence, to call it. The following were the questions upon which the Board of Trade required the opinions of the Court:—(1) Whether the owners of the vessel and their servant were responsible for the design of the vessel, and, if so, whether they furnished the builders with information as to the proposed stability of the vessel? (2) Whether proper calculations were made, and whether proper measures were taken, to ascertain the stability of the vessel, and whether, as constructed, she was deficient in stability? (3) Whether instructions were issued to the master and officers as to the loading, coaling, ballasting, or others wise affecting the stability of the vessel, and, if so, whether the same were sufficient? (4) What were the circumstances in which the vessel took a list on the 6th of November, and whether such list was sufficient to have warned the master and officers as to her stability when coaling; and, if so, whether proper instruction were thereafter issued, and whether proper measures were taken with reference to the coaling, to insure the safety of the vessel? (5) Whether the master was justified in ordering the ballast tanks to be pumped out? (6) Whether, at 11 p.m. on the night of the 10th of November, the vessel had any list; if so, to which side, and what was the cause thereof? (7) Whether a sufficient and proper watch was kept on the night of the 10th-11th of November; and whether, having regard to the regulations issued by the company to their officers, the master was justified in leaving the deck with no certificated officer in charge? (8) Whether the chief engineer took proper measures to superintend the coaling of the vessel, and was he responsible for the fact that coaling was going on without his knowledge? (9) Whether the chief officer was justified in leaving the deck without an officer in charge thereof, when the Austral was taking in coal on the night of the 10th of November? (10) What was the cause of the casualty which happened to the vessel on the morning of the 11th of November? (11) Whether every possible effort was made to save life? (12) Whether, in the opinion of the Court, having regard to the purposes for which she was constructed, the Austral was, as laden on the 10th of November, deficient in stability? (13) Whether the masters, officers, and engineers are, or either of them is, in default? (14) Whether blame attaches to the owners?

The owners then proceeded to produce evidence.

Mr. Francis Elgar, examined by Mr. Baden Powell, said he was a consulting engineer and naval architect, member of the Institute of Naval Architects, &c., and had had considerable practice in designing ships and calculating stability. He inclined the Austral on August 6th last, and has made calculations as to her stability, &c. When inclined the draught was 20ft. 1½in. forward, 21ft. 6½in. aft—a mean of 20ft. 10in. The displacement in fresh water—Queen's Dock, Glasgow—was 7200 tons. They used 10¼ tons to incline her, the weights arranged in the usual way, half on each side of the ship, on the promenade deck. The effect of placing the whole of the weight with its centre of gravity 19½ft. from the middle line was to incline the ship 1·1 deg. The metacentric height would thus be 1·593; about 1ft. 7in. The metacentre was 21·3ft. above top of keel. The height of the centre of gravity above the keel was 19·707ft. A piece of tunnel shafting —10 tons—had been taken out at Sydney which was in her at Glasgow, and also a piece of spare shafting, 10 tons. There were three pistons not in her at Sydney weighing 10·5 tons. There was some extra engine gear weighing 1·5 tons. Two tanks in the after hold weighed 4·5 tons. There were also casks weighing 5 tons. The bunker coal weighed 890·9 tons at 41·25ft. to the ton. The water in the tanks forward weighed 71·5 tons, part being salt water. There were 114 tons—salt water—in the fresh water tank. The foremost ballast tank contained 151·5 tons. In the remaining tanks and bilges there was some loose water, which he calculated at 53·5 tons. He allowed 35 cubic feet per ton for salt water. Of ship's stores and odd items of outfit there were 42 tons, men's tools 5 tons, and 10¼ tons of ballast used for inclining. Two boats, not on board at Sydney, weighed about 2 tons. Total, 1385·85 tons. These weights were on board when he inclined her in Glasgow, but were not on board at Sydney. These being taken out would give the light weight of the ship, with the exception of such coal, ballast, stores, &c., as were on board at Sydney. The 7200 tons, less 1385·85, left 5815·15. The weights to be added were:—Two sheer-legs and tackle on the upper deck for lifting out the shafting, 1·5 ton, two valves on the upper deck weighing 1·5 ton, coal on the upper deck weighing 1·5 ton, some materials and fittings removed at Sydney since the accident estimated at 30 tons, namely, ceiling in main 'tween decks, cabin fittings, &c. He had taken into consideration the positions of these weights. Some shifting of iron bedsteads and sails altered the position of centre of gravity, but not the weight. These additions brought the weight of the ship on the night of the accident, without coal, &c., to 5850 tons, and the centre of gravity to 22·37ft.—above top of keel—making allowance for the positions of the weights. The original displacement scale gave 5842 tons displacement for that draught, and 21ft. 11in. height of centre of gravity. He presumed that was an approximate calculation. It was that given to the Court by Mr. Shepherd. The light draught at 5850 tons displacement would be 17½ft. mean; metacentric height, *minus* 9½in., or *minus* ·8ft, or 21·57 for the height metacentric above the keel. She would be at rest at 16 deg. to 20 deg. inclination. That was common in all classes of vessel—ships of the old and new type. The largest *minus* metacentric height he knew of was 2ft. He had seen the same in large passenger steamers, some without ballast tanks. The Austral had ballast tanks holding 785 tons, fresh-water tanks included —604 tons salt, 111 fresh, and 70 tons forward. If the 785 tons of water were admitted into the tanks it would make the displacement 6635 tons. The centre of gravity would then be 20·208ft. above top of keel, and metacentric height 1·162—*i.e.*, admitting the water ballast at once gives the ship a positive metacentric height of 1·162ft.

The Commissioner.—It lowers the centre of gravity 2ft.?—Yes. That was good stability. It was a large metacentric height; he did not mean excessive, but sufficiently large. It would make her a stiff ship.

Mr. Baden Powell.—Fitted as she was, there was no reason why she should be unstable, because by means of the ballast tanks that metacentric height could be given. He would proceed to add the weights she had on board at Sydney. The coal on board before the night of the accident was 1612 tons. In the forward tank there were 70 tons of fresh water, and 111 in the reserve tank, 190 tons of pig iron, 65 tons of stores; men and effects he estimated at 22 tons; loose water in the bilges and tanks, 30 tons—a total weight of 2100 tons. Adding the 120 tons of coal put in on Friday-Saturday, brought the total to 2220 tons, giving a total displacement of 8070 tons. That would make the centre of gravity 20·094ft. above the top of the keel, and metacentre 21·37ft., giving a metacentric height of 1·276ft., or nearly 15·5in. The 5850 tons given as the right weight of the ship allowed for water in the port, forward, and donkey boilers, those being the only ones full on the night of the accident, and no water in the condenser. Her mean draught was 22ft. 3½in. He had drawn a curve of stability for the ship in that state. That curve showed that 61 deg. was the angle of maximum stability, the length of the righting lever at that angle being 2·88ft., and righting moment 23,242 foot-tons. That was with the ballast tanks empty. At 90 deg. the righting lever was 1·71ft., and righting moment 13,800 foot-tons, an exceptionally large amount at 90 deg. She would have to go far beyond that —*i.e.*, much beyond her beam ends, before she went over. The ship was trimmed by the stern. He had taken that into account in considering the height of the ports above the water. He had calculated the trim also from the trim at Glasgow, and found she must have been 3ft. 1in. by the stern. That would give a draught at the time of the accident of 20ft. 9in. forward, 23ft. 10in. aft. On that calculation he had made a plan which showed the water-line inclined at 12 deg., showing that at that angle water would begin to enter into the after coaling ports. The bottom of the after coaling port would be 5ft. above the water, assuming her to be upright. It would be 5ft. 3in. out before the 120 tons of coal were put in, and 5ft. after. He had taken the disposition of the coals from the statements of the chief engineer in evidence, and the plan produced by him. The 120 tons put in would bodily sink the whole ship 3in. The foremost port would be 6ft. 8in. out of water after the 120 tons of coal were put in. He had assumed the coal ports to be all open in the calculations which followed. If 120 tons of coal were merely put into the ports, and not trimmed, it would incline the ship 12 deg., the 120 tons being so put in that its centre of gravity was 7ft. 2in. inboard from the side. That would put the two after ports just into the water, so that water would begin to flow into them. The foremost ports would be 1½ft., or 1ft. 8in. out of water at that time. If, on the other hand, the ballast tanks had all been full, the metacentric height would have been 2·52ft., and the arrangement of weights which inclined the ship to 12 deg. would in that case only have inclined her 6·08 deg.—that is, if 604 tons of water had been placed in the empty ballast tanks. She would then have had an additional mean immersion of 14in.; the trim by the stern would have been diminished 14in.; and the draught would have been 22ft. 6in. forward, 24ft. 5in. aft. The after coal port would then be 4ft. out of water if the ship were upright. The inclination of 6·08 deg. would leave the after port 1ft. 6in. out of water. There was no loose weight about the ship which could incline her 12 deg. It would require 200 tons—80 tons more than the 120—to put her after ports under water if the ballast tanks were full. It was his opinion that the ship was steadily inclined from the upright position till the water entered the ports. For each degree of inclination till the ports came into the water 178 foot-tons of heeling moment had to be applied. A sudden lurch was impossible, unless there was some great weight in her that shifted. But on the ports becoming awash a new state of things would be set up. The water would first flow in and lie along the steel orlop deck up to the level of the coal port; that would be a rapid introduction of 100 tons of water. This would nearly double the heeling moment which was previously acting on the ship, and she would at that time take a sudden inclination. Next the water would find its way into the side bunkers, and, after allowing for the coal in them, the pockets and 'tween-decks alone would hold 400 tons of water. That would carry the ship over to about 30 deg. inclination. At the same time the water would be going below into the thwart-ship bunkers to the weight of 610 tons, making 1010 tons of water altogether enclosed by the bunker bulkheads. Assuming the coal bunkers to be water-tight, the 1010 tons of water they held allowing for the coal in them would give the ship an increased mean immersion of 1ft. 11in., reduce the trim by the stern by about 1ft., and hold the vessel floating at a permanent angle of heel of about 27 deg. That was assuming that the coal did not shift over to the starboard. It would be likely to shift at 27 deg., and the entry and the flow of water would assist the shifting. If the bunker doors had all been closed and the bunkers had been tight, the admission of water would have been restricted to 1010 tons. The door in the forward bunker being open—there was evidence, he said, of that—the water found its way into the two boiler rooms and engine-room, and through one or two open doors in the after engine-room bulkhead into the after-hold, which would put the vessel down by the stern. The witness thought that when the captain saw the rail down the water had already flowed aft. If the ship had been laden with a homogeneous cargo of 100ft. to the ton in all cargo spaces, which would give 1542 tons weight, bunkers filled with coals 2530 tons, fresh water in the tanks and reserve ballast tank 181, stores 65, and men and effects 20 tons, the metacentric height at the load draught of 26ft. 6in. would be 1·26ft. He thought that a good metacentric height. In that condition at 90 deg. inclination, 10,300 foot-tons would be the righting movement. That would be a good stability. If all coals, water, and stores were consumed, and the draught thus reduced to 21ft. 3in., the metacentric height would then be reduced to *minus* 5in. If then all the ballast tanks were filled—not including 70 tons in the fresh water tanks—the metacentric height would become 1·16ft. That would be a good stability, and give 22ft. 6in. draught, with a large righting moment at 90 deg.—12,640 foot-tons. So that with ballast tanks full you could always keep a good metacentric height. He did not understand what the captain meant when he said 120 tons showed the vanishing point of her stability.

The examination-in-chief of Mr. Elgar had been finished when the Court adjourned.

Mr. Baden-Powell next day continued his examination of Mr. Elgar, who produced some further calculations as to stability. He had made a curve of stability for the ship, assuming her to have had no metacentric height whatever at the time of the accident. In this condition the angle of maximum stability is at 57½ deg. She would gain but little up to 10 deg., but beyond that would gain stability very rapidly. At 57½ deg. the righting lever is 1·78ft., the moment 14·350 foot tons. At 90 deg. the righting lever is ·434ft. and moment 3500 foot tons. The tendency of the ship as she sank would be to somewhat recover, and not to incline farther over. The effect of grounding aft would be to trip her further over, not to right her.

By Mr. Israel Davis.—The side bunkers were in the shape of a box above, and of a tapering form against the side of the ship below. Their width in the 'tween decks from skin towards the midships was 14½ft. When full, the centre of gravity of coal in the 'tween decks would be 7ft. 3in. from the side; in the pockets below it would be much nearer the side of the ship. No trimming could throw the centre of gravity of this portion of the coal any more towards amidships; the only remedy for a list caused by it would be the shifting the collier to port, not by anything which could be done in these bunkers.

By Mr. Nelson.—When he inclined the vessel at Glasgow he did not pay attention to the bracing of the yards required by the Queen's Dock, that being, for the purpose, immaterial. He had heard that 220 tons of coal were put into her on the Monday before the accident at Sydney, on the starboard side. The ship was much stiffer then than on the night of the accident, because her water-ballast tanks were full. She would not then list more than 7 deg. or 8 deg., so far as he could judge. Thirty-six tons were pumped out of the ballast tank to right her, and coal also was trimmed. The 80 tons surplus of machinery on the starboard would be well out from the centre line. Assuming weights equally balanced, and ballast tanks empty, 37½ tons put in on the extreme starboard would incline her 5 deg.; 53 tons put inboard 7ft. 2in. from the starboard side would incline her 5 deg. The side bunkers were 14ft. 6in. wide in the 'tween decks. They were loading one cross-bunker. If trimmed level across the ship, the centre of gravity would be in the centre of the ship. Up till two o'clock, he had heard, the vessel remained upright. That might be accounted for by coal being trimmed into the cross bunker properly, or by such list as she had not being observed. Fifty-three tons would have given her 5 deg. list, and therefore by 2 she would have had a list if the coal had not been trimmed, but left at 7ft. 2in. from the side of the ship. The carpenter could not be right in his account of the draught of the ship, unless the weights given to the witness were wrong. He could answer for it that the displacement scale was not wrong. It was proper to coal on both sides or to move the collier round. He took a great deal of interest in the foundering of the Escambia. He did not know that she had a cellular bottom. She had water-ballast tanks fore and aft. She turned over.

By Mr. Mansel Jones.—He thought 10¼ tons were enough to test the vessel with. There was no definite standard among shipbuilders for metacentric height; the data for forming an opinion respecting the amount absolutely necessary for a ship were very imperfect. If captains were supplied with the curve of stability, the majority would not be competent to calculate the stability for each voyage. Captains had other modes of ascertaining stability—experimental methods, such as shifting weights, setting topsails, &c. If the captain saw the vessel light, he knew or could ascertain as much about her stability in the light condition as you could tell him. He would see whether she had a positive or negative metacentric weight. The Austral's sails, &c., would weigh about eight tons. Taking out the ten tons of shafting over one side of the deck would give her only one degree of list, scarcely perceptible. The captain would be justified in thinking her stable after that. The 120 tons of coal, if accumulated at the end of each shoot, would accumulate at a distance of 5½ft. from the side of the ship. As the vessel inclined, the tendency would be for the coal to slide towards the lee-side. Besides coal, the only other factor that affected the heel was thirty tons of loose water, which he estimated for. The carpenter's evidence would give more, but the carpenter sounded in a sunken part of the ship, which was no test at all. The lighter on the port side might slightly counteract the tendency to starboard. If the lighter rope broke it would cause a sudden list to starboard. The effect would be very slight, because it was measured by the strength of the hawser, which, he had heard in Court, was not great.

The Commissioner.—The lighter was moored forward, and would thus have less effect.

Witness continued, in answer to Mr. Jones:—He could not imagine any other factor. The ballast tanks were divided to port and starboard, so that the oscillation in them would be small, and the form of the tanks was such as to restrict it. Loose water in the Austral's tanks, as they were arranged, would not reduce her stability. His opinion was that to get the centre of gravity of the 120 tons at 7ft. 2in. from the side a considerable amount of trimming over to port was necessary. This would be the more necessary, because a portion was in the after pocket, and so was fixed to the side of the ship. The remainder was in the forward cross-bunker, and, if trimmed level, it would have to be taken right across the middle line to the port side. His calculations had gone on for months, corrected by what he had heard by listening to the evidence at the inquiry. He attributed the sinking to continual coaling on the one side till the ports came into the water. Had a watch been kept and the collier taken round when the ports were a foot from the water, the accident would have been impossible.

By Mr. Bucknill.—She was, from his calculations, a vessel possessed of sufficient stability for all sea-going purposes, and even though she had, when empty, the minus metacentric height of which he had spoken, she could easily, by means of the ballast tank, have had a safe positive metacentric height given to her. So it was important to look after the water-ballast tanks. He had thoroughly mastered the plans of the Austral, and had no fault to find with them. He had not consulted with Mr. Shepherd—he desired that his evidence might be independent. The captain's evidence that on the previous voyage he filled his tanks after getting into the river could not be correct. It would have sunk his Plimsoll mark; it would take her down 14in. to 14½in.

By the Court.—The orifices in the steel deck leading to the lower bunkers were opposite the ports and 5½ft. from the side, and the depth of the steel deck below the sill of the ports was 5½ft. The inside shoot was 7ft., which would bring it to the orifice. The coal would first pass down to the starboard side of the lower bunker, and the heap be accumulated at 5½ft. from the side. Consequently a smaller quantity at 5½ft. would have the same inclining moment as the larger at 7ft. 2in. Therefore to get 7ft. 2in. there must have been a considerable amount of trimming. Supposing the curve of stability were given to a captain, he did not mean that it would necessarily be of no use to him. It was important to a captain, in loading many classes of vessels, to know it. In grain laden ships the metacentric height of the vessel when empty and her curve of stability ought to be known to the captain. Many, however, of them, would not understand it. They could be taught that at a certain inclination, for example, their ship's stability vanished. It was absolutely necessary in some classes of vessels. Witness had been speaking in his evidence with regard to this particular ship. He could not speak as to Captain Murdoch. Witness knew some captains to whom a knowledge of the stability of their ships would be of use. In this class of ships the curve of stability was not important to captains, because, if they had a metacentric height, they would have a large growth and range of stability. A captain sent to watch the construction and loading of a ship got more knowledge into his mind probably, that way, than could be put into it by information relating to metacentric heights and curves of stability. Witness was not against calculating metacentric heights of ships. He thought it should be done when they were designed, and that they should be inclined before they left. The extent to which the calculations are necessary to be carried depends greatly on the type of ship. An inclination of 5 deg. would be perceptible, but he doubted if it would attract the attention of a seaman at night. A person in the engine-room might not perceive it at all. He had no doubt whatever that the carpenter's evidence as to draught was inaccurate. A hundred and twenty tons, if 9ft. outside of the skin of the ship's side, with tanks full, would have brought her over 12 deg.; 120 tons, 5ft. inboard from the side, tanks full, would heel her over about 6⅜ deg. Every 10 tons at 7ft. 2in. inboard—with tanks empty—from the side of the ship would incline her 1 deg. If tanks were filled very nearly double the quantity would be required. By filling the tanks the metacentric height would be doubled. With tanks full the vessel

would incline 1 deg. for every 20 tons. The righting moment at 12 deg. of the ship at Sydney was 2233 foot-tons laden as she was, with tanks empty. That was on the assumption that the ports were closed. He did not know of any bunkers being absolutely water-tight. The water would percolate through the joints of the plating. If water got into the bunkers the coal would have a greater tendency to shift as the ship inclined. The bunker door leading into the boiler-room would not be perfectly water-tight. Asked by the Court, the witness stated that, as a general proposition, captains should know all about the curve of stability of their ships. He said it might be misleading if a captain did not understand it, but that it would be misleading in the same sense if a captain did not know how to steer. Owners had to deal with captains as they were. Some one ought to know the stability, and the owner should use his judgment as to the instructions he should give to the commander.

Mr. John M'Dougall, chief engineer, called by Mr. Bucknill, said his log would show the state of the ballast-tanks. On the first voyage they got into the river on May 17, 1882, from London. The salt-water tanks were empty then. On June 16 the ballast-tanks under the forward boilers were filled. That was between Aden and Melbourne. On the 21st of June they filled the starboard after tank. On the 23rd of June another tank was filled, the starboard after tank under the after bunker; then the port tank, under the after bunker. On the 25th, at 3.15 p.m., they filled the port after-boiler-tank. On the 27th they pumped out the main-hold tanks, and after-boiler-room tanks. On the 30th of June part only of the tanks were filled, not all, as the captain said. On the return voyage the tanks were filled from time to time as coal was consumed.

By Mr. Israel Davis.—He had never heard of the chief engineer being required to set a watch on deck. He oiled the hinges of the ports on the Saturday when he opened the ports. The greater part of the 120 tons brought in on Saturday morning was put in the side bunkers. The after bunker was filled, wanting 7 tons, the fore wanting 23. A small quantity was put in the thwartship bunker.

By Mr. Mansel Jones.—The draught of water was not entered in his log of the first voyage. He had to ask for it from the chief officer. He could not set the draught aft, except by getting a man aft by a rope or by weights. He kept the draught on the next voyage, having more time than when the ship was quite new. On arriving at Sydney on the second voyage, all tanks were full; he did not know why. No one but the donkeyman was a watch in the engine-room.

By the Court.—It was from his examination of the bunkers he knew that most of the 120 tons of coals were put into the side bunkers.

Mr. Martell, examined by Mr. Baden-Powell, said he was chief surveyor at Lloyd's. In regard to a ship of the Austral type, they would not require a curve of stability before giving her a load-line. They look at the proportions of the ship, and consider whether she can carry a homogeneous cargo. If they do not think she can, they then require the ship to be inclined. If they had a ship like the Austral, with the 'tweendecks appropriated to passengers, they could not think how she could be dangerous, and so would not require her to be inclined for freeboard, which, by their rules, might be 10ft. In many cases they would require the ship to be inclined.

By the Court.—That was simply with reference to fixing her freeboard. In this case he had heard she had a minus metacentric height when empty of —0·8. With certain types of ships it was of great importance to obtain the stability. In ordinary ships, loaded with a minimum freeboard, when they knew such a ship might capsize, and knew precisely what would make her safe, it was essential to make the calculation. Ordinary captains would not, however, understand a curve of stability, but might be told, "You must leave out so much between decks, or put water-ballast in."

The Court said it had come out that arrangements were made for loading the Austral through her ports, and that with 190 tons dead weight and 1600 tons of coal, and with her two fresh-water tanks filled, but ballast-tanks empty, the ports by which she was to take in the remainder of her coal would be about 5ft. 3in. out of the water, and that 120 tons of coal at 7ft. 2in. from the side would incline her to 12 deg., and put the after ports under water. Given those facts, and the fact that with tanks filled, although the ports would be 1ft. 3in. nearer water, yet it would require much more coal to be put in to incline her till the ports reached the water, it would not have been very desirable that those who had the management—the agent in Australia, the owner here, whoever it might be—should have know the metacentric height of the vessel, both with and without full tanks? The witness agreed that persons in charge could be assisted by calculations; it would be better, and with some types of ships it would be essential. But he could not conceive anybody having charge of a ship like this and not availing himself of water ballast at the very time when the ballast was required—*i.e.*, when the ship was empty. Pressed if he did not think it would have been useful for the master to have the metacentric height, he said that the mere result of giving those calculations to captains might be misleading until the Board of Trade examined them in such subjects. The Board should, however, make such requirements of captains, and then the calculations would be useful. Shipowners themselves ought to know. They could then instruct their captains how to load; the more information the captain had the better. But if a captain did not know that when his ship was empty he should use water ballast, then a managing owner could not manage a ship at all. The witness insisted that this country's greatness had been built up by a mercantile marine commanded by men no one of whom thought of calculating stability, as in sailing ships for example. The Commissioner put it to him whether it would not have been better that the captain should have known that the Austral had no initial stability. The witness rejoined that he had long known the learned Commissioner's views as to calculations of stability, and agreed with them to a certain extent, but the captain would not understand metacentric height. It was only recently that scientific knowledge of that kind had been acquired by the few. Captains with their multifarious duties could not devote their time to learning the doctrine of stability, and a little superficial knowledge would be probably more dangerous than none at all. "A little knowledge was a dangerous thing."

The Commissioner.—I was not assuming you were to give the captain all the mathematical details, but you could give him the effect of them. The witness said he agreed with certain reservations, but the Austral ought not to have come to grief with the most ordinary care.

Mr. Batham recalled Mr. Godfrey Turner Richards, the first mate. Mr. Richards said that when he awoke he went to the captain's cabin, and immediately walked along the promenade deck, went down the stairs, and called all the men from the forecastle companion. He went into the lighter, followed by the captain. He saw three men come out of the coaling ports on the port side. The carpenter, second officer, and he went to shut a door between the reserve bunker and the main hold. The water rushed in and prevented them. They got into the lighter as it was pushing away. He helped to save the fireman who was grated down. He did not know the ballast tanks were empty. He thought they were full. He had never called the chief engineer for coaling, except when specially requested by that officer to do so.

By the Court.—One officer on the bridge was enough at sea; a junior in addition would have been better. In mid-ocean only one officer was on deck in a watch. In his opinion that was enough for a large vessel like that. On approaching land they had two officers in the watch, one for sounding and to assist the other in keeping a good look-out. Witness always had a fourth officer with him on the bridge. If an officer had to go below he could send and turn out another officer before he left the bridge. They found it work very well. From Ushant to the Red Sea they had three watches. He considered more than four officers necessary for a ship of that size in port. The three beneath him had a hold each to look after. He had to attend to the deck. They could not also keep watch at night.

Mr. Batham then addressed the Court on behalf of the chief officer. The officer adopted as to the watch the usual plan, which was approved by the master of the ship. Information about the tanks being emptied ought to have been conveyed to the chief officer. He turned in, having left instructions with Lowman to call him. It was the practice for the chief mate to be communicated with by the chief coal man before shifting the collier. It was no part of the chief mate's duty to call the chief engineer, and he had never done it; he had no orders to that effect. The chief engineer ought to have heard the noise of the coaling. The captain said the chief engineer knew the coal was coming. A man was placed by the engineer to let him know when the coal was coming; he did not let him know. The real cause of the ship going over was the tanks being pumped out.

Mr. Israel Davis, on behalf of the chief engineer, said that no intimation of the coaling was given him. The captain was in the habit of giving him official intimation when it was known beforehand that a collier was coming. When she came alongside it was the duty of the watch on deck to inform him. It could not be contended that two watches were to be kept on deck, one for the general purposes of the ship, and the other exclusively by and for the engineer. The engineer set no watch on deck; he was put in motion by the youngest officer in charge of the deck, whose orders he was bound to obey. The eyes and ears of the ship were supplied by the watch on deck; the engineers' department only acted when roused by them.

On the 3rd, Mr. Israel Davis, continuing his address on behalf of the chief engineer, said that after a long voyage, with much machinery to overhaul and clean, it was impossible for the chief engineer to station a special watch on deck to notify the appearance of the collier. In the organism of a ship the deck officers might be considered the sensory nerves who transmitted impressions to the engine-room. For each department to set its own watch on deck would be as wasteful of energy as if in an animal organism each member were provided with an eye of its own. Besides, a fireman would in many circumstances be sent down, and in many passenger ships would only be allowed to air himself on one side of the deck. The engineer was justified in assuming that the officer in charge of the deck would inform him; and the captain, the chief arbiter of discipline in the ship, confirmed that view when he said in his evidence, "On the night when the Woonoona came in sight it was the chief officer's duty to give information of her coming to the chief engineer." The chief officer himself admitted that he had frequently been requested by the chief engineer to warn him when colliers came alongside. It was the duty of some deck officer to be on deck to shift the collier round when a list was established, and to provide against the sudden squalls called "southerly blusters;" and the watchman Lowman, A.B., had orders to call a deck officer, the mate, when a collier came. The official intimation could therefore conveniently be given, and should have been given, to the engineer by the chief officer; but the engineer adopted extra precautions in telling Morris, a fireman, who assisted him in inspecting the loading of coal, to call him if a collier came. In addition to this he set Wilson, the donkeyman, on watch in the engine room, relieved him from all day duty, and was not responsible for his going to sleep instead of remaining at his post. The consideration whether he would have employed Morris or the fourth engineer, who had not been called as a witness, to assist in supervising the coaling was immaterial, since admittedly he did not supervise, having no knowledge that the collier was there; and therefore it was not proper to assume that if he had supervised he would have done so through Morris. That was a mere hypothetical default. But it would have been no default, for the skilled engineers were busy in overhauling the immense and intricate machinery of a huge vessel which had just crossed the globe, and it would have been proper to employ for a duty which needed only care and not engineering skill a man in whose diligence he could confide. Even if he was in fault in not knowing the collier was there, his ignorance did not contribute to the casualty. It was not his duty to do more than check the quantity of coal delivered. The trimming was done by contract. But she was, in fact, properly trimmed, so far as mere trimming was concerned, the centre of gravity of coal in the side bunkers being necessarily not more than 7ft. 3in. from the side, and it being impossible to correct the list by trimming in those side bunkers.

The Commissioner said it was suggested that if the engineer had had a man in the bunkers the water would have been seen coming in.

Mr. Israel Davis rejoined that that would have been too late. There was no reference to that suggestion in the questions submitted by the Board of Trade. It should have been definitely charged in the questions.

The Commissioner.—I should certainly not deal with an officer's certificate on that ground, as it is not definitely pointed out in the questions.

Counsel added that the only way to correct a list which resulted from filling the side bunkers was to order the collier to the other side, but that was a deck officer's duty, not the engineer's. Mr. Elgar had established that a good deal of trimming was done, since, as the Court elicited, coal would first fall 5½ft. from the side, and if it had been suffered to remain there, a dangerous list would have been established much earlier. The causes of the catastrophe were the non-shifting of the collier when the tanks were empty and the coal ports open. In pumping out the tanks and opening the ports the engineer had merely obeyed the instructions of the captain; the non-shifting of a collier was a deck officer's dereliction of duty. Anything which happened at any other time was immaterial to the casualty, and ought not to be used to prejudice him; but he had, in fact, personally superintended the coaling wherever requisite. Mr. M'Dougall had won golden opinions from everyone with whom he had been brought in contact. The agent of the line in Australia wrote: "Mr. M'Dougall's conduct ever since the accident has been beyond praise. In the face of considerable trouble . . . he has been able to keep the works steadily going in his department, and has now got his engines in working order. He had steam in his boilers and a trial of his engines, when everything worked as smoothly as possible." The captain said the chief engineer was "the best man in the service," "the cleverest engineer he had ever met," and that he "rendered him every possible assistance." The chief officer also described him as a good man. He felt sure the Court would take a considerate view of the conduct of an officer to whom his reputation was as the air he breathed.

Mr. Bucknill said the company had great and formidable rivals, but had done their utmost to connect England and the colonies. The captain, chief engineer, and carpenter were sent to Glasgow to see the construction of the Austral after the plans had been prepared for the owners by Mr. Shepherd, who afterwards became manager to Messrs. Elder and Co. All trials being a success, the Government inspector having said she was a magnificent piece of work, she commenced the voyages for which she was expressly built. The tanks were put in for the express purpose of keeping her safe, and the evidence showed that, with her tanks attended to, she was absolutely safe. When the captain asked for dead weight to be put in, the owners put it in, although the ballast tanks were sufficient. In safety she performed her first voyage and the second passage out. On this passage the captain was quite willing to go without dead weight, but the owners said he should take a little dead weight, not from want of confidence in the ship, but so that the captain might feel absolutely master of her. The captain in his evidence said he thought he filled his water tanks before his coal was burnt, which would have sunk his Plimsoll mark, and it was clear it was not below the water line. The captain was responsible for the ports being open and for work not being done properly on the ship. It was an exceptional state of things; the ship nearly empty of cargo, some dead weight it was true—over 1600 tons—the tanks empty, the coal ports open. There was no evidence to show that inside shoots were placed there. A small list would not be observed; but if she listed 6 deg., that would be half way through her dangerous part. No doubt she was listing from the first. The chief engineer had put in two plans—one from his recollection, before coaling, of the coal in, the second from the ship as raised. The second showed she had 160 tons more on the starboard than on the port side. There might in the thwartship bunkers have been some which had rolled in after the sinking, but some might be carried to port by the rush of water. Leaving out that assumption, it confirmed Mr. Elgar's evidence that 120 tons more had been put in on the starboard. Mr. Elgar's figures showed that the vessel, when inclined by him, had an absence of positive initial stability. These big steamers were not intended to go to sea with a clean-swept hold. They were so constructed that when they had on board the cargo, life and property, which they were built to carry, they should be safe.

The Commisioner.—I never intended, in questions to Mr. Martell, to imply it was wrong that a vessel with a clean-swept hold should have a negative metacentric height. Mr. Elgar said he had known passenger vessels with 2ft. of minus metacentric height. The object of my question was to know whether Mr. Martell thought that the captain should know whether she had positive or negative metacentric height when clean, so that he should know how to load her.

Mr. Bucknill added that these vessels were purposely made as the Austral was, and if not they would roll to such an extent that passengers would be seriously uncomfortable.

The Commissioner assented. That was proved, he added, in the Atalanta inquiry.

Mr. Bucknill continued.—When the ship had her machinery, stores, &c., in, the metacentric height became positive. At Neutral Bay she had a metacentric height of 1·276, an arm of safety of 2·88ft., at the angle of her maximum stability, 61 deg., and a righting moment of 23,352 foot-tons. At 90 deg. she had 1·7ft. metacentric height, and a righting moment of 13,800. Her Majesty's ship Monarch's stability was much less; it vanished at 70 deg. The vessel was so designed as to make her a capital sea-going ship, an easy and not excessive roller. Laden to her load-line, with all her cargo spaces full, she had a mean draught of 26ft. 6in.; displacement, 10,300 tons; metacentric height, 1ft. 3in.; and at 90 deg. inclination, a righting lever of 1·01, and moment of 10,403 foot-tons. The last was when laden down to her disc, without water ballast. A ship could not have better figures than this.

The Commissioner.—I have it from Mr. Elgar that when laden with homogeneous cargo, &c., her positive metacentric height would be 1·26—a very good metacentric height, and a righting moment of 10,300 tons at 90 deg.

Mr. Bucknill.—Supposing she had no metacentric height at all, the angle of maximum stability was 57½ deg. The figures showed that the vessel was not one, the stability of which vanished at 12 deg., as suggested by the captain. At 90 deg. she still had a large amount of stability. Mr. Shepherd had made calculations which satisfied himself that this ship was stiff at 45 deg., and under all conditions. The Board of Trade surveyor, Lloyd's, the builders—no one suggested that she should be inclined. No one believed it was necessary. If Captain Murdoch had had the curve of stability, he could have said he knew better from three voyages that she would go over 6 deg. with certain weights. The question was, what was the knowledge of those on board the ship who were responsible. Captain Murdoch would not have been benefitted by all the calculations which had been given to the Court.

The Commissioner. — Supposing Captain Murdoch had been informed before he left, and knew in Sydney, that the vessel had a negative metacentric height when quite empty, and that on filling the tanks you made it positive; supposing that he had been told that 120 tons put into her on one side when quite upright, at 7ft. 2in. from the side, would incline her 12 deg. if the tanks were empty, but if they were full only 6 deg., would not these calculations have somewhat awakened Captain Murdoch to the importance of seeing whether or not it would be desirable to watch more carefully the coaling of the vessel?

Mr. Bucknill.—If you give a man all you can, he cannot say you are to blame.

Counsel passed to a question raised with respect to the number of officers, and ended by paying a warm tribute to the conduct of the officers who remained at Sydney after the sinking, including the chief engineer and the chief officer.

Mr. Nelson said the master had attained the highest rank in the mercantile marine; he had the certificate, the extra certificate, and had passed in steam. He was practically the Vice-Commodore of the Orient fleet, and to be called in question for a loss was a source of great suffering to him. The temporary loss of the Austral came from a series of small mistakes. The first mistake was that of the Board of Trade, who granted a certificate for a passenger vessel to carry 1000 people across the ocean, costing, perhaps, £250,000, and did not calculate the stability. The chief engineer said, and Morris admitted, that a collier might come, and Morris had instructions to call the chief engineer when she came. Morris went to sleep. If Morris had done what the chief engineer had told him to do, the catastrophe would not have happened. The vessel inclined in consequence of starboard coaling till the water entered her ports. The catastrophe would have happened a little later, even if the water ballast had been in, if the master had not been called. The angle would have been less, and the list less likely to draw attention.

The Court inquired of Mr. Elgar what angle would have sunk her ports to the water's edge if the ballast tanks had been full, and Mr. Elgar answered 9 3·5 deg.

Mr. Nelson added that the fact was scarcely conceivable that coal-trimmers should have gone on coaling the vessel as they had, till the water came into her ports. The master had enjoyed the confidence of leading shipowners for many years, and had received testimonials from the outside world. He desired to explain that the captain, in saying it was the chief mate's duty to call the chief engineer, meant merely that it was his duty to send some one to call the chief engineer, not to do it *per se*.

Mr. Mansel Jones contended that the owners were responsible for the design of the vessel, which was made by a gentleman in their employ. The tests of inclination were not applied, because it seemed they were in a great hurry to get the vessel out of the builders' hands. Mr. Elgar said, and counsel admitted, a negative stability when empty was often found in passenger vessels, to a much larger extent than in the Austral, but up to 90 deg. there was no vanishing point of her stability, so that she was very stable. The chief engineer had not carried out the instructions in Article 118 of the owners' regulations. Had he warned the third and fourth engineers to be in the bunker, the water could have been seen coming in, but he merely gave general instructions to Morris. He was going to leave it to the trimmers to trim, as probably he always did. Counsel admitted that every effort was made to save life after the casualty, and proceeded to refer to the engineer's log of a previous voyage, in which a column was headed for draught of water, and had not been filled up. Counsel having commented on this,

The Commissioner interposed by observing that the engineer does not take the draught of water. It was the deck officers' business.

Mr. Mansel Jones insisted that the omission was blameworthy. He added that in dealing with the coaling question, it must be remembered that the captain acted under positive instructions to coal through the ports. With regard to the question whether blame attached to the owners, it appeared that the captain had not asked for additional officers. He did not wish to press on the officers, one could only sympathise with them in their calamity; but if it were their fault they must answer for it.

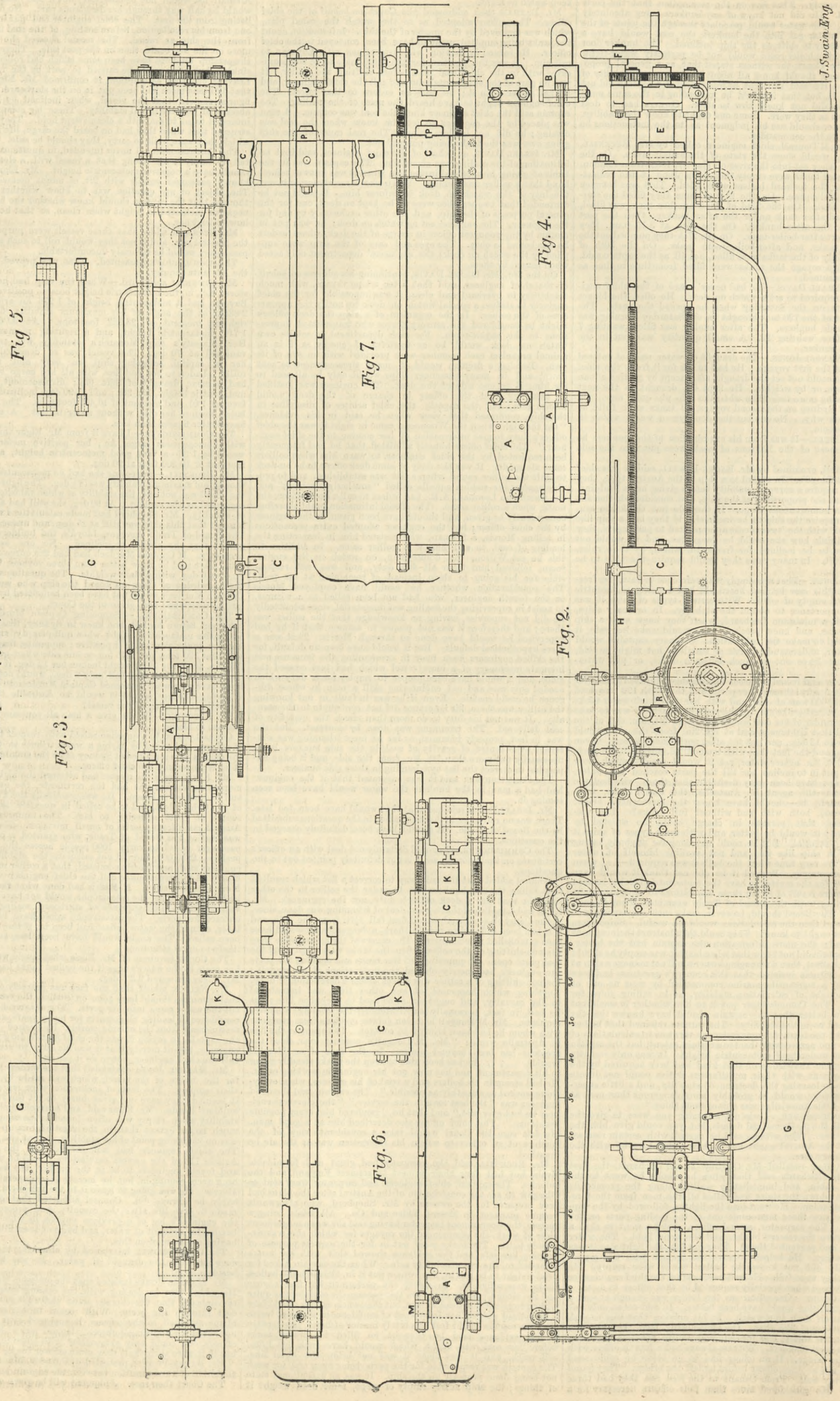
Mr. Baden-Powell protested against Mr. Mansel Jones's representation of a conversation between the captain and the owners.

The Court then rose. Judgment will be given on Saturday.

TESTING MACHINE, METALLURGICAL LABORATORY, KING'S COLLEGE.

MESSRS. GREENWOOD AND BATLEY, LEEDS, ENGINEERS.

(For description see page 267.)



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RIBBON TELEGRAPH POSTS.

(To the Editor of The Engineer.)

Sir,—Can any of your readers tell me where the above can be obtained? Their special feature was a taper frame of iron stiffened by a number of pieces of flat ribbon iron wound spirally. They were exhibited at the Institute of Civil Engineers some eight years ago. K. H.

London, September 29th.

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THE ENGINEER.

OCTOBER 5, 1883.

THE AUSTRAL INQUIRY.

The inquiry into the cause of the sinking of the screw steamer Austral at her moorings in Sydney Harbour, on the morning of the 11th November of last year, which commenced at Westminster on Monday, the 24th ult., before the Wreck Commissioner, was concluded on Wednesday last. As we stated in our last week's issue, the evidence of the ships' officers and others, while no doubt valuable as showing the exact condition in which the vessel was placed on the night of the disaster, could not be considered sufficient to enable the Court to arrive at a conclusion as to the cause of the accident with certainty, and that this evidence ought to be supplemented by evidence based on scientific calculation of the stability of the vessel in the several conditions in which she was placed.

Mr. Elgar, who has been instructed on behalf of the owners of the vessel to make the necessary calculations, was called as a witness on Monday last, and his examination extended over two days. He stated that he inclined the Austral in dock at Glasgow on the 6th of August with a view to ascertaining the exact position of the centre of gravity. For this purpose 10·25 tons of ballast were placed in two equal quantities on the promenade deck at the sides, and when one of these weights was moved across the vessel to the other side, so that the centre of gravity of the whole of the ballast was 19·5ft. from the middle line, the vessel became inclined through 1·1 degree. From this data, and with the aid of the vessel's drawings, Mr. Elgar was enabled to calculate the exact position of her centre of gravity in that condition, and also the metacentric height. The height in the vessel of the metacentre and the centre of gravity in this and other conditions were given in evidence in Court, and we have been enabled from those figures to construct a metacentric diagram for the vessel, which will be found on page 267. The mean draught of water was 20ft. 10in. in fresh water, and the displacement 7200 tons. The height of the metacentre M above the centre of gravity G in this condition was 1·593ft., and the height of the centre of gravity above the top of the keel 19·707ft. To bring the vessel into the condition in which she was on the night of the disaster, the whole of the weight, including water ballast, coals, &c., amounting to 1385 tons, on board at the time of the experiment were first removed, and the vessel left in what is termed the light condition, viz., without cargo, with all coal and stores consumed, and with the water-ballast tanks empty. In this condition the metacentre is below the centre of gravity as shown on the diagram, the value of the metacentric height $G_2 M_2$ being minus 9½in. If, therefore, the vessel were reduced to this condition, the water tanks being empty, she would be unable to stand upright, and would loll over to an angle of from 16 deg. to 20 deg. before reaching a position of stability. It should be observed, however, that if the water-ballast tanks were filled—and they are fitted for the purpose of being filled under such circumstances—the centre of gravity would be lowered nearly 2ft. to G_3, and the metacentric height $G_3 M_3$ would be increased to 1·162ft. Mr. Elgar went on to state that, after supposing 1732 tons of coals, 182 tons of fresh water, 190 tons of pig iron, 65 tons of stores, 22 tons of men and effects, and 30 tons of loose water in the bilges and in the ballast tanks placed on board the Austral, so as to bring her as nearly as possible into the condition in which she was placed at the time of the accident, the displacement would be increased to 8070 tons, and the mean draught of water to 22ft. 3½in. In this condition it was found that the centre of gravity G_4 was 20·094ft. above the top of the keel, and the metacentre M_4 1·267ft. above the centre of gravity. With the above data it was possible to construct a curve of stability for the vessel, and this has been done. It was stated that if the 120 tons of coal received on the Friday night and early on the Saturday morning, had been trimmed in such a way as not to heel the vessel, her maximum stability would not have been attained until an angle of 61 deg. had been reached, when the length of the righting lever would be 2·88ft., and that even at an inclination of 90 deg. the righting lever would have a length of 1·71ft. With so large an amount of stability as the vessel was thus shown to possess, it would have been impossible to sink her unless that stability were in some way destroyed by the entrance of water. From his calculations Mr. Elgar was able to state that the vessel was trimmed 3ft. 1in. by the stern, and that before the 120 tons of coal were received on board on the Friday night, the aftermost coaling port on the starboard side was 5ft. 3in. out of the water. It was not, however, known how far the centre of gravity of the 120 tons of coal was from the middle line on the starboard side, and the problem which had to be solved was to find whether it was possible in the ordinary process of coaling that the centre of gravity of this coal could have been so placed as to give the vessel sufficient heel to bring the lower edge of the aftermost coaling port on the starboard side level with the water. It was ascertained from the drawings that an inclination of 12 deg. would be sufficient to accomplish this, and from the curve of stability the magnitude of the upsetting moment necessary to give the 12 deg. inclinatiou could be deduced. Proceeding in this way, Mr. Elgar found that if the 120 tons of coal had been placed on board with its centre of gravity 7ft. 2in. from the vessel's side the necessary upsetting moment would have been obtained, and as it was seen to be possible for the coal to be so placed, this explanation was accepted by the Court as sufficient to account for the capsizing of the vessel.

There appears to be no doubt, therefore, that the Austral at the time of the disaster had an ample margin of stability, and that her loss was entirely due to the entrance of water through the coaling ports. It seems probable that the coaling, at all events toward the latter part of the time, must have been going on through some of the forward ports, and that, in the darkness, the proximity of the aftermost port to the water level was not observed by those on board the collier. On board the Austral the look-out appears to have been of a most inefficient description. Indeed it became painfully apparent during the progress of the inquiry that an amount of looseness and want of discipline prevailed, which especially in a large passenger steamer, cannot be considered as satisfactory. The printed instructions issued by the owners for the guidance of the officers stated that it was to be the duty of the second and third engineers to superintend the trimming of the coal in the bunkers, yet both those officers when under examination stated that it was not their practice to do so, and that they did not consider it their duty. This important work appears to have been left generally in the hands of one of the stokers. The chief engineer seems to have been seldom aware that coal was to have been received on board until he saw the collier alongside the vessel. On the night of the disaster the Woonoona coaled the Austral from about 11.15 p.m. until nearly 4 a.m., yet it appeared to have been considered the duty of none of those on watch to call the attention of the chief engineer and his subordinates, who were asleep, to the fact that coaling was going on.

It was repeatedly stated during the progress of the inquiry that the Austral possessed facilities for coaling from the upper deck, as well as through the side ports, and that on the night of the accident the coaling might have been carried on in this manner. To those, however, who have been on board a steamship at the time when coaling has been going on, the reasons which led those in authority to decide that the coal should be taken in through the side ports will be apparent, for when coaling from the deck the fine particles of coal dust find their way into every part of the vessel. In a ship fitted up for passenger accommodation the avoidance of this inconvenience is, no doubt, very desirable; but experience has shown again and again that whenever the provision of a convenience on board ship is likely to entail serious accident, or the loss of the vessel, unless skilfully and carefully used, it is far better to dispense with the convenience. If the Austral had had no coaling ports fitted in the sides the crew would have had some cleaning to do, no doubt, but there would have been no necessity for the inquiry which has just concluded. It would appear from the evidence that the pumping out of the Austral's water ballast tanks, which was freely commented upon at the time, and since, as being the cause of the disaster, was only remotely connected with the foundering of the vessel. It was shown that with the coaling ports closed the vessel's stability was ample for every purpose, and that had those ports been open and the tanks full, 200 tons of coal instead of 120 would have been necessary to have brought the lower edge of the coaling port to the water level. It is, no doubt, highly satisfactory that the deductions made from Mr. Elgar's calculations should accord so completely with the observed facts as detailed by the several witnesses, and it is to be hoped that in future a more extended use of scientific evidence will be made in the conduct of inquiries into the causes of the loss of missing vessels before the Wreck Commissioner. It is a much to be regretted fact that although these inquiries are held at the instance of the Board of Trade, for the purpose of ascertaining the cause of loss, the Board do not think it their duty to tender scientific evidence even in cases where it is most probable that the vessels have been lost through want of stability, though the Court is frequently asked to determine whether the missing vessel had or had not sufficient stability. In the case of the Austral, where it must have been apparent, even before the commencement of the proceedings, that the only way in which the inquiry could be satisfactorily concluded was by the aid of scientific evidence, the Board of Trade appeared to have made no effort to produce evidence of this kind, and had it not been for the fact that the owners, with great public spirit, undertook the expense of having the necessary calculations made, the true facts connected with the foundering of this vessel would never have been made public.

LIMITING OUTPUT.

The relations existing between labour and capital are just now of the most unsatisfactory kind. Strikes past, present, and to come, are heard of on every side and in almost every trade. In one district the colliers are turning out or preparing to turn out; in another, the cotton spinners and weavers are striking; a question concerning apprentices has upset the engineering trades of Sunderland and the Tyne. Matters have gone on in this fashion for a considerable period now; and it does not appear that the end is yet in sight. Argument and persuasion have been tried, as they have been tried before, to induce the workmen to take such wages as the masters offer them, but without avail. Indeed, if the arguments supplied by semi-starvation are not sufficient to induce a man to continue at work, it is not likely that mere words can effect any useful purpose. Among the other cries we hear just now are the old well-worn watchwords, "reduce output;" and as the effect of diminishing the production in any district does not come home so forcibly to a collier or an ironworker as a reduction in his wages, it may be possible to persuade such men that limiting production can do them little or no good. The facts admit of being very simply stated, and we think that they ought to be generally made known.

The theory that by reducing production, prices, and therefore wages, can be raised is very old. The scheme has often been reduced to practice; but it is very doubtful if it ever had much effect even in former years. In the present day it is virtually useless. Those who advocate it suppose that if less coal, let us say, was raised than is now brought to the surface it must become dearer. This idea is based on the assumption that the demand for coal will be nearly the same, no matter what the price. There is, however, no good reason for thinking this. Coal is bought in very great quantities for use in ironworks. If these works were closed altogether, or compelled to run short time for want of orders, there would be an immediate reduction in the demand for coal, and the price would fall, no matter whether there was much or little coal to be had. But unless the ironmasters can sell iron and steel at given prices, they cannot sell at all. If coal is dear, then iron and steel will be dear too, and the sale of the metals and the demand for coal will both fall off. It is not necessary, we think, to follow up this chain of reasoning further, or to show at length that cheap coal means cheap iron, and this last means cheap ships, which in turn mean low freights, and consequently the securing of plenty of work. Regarding the coal-mining industry of Great Britain as a whole, it may be said that the more coal sold the larger will be the gross sum to be divided between the capitalist and the coal miner. Any reduction in the quantity sold must reduce the receipts of the trade. It will be urged, however, no doubt, that this statement is wrong. The whole quantity sold will be reduced, but the rise in price will more than balance the difference. Unfortunately, it is impossible to prove the soundness of this proposition. On the contrary, the rise in price never balances the loss due to the diminution in quantity. Let us suppose that 5,000,000 of tons of coal are raised and sold in three months in any district at 6s. per ton. The gross receipts in the district will be £1,500,000. If, now, the price were raised to 7s., the receipts for the same quantity of coal would be £1,750,000. If, however, the demand was reduced only one-sixth, then the whole receipts would amount to but £1,458,334, and the district would therefore, on the whole, be worse off than it was before by £41,666. But a reduction of one-sixth in the demand might be very easily brought about. Indeed, the entire operation is based, curiously enough, on the theory that quantity powerfully affects price. It is argued that the greater the quantity in the market the lower will be the price; but those who reason on this basis fail to see that their argument cuts both ways. If a very large supply can cut down prices, then it is clear that high prices ought to reduce demand. All past experience goes to show that this result invariably follows. We have heard the coal famine of ten or a dozen years ago cited as a proof that reduced output raised prices. It is true that no attempt was made to limit the supply, but the demand was increased; and it is urged that it is all the same whether demand augments or supply

decreases; prices must rise in either case. This is a complete mistake, however. The reason why coal ran up to fabulous prices at the period named was that the demand for iron and steel was enormous. The condition of the markets was strictly exceptional, and it is but too well known that high prices were followed by a disastrous reaction.

There is another point of view from which this subject may be regarded, and it is even more important than that which we have been considering. It leaves on one side the question of demand. The point is that output cannot be diminished in any great manufacturing country by any efforts made by working men alone. Nothing can diminish output but united action by all those concerned in any particular trade. Such united action never yet seems to have been exerted, at least for any time. The ironmasters of the North of England and of Scotland recently banded together to reduce the make of pig iron. It does not appear, however, that they succeeded in obtaining anything like a commensurate rise in the price of pig; and it is well known that the working men in the districts affected suffered by the change, for the blowing out of a blast furnace throws many hands out of employment. In order that output might be effectually reduced, it would be necessary for all the ironmasters in Great Britain to unite together and agree not to make more than a given quantity during the year. Union such as this cannot be obtained. Let us suppose, however, that a solemn league and covenant was entered into, and it was religiously kept as well by the men of Wales as by those of Scotland, Staffordshire, and the Cleveland district, would prices go up? There can be no manner of doubt that they would for a time, but only for a time. The shipbuilding industry would probably be driven from our shores to America and France. The whole finished iron trade would suffer; rolling mills would be closed; railway enterprise would languish, the coal trade would suffer instantly; less coal would be required, and the demand, and with it the price, would fall off; and there can be no doubt that the loss to the country would be very large. However, it may be said that the price of coal would be kept up by still further decreasing supply, but the folly of this argument may be made apparent in a moment by pushing it far enough. Pig iron might, let us say, be made worth £10 or £15 a ton, by reducing supply, but does anyone in his senses think that the iron trade of this country would be better off then than it is now? The commercial prosperity of the country would be wrecked under such conditions. It is, however, almost waste of time to speculate on this point, because no such united action as that suggested ever can be secured. In order that prices should be materially raised by diminishing output, it would be essential in the present day that not only all the British, but all the foreign iron makers as well should combine. A material rise of price here due to scarcity would only drive the purchaser to other countries, such as France or Belgium, unless iron were equally scarce there. The result of a considerable limitation would no doubt be, as we have said, a temporary rise in price; but the volume of trade would be reduced, and with it the income of the nation.

But it may be asked, is supply never to be limited? We reply, certainly it is; but the limitation almost invariably comes under what may be termed the operation of a natural law. So long as iron, or calico, or coal, finds a market, then this market ought to be supplied; always provided that the price is such that a reasonable profit can be made. To make goods which cannot be sold at any price is, however, folly, thus it appears to be a matter of doubtful prudence to keep on adding continually to the stocks in Messrs. Connal's yards. To do this is not to supply a demand. Of course, the question of what constitutes a reasonable profit admits of elaborate discussion; but with this we do not care to concern ourselves. The broad facts on which we would insist are—first, that reducing output in districts can have no effect save one more or less disastrous on the districts; secondly, only widespread united action in the required direction can much affect prices; thirdly, that a rise in price of any raw material caused by limitation in the supply must tell injuriously on all industries depending for success on an abundant supply of the said material; and, lastly, that it is almost certain that the reduction in demand due to a rise in price would more than counterbalance the nominal gain. We do not think that these propositions can be refuted. If they cannot, then tempting as the reduction of output may appear, it must be rejected as an expedient for raising wages by sensible men, whether capitalists or workers.

RAILWAYS AND INDIAN WARFARE.

Of the useful purposes our railroads must serve in the event of hostilities we have long been convinced, but any evidence which tends to extend our knowledge of the capacity they possess for the movement of troops will be a welcome addition to our stock of experience. That experience, as far as regards European railways, has been extensive enough; but these means of communication in India, widespread though they be in one sense of the term, have not a similar relative proportion to the vast areas and great mileage to be traversed in that country. It has long been a dictum that as railways become more extended in India, so far in proportion will our means of defensive operations there be increased; and as they are pushed on towards our extreme frontiers towards the north, in which quarter our greatest difficulties now, and must for the future, arise, the greater becomes our capacity for holding that frontier in safety. Information recently made public as to the carrying powers of some of these northern lines becomes therefore of the greatest possible value. From it we can judge as to how far railways as an adjunct to our military force in India can be relied upon for warlike operations in the future should the necessity for these arise; and it would be too much to hope for complete immunity from such necessity for many years to come.

One of the most important of the railways as yet constructed in India having such a direct object in view, is the Scinde, Punjaub, and Delhi Railway. During the late campaign in Afghanistan the whole of the war material required for its prosecution, as well as the troops themselves, had to be transported by its agency from the base of operations as far towards the front as its lines extended, and we learn from a publication recently made by Mr. Ross, who superintended the arrangements for the despatch of troops and stores on the occasion referred to, that during the time of the war 538,364 troops and followers; 114,156 horses, ponies, and mules; 15,477 bullocks; 8645 camels; 479 guns, artillery, and engineer carriages; 148,889 tons of military stores; and 93,099 tons of material for frontier railways, were booked under Government warrants. These figures, of course, include return journeys, &c. It must be borne in mind when estimating the strain that such an amount of transport threw upon the organisation of the railway system, that during the whole period of the war, the ordinary commercial and passenger traffic of the line had also to be carried on, and we have not heard that this was subject at any time to any protracted derangement. As a matter of course the military stores, &c., were given precedence, but by means of the careful arrangements made, and the full supply of rolling stock which the similiarity of gauge throughout nearly all the Indian lines placed at the disposal of the traffic management, comparatively small inconvenience was caused to the mercantile and civil community generally by the necessity for such precedence being accorded.

It will be interesting to enquire how the management was able to cope so successfully with the enormous demand thus caused upon it. We learn in the first place that all trains were despatched under "caution messages," and so rapid was the succession of their departure from the base station, that intervals of only from ten to fifteen minutes could be allowed from the time of one train starting to the signal being given for the sending on of that following. Under such conditions it was a matter of imperative necessity that a limit should be placed upon speed, and we are informed that this was fixed at twenty-one miles per hour. The result of the care exercised was that scarcely a single accident of importance occurred during the whole time that this excessive traffic was being carried on, although while the highest pressure lasted no less than sixty trains were running daily into Lahore Station. This number may seem to be comparatively trifling to those accustomed to such traffic as we in England witness at some of our great railway junctions, such as Willesden, Clapham, &c.; but everything is relative, and in India, as yet, at all events, on all but the largest of the main lines, the provision has not had to be made which renders it a matter of ease to accommodate the daily traffic on our English lines. That with such limited conveniences and appliances the management of the Scinde, Punjaub, and Delhi Railway coped successfully with the demand made upon its resources, is a fact that must be held to be highly creditable to all the staff of the line.

It is doubtless an important factor in the question of the extension of railways in India that the return likely to be obtained from them should be considered. No country, indeed, can go on extending its lines in the face of an assured annual deficit; but as regards frontier railways in that country, it is manifest that such consideration will have to be given from two sides. Practically speaking, all the railways as yet constructed therein are Government lines—that is to say, that even those which have been built by private capital have all been undertaken on a guarantee entitling the Government to exercise material power over their direction, and to share in the profits after that guarantee is exceeded by the net earnings. During last year no less a sum than half a million sterling accrued from this source to the Indian Exchequer, and it is therefore evident that, as regards individual lines which may be proposed by the authorities more for strategical reasons than with a view of commercial profit, a decision need not be restricted by the ordinary considerations of profit and loss. If the latter should prove to be the result of one railway, it may and will probably, as far as can be foreseen, be amply compensated for by profit arising from the general system. The evidence that we have adduced in this brief summary of the aid to the military operations in Afghanistan rendered by the Scinde, Punjaub, and Delhi Railway, shows that it is with no sparing hand that further extensions towards our frontier in India should be undertaken. It is not too much to say that without that aid those operations would probably have had to be extended over years instead of months, and the saving in their cost must consequently have repaid that of railway construction over and over again. Apart from the economical question thus demonstrated, we hold that nothing can more strongly show the wisdom of adhering to similarity of gauge in India than the fact we have mentioned as to the enormous amount of rolling stock always available, enabling railway transport to be so extensively utilised as it was during the campaign in Afghanistan.

THE DETERMINATION OF SULPHUR IN SAMPLES OF COAL GAS.

According to a paper recently published in the *Zeitschrift für analystische Chemie* by Th. Poleck, the following modifications of the processes usually adopted for these determinations are accurate and satisfactory. He describes an apparatus which is readily fitted up, acts continuously, hardly requires constant attention, and admits of large quantities of gas being burnt. In other respects the process agrees in principle with those in general use in that the gas is completely burnt in air, whereby the sulphur is perfectly converted into sulphurous acid, which is oxidised with bromised caustic soda to sulphuric acid, and then determined as sulphate of baryta. A Bunsen burner is placed in connection with the gas meter, and is also put under a broader tube opening downwards, so that the Bunsen burner passes up into it about 2 cm., and the flame must burn non-luminously, and must not be too high. By means of an aspirator placed in communication with a water-pump, the products of combustion are carried through three U-tubes, of which the first two are filled with bromised caustic soda, and the last with caustic soda which is not bromised. At the end of the experiment the amount of gas burnt and examined is read off the meter, and the sulphur determined in the form of sulphate of baryta. By this process the whole of the sulphur present in the crude gas, as well as in the purified material, can be readily determined. If the amounts of sulphuretted hydrogen and carbon disulphide present in the gas be determined in special operations, and the amounts of sulphur be detected, on deducting them from the entire amount of sulphur present, we have in the difference the amount of sulphur present in the form of sulphurised hydrocarbon in coal gas. The carbon disulphide is to be determined by converting it into the triethyl-phosphine compound. An investigation of the amount of sulphur present in samples of gas from different parts of the apparatus gave:—In 100 litres immediately from the retort, 0·600 gramme; before the scrubbers, 0·540 gramme; after them, 0·464 gramme; behind the condenser, 0·440 gramme; and in the purified gas, free from sulphuretted hydrogen, 0·276 gramme of sulphur.

A WELL-TRIED STEEL STEAMER.

New Zealand papers to hand contain accounts of the grounding of the steamer Rotomahana, belonging to the Union Steamship Company of New Zealand, Limited, on Waipapapa Point—the same dangerous reef on which the ill-fated Tararua and many lives were lost on the 28th April, 1881, and where it had been the subsequent intention of the New Zealand Government to erect a lighthouse. The mishap to the Rotomahana occurred on the morning of Saturday, the 4th August. At the time of the accident the vessel was steaming at the rate of nine knots an hour, but the discovery that she was in the vicinity of the reef enabled the officers in charge to telegraph to the engine-room, which had the effect of considerably reducing speed and taking way off the vessel before she struck. She remained bumping on the reef for some time, but was ultimately got clear and returned to Port Chalmers in safety. Subsequent docking of the vessel showed that she had sustained serious damage to her propeller and stern-frame, large portions of which were completely broken away. In addition to these, the bottom of the vessel for a considerable length aft had been dented and misshapen, and rivets started, but no actual piercing of the bottom had taken place, owing, doubtless, to the material of which she is built being mild steel. It is estimated that the cost of putting the vessel to rights will amount to between £4000 and £5000. The Rotomahana was built in 1879 by Messrs. Denny, of Dumbarton, and was the first ocean-going steamer constructed of mild steel. This is now the third occasion on which she has been aground, sustaining damage, and yet coming remarkably well through the ordeal. She went on the rocks some time after arriving in New Zealand waters, and the damage she then sustained, or, rather, the admirable behaviour of the material under most crucial tests, was amongst the first and most convincing proofs that were instanced in scientific societies of the suitability of mild steel for shipbuilding purposes. This recent case is as severe a test as any of the former cases, and the hard experiences of the Rotomahana, it may safely be considered, are pretty conclusive as regards the value of steel ships.

A NEW METHOD OF VOLUMETRIC DETERMINATION OF PHOSPHORIC ACID IN SUPERPHOSPHATE.

A paper on this subject has recently been published in the *Zeitschrift für analystische Chemie*, by A. Mollenda. To prepare superphosphate, bones or crude phosphate are decomposed with so much sulphuric acid that exactly acid phosphate of lime is formed from the normal phosphate of lime, and as a consequence the commercial superphosphate rarely contains free phosphoric acid or sulphuric acid. The author has endeavoured to arrive at a knowledge of the amount of phosphoric acid present as acid phosphate of lime in such superphosphate, which contains no free acid, by volumetric determination with soda carbonate. For this purpose it is so neutralised that the ordinary phosphate of soda is formed. To accomplish this it is necessary first of all to throw down the lime present as sulphate in the superphosphate with oxalate of soda. The soda carbonate is heated to the boiling point, and added so long to the solution to be titrated till the litmus added in small quantities, even when the solution becomes cold, remains blue. The mode of calculation is shown by the equation:—$2\,Na\,H_2\,PO_4 + Na_2\,CO_3 = 2\,Na_2\,HPO_4 + CO_2 + H_2O$. The results obtained by this method show a satisfactory accordance with those obtained by weighing or by titration with acetate of uranium. Still simpler than with carbonate of soda it is to titrate the phosphoric acid soluble in water with the half normal caustic soda solution. This can be carried on in the cold, and consequently be also used for the analysis of ammonia superphosphate. If a phosphate contains free acid, we must add to the solution so much lime water or carbonate of soda before the addition of sodic oxalate till a faint turbidity makes its appearance. During the titration with caustic soda solution it is good to employ phenolphtaleine or phenacetolin as an indicator.

LITERATURE.

The Compound Boiler; How to Use it and Run it at Sea. Explaining Causes of all Corrosion, and the Formation of Scale, with Instructions for its Entire Prevention; together with Useful Information for Maintaining Steam at Sea. By A Sea-going Engineer. H. G. Reid: Stockton-on-Tees. E. and F. N. Spon: London. 1883.

Under such a comprehensive title as the above, one is naturally inclined to look for a work of many volumes, each of which records elaborate reasearches into all the questions involved under the headings of corrosion, economy of fuel, life of boilers, &c. &c.; and when it is borne in mind that many books have been devoted to these subjects, it must be confessed that it is highly refreshing to come across an author who considers that he has reduced the whole question, and treated it as exhaustively as his title gives one to suppose, within the narrow limits of a thirty page pamphlet.

Our author, without any preface as to the intention of his little work, launches at once into his subject, beginning, in an abrupt fashion, with a section devoted to the circulation of water in multitubular boilers. The questions of corrosion, &c., have, as we before said, been treated by the best authorities in the world of engineering. A Royal Commission was appointed to take evidence from every engineer—land or sea-going—in the country whose opinion was considered to be worth having, and the results were published in a Blue Book, the most surprising thing connected with which was that it showed how completely antagonistic were the opinions of eminent, or at least well-known, men. But now forth comes a sea-going engineer, who, with simple-minded egotism, dogmatises and reduces the whole subject to a few pages. These few pages, however, are well worth perusal, and beyond doubt contain many hints and suggestions for the guidance of the engineer in charge of boilers at sea, though we do not see that

much, if anything, has been added to our knowledge of corrosion, &c. At the head of the paragraph devoted to corrosion by water our author says:—"Sea water is generally supposed to be more corrosive in its properties than fresh when used in marine boilers; but my experience has taught me that there is not the slightest difference. Both waters gather their corrosive powers during their passage through the condenser in exactly the same proportion;" and a little further on, "The density of sea water does not make its corrosiveness, but by being strong or dense it retains and holds the galvanic powers which the water has gathered in a more combined form than fresh." Now this looks very like a contradiction, for if corrosive powers are due to the density of the water, that is to say, if dense or strong water "retains or holds galvanic powers in a more combined form," then, as sea water is by its very nature more dense than fresh, it must possess more corrosive properties. It is to be presumed that "A Sea-going Engineer" has carried out experiments with a view to settling the question of corrosion by using for an extended time fresh water for the supply of his boilers, and that his engines were surface condensing. If this is not the case, he can scarcely speak of his own experience, and if it is the case, a detailed report from his pen might be of considerable practical advantage. Another point is to be noticed under the same heading. He writes, "There is one peculiarity which will always be noticed in a boiler which is run without changing the water by blowing off, that is, no matter how strong or dense the water may be, it will always be found that no salt will be deposited in a hard or compact scale on the iron of the boiler. It is not the state of the water which prevents this, but the amount of oil that is in circulation with the water." It is not quite clear here whether the author means scale or salt. In his pamphlet he has drawn no distinction between scale, which is a composition of sulphates and carbonates of lime, magnesia, &c., and salt proper, which is an important element in deposit, and we are therefore justified in assuming that scale is meant. Now the lime which goes to form scale will be thrown down by heat alone, while the salt will be deposited when the water has become so saturated with it that it can carry no more, that is when a density of about 2½ to 3 times that of sea water has been reached, and this salt and lime will most certainly form in the shape of a hard compact scale on the iron surfaces if they are clean, free from rust, and if no soda has been sent through the condenser, for soda in the boiler will absolutely prevent the formation of any scale. In general practice the use of much oil or tallow has been discontinued for the lubrication of the cylinders — which theoretically require none—and very few of the better class of sea-going engineers use more than a few drops in the day, say a tablespoonful. Such being the case, we can hardly accept the theory offered in the pages under notice. The object of every engineer of a steamer should first be to get a nice thin uniform scale on the surfaces of his boiler, and no better preventive of corrosion can be found, and this can beyond doubt be done if the engineer knows his business. Should the plates of the furnaces and combustion chambers be rusty, lime water has been found to be of great use, and it is the practice of many "chiefs" to mix up a few handfuls of lime in a bucket of water, then to let it settle, and to send the clear water drained off into the boiler. The best section in the pamphlet is that on pitting, which contains very useful directions, and should be read by engineers in charge of boilers. The author shows that pitting is due to the dirt originally contained in the water mixing with the oil which gets into the boilers, and in the form of "grease balls" lying along the bottoms. When, however, a minimum of oil is used, and careful blowing off has rendered the water clean, there is little danger from this cause, especially if lime water has been used.

Our author says little on the subject of collapsed furnace crowns, but that little is so good that we can only wish he had treated the subject more exhaustively. However, he only regards the matter from the point of view of the most gross neglect, and we know that crowns do come down from many other causes. Not long ago an engineer, remarkable alike for his intelligence and his care, brought his ship into the Thames with a badly collapsed furnace crown, for which he could not account. The boiler was examined, and found to be quite clean, and in excellent order, and with a very thin black scale on the furnace crowns. The necessary repairs were carried out, and the ship went to sea again, but had not been long away before the other crown of the same boiler came down. The case was investigated by a well-known engineer, who in the course of his inquiries discovered that a considerable quantity of a certain well-known patent lubricant was used for the cylinders. He procured some of this and evaporated it in a common garden bucket, until a slight thin dark deposit remained. He then filled the bucket with water and placed it over a common fire, but before the water began to boil the bottom of the bucket was red hot. Furnaces collapse from many causes. The London Mutual Boiler Insurance Company have now before their engineer a case in which a large flue collapsed to explosion upwards.

The longest paragraph is devoted to instructions on the management of the compound boiler, and "A Seagoing Engineer" manages it almost entirely according to the deposit which the water from the boiler leaves when evaporated in this way. He draws a little water in a small basin from any convenient cock. The water is then evaporated, and in the course of evaporation the oil contained in the water will float at the top and will deposit at what was the water level; "the depth of this rim of baked oil and its thickness show the amount of oil in the boiler which needs removal." When the water has been evaporated "the colour of the sediment at the bottom will show the amount of blowing or changing of water that is necessary for the removing of the corrosive power of the water." It is then stated that "if pure fresh water is used for the boiler, and there is no corrosive power in it, no salt will be found. If there should be no galvanic power in the boiler, no colouring will be left on the bottom, and no changing of water or scumming is necessary." And so on; if the deposit is pure white, too much scale is being laid on; in fact, any colour in this deposit shows that the water possesses this power to the shade of the colouring found, a very faint straw being the proper colour to maintain. Now in theory this may be all very well, but a thousand different things may get into the boiler which will affect the colour of the water, hence that of the deposit, and finally the deduction adduced. Zinc plates do not seem to have met the approval of our author, who says, "Of what use then can zinc plates be when it is well known that they are destroyed after being in the boilers four or five days." Now zinc plates are undoubtedly admirable anti-corrosives, and as such are extensively used, and if put into a boiler properly they certainly will not be destroyed in anything like four or five days, indeed, four or five weeks would be very much nearer the mark. If, when properly put in, not hung, they do really disappear in four or five days, a very active galvanic action is going on, and larger plates or some other method should be adopted to prevent this. The necessity of keeping the condenser clean is strongly insisted upon, and upon no more important point could stress have been laid; but the method advised can be improved upon in all condensers which are fitted with hot well overflow pipes. The author suggests caustic soda, and water put in with a syringe in port. We would suggest that the day before going to sea a strong solution of alkali should be put into the condenser, say six or seven buckets full, the suction valves to the feed pumps having been previously carefully shut, and this should be allowed to remain in for the remainder of the time until the ship is ready for sea. The boilers having now been pumped up to three-quarter glass, the engines may be run without a feed for a little while—say half an hour—during which time the flow of water through the overflow pipes will remove every trace of dirt or deposit, &c., previously loosened by the alkali.

The little work is wound up by some apt and sensible remarks on the advantage of engineers being good firemen; the management of men; the importance of the use by every engineer of the indicator; and the last page is devoted to some useful remarks anent the loading of ships, which appropriately wind up a practical pamphlet which cannot fail to give suggestions to all sea-going or superintending engineers who will read it. We take exception to some of the author's arguments and reasoning, but on the whole the pamphlet is well worth perusal.

THE IRON AND STEEL INSTITUTE.

Although, on account of an accident, the official visit to the North-Eastern Steel Company's Works was abandoned, a large number of members took the opportunity of making individual visits. These works were commenced in 1881, on 32 acres of ground, for converting phosphoriferous Cleveland pig into steel by the Thomas-Gilchrist process. They began operations last June, and turn out about 1000 tons of rails weekly, employing 500 men, working double shift. The magnesian limestone for the basic lining is calcined in three kilns, and then crushed, ground, and mixed with tar, so as to form a stiff paste. This is used for lining the converters, iron rods, which are afterwards withdrawn, forming the holes in the bottom for the blast. There are four 15-ton converters, arranged in a single row on a gantry 20ft. above the floor. The pig iron is melted in three cupolas, and the molten metal is received in 12-ton ladles mounted on trucks, and pushed by a small locomotive to a 20-ton hydraulic lift, by which they are raised to the top of the gantry. Here another locomotive pushes the truck to the converter's mouth, and the metal is poured into it by means of a worm and wheel on the ladle. After the addition of the lime and the spiegeleisen, and when it has been ascertained by a test ingot that the blow has been continued long enough, the steel is poured into a ladle, which is transferred by a crane serving two converters to the pit crane, when the ingot moulds are filled in the usual manner. The ingots—sufficiently large for three-length 80 lb. rails—are run on bogies to Gjers' soaking pits, whence they are transferred by live rollers to the cogging and finishing mills.

These works and four others—B. Samuelson and Co.'s blast furnaces, Gjers, Mills, and Co.'s ironworks, Jones Bros.' rolling mills, and Watson's wharf—all situate on the West Marsh, Middlesbrough, are illuminated by the Brush electric light from a central station. This is carried out by a branch of the Hammond Electric Light Company, called the Yorkshire Brush Electric Light and Power Company, whose works should have been visited on the second day of the meeting. Their station forms the centre of a quadrant, bounded by the Tees, on which are situate about a dozen ironworks, &c., all of which were open to the inspection of the members. The company has put down a 16-horse power portable engine, by Messrs. Fowler, of Leeds, and a Brush 40-light dynamo machine, with a second in reserve, and has laid about six and a-half miles of main cables, consisting of No. 8 B.W.G. copper wire, supported on poles on its own land, and seven No. 16 Glover wires, insulated with gutta-percha, in the works that it illuminates. From this main cable it leads branch lines to the different works as required, and it has let all the power that it at present generates. The company is about to put down further plant, in the expectation of taking contracts for a 200-light supply; and it is worthy of note that it is successfully running three parallels, of eight incandescent lamps each, off the same cables as the arc lamps. The dynamo machine has an electro-motive force of over 200 volts, and is run at 680 revolutions a minute. An ingenious arrangement has been devised for tightening the driving belt. The dynamo is supported on a platform, to the under side of which are attached two oak bearers, and these slide on pitch pine balks, the surfaces being treated with a mixture of plumbago and tallow. Embracing the platform are two strap-bolts, the nuts of which are screwed up uniformly, according to requirements; thus drawing the dynamo away from the engine. There are switches for turning the light off from the different works, and sending it through a resistance coil. The foreman goes round to all the works every evening to see that the lamps are working properly, and take orders for the following night. The company charges £25 per annum for each 2000-candle lamp, and the current from sunset to sunrise, not including carbons; but hopes shortly to be able to charge for the current per meter as used.

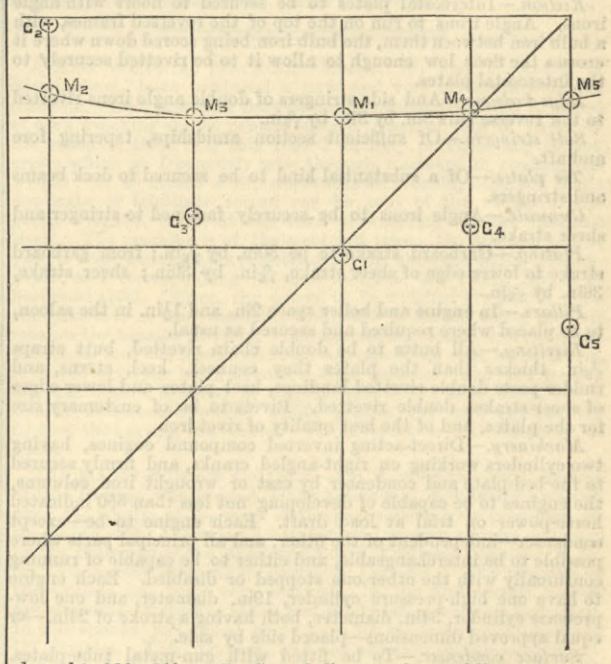
On the night of the *conversazione* at Marton Hall, the Hammond Company illuminated the conservatories with twenty-five 20-candle power Swan electric lamps, supplied by twenty-six Faure-Volckmar storage batteries, that had been charged in London, and sent down by passenger train the previous day. The work of laying the wires was begun on the morning of the *conversazione* by Mr. T. Smith, the company's engineer, and completed in time, the light being available for more than three hours.

An interesting fact in connection with Middlesbrough is the large extent to which blast furnace slag is utilised. No less than 2,000,000 tons of this substance has been absorbed by the works of the Tees Conservancy Commission, and it is probably due to this circumstance that Mr. Charles Wood's methods for the utilisation of slag have not received a wider application in the district. As it is, the company with which he is connected is the only one at present to put them in practice in the United Kingdom. The whole of the arrangements were open to inspection by the members.

The Tees Ironworks, of which Mr. Wood is the manager, are the second that were put up in Cleveland, Messrs. Bolckow, Vaughan, and Co.'s being the first, but the original furnaces have long since given place to three 75ft. high, and two 85ft. high. Gjers' cast iron pipe stoves have also been superseded by the latest type of Cowper's hot-blast stoves. The production is 2750 tons of foundry pig a week. There is also an ironfoundry, in which machine moulding is largely employed, capable of turning out 650 tons a week of railway chairs, screw piles, straining posts for wire fences, and such like articles. A large portion of the slag is taken by the Tees Conservancy Commissioners, the balls when cold being run by locomotives under a two-jibbed Titan, devised by Mr. Fowler and Mr. Wood, and made by Messrs. Appleby Brothers, by which they are shipped on the barges. The remainder is received as it runs from the furnace, either on a horizontally revolving table, kept cool by water and thus converted into slag shingle for making concrete; in a vertically revolving wheel, when by contact with water it becomes sand for making mortar; or in a special machine, in which a jet of steam converts it into silicate cotton. This latter substance is taken entirely by a London firm for making non-conducting coverings for steam pipes and boilers, and also for deadening sound and fire-proofing houses. Near to the furnaces are works for making slag bricks, which can be sold for five or six shillings less than clay bricks. The slag sand is intimately mixed with suitable proportions of finely ground lime and gypsum and a little ironstone, and then compressed in a rotary machine devised by Mr. Wood, the bricks setting hard in the course of a week or two.

METACENTRIC DIAGRAM OF S.S. AUSTRAL.

We give here a metacentric diagram of the steamship Austral, to which we have referred at some length in another page. G_2 is the position as at Sydney, but with tanks full; draught, 23ft. 6in. M_1, M_2, M_3, M_4 and M_5, as at Sydney at the time of the accident;



draught, 22ft. 3½in. G_1, G_3 and G_4, experimental line; draught, 20ft. 10in. The next line below, light condition, but with ballast tanks full; draught, 19ft. 3in. Lastly we have, light condition, ballast tanks empty; draught, 17ft. 6in.

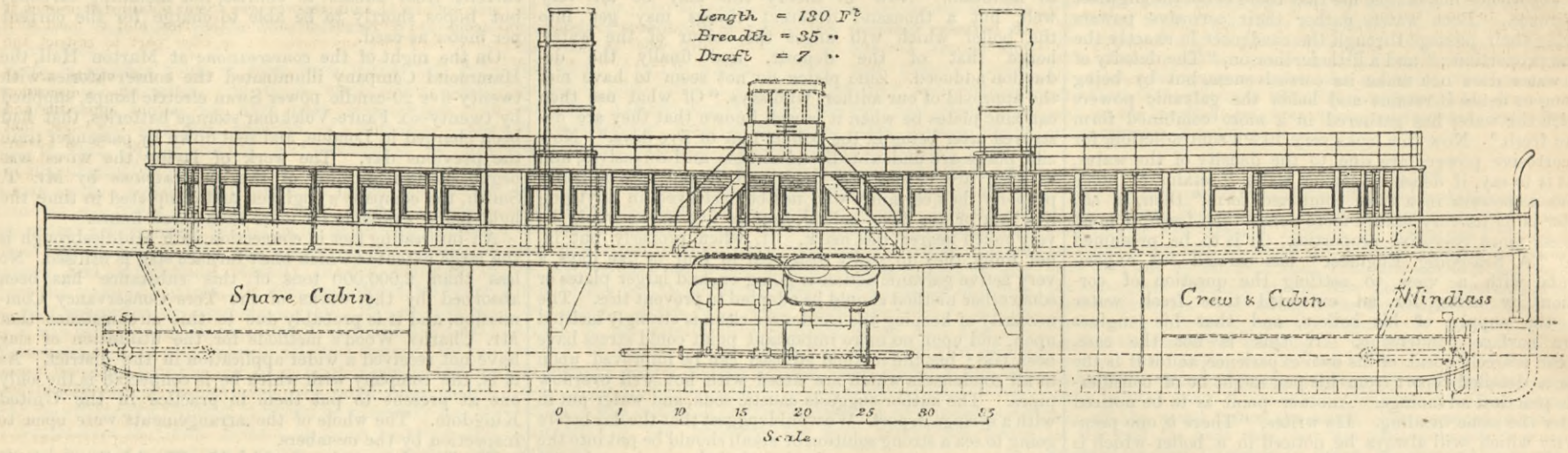
TESTING MACHINE, KING'S COLLEGE.

On page 264 will be found engravings illustrating a testing machine lately erected in the Metallurgical Laboratory of King's College under Professor Huntington. Of this machine we shall give further engravings in another impression, and at the same time a description of the machine.

South Kensington Museum.—Visitors during the week ending Sept. 29th, 1883:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 10,605; mercantile marine, Indian section, and other collections, 5389. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. to 5 p.m., Museum, 1304; mercantile marine, Indian section, and other collections, 2430. Total, 19,728. Average of corresponding week in former years, 18,346. Total from the opening of the Museum, 22,431,414.

CONTRACTS OPEN—FERRY STEAMERS FOR THE WALLASEY LOCAL BOARD.

MESSRS. FLANNERY AND FAWCUS, LIVERPOOL, ENGINEERS.



CONTRACTS OPEN.

WALLASEY LOCAL BOARD.

The following is from the specification of a double-twin screw passenger steamer, to be classed 100 A 1 at Lloyd's, for ferry purposes. Messrs. Flannery and Fawcus, engineers, 17, Water-street, Liverpool.

Dimensions.—Length over all, 130ft.; breadth moulded, 35ft.; depth moulded, 11ft. 5in.; draft loaded, 7ft.; freeboard, 5ft.

General.—The boat to be divided into at least 18 water-tight compartments by iron bulkheads, as shown on plans. To be double-bowed with rudder at each end. Machinery amidships under main deck. Saloon fore and aft on main deck and supplementary saloons below deck as large as possible. Cabins for officers and crew under main deck at end of machinery space. Draught of water not to exceed 7ft. with 10 tons of coal on board, and speed to be 11 knots per hour in smooth water. Model and plan to be approved before the work is commenced.

**Scantlings.*—All to be as per Lloyd's rules for 100 A 1 class. Iron used to be of best quality of shipbuilding iron, the brand to be approved. If the vessel is built of steel, only that made by the Landore-Siemens Company, or by the Steel Company of Scotland, is to be used, except by special permission in writing.

Keel.—To be of forged iron out of best w. scrap, 7in. by 1⅝in., scarphs 15in. long.

Stern and rudder posts.—6½in. by 3in. properly secured to keel.

Frames.—Of angle iron 3½in. by 3in. by $\frac{6}{16}$in. spaced 21in. apart, with doubling pieces 3ft. long across the floors.

Floors.—15in. by $\frac{6}{16}$in., except in way of engines and boilers, where they must be $\frac{7}{16}$in., and to be in one plate, or welded up, and the weld properly alternated on either side of the keel.

Reverse frames.—Of angle irons 3in. by 2½in. by $\frac{5}{16}$in., extending alternately to the side and to the gunwale. In the engine-room doubled from bilge to bilge.

Deck beams.—Of T-bulb iron 7in. by 4in. on alternate frames with the necessary fore and afters, and carlings for boiler and engine hatches and companion ways to have substantial knees, 18in. by 18in. by $\frac{7}{16}$in. welded on.

Bulkheads.—Six water-tight bulkheads of ⅜in. plate, properly stiffened with 2½in. by 2½in. angle irons 30in. apart, and caulked and made perfectly water-tight. Engine-room bulkheads placed between double frames, and remainder on single frames. One longitudinal bulkhead at centre, from fore end of boiler space to fore end of peak, of $\frac{5}{16}$in. plate, stiffened with suitable angle iron. All bulkheads to be properly caulked. The necessary manholes for accessibility to every part to be provided.

Keelson.—Intercostal plates to be secured to floors with angle irons. Angle irons to run on the top of the reversed frames, with a bulb iron between them, the bulb iron being scored down where it crosses the floor low enough to allow it to be rivetted securely to the intercostal plates.

Bilge keelsons.—And side stringers of double angle irons rivetted to the reverse bars 3in. by 3in. by $\frac{6}{16}$in.

Side stringers.—Of sufficient section amidships, tapering fore and aft.

Tie plates.—Of a substantial kind to be secured to deck beams and stringers.

Gunwale.—Angle irons to be securely fastened to stringer and sheer strake.

Plating.—Garboard strake to be 30in. by $\frac{7}{16}$in.; from garboard strake to lower edge of sheer strake, $\frac{6}{16}$in. by 30in.; sheer strake, 36in. by $\frac{8}{16}$in.

Pillars.—In engine and boiler space 2in. and 1½in. in the saloon, to be placed where required and secured as usual.

Rivetting.—All butts to be double chain rivetted, butt straps $\frac{1}{16}$in. thicker than the plates they connect, keel, sterns, and rudder-posts double rivetted landings, keel plates and lower edges of sheer strakes double rivetted. Rivets to be of customary size for the plates, and of the best quality of rivet iron.

Machinery.—Direct-acting inverted compound engines, having two cylinders working on right-angled cranks, and firmly secured to the bed-plate and condenser by cast or wrought iron columns, the engines to be capable of developing not less than 550 indicated horse-power on trial at load draft. Each engine to be—except condenser—independent of the other, and all principal parts where possible to be interchangeable, and either to be capable of running continually with the other one stopped or disabled. Each engine to have one high-pressure cylinder, 19in. diameter, and one low-pressure cylinder, 34in. diameter, both having a stroke of 24in.—or equal approved dimensions—placed side by side.

Surface condenser.—To be fitted with gun-metal tube-plates. Condensing tubes ⅝in. diameter and No. 20 W.G. packed with brass screw glands and cotton cords. Condenser to have a cooling surface of 1400 square feet. The circulating water to be passed through the tubes and the steam outside them. A brass cock to be fitted so as to give soda injection for cleaning the tubes, and also approved means for preventing the dirt entering the boiler, to be fitted with mud doors in bottom, placed conveniently for cleaning. All bolts, stays, and nuts inside condenser to be of Muntz metal.

Air Pumps.—To be not less than one-twelfth capacity of low-pressure cylinder. To be of cast iron, lined with brass, smoothly bored, and bolted to the back of the condenser, and fitted with head, bucket, and foot valves and seatings. All air pumps and feed seatings to be of gun-metal, with Kinghorn's metallic valves, rods of manganese bronze. No iron bolts or nuts to be exposed to the action of the water. Air pumps to be fitted with suitable hotwells on delivery and overflow to engine room.

Boilers.—To have two circular return tube boilers with total heating surface of not less than 1700 square feet. To be 9ft. 6in. diameter and 10ft. long. Detail drawing of boiler to be submitted and approved before the work is taken in hand. Shell plates to be of the "best" Staffordshire, double rivetted in longitudinal seams, with double butt straps, end plates of "best best." Top of furnace, Lowmoor; bottom, "best best." Tube plates of combustion chamber, Lowmoor; both to be one plate with no seams, back and side plates of "best best." Front tube plate to be one-sixteenth larger in the hole than the back, for ease in drawing tubes. Tubes to be so fitted that they and the tube plates may be scaled without removal. The boilers to have not less than 330 cubic feet of steam space. A steel boiler of suitable and approved scantlings may be fitted, if desired by owners. Plates to be chipped or planed on edges and to be caulked outside and inside where practicable. Boilers to have three combustion chambers, and to be accessible for cleaning over top of furnaces. Stays to be placed sufficiently wide apart to allow a man to pass between them.

Sealed tenders, which are to state price for vessels constructed of both iron and steel, addressed to the "Chairman of the Ferry Committee," and endorsed "Tender for Steamers," to be left at the office of the Clerk of the Borough, Egremont, Cheshire, not later than 5 o'clock in the afternoon of Thursday, the 11th proximo.

* The scantlings stated above are for iron, corresponding deductions in weight as allowed by Lloyd's to be made for building in steel.

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

(From our own Correspondent.)

The uncertainty overhanging the coal market, consequent upon the action which the colliers are taking with a view to secure a rise in wages, tended to impart strength to the iron markets of Wolverhampton and Birmingham yesterday and to-day—Thursday.

Boiler-plates were quoted firm at from £8 10s. to £9 and £9 10s. Tank plates were procurable at £8. Yet the demand for plates was not active. Sheets were in more favour. Merchants are purchasing upon account of India and Russia, and some makers reported a capital business doing with Odessa, through German middlemen. The home trade keeps good with the galvanisers, the stampers, and the braziers. Singles were quoted £7 17s. 6d. upwards; doubles, £8 5s.; and trebles, £9 5s.

Upon the occasion next week of the quarterly meeting, the sheet firms will assemble to adopt a memorial to the Board of Trade, in behalf of the issuing by that authority of a special wire gauge, to avoid, in the behalf of makers and consumers alike, the inconveniences otherwise inevitable from the new standard gauge.

Galvanised sheets were a little firmer in price. The Birkenhead Galvanising Company quoted £13 per ton f.o.b., and refused offers of less money. Most of the corrugated sheet firms have an average of work in hand; but new orders are coming forward slowly. This week's advices from Australia speak of a steady but a cautious market, with prices without alteration. By some other firms galvanised corrugated sheets were quoted, with delivery London or Liverpool, at £12 10s. to £13 for 18 and 20 w.g., £13 10s. to £14 for 24 w.g., £15 10s. to £16 for 26 w.g., and £17 10s. to £18 for 28 w.g. Galvanised flat sheets in cases were for the "Woodford" brand £16 for 18 and 20 g., £18 for 24 g., £19 10s. for 26 g., and £21 10s. for 28 g. Best close annealed sheets in cases were £18 10s., £20 10s., £22, and £24, according to gauge, and double best ditto were £20, £22, £24, and £26 per ton, according to gauge.

Hoops for coopers' use were quoted £6 10s. with a steady demand; and strips £6 5s. with an active sale for gas tube, and for nail and bedstead purposes.

Bars were procurable at from £6 2s. 6d. for a common smithy quality up to £7 10s. and £8 2s. 6d. for marked qualities; while an excellent bar was to be had in any quantity at £7, at which price it was selling for use in the Australias and New Zealand.

Native pigs were tame, but makers continue the same rate of output that has been current for some time past. Best cold blast are quoted 85s., and hot blast 65s. to 62s. 6d. These prices are likely to be redeclared at the quarterly meetings. Part mine pigs are 52s. 6d., and common 42s. 6d. to 40s. Vendors of foreign medium class pigs again reported some tolerable sales in advance of next week's meetings, and they were rather firmer in quotations. Good Derbyshire sorts were quoted 47s. 6d.; Northamptons, 46s. 3d.; Leicestershires, 48s. 6d.; and Lincolnshires, 50s. Hematites were easy. The Tredegar brand was 61s.

Coal was in very abundant supply, and for the present, at any rate, prices were certainly no stronger. Furnace qualities were 9s. to 8s. per ton; mill qualities, 7s. 6d. to 7s.; good forge, 6s. 6d.; and inferior, 6s. to 5s. 9d. per ton. Even at this last price there were offers to sell 10,000 tons forward with delivery extending over the ensuing twelve months. Steam coal was 5s. 6d. per ton.

Cokes were quiet, especially as to best South Yorkshire qualities, for which such prices as 16s. 6d. to 17s. 6d. per ton were demanded. Derbyshire cokes were quoted about 15s. 6d. and North Staffordshire sorts 14s. to 14s. 6d., delivered in the Midlands.

The Mill and Forge Wages Board met on Friday in Birmingham to discuss the rate of wages to be paid during the ensuing three months, the operatives having given notice to discontinue the sliding scale and to claim a revision of the wages basis. The masters sought a reduction. They urged that they could no longer go on paying 7s. 6d. per ton for puddling now that wages had just been dropped in the North of England to 7s. per ton. The Staffordshire masters could not afford to pay more than their competitors in the North. The men's representatives claimed that the present basis was arranged much too low, and that it was no answer to say that because there had been a reduction in the North there should be a reduction in Staffordshire. The last ascertained average net selling price of bars in Staffordshire was £6 15s. 7d. per ton, whereas the average of all classes of iron in the North was only £6 2s. 4d. The men further hazarded the assertion that if the average of all classes of iron was ascertained in Staffordshire the net average would be £8 2s. 4d. per ton. On these grounds, and on the ground that there was a good demand for iron, the men claimed a 7½ per cent. advance. The President promised his decision in a few days.

The award of the President of the Wages Board was made known to-day—Thursday—in Birmingham. It states that no sufficient reason was cited to justify either a reduction or an advance; and decrees that from October 2nd to December 31st next, puddlers wages shall be 7s. 6d. per ton, and millmen's in proportion. After the end of the year a month's notice may be given to terminate the agreement.

Likewise on Friday there was an effort by the coalmasters to make progress with the Conciliation Board formed in connection with the coal trade; but through the apparent determination of the colliers' representatives to establish a permanent rise and to maintain it the meeting came to nothing, and the business of the board has reached a dead lock. While now some sections of the men are urging that a demand should be preferred for a rise of 10 per cent., and the present 3s. 8d. per day in the thick coal seams to be the minimum wages, others, as the Old Hill district men, have issued an appeal for a similar demand to be made all along the line without reference to the Conciliation Board.

The annual meeting of the Mines Drainage Commission was held in Wolverhampton on Wednesday. The annual reports, which were on the whole satisfactory, were passed, and Mr. Walter Williams was re-elected chairman for the ensuing year. Steady progress in alike the underground and surface works was reported, with capital results, especially from the new Stow Heath pumping engine, for deep drainage. The chairman stated that with a little more patience the work of the Commission would be satisfactorily completed.

The builders of machinery for making nuts and bolts were never busier. From Scotland, the North of England, and Lancashire, the demand is remarkably active. Engineers' bright bolts are likewise in good demand.

In some branches of the hardware trades there is this week much pressure in the completing of orders to be sent to the North of Europe and Canada before the frosts set in. Some fair orders continue to arrive from South Africa, and there is an increase of purchases on account of India. Certain of the South American markets are still demanding large aggregate lots.

Manufacturers of metal wares who have hitherto been accustomed to supply the War Office and the Admiralty through middlemen, are now beginning to make for the Government direct. This results from interviews had with Mr. Nepean, when, sometime ago, he attended at the Chambers of Commerce in Birmingham, in Wolverhampton, and in Walsall, in promotion of the desire of the departments to buy from manufacturers themselves.

This week the representatives of about two thousand horse nail makers in the South Staffordshire and East Worcestershire districts have given the masters a fortnight's notice for an advance in wages of 3d. per thousand upon the present rate, which is 2s. 9d. per thousand.

"Wilson's Gas Producer" was the subject of a paper read before the Institute of Iron and Steel Works Managers, at Dudley, on Saturday. The author, Mr. C. H. Treglown, showed how cheaply and successfully the machine produced gas fuel for heating purposes.

The Worcester Town Council on Tuesday determined to apply for a provisional order under the Electric Lighting Act, 1882, for supplying the electric light in that city. The object of the application is to prevent public companies from getting control of the lighting, though the Council have not at all made up their minds whether or not they will proceed with the order after obtaining it.

The Hanley Corporation are complaining that serious damage is being done to property in that borough by the mining operations of Lord Granville. A number of houses have been rendered untenantable, and heavy losses to the borough funds in rates are, it is alleged, in consequence sustained. The Council have addressed Lord Granville through his lordship's agent, expressing the hope that immediate steps will be taken to prevent further damage.

NOTES FROM LANCASHIRE.

(From our own Correspondents.)

Manchester.—The iron trade of this district continues fairly steady, so far as present business is concerned, but the market is devoid of animation, and there is still an absence of any weight of new business coming forward to take the place of the contracts now being worked off. So far as prices are tested by the limited transactions reported in the market, the tendency is in a downward direction, but as yet there is no very material actual giving way, and makers generally do not show any very great anxiety to press sales.

Dulness was again the prevailing tone of the Manchester iron market on Tuesday. For pig iron very little inquiry was reported, and buyers who have any orders of weight to give out, hold back for lower prices. Lancashire makers were rather easier to deal with so far as foundry qualities are concerned, and they are now prepared to give way a little to meet buyers where business can be done, but in forge iron they are so fully sold for the remainder of the year, that they are indifferent about further orders at present, and for this quality of iron are very stiff in their prices. In fact, it may be said that Lancashire makers now want the same price both for forge and foundry qualities, and 45s. 3d. less 2½ delivered equal to Manchester represents the present basis of values. In district brands of pig iron occasional sales are made which in the bulk represent a moderate amount of business, and quotations remain on the basis of 44s. 10d. to 45s. 10d. less 2½ for forge and foundry Lincolnshire delivered here. Sellers, however, take under these figures for orders of any weight. A few sales of Middlesbrough iron are reported at about 48s. net cash for good foundry brands delivered here, and in hematites there have been transactions to a moderate extent at about 58s. 6d. less 2½ for foundry qualities delivered equal to Manchester.

The forges generally throughout the district are kept in full work, and with present business makers may be said to be busy. There is, however, comparatively little work in prospect ahead, and although for prompt delivery prices are firm, there is a tendency to give way a little for forward contracts, and merchants in some cases are operating as "bears" on future business. The unsettled state of the men in some of the large iron districts, and the pros-

pect of serious labour difficulties, are, however, calculated to induce caution into business transactions, and with so much uncertainty surrounding the future course of the market, any large operations on the basis of falling prices would certainly involve a very considerable amount of risk. Present quotations, for delivery into the Manchester district, remain at £6 2s. 6d. to £6 5s. for bars, £6 12s. 6d. for hoops, and £8 5s. to £8 7s. 6d. for sheets.

Several important modifications of the Manchester Ship Canal scheme have been decided upon by the promoters with the view of removing some of the objections which were raised by the opponents of the Bill before the Parliamentary Committees. At present I am only in a position to indicate generally the direction in which these modifications tend. The proposed Warrington tunnel has been given up in favour of a high-level bridge; the gradients for the railway bridges, which were originally fixed at 1 in 114, are to be somewhat improved, and an important alteration is to be made in the line of the canal near Warrington, which, it is expected, will tend to weaken the opposition of the Liverpool Dock Board.

The annual meeting of the Manchester Geological Society was held on Tuesday, and Mr. Edmund Pilkington was elected president for the ensuing year. The report showed a slight falling off in the number of members, but the society—which, during the last few years, has become more an association of mining engineers than of geologists—simply still occupies a strong position, both as regards membership and funds. To meet the wishes of a large number of West Lancashire mining engineers who are members, three meetings are to be held during the ensuing session at Wigan.

A fairly steady business for the season of the year is being done in the coal trade of this district, but the demand is not such that it has warranted any further general advance in prices this month. At several of the Bolton collieries prices have been put up about 10d. per ton, and in West Lancashire, where the whole of the advance put on at the commencement of last month has not been realised, colliery proprietors are stiffening up to the full prices, but beyond that there has been no upward movement, and quoted rates are practically unchanged. All classes of round coal are moving away without difficulty, and at the pit mouth prices average 9s. 6d. to 10s. for best coals; 7s. 9d. to 8s. 6d. for seconds; and 5s. 9d. to 6s. 6d. for common coal. Engine fuel continues bad to sell, and slack, which is a general drug, is being pushed for sale at very low figures. Burgy averages 4s. 6d. to 5s.; good slack, 3s. 6d. to 4s., with common sorts to be bought at almost any figure from 2s. 6d. per ton upwards.

Shipping keeps fairly active, with Lancashire steam coal delivered at the high level, Liverpool, or the Garston docks, fetching 7s. 9d. to 8s. per ton.

Coke meets with a moderately good demand at late rates.

A conference of miners representing the districts of Lancashire, Yorkshire, Cheshire, North and South Staffordshire, Worcestershire, and Warwick has been sitting in Manchester this week to consider the question of wages, and at the meeting yesterday—Thursday—it was decided to ask for an advance of 15 per cent.

Barrow.—I can hear of no improvement being manifested in the hematite pig iron trade. The quiet tone reported as existing last week still continues. The business coming to hand is inconsiderable, and there is a disposition on the part of buyers to order at lower prices than are now ruling, but these orders are refused, as makers consider the prices now ruling are as low as are commercially practicable. The sales are not by any means equal to the output, and makers are considering the advisability of reducing the output of metal. The shipments not being heavy, there is a tendency to increase the stocks, which are already very large. Quotations have experienced no change, the current prices being for No. 1 Bessemer 49s. 6d. per ton net at works; No. 2, 48s. 6d.; and No. 3, 47s. 6d. Steel makers are busily employed in all departments, but especially in the rail and merchant mills; the orders coming to hand, however, are practically few, and before long there will be less activity displayed in these departments. Rails are quoted at from £4 10s. to £5 for heavy sections and prompt delivery. Shipbuilders are indifferently employed, and there are few engineers. Iron ore in quiet demand at unchanged prices, 9s. to 12s. per ton being the ruling quotations. Stocks remain very heavy at mines. Coal and coke firm. Shipping dull, as freights are low.

THE SHEFFIELD DISTRICT.

(From our own Correspondent.)

The South Yorkshire coalowners have at length taken decided action in regard to the demand of the miners' delegates for an advance of 15 per cent. in wages. At a meeting held at Sheffield on Tuesday, over forty collieries were represented, the output from which was upwards of 15,000,000 tons per annum. It was unanimously resolved:—(1) That this meeting greatly regrets that inaccurate information has been given to the colliers of the district, calculated to mislead them with regard to the position of the coal trade, and consider it due to the workmen and the public to make the following statement: That it is not correct that any of the collieries of the district have been making enormous profits during the last twelve months; but it is a fact that a very large number of them have been working at a positive loss, and only those in an exceptionally favourable position have been able to make any profit at all; that although the average prices of best coal have advanced about 6d. per ton since this time last year, the price of inferior coal and slack—of which more than one-third of the output consists—and also of coke has not gone up, but is, in fact, lower than last year, so that the advance cannot be considered more than 5d. per ton all round, of which more than 3d. per ton has been paid to the colliers in the last 10 per cent.; that the iron and other trades dependent on a good supply of coal are in a very depressed state, prices being exceptionally low, and foreign competition very severe; and that any great advance in the price of coal at the present time would be most injurious to these interests. (2) Believing that any advance is not warranted by the state of the coal trade, and would be detrimental to the interests of the country at large, it is resolved that a committee of the coalowners of South Yorkshire be appointed to confer with the coalowners of West Yorkshire, Derbyshire, and Nottinghamshire, with a view to resisting any demands that may be made. An influential committee was appointed to carry out these resolutions, and there is no doubt that a most vigorous opposition will be offered to the miners if they should persist in an attempt to put 15 per cent. upon the 10 per cent. obtained last year.

An effort was made to sell a small colliery last Friday. There were eighteen acres of unworked coal, 4ft. 9in. thick, and the colliery was offered as a going concern. It was estimated that the value of the ungot coal was £3600, and yet the highest bid that could be attained was £500, not the value of the plant on the place if broken up. It is said that over £20,000 has been spent on the colliery.

Nearly a score of Sheffield firms will be represented at the Calcutta Exhibition. The Hadfield Steel Foundry Company, Newhall-road, is sending specimens of their solid castings, which have grown to be quite a special trade in Sheffield. Messrs. Easterwood, Allcard, and Co., Penistone-road; Messrs. E. Lucus and Son, Dronfield; the Hardy Patent Pick Company; Messrs Taylor Brothers and other firms have to be added to the exhibitors mentioned in previous letters.

Makers of agricultural machinery and implements, &c., are again dull for home markets, but report a good business doing on foreign account. Heavy rains have seriously interfered with the ingathering of the harvest in late districts, but in other parts it has been fairly well secured on the whole.

There is more business in the cutlery and general hardware departments. A heavy Government contract for soldiers' knives, &c., has been recently divided between Messrs. Michael Hunter and Son, Talbot Works, and Messrs. Atkinson Bros., Milton Works. In the silver and "E. P." trades the leading houses are rather better off. Messrs. James Dixon and Sons, Cornish-place, have brought out a pretty novelty in "Oxford" and "Cambridge" ware; the light blue is the greatest favourite in English markets, and is specially well adapted for breakfast cruets and smaller wares.

The Butterley Company has just received an order of some magnitude from Buenos Ayres. The order includes several hundred tons of iron plates, about 400 tons of iron girders, with heavy weights of pillars, tie rods, &c. The whole order is stated at 1200 tons. The Butterley Company has given up the retail trade n this district.

THE NORTH OF ENGLAND.

(From our own Correspondent.)

Business was very quiet again at the Cleveland iron market held at Middlesbrough on Tuesday last, and there is scarcely any new feature to report. Prices do not advance, though No. 3, g.m.b., is still scarce, and the shipments for this month are expected to be large. Some makers are, in fact, accepting the same price as merchants for small quantities of No. 3 for prompt delivery, viz., 39s. per ton. The majority of the smelters are, however, firm at 39s. 3d. for that brand, and some special brands still realise 39s. 6d. per ton. For forward delivery of No. 3 consumers are offering 38s. 3d.; but producers are not prepared to commit themselves at so low a figure. Grey forge iron for both prompt and forward delivery is offered at 37s. 6d. per ton.

On Monday last Messrs. Connal and Co. had 69,360 tons of Cleveland pig iron in their Middlesbrough store, being a decrease of 200 tons for the week.

Nothing new can be said with regard to the finished iron trade. All the works are kept fully employed, but very few orders are being placed. Manufacturers will now feel the benefit of the reduction in wages, but are not likely to reduce their prices, which are still quoted as follows:—Ship plates, £6 5s.; shipbuilding angles, £5 12s. 6d.; and common bar, £5 17s. 6d. per ton free on trucks at makers' works, cash 10th less 2½ per cent.

The accountants appointed under the Northumberland miners' sliding scale arrangement have issued their certificate for the quarter just ended, which shows that the average net selling price of coal was 5s. 4·87d. per ton, being an increase of 8·87d. This gives an advance of 2½ per cent. in miners' wages.

The engineers employed by the North-Eastern Railway Company to report on the salt workings at Middlesbrough, as to the possibility of a subsidence, state that no apprehension of a dangerous subsidence need be entertained, provided the bore-holes are kept about 800 yards apart. Before the report was given, inquiries were made respecting continental salt workings, which are similar to those at Middlesbrough.

The Darlington Steel and Iron Company issued a notice last week stating that if men employed at No. 1 and 2 rail mills were prepared to accept a reduction of 7½ per cent. they might resume work on Monday. These men, numbering about 300, decided to submit to the reduction and went to work as usual. The remainder of the workmen, some 800 in all, were paid off on Monday afternoon. It is thought that the other mills will be started again on Monday next if the whole of the men will submit to 7½ per cent. reduction. Nothing definite has been settled, but the men will doubtless be glad to accept this offer.

The ironworkers connected with the North of England Board of Arbitration have decided to abide by the agreement made with the Board, and are working this week at the reduced rates. They have, however, given three months' notice to abandon the sliding scale now in operation. The employers have also given notice of their intention to revert to the practice of working eleven shifts per man per fortnight.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

The upward turn in price of warrants continued until Monday last, when after 46s. 9½d. per ton had been reached, the tone of the market changed, and prices on Tuesday began to decline. Towards the end of last week a large quantity of warrants changed hands, some 50,000 tons being bought in the ring in two days. This operation is, of course, of a speculative nature. The supply of pig iron is fully equal to the demand, and considerable quantities are now going into stock. The inquiry from Canada is declining, as is usual at the present season, and the United States demand falls short of expectations. At the same time, the shipments continue good, and there is a large inland consumption of pigs. Makers' prices do not show much alteration; they are too low to be profitable to any extent, and the ironmasters are directing their attention more than ever to the question of economy. One furnace has been blown out at Glengarnock Ironworks for repairs, and there are now 114 in operation against 107 at the same date in 1882.

Business was done in the warrant market on Friday at 46s. 5½d. to 46s. 7½d. cash, the tone of the market then being firm. On Monday forenoon transactions took place at 46s. 7d. to 46s. 9½d. cash, and 46s. 9½d. to 46s. 11½d. one month, the afternoon prices being 46s. 9½d. to 46s. 7½d. cash, and 46s. 11½d. to 46s. 10d. one month. Business was done on Tuesday at 46s. 7d. to 46s. 5d. cash, and 46s. 9d. to 46s. 7½d. one month. The market was active on Wednesday at 46s. 4d. to 46s. 7d. cash, and 46s. 7½d. to 46s. 9d. one month. To-day—Thursday—business was done up to 46s. 11d. cash, and 47s. 0½d. one month.

The prices of makers' iron are as follows:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 55s; No. 3, 51s. 6d.; Coltness, 57s. 6d. and 52s.; Langloan, 58s. and 52s.; Summerlee, 56s. 6d. and 50s. 6d.; Chapelhall, 55s. and 52s.; Calder, 57s. and 49s.; Carnbroe, 54s. 6d. and 48s. 3d.; Clyde, 49s. 9d. and 47s. 9d.; Monkland, 47s. 3d. and 45s. 6d.; Quarter, 47s. and 45s.; Govan, at Broomielaw, 47s. 6d. and 45s. 6d.; Shotts at Leith, 58s. and 53s. 6d.; Carron, at Grangemouth, 48s. 6d. (specially selected, 54s. 6d.) and 47s.; Kinneil, at Bo'ness, 48s. and 47s.; Glengarnock, at Ardrossan, 54s. 3d. and 47s. 3d.; Eglinton, 48s. and 45s.; Dalmellington, 48s. 6d. and 47s. 6d.

The past week's shipments of Scotch pigs amounted to 13,238 tons, as compared with 14,338 in the preceding week, and 15,023 in the corresponding week of 1882. The arrivals from Middlesbrough were 4815, against 7485 in the same week last year.

There is considerable activity in the various departments of the malleable iron and steel trades, and prices are generally without alteration.

At the collieries in the different parts of Lanarkshire, the miners have been working better than of late, and the business is large and pressing. The foreign shipments of coals from Glasgow are considerably over the average, amounting to from 20,000 to 25,000 tons per week. Prices in Lanarkshire are also well maintained, being, indeed, about 3d. per ton higher for good qualities that are much in request for shipment. In the Lothians, furnace and steam coals are in excellent demand, and the household inquiry is likewise manifesting a slight improvement. Parrot coal has advanced somewhat in price in Fifeshire, but other sorts are without material change. Here the shipping and inland trades are in a satisfactory condition, and the prospects for the remainder of the present month are considered to be favourable. About 7000 tons of coal were exported during the week from Leith, and no less than 11,465 tons at Grangemouth.

The belief seems to be that in Lanarkshire the miners' agitation for an advance of wages has hopelessly collapsed. At the last delegates' meeting, which took place a few days ago at Hamilton, a report was supplied which stated that "in respect of favourable reports from various coalmasters, it was resolved to recall the order for an idle day, and authorise the men to work as usual, to test the sincerity of the masters." In Fife and Clackmannan, the executive of the miners has recommended extreme measures, unless the coalowners either grant an increase at once, or meet the representatives of the men in conference to discuss the question. The Employers' Association held a meeting at Dunfermline on Saturday, under the presidency of Mr. Spowart, of Broomhead, when it was considered that it would require at least 1s. more per ton on the prices to enable an advance of wages to be given. As there was no prospect of such an increase of prices being obtained at present, it was decided to refuse the demand of the men, and to meet with strenuous resistance any movement on their part to restrict the output of coal.

The Mining Institute of Scotland met a few nights ago at Hamilton, Mr. James M'Creath, M.E., presiding, when a discussion took place on the merits of the Fleuss breathing apparatus and lamp in cases of mining accidents, and it was acknowledged that there were circumstances in which the dress might be of advantage. Mr. Beith read a paper on the relative merits of the exhaust and forcing fan, and Mr. George Beilby afterwards described Young and Beilby's process for the treatment of coal, so as to recover the products of distillation.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

There was a good deal of ferment on Monday in the ironworks from Cyfarthfa to Ebbw Vale, consequent upon the announcement that the reduction would be 10 per cent. to most of the branches, and at Ebbw Vale, Dowlais, and Tredegar a strong disposition was shown to resist. Some intimated a willingness to accept a 5 per cent. reduction, others contended that the question should be left to arbitrators; but finally it was evident that with the exception of a portion of the labourers and blast furnacemen, there was but a timid opposition, and by the time my letter is received work generally will have been resumed. Rhymney and Cyfarthfa were scarcely affected by the "strike" movement, and at no time, except perhaps at Tredegar, were affairs serious in appearance or prospect. The depreciation that has shown itself in iron and steel, the slackness of American trade, the losses sustained by tin-plate failures, all are evident enough to the mass of the ironworkers, and the fact that English ironworkers have accepted a 7½ per cent. advance has not been unobserved.

It is not improbable but that the present rather idle week will be taken advantage of to weed out a superfluity of labour in some of the works, though the roughest of it cannot be said to be highly paid, 2s. a day being the rate in many cases.

There is an earnest movement on foot amongst the colliers, to which I readily lend my humble support. This is to increase the number of sub-inspectors of mines. Thanks to the skill exercised by mining engineers and the greater care of colliers, accidents are by no means numerous; but Government inspection is of little use in aiding this state of things. It is a physical impossibility for them to inspect all the pits, and so the value of inspection is only brought to bear after an inquest. In all other cases of Government inspection, notably that of factories, it is inspection that detects the existence of defective arrangements, before mischief is committed.

The staple trades are in about the same state as they have been for some time. Iron is in little demand, and prices rule low. Tinplate is tolerably brisk, and for ordinary qualities full market rates are obtained.

It is, however, in the coal trade, that the greatest activity is to be seen, and at collieries, on railways, and at the ports, there is no cessation of the fullest briskness.

The reduction on the Taff Vale Railway in coal rates will amount to a good round sum to the large colliery owners. It will vary according to distance from one halfpenny to a penny per ton, and where there is a dispatch of 10,000 tons a week the reduction will be acceptable.

A large meeting of house colliers was held this week in the Monmouthshire district, when amongst other resolutions one was passed with great fervour to the effect that in their opinion the sliding scale, Conciliation Board, and arbitration system formed the best methods of settling disputes between workmen and employers. Better testimony could not be given to the value of the services rendered by Mr. Wm. T. Lewis in the tranquilisation of labour, and in the peaceful and thorough development of the Welsh coalfield.

Winter prospects are encouraging in Swansea.

Parkend and New Fancy collieries in the Forest of Dean are stopped, and 600 hands idle. Cause unknown.

A New Weighing Machine.—Messrs. W. and T. Avery, of Birmingham, have produced a new and very ingenious weighing machine, which possesses the following peculiarities:—(1) A record of each weighing can be printed upon a ticket or slip of paper by the machine itself; (2) this record entirely prevents any of the errors which so frequently arise through mistakes in reading the weight; (3) by means of this apparatus an indelibly stamped single duplicate or triplicate record can be kept of the weight of the goods weighed, taken at the time of weighing by the machine itself. The machine is of the steelyard type. On the top of the yard are the usual marks or notches for the sliding weight. Underneath, and corresponding to these notches, are raised figures of hardened steel. When the goods to be weighed are placed upon the platform of the machine, the slide is moved along until it reaches the nearest division, when a small bar which slides through this slide, and has figures likewise corresponding with its divisions, is moved until the beam attains a true balance. The card or slip of paper is then inserted in a small slot in the large slide, and a handle underneath pulled which presses the card against the figures, thus giving the record. The inventor is M. Chameroy, of Paris.

The Mason Science College.—On Tuesday the fourth session of this College was opened. The prizes and certificates awarded upon the results of the work of the past session were presented by the Bailiff, Mr. Alderman Chamberlain; and an address delivered by the chairman of the Academic Board, Professor Poynting, M.A., on "University Training in Provincial Colleges." The progress of the College has been very marked. In the first session ninety-five students—sixty-five males and thirty females—were registered. In the session just ended there were 366 students—229 males and 137 females. This increase, and the addition of two new departments—botany and coal mining—have necessitated an extension and alteration of the College buildings in order to provide a botanical laboratory and an additional lecture theatre. A new laboratory has been added to the zoological department, so that the museum of natural history may be enlarged. The Council having extended the course of instruction so as to include all the subjects required for degrees in arts and science, have now made arrangements by which three of the examinations of the University of London are held in the College, so that students who are candidates for the intermediate examinations in arts and science and the preliminary scientific—M.B.—examination are no longer compelled to sit for examination in London. A scheme for the abolition of the chairs of chemistry, botany, and physiology in Queen's College, and the transfer of the students to the Mason College for instruction in those subjects, was carried out prior to the commencement of the past session, and eighty-three students from Queen's College have been in attendance upon classes at Mason College. The Council have established a department for the teaching of the theory and practice of coal mining and colliery management, with Mr. John Brown, M. Inst. C.E., F.G.S., as lecturer. In addition to Mr. Brown's course of lectures on the theory and practice of coal mining and colliery management, Professors Tilden and Lapworth will deliver courses of lectures on the chemistry and geology of coal mining; and Professor R. H. Smith, M.I.C.E., will lecture on mechanical engineering as applied to coal mining. The complete course will embrace about seventy lectures in all, and will extend over two years.

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.**

25th September, 1883.

4562. Counteracting Incrustation in Boilers, G. E. R. Mills, Langley Burrell.
4563. Electric Armatures, H. J. Haddan.—(*C. F. Brush, Cleveland, U.S.*)
4564. Charging Gas Retorts, F. C. Glaser.—(*R. W Grice, Aix-la-Chapelle.*)
4565. Preventing Watches being Stolen from the Pocket, W. Wain, Skegness.
4566. Rock-boring Drills, R. Stephens, Illogan.
4567. Boilers, &c., H. J. Haddan.—(*J. Prégardin, Deutz, Germany.*)
4568. Cleaning, &c., Coats, A. Elliott, London.
4569. Paper-folding Machinery, &c, R. Cundall, Thornton.
4570. Straining Paints, J. C. Mewburn.—(*J. C. Matter, Paris.*)
4571. Separating Solid and Liquid Matter, J. Young and P. Fyfe, Glasgow.
4572. Loom Shuttle, W. Youngjohns, Kidderminster.
4573. Portable Electric Lamps, R. Barlow, Dalston.
4574. Crucibles, J. E. Bott, Manchester.
4575. Printing Presses, W. R. Lake.—(*B. Huber and W. K. Hodgson, Taunton, U.S.*)
4576. Electrical Transmission of News, &c., G. L. Anders, London.
4577. Gauge Glass Fittings, A. J. Boult.—(*V. Agnès, Longuyon.*)

26th September, 1883.

4578. Dynamo-electric Machines, W. P. Thompson.—(*R. J. Sheehy, New York.*)
4579. Engine Direction Indicators, &c., C. Stout, Liverpool.
4580. Packing Frilling, J. McCallum, Manchester.
4581. Washing Machines, E. A. Brydges.—(*J. Szczesny, Ludwigshist, Germany.*)
4582. Boxes, &c., F. Temple-Allen, Brixton.
4583. Compressing Yarn, G. Duncan, Lochee.
4584. Separating Oil from Metal Turnings, A. G. Brookes.—(*G. W. Gregory, Boston, U.S.*)
4585. Galvanic Batteries, A. W. Warden, London.
4586. Bracket for Seats, A. Barker, London.
4587. Milk Cans, W. B. Williamson, Worcester.
4588. Steam Boilers, J. and H. Layfield, Burnley.
4589. Ornamenting Glass, V. Blüthgen, Prussia.
4590. Knitting Stair Pads, &c., J. Burdon and C. Till, Leicester.
4591. Equilibrium Expansion Valves, &c., J. Brooks, Hulme.
4592. Strontia Treatment of Molasses, J. Imray.—(*H. Leplay, Paris.*)
4593. Glycerine, J. Imray.—(*I. A. F. Bang, Paris.*)
4594. Dynamo-electric Machines, F. H. Varley, J. R. Shearer, W. Beale, and R. H. Padbury, London.

27th September, 1883.

4595. Fastenings for Boots, E. Wright, Evesham.
4596. Hand Steering Gear, W. Adair, Liverpool.
4597. Disengaging Hooks, L. E. Liardet, London.
4598. Motive Power, H. Glen, Beith.
4599. Valves, J. Imray.—(*A. Kaiser, Freiburg.*)
4600. Fire-proof Plates, J. Imray.—(*J. Nagel, Vienna.*)
4601. Extracting Fat from Cacao, F. C. Glaser.—(*H. Michaelis, Berlin.*)
4602. Loading Vessels from Lighters, T. E. Heath, Northlands.
4603. Protective Signalling Apparatus for Shooting Ranges, W. Begg, Glasgow.
4604. Rolling Wire, G. W. von Nawrocki.—(*Schmidt Brothers, Schwelm.*)
4605. Retarding Ships to Prevent Collisions, &c., J. Love, Finchley.
4606. Ships' Bulwarks, C. Grey, Glasgow.
4607. Converting Reciprocating Motion into Rotary Motion, A. M. Clark.—(*A. W. Bush and C. R. Roberts, Boulder, U.S.*)
4608. Perforating Paper for Music Sheets, J. Maxfield, London.
4609. Electric Clocks, W. P. Thompson.—(*B. Winbauer, Baden.*)
4610. Steel Disc Wheels, E. Edwards.—(*La Compagnie anonyme des Forges de Châtillon et Commentry, France.*)
4611. Stretching Trousers, R. V. Ash, London.
4612. Electric Accumulators, G. F. Redfern.—(*D. Lontin, Paris.*)

28th September, 1883.

4613. Fences, W. George and F. Garland, East Molesey.
4614. Cutting Wool, W. E. Bennett, Condover.
4615. Folding Baskets, F. H. White, Liverpool.
4616. Ship's Propellers, &c., I. W. Boulton, Ashton-under-Lyne.
4617. Generating, &c, Electric Currents, W. Thomson, Glasgow.
4618. Ventilating Buildings, H. C. Paterson, Glasgow.
4619. Supporting Electrical Conductors, J. Sitzenstatter, London.
4620. Flues of Steam Boilers, G. Rowland, Stalybridge.
4621. Yellow Colouring Matters, J. Imray.—(*La Société Anonyme des Matières Colorantes et Produits Chimiques and Messrs. L. Roussin and A. Rosenstiehl, Paris.*)
4622. Lubricating Bearings, H. Reisert, Cologne.
4623. Hoes, &c., D. Smith, jun., Wolverhampton.
4624. Purifying Smoke, J. Griffiths, Weobley.
4625. Signalling between Vessels, H. Gardner.—(*G. M. Mowbray, Massachusetts, U.S.*)
4626. Dressing Millstones, A. J. Boult.—(*V. Bernard, Montpont.*)
4627. Transmitting Motive Power, &c., J. Robertson, Govan.
4628. Regulating the Feed of Steam Boilers, F. H. F. Engel.—(*W. Ritter, Altona.*)
4629. Buckles, H. J. Haddan.—(*H. Kimball, U.S.*)
4630. Colour Printing on Porcelain, R. Beyerman and A. Kürth, Germany.
4631. Show-cases for Shops, H. J. Haddan.—(*J. A. Houston, Massachusetts.*)
4632. Rabbit Traps, W. Burgess, Malvern Weils.
4633. Man Traps, W. Burgess, Malvern Wells.
4634. Ascertaining Ships' Courses, G. Lilley, London.
4635. Beds, J. S. Hill, Clifton.
4636. Spinning Frames, J. Elce, Manchester, and W. Hammond, Todmorden.
4637. Flying Targets for Shooting, C. J. Barrett.—(*J. E. Bloom, Cincinnatti.*)
4638. Electro-motors, O. March and F. Cheeswright, London.

29th September, 1883.

4639. Thimbles, M. Demme, Mülhausen.
4640. Fastening for Fish-plates, J. Glover, Birkdale, and C. Walton, London.
4641. Water-closet Basins, G. MacWilliam, London.
4642. Economising Fuel, T. J. Barnard, London.
4643. Cranes, W. L. Williams and H. Adams, London.
4644. Treating Carbonaceous Substances, H. Aitken, Falkirk.
4645. Ships, A. E. Fairman, Glasgow.
4646. Sorting Tea, A. Carson, Stirling, and S. R. Baildon, Glasgow.
4647. Packing Tea, A. Carson, Stirling, and S. R. Baildon, Glasgow.
4648. Grinding Grain, J. Y. Johnson.—(*A. Decaup, Marseilles.*)
4649. Production of Gas, H. C. Bull.
4650. Winding Yarn, B. A. Dobson, J. Hill, and J. A. Waite, Bolton.
4651. Valves, W. H. Bailey and W. Lawson, Salford.
4652. Willow Teazers, J. Haigh, Huddersfield.
4653. Submarine Exploration, H. H. Lake.—(*A. Toselli, Paris.*)
4654. Enabling the Vehicles of Narrow-gauge Railways to Run upon Broad-gauge Railways, H. W. Hargrave, Adelaide, Australia.
4655. Optical Instruments, D. R Cameron, Sheerness.
4656. Railway Couplings, H. A. Barns, London.

1st October, 1883.

4657. Secondary Voltaic Batteries, H. Joel, London.
4658. Children's Cots, G. W. Moon, London.
4659. Slipping Apparatus for Harness, &c , C. F. C. Morris, Southwark.
4660. Cutting Files, A. Shardlow, Sheffield.
4661. Forks, H. Vaughan and J. Ball, Sheffield.
4662. Ascending Towers, C. H. Fitzmaurice, London.
4663. Hot-blast Stoves, A. M. Clark.—(*C. Alger, U.S.*)
4664. Time-checking Apparatus, W. T. Ellis, Glasgow.
4665. Repeating Fire-arms, E. G. Brewer.—(*V. Verner and A. Beer, Paris.*)
4666. Coal-shipping Appliances, P. G. B. Westmacott, Newcastle-upon-Tyne.
4667. Pipe Couplings, N. Thompson, London.

Inventions Protected for Six Months on Deposit of Complete Specifications.

4567. Boilers, Flues, &c., H. J. Haddan, Kensington.—A communication from J. Prégardien, Dentz.—*25th September*, 1883.
4602. Loading Vessels from Lighters, T. E. Heath, Northlands.—*27th September*, 1883.
4629. Buckles, H. J. Haddan, Kensington.—A communication from H. Kimball, U.S.—*28th September*, 1883.
4632. Rabbit Traps, W. Burgess, Malvern Wells.—*28th September*, 1883.
4633. Man Traps, W. Burgess, Malvern Wells —*28th September*, 1883.

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

3865. Increasing the Illuminating Power of Coal Gas, F. Weston, Brixton.—*24th September*, 1880.
3867. Manufacturing Oleine, B. Hofmann, Bermondsey.—*24th September*, 1880.
3894. Electro-magnetic Railroads, P. Jensen, London.—*25th September*, 1880.
3917. Crochet-like Edgings, J. Booth, New Basford.—*27th September*, 1880.
3936. Shackle Insulators, J. W. Fletcher, Stockport.—*28th September*, 1880.
3975. Fermented Liquors, J. A. Fawcett, Wakefield.—*1st October*, 1880.
3988. Steam Cultivation, D. Greig and T. Benstead, Leeds.—*1st October*, 1880.
3901. Jewel Cases, &c., T. Heath, Birmingham.—*27th September*, 1880.
3925. Testing Lightning Conductors, &c., S. Vyle, Middlesbrough.—*28th September*, 1880.
4420. Weaving Reversible Fabrics, A. and C. H. Rothwell, Bury.—*29th October*, 1880.
3902. Stamping Letters, C. Pieper, Berlin.—*27th September*, 1880.
3947. Bevelling Glass, W. H. Beck, London.—*29th September*, 1880.
3938. Fire-arms, C. A. McEvoy, London, and G. V. Fosbery, Paris.—*28th September*, 1880.
3953. Hoisting Coal, B. Hunt, London.—*29th September*, 1880.
3992. Piled Fabrics, D. Scott, Manchester.—*2nd October*, 1880.
3996. Skates, P. Everitt, London.—*2nd October*, 1880.
4005 Dynamo-electric Machines, E. G. Brewer, London.—*2nd October*, 1880.
4056. White Lead, W. Thompson, Limehouse.—*6th October*, 1880.
3944. Weaving Looms, A. F. Firth and J. Boothman, Bailiffe Bridge.—*29th September*, 1883.
3945. Spindle Bearings, J. Elce, Manchester.—*29th September*, 1880.
3982. Paper, P. Ambjörn, Paris.—*1st October*, 1880.
4406. Breech-loading Repeating Fire-arms, &c., B. Burton, Brooklyn.—*5th October*, 1880.

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

3808. Closing Doors, J. A. Fahie, Dublin.—*30th September*, 1876.
3831. Steam Cultivators, G. Greig, Harvieston.—*3rd October*, 1876.
3763. Pumps, G. T. and J. W. Blundell, Limehouse, and F. Holmes, London.—*26th September*, 1876.
3773. Lubricants, H. P. Scott and B. H. Zerbe, Bow.—*28th September*, 1876.

Notices of Intention to Proceed with Applications.

(*Last day for filing opposition*, *19th October*, 1883.)

1497. Sugar, A. J. Boult, London.—A communication from C. Blandin.—*21st March*, 1883.
1840. Lubricating Apparatus, T. Holland, Troy, U.S.—*11th April*, 1883.
2488. Sewing Machines, H. J. Allison, London.—A communication from C. Wuterich.—*18th May*, 1883.
2549. Tannic Black, W. G. Gard and T. H. Cobley, Dunstable.—*22nd May*, 1883.
2557. Barbed Wire, H. H. Lake, London.—A communication from P. Miles.—*22nd May*, 1883.
2565. Feeding Apparatus for Carding Engines, E. Edwards, London. — A communication from A Crémer-Pirnay and Co.—*22nd May*, 1883.
2577. Metallising, &c., Non-metallic Substances, C. G. Hammersley, London.—A communication from F. J. Lynam.—*23rd May*, 1883.
2589. Instrument for Measuring Distances, F. Weldon, Farnham.—*24th May*, 1883.
2599. Stoppering Bottles, W. W. Macvay and R. Sykes, Castleford.—*24th May*, 1883.
2605. Chronographs, W. H. Douglas, Stourbridge.—*25th May*, 1883.
2611. Saddle Bars, H. Born, Whitton.—*25th May*, 1883.
2617. Automatic Lathes, F. Wirth, Frankfort-on-the-Main.—Com. from E. H. Freter.—*25th May*, 1883.
2621. Extracting Sulphurous Acid from the Fumes of Furnaces, E. A. Brydges, Berlin.—Com. from E. Hänisch and M. Schröeder.—*26th May*, 1883.
2622. Excavating Apparatus, J. F. Sang, London.—*26th May*, 1883.
2625. Portable Forges, W. Allday, jun., Birmingham.—*26th May*, 1883.
2632. Stretching, &c., Fabrics, H. B. Barlow, Manchester.—Com. from E. Welter.—*26th May*, 1883.
2643. Steam-boiler Furnaces, J. Elliot, jun., and T. A. Cunningham, Dalbeattie.—*28th May*, 1883.
2646. Breech-loading Rifles, &c., W. Field, Birmingham.—*28th May*, 1883.
2647. Food for Infants, W. R. Barker and A. L. Savory, London.—*28th May*, 1883.
2732. Steam Boilers, E. H. Nicholson and W. Mather, Newark-upon-Trent.—*1st June*, 1883.
2749. Sheet-delivery Apparatus for Printing Machines, W. Conquest, London.—A communication from Messrs. R. Hoe and Company.—*2nd June*, 1883.
2753. Firing Gunpowder for Blasting Purposes, C. W. Curtis, London.—*2nd June*, 1883.
2790. Gas Motor Engines, W. P. Thompson, Liverpool.—Com. from S. Marcus.—*5th June*, 1883.
2794. Producing Draught in Locomotive Furnaces, W. R. Lake, London.—A communication from H. W. Norwood.—*5th June*, 1883.
2797. Measuring Tapes, L. P. Casella, London.—*5th June*, 1883.
2798. Extracting Glycerine from Fatty Substances, W. R. Lake, London.—A communication from E. O. Baujard.—*5th June*, 1883.
2926. Lamp Burners, P. C. G. Klingberg, London.—Com. from A. F. Lundeberg.—*12th June*, 1883.
2980. Railway Carriages, H. E. Newton, London.—Com. from B. T. Hutchinson.—*15th June*, 1883.
3146. Flushing Apparatus, M. Syer and W. R. Clark, Peckham, and J. Gilmore, Lower Norwood.—*25th June*, 1883.
3392. Electric Arc Lamps, F. M. Newton, Belfast.—*9th July*, 1883.
3654. Apparatus for Curling Hair, H. Roman, London.—*25th July*, 1883.
3953 Boots and Shoes, A. Bowman, Birmingham.—*15th August*, 1883.
4046. Gas Motors, D. Clerk, Glasgow.—*21st August*, 1883.
4105. Harvesting Machinery, J. Hornsby and J. Innocent, Grantham.—*24th August*, 1883.
4138. Manufacture of Gases, &c., W. Arthur, Cowes.—Com. from J. P. Gill.—*28th August*, 1883.

(*Last day for filing opposition*, *23rd October*, 1883.)

2620. Money Boxes, E. A. Jahncke and H. W. Herbst, London.—*26th May*, 1883.
2640. Lasts for Boots, &c., A. Stürmer, Elberfeld.—*28th May*, 1883.
2644. Fastening Device for Wearing Apparel, &c., H. J. Haddan, London.—A communication from H. Brunner.—*28th May*, 1883.
2648. Hydrate of Strontia, &c., C. F. Claus, London.—*28th May*, 1883.
2650. Chilled Castings, H. H. Lake, London.—Com. from J. A. Parks.—*28th May*, 1883.
2655. Facilitating the Sinking of Shafts, C. D. Abel, London.—Com. from F. Poetsch.—*29th May*, 1883.
2661. Electric Arc Lamps, J. Brockie, Brixton.—*29th May*, 1883.
2681. Horse Nails, E A. Brydges, Berlin.—A communication from A. Gross.—*30th May*, 1883.
2685. Button Fastener, T. W. Taylor, Birmingham.—*30th May*, 1883.
2694. Railway Trucks, A. J. Boult, London.—A communication from P. Dietrich.—*30th May*, 1883.
2696. Staiths, G. Taylor, Penarth.—*30th May*, 1883.
2710. Preventing Rust on Cast Iron, &c., L. A. Groth, London.—Com. from E. Nicolaus.—*31st May*, 1883.
2711. Scissors, &c., L. A. Groth, London.—A communication from B. Cunze.—*31st May*, 1883.
2714. Lager Beer, J. P. Jackson, Liverpool.—*31st May*, 1883.
2715. Wedge-shaped Air Balloon, G. Wellner, Austria.—*31st May*, 1883.
2731. Motor, R. Anderson, Bermondsey.—*1st June*, 1883.
2738. Coal Staith, G. Taylor, Penarth.—*1st June*, 1883.
2741. Electro-magnetic Engines, R. W. M. Fraser, London.—Com. from J. R. Fraser.—*1st June*, 1883.
2766. Revolving Back Collars for Axles, E. Partridge, Smethwick.—*4th June*, 1883.
2834. Rotary Engines, T. Nordenfelt, London.—Com. from G. W. Garrett.—*7th June*, 1883.
2835. Cartridges, T. Nordenfelt, London.—*7th June*, 1883.
2836. Lithographic Stones, H. J. Haddan, London.—Com. from P. C. Möller—*7th June*, 1883.
2837. Forming Starch into Blocks, H. J. Haddan, London.—Com. from W. H. Uhland, Leipzig, and V. Machovsky, Prag.—*7th June*, 1883.
2996. Blank Cartridge, C. D. Abel, London —A communication from W. Lorenz.—*16th June*, 1883.
3018. Securing Corks in Bottles, F. G. Riley, London —*18th June*, 1883.
3136. Lacing Gloves and Boots, A. C. Mather, Liverpool.—*25th June*, 1883.
3163. Compasses, &c., A. M. Clark, London.—A communication from W. H. Mitchell.—*26th June*, 1883.
3196. Lucifers, F. H. F. Engel, Hamburg.—A communication from W. Holmström.—*27th June*, 1883.
3240. Fibrous Ligneous Cellulose, A. M. Clark, London.—Com. from R. Blitz.—*29th June*, 1883.
3266. Clipping Seal Skins, L. A. Groth, London.—Com. from G. and F. Cimiotti —*2nd July*, 1883.
3697. Pantographs, C. Pieper, Altona.—*28th July*, 1883.
3893. Dyeing Cotton Fabrics, F. A. Gatty, Accrington.—*11th August*, 1883.
3912. Manufacture of Flour, S. Leetham, York.—*13th August*, 1883.
3929. Dynamic Sector, H. J. Allison, London.—A communication from H. Glover.—*14th August*, 1883.
4053. Regulating Wort, &c., W. P. Thompson, London.—A communication from H. G. Pommer and P. Ebell.—*21st August*, 1883.
4115. Sewing Machines, A. J. Hurtu, Paris.—*25th August*, 1883.
4337. Sulphurous Acid, C. A. Allison, London.—A communication from National Chemical Machine and Manufacturing Company, Incorporated.—*11th September*, 1883.
4338. Velocipedes, C. A. Allison, London.—A communication from C. F. Waldo.—*11th September*, 1883.
4567. Boilers, &c., H. J. Haddan, London.—A communication from J. Prégardien.—*25th September*, 1883.
4602. Loading Vessels, T. E. Heath, Northlands.—*27th September*, 1883.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the 28th September*, 1883.)

1102. Fur Clipping Machine, A. M. Clark, London.—*1st March*, 1883.
1591. Feeding Paper to Printing Machines, A. Godfrey, New Reddish.—*29th March*, 1883.
1599. Smoke-preventing Grates, A. F. Andresen, London.—*29th March*, 1883.
1600. Fastenings for Gloves, F. J. Martin, London.—*29th March*, 1883.
1620. Voltaic Arc Lamps, B. J. B. Mills, London.—*31st March*, 1883.
1628. Crucibles, J. C. Waterhouse, Wakefield.—*31st March*, 1883.
1632. Electric Signalling Apparatus, W. H. Preece, Wimbledon, and W. E. Langdon, Derby. — *31st March*, 1883.
1636. Oscillating Movement of Fans, A. J. Boult, London.—*31st March*, 1883.
1639. Dynamo-electric Machinery, S. P. Thompson, Bristol.—*31st March*, 1883.
1650. Photographic Shutters, R. Reynolds and F. W. Branson, Leeds.—*2nd April*, 1883.
1651. Concentrating Sulphuric Acid, W. P. Thompson, Liverpool.—*2nd April*, 1883.
1655. Turbines, F. H. F. Engel, Hamburg.—*2nd April*, 1883.
1657. Obtaining Slags from Steel, J. Wright, London.—*3rd April*, 1883.
1662. Folding Chairs, E. Smith, West Dulwich.—*3rd April*, 1883.
1664. Tassels for Umbrellas, M. H. Harris, London.—*3rd April*, 1883.
1668. Tramways and Railways, R. G. Fairlie, London.—*3rd April*, 1883.
1670. Protective Coverings for Bottles, F. Hall, Sheffield.—*3rd April*, 1883.
1682. Propelling, &c., Vehicles, F. J. Clarke, J. W. Graham, and J. Kirby, Lincoln.—*3rd April*, 1883.
1694. Balancing, &c., Window Sashes, J. B. Adams and J. Telford, Liverpool.—*4th April*, 1883.
1698. Pyrometers, W. L. Wise, London.—*4th April*, 1883.
1706. Lubrication of Bolsters, R. Balderston, Paisley.—*5th April*, 1883.
1717. Drawing, &c., Fibres, W. Walker and A. Binns, Halifax.—*5th April*, 1883.
1725. Communicator for Cabs, F. Armstrong, Beckenham.—*5th April*, 1883.
1738. Ordnance, P. M. Parsons, Blackheath.—*6th April*, 1883.
1753. Electric Arc Lamps, J. T. King, Liverpool.—*7th April*, 1883.
1754. Electrodes, F. E. Elmore, London.—*7th April*, 1883.
1805. Electric Pile, J. C. Mewburn, London.—*10th April*, 1883.
1853. Slide Cutting Lathes, M. Wadsworth, Ripponden.—*12th April*, 1883.
1864. Life Buoy, G. J. Kirchenpauer and L. H. Philippi, Hamburg.—*12th April*, 1883.
1870. Utilising Solar Heat, W. L. Wise, London.—*12th April*, 1883.
1878. Bogie Trucks, W. M. Smith, Taybank.—*13th April*, 1883.
1888. Reversing, &c., the Motion of Planing, &c., Machines, P. R. Allen, London.—*13th April*, 1883.
1889. Electric Cables, &c , W. R. Lake, London.—*13th April*, 1883.
1917. Water Meters, O. Imray, London.—*16th April*, 1883.
1934. Tramways, A. E. Adlard, London.—*17th April*, 1883.
1952. Transmitting Electrical Signals, C. D. Abel, London.—*17th April*, 1883.
1962. Ovens for the Manufacture of Coke, F. C. Glaser, Berlin.—*18th April*, 1883.
1972. Cartridges, &c., for Rifles, H. Simon, Manchester.—*18th April*, 1883.
2038. Washing Clothes, J. H. Johnson, London.—*21st April*, 1883.
2040. Regulating, &c., Temperature, J. H. Johnson, London.—*21st April*, 1883.
2048. Mooring Anchor, E. C. G. Thomas, London.—*23rd April*, 1883.
2049. Automatic Dredger, E. C. G. Thomas, London.—*23rd April*, 1883.
2079. Disinfecting Water-closets, &c., H. H. Lake, London.—*24th April*, 1883.
2114. Drawing Geometrical Figures, F. H. Wood, Chiswick.—*26th April*, 1883.
2153. Electric Cut-outs, F. V. Andersen, Poplar.—*28th April*, 1883.
2542. Pencil Cases, H. J. Haddan, London.—*22nd May*, 1883.
2618. Producing Warmth by Absorbing Water Vapour, F. Wirth, Frankfort-on-the-Main.—*25th May*, 1883.
2678. Plate Springs, G. W. Willford, Sheffield.—*30th May*, 1883.
2881. Fire-grates, H. H. Leigh, London.—*9th June*, 1883.
3003. Stockings, A. P. Sheffield and A. W. Wills, Leicester.—*16th June*, 1883.
3177. Printing Cloth, L. H. Philippi, Hamburg.—*26th June*, 1883.
3326. Garments Called Drawers, G. Macaulay-Cruikshank, Glasgow.—*5th July*, 1883.
3376. Conductors for Electrical Railways, H. E. M. D. C. Upton, London.—*7th July*, 1883.
3406. Manufacture of Gas, J. E. Dowson, London.—*10th July*, 1883.
3433. Working Railway Points, W. Buck, Kilburn.—*12th July*, 1883.
3533. Electric Meter, W. McWhirter, Glasgow.—*18th July*, 1883.
3624. Extracting Sulphur Compounds from Alkali Waste, J. Simpson, Liverpool.—*24th July*, 1883.
3632. Insulated Wires, H. E. Newton, London.—*24th July*, 1883.
3713. Radiating Axles, L. S. Zachariasen, Christiania.—*30th July*, 1883.
3747. Nut Lock, W. R. Lake, London.—*31st July*, 1883.

(*List of Letters Patent which passed the Great Seal on the 2nd October*, 1883.)

1665. Impressing Typographic Characters, C. H. Davids, New York —*3rd April*, 1883.
1669. Silk, &c., Hats, M. Haslam, Stockport.—*3rd April*, 1883.
1674. Food for Cattle, P. Jensen, London.—*3rd April*, 1883.
1685. Dividing, &c., Paper, E. H. C. Colley, Surrey.—*4th April*, 1883.
1690. Lavatories, F. P. and E. J. Preston, and J. T. Prestige, Deptford, and E. W. de Rusett, Anerley.—*4th April*, 1883.
1700. Boxes for Eggs, &c., E. Wright, Southend-on-Sea.—*4th April*, 1883.
1702. Starting Tram-cars, B. J. B. Mills, London.—*4th April*, 1883.
1704. Controlling Electric Currents, J. M. M. Munro, Glasgow.—*5th April*, 1883.
1705. Hot-water Apparatus, T. C. Olney, Manchester.—*5th April*, 1883.
1711. Fleece Dividing Attachments, H. J. Haddan, London.—*5th April*, 1883.
1715. Drying Excreta, J. M. Sutton, Manchester.—*5th April*, 1883.
1724. Locks for Canals, W. R. Lake, London.—*5th April*, 1883.
1728. Pointing Tool, F. Service, London.—*5th April*, 1883.
1744. Rendering Wood, &c., Uninflammable, F. K. de Stasicki, London.—*6th April*, 1883.
1746. Velocipedes, A. L. Bricknell, Brixton.—*6th April*, 1883.
1747. Velocipedes, A. L. Bricknell, Brixton.—*6th April*, 1883.
1748. Distributing Apparatus, W. R. Lake, London.—*6th April*, 1883.
1750. Facilitating the Removal of Sand, &c., from Rivers, W. R. Lake, London.—*6th April*, 1883.
1751. Drying Paper, &c., A. Annandale, Dunbar.—*7th April*, 1883.
1765. Binding Sheaves, B. G. Hall, Malvern Wells.—*7th April*, 1883.
1766. Gas Regulators, J. and W. Goodson, London.—*7th April*, 1883.
1767. Weather-proof Explosive Compounds, P. Jensen, London.—*7th April*, 1883.
1775. Cigarette Machines, A. C. Henderson, London.—*9th April*, 1883.
1783. Covering Wire with Gutta-percha, A. C. Moffatt and W. H. Wardale, London.—*9th April*, 1883.
1814. Electric Meter, A. M. Clark, London.—*10th April*, 1883.
1825. Railway Rails, W. P. Alexander, London.—*11th April*, 1883.
1830. Cigarette Machines, A. C. Henderson, London.—*11th April*, 1883.
1832. Incandescent Electric Lamps, J. W. Swan, Bromley.—*11th April*, 1883.
1834. Bath Chair, O. Wolff, Dresden.—*11th April*, 1883.
1857. Electric Telegraphs, A. A. Favarger, Switzerland.—*12th April*, 1883.
1898. Railway Tickets, J. H. Johnson, London.—*14th April*, 1883.
1902. Valise for Foot Soldiers, W. A. F. Blakeney, Glasgow.—*14th April*, 1883.
1932. Galvanic Batteries, C. L. Clarke, Manchester.—*17th April*, 1883.
1985. Rotary Engines, J. C. Mewburn, London.—*19th April*, 1883.
2078. Water-closets, D. S. Keith, Toronto. — *24th April*, 1883.
2167. Sugar, W. R. Lake, London.—*28th April*, 1883.
2220. Paper Feeding Devices, C. Ellery, Albany, U.S.—*1st May*, 1883.
2539. Arc Regulator Lamps, R. E. B. Crompton, London, and T. Crabb, Chelmsford.—*22nd May*, 1883.
2947. Spirit Cooking Stoves, D. Poznainski, London.—*13th June*, 1883.
3084. Distillation of Coal, &c., J. H. Darby, Brymbo.—*21st June*, 1883.
3168. Indicating the Position of a Ship's Helm, J. E. Liardet, Brockley.—*26th June*, 1883.
3391. Carburetters, H. J. Haddan, Kensington.—*9th July*, 1883.
3488. Water-closets, &c., J. Fairbairn, Edinburgh.—*16th July*, 1883.
3581. Steam Packing, J. V. Taylor, Warrington.—*21st July*, 1883.

3663. DISTRIBUTING BLAST, D. P. P. de la Sala, London. —*26th July*, 1883.

List of Specifications published during the week ending September 29th, 1883.

5685, 6d.; 71, 2d.; 143, 2d.; 156, 6d.; 170, 4d; 211, 2d.; 225, 6d.; 323, 3d.; 334, 6d.; 349, 6d.; 375, 2d; 400, 6d.; 403, 2d.; 415, 6d; 423, 4d.; 449, 2d.; 450, 6d.; 458, 2d.; 460, 2d.; 497, 2d.; 529, 2d.; 536, 2d.; 537, 2d.; 544, 2d; 545, 2d.; 546, 2d.; 552, 2d.; 553, 2d.; 557, 2d.; 560, 2d.; 561, 2d; 567, 2d.; 569, 2d.; 572, 2d.; 586, 2d.; 593, 2d.; 594, 2d.; 600, 2d.; 603, 2d.; 605, 2d; 606, 6d.; 608, 2d.; 609, 6d.; 611, 2d.; 613, 2d.; 615, 2d.; 616, 6d.; 617, 2d.; 618, 2d.; 619, 4d.; 620, 4d.; 622, 2d.; 623, 6d.; 624, 6d.; 625, 4d.; 626, 6d.; 628, 2d; 629, 2d.; 630, 6d.; 631, 6d.; 632, 2d.; 633, 4d.; 634, 2d.; 637, 4d.; 640, 2d.; 641, 2d; 642, 2d.; 643, 2d.; 644, 2d.; 645, 10d.; 646, 2d; 649, 6d.; 650, 6d.; 651, 6d.; 652, 2d; 654, 6d.; 655, 6d.; 657, 6d.; 659, 2d.; 661, 6d.; 662, 4d.; 663, 6d.; 665, 2d.; 667, 6d.; 668, 2d.; 669, 2d.; 670, 2d.; 672, 2d.; 673, 2d.; 674, 4d.; 675, 2d.; 676, 6d.; 680, 6d.; 684, 6d.; 685, 6d.; 686, 6d.; 689, 6d.; 690, 6d; 691, 6d.; 692, 4d; 693, 6d.; 695, 4d.; 697, 6d.; 698, 6d.; 699, 6d; 700, 6d; 701, 8d.; 703, 4d.; 705, 8d.; 708, 6d.; 712, 6d; 718, 4d; 719, 6d; 721, 6d.; 722, 6d.; 723, 6d.; 724, 6d.; 726, 6d.; 727, 2d., 728, 4d.; 731, 6d.; 733, 6d.; 734, 4d.; 735, 4d.; 736, 6d.; 737, 4d; 739, 6d.; 740, 6d; 744, 6d.; 745, 8d.; 747, 4d.; 748, 4d.; 750, 4d; 751, 2d.; 752, 4d.; 754, 6d.; 755, 6d.; 756, 8d.; 758, 4d.; 761, 8d.; 762, 2d.; 763, 4d.; 764, 6d.; 766, 6d.; 768, 6d.; 771, 6d.; 773, 4d; 774, 4d.; 775, 8d; 776, 6d.; 778, 4d.; 780, 4d.; 781, 6d.; 782, 6d.; 783, 6d.; 784, 6d.; 787, 2d.; 788, 10d.; 790, 6d.; 791, 6d.; 792, 6d.; 795, 6d.; 798, 6d.; 803, 4d.; 805, 6d; 806, 10d.; 812, 6d.; 813, 6d.; 814, 6d.; 818, 6d; 828, 6d.; 837, 6d.; 838, 10d.; 858, 6d.; 865, 6d.; 882, 4d.; 905, 6d., 924, 6d.; 925, 6d.; 927, 4d.; 931, 8d; 1008, 8d.; 1207, 1s.; 1813, 4d.; 2903, 6d.; 2904, 4d.; 2916, 6d.; 3007, 6d., 3035, 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.

5685. WALLS, ARCHES, AND OTHER BRICKWORK, &c., *F. Smith, Lambeth.—29th November*, 1882. 6d.

The object is to construct brickwork so that the mortar forming the joints shall not be liable to be washed out, and also to increase the strength of the brickwork and improve the sightliness of the work, and in case of glazed walls to increase the light-reflecting efficiency thereof; and it consists in forming the edges of the bricks with a beading all round, so that when built up an enlarged space is formed inside the bricks, the outer joint being much narrower than usual.

71. SEAMS FOR UNITING THE COVERS OF BALLS, *J. Neville, Hackney.—5th January*, 1883.—(*Provisional protection not allowed.*) 2d.

This consists in first sewing round on the edges of the covers, then fastening the covers to the balls as usual, and the seam finished by passing a thread through the edges of the cloth, bringing it to the back of and round the stitch previously made.

143. MATCHES, *L. A. Groth, London.—10th January*, 1883.—(*A communication from H. R. P. Hosemann, Berlin.*)—(*Provisional protection not allowed.*) 2d.

This consists in providing the end of the match opposite to that at which the igniting composition is applied with a covering of fireproof material, so as to form a handle, on reaching which the flame will be extinguished.

170. TREATMENT AND MANUFACTURE OF COLOURING MATTERS, *J. H. Loder, Brussels.—11th January*, 1883.—(*Provisional protection not allowed.*) 4d.

The colouring matters are obtained by the fermentation of sugar or glucose mixed with colouring matters, aromatic principles, nitric salts, and iron salts.

211. HARVEST-SAVING APPLIANCES, &c., *E. O. Greening and E. D. Barker, London.—13th January*, 1883.—(*Provisional protection not allowed.*) 2d.

This relates to a special arrangement of gearing for driving fans to exhaust hot air from stacks of hay or corn, the pipes passing from the fan to the stack being preferably of a half-round or triangular section, and either tapering or telescopic, so as to pack into a small space.

225. BELTING, *H. J. Haddan, Kensington.—15th January*, 1883.—(*A communication from E. M. Cross, New York.*) 6d.

The object is to prevent the stretching of belting by stitching through the length of the belt two or more rows of stitches of waxed thread or metallic thread.

323. DRESSING COMBS FOR LADIES, *H. G. A. de Bysterveld, Paris.—19th January*, 1883.—(*Provisional protection not allowed.*) 2d.

According to one arrangement a comb is composed of three hair-pins or prongs connected by a cross piece, and the lower portions of which form a continuous comb. The heads of the pins are formed with eyes, through which a lock or tress of hair can be passed.

334. HANSOMS, &c., *H. Brockelbank, London.—20th January*, 1883. 6d.

The window is in the form of the roof of the cab, beneath which it is placed and can be thrown forward and then closed down by means of a suitable arrangement of levers and toothed wheels. The invention further relates to an improved rein rest on the roof, so as to enable the driver to shift the reins to a distance on either side.

375. FORMING AND MAINTAINING VACUUM, &c., *J. F. McLaren, Glasgow.—23rd January*, 1883.—(*Not proceeded with.*) 2d.

This relates to apparatus for forming and maintaining a vacuum and obtaining motive power from the pressure of the atmosphere. Three cylinders of equal length are used, the centre one closed at each end and all of them placed in line, the other two being open at the outer ends. Each cylinder has a piston, all of which are attached to one rod which is hollow, but has partitions in the centre. Air is received and ejected from the centre cylinders entering by inlets controlled by valves and leaving by the rod. Another arrangement is also described.

403. BATTING GLOVES, *G. Burbery, Chester.—25th January*, 1883.—(*Not proceeded with.*) 2d.

This consists in quilting the parts of the gloves where necessary, and inserting pieces of india-rubber between the two thicknesses of material.

415. RAISING AND LOWERING WEIGHTS, *J. and J. T. Pickering, Stockton-on-Tees.—25th January*, 1883. 6d.

The object is to construct hoisting apparatus so that when not being worked the load is suspended automatically. A shaft carries a drum, within which are two flanges, one plain and the other having a face resembling a scroll form of clutch consisting of inclined planes, the end of the drum having a corresponding face. The plain flange has a sleeve running loosely on the shaft, and carrying at its outer end a ratchet wheel with which a pawl engages. On the scroll clutch is another sleeve running loosely on the first, and carrying a pinion gearing with a wheel. When power is applied to the shaft the scroll flange is wedged to drum scroll, and forces round the sleeves which carry the pinion and ratchet. When the motion ceases, the pawl retains the ratchet wheel.

423. FELT HATS, *C. Vero and J. Everitt, Warwick.—25th January*, 1883. 4d.

This relates to improvements in the manufacture of smooth-faced napless felt bodies used for flexible and hard hats, and it consists in combing a fur cover with a hardened and unfelted body of wool or mixed materials, by placing them together and operating upon them first with a flat hardener, and afterwards felting them.

449. NOTE PAPER AND ENVELOPE COMBINED, *C. A. Drake, London.—27th January*, 1883.—(*Provisional protection not allowed.*) 2d.

This consists in forming a sheet of paper with lappets which, when the sheet is folded, serve as a means of securing it, and which are perforated so as to facilitate the opening of the sheet when required.

450. ROPE TRACTION TRAMWAYS OR RAILWAYS, &c., *G. J. Chapman, Enfield.—27th January*, 1883. 6d.

This relates to rope traction tramways with an underground tube or channel, in which travels a rope that is connected by a gripping apparatus passing through a continuous slit in the tube to the vehicle above, and it consists in forming the tube of two rolled side plates having their lower lips joined and their upper lips separated to form the slit, and kept in form and position by frames and brackets fixed to them at intervals. The gripper frames are mounted on a bar bearing on the two axles of the vehicle, and capable of being turned in a longitudinal plane clear of the ground. The grip pulleys or jaws can be swept half round and held in a position for gripping a rope on either side of the gripper frame.

458. MECHANICAL MUSICAL INSTRUMENTS, *H. J. Haddan, Kensington.—27th January*, 1883.—(*A communication from C. Neumeister, Leipzig.*)—(*Not proceeded with.*) 2d.

This relates to instruments in which the usual revolving pin barrel is replaced by a reciprocating music board with pins, which are brought into contact with pins on the operating levers of the valves.

480. APPARATUS FOR THE MANUFACTURE OF GAS, *W. White, Abersychan.—29th January*, 1883.—(*Not proceeded with.*) 2d.

This relates to the construction of the retorts.

481. GRAPPLING AND HOISTING STONE, &c., *R. Stone, New York.—29th January*, 1883. 8d.

A range of radial claws are jointed at their inner ends to a crown piece, and springs tend to close them inwardly towards each other. The springs are combined with braces to prevent the claws opening too far. To the crown a vertical rod is connected by a ball joint and coupling, and the hoisting ropes are applied to the upper part of the rod. A sleeve surrounds the rods and is connected by chains to the claws, so that by actuating the sleeve the claws are opened or closed. The grapple may be worked by a derrick or crane, with a turnable base and a vertical mast supported at top by a pivot. The mast is in two parts, between which lazy-tongs or cross bars are pivotted, and actuated by ropes or chains and winch barrels so as to lower, draw back, and turn the grapple round with the mast and turntable.

483. APPARATUS FOR OIL PRESSING, *F. Wirth, Frankfort.—29th January*, 1883.—(*A communication from R. Traumann, Mannheim.*)—(*Not proceeded with.*) 2d.

According to this invention, instead of the manifold wrappers or press cloths, simple press mats are used, which, without being turned over at the edges, are laid in between layers of raw material of suitable depth and quite unenclosed, that is to say, these layers are to be in direct contact with the air at their edges.

484. STEAM BOILERS, *A. M. Clark, London.—29th January*, 1883.—(*A communication from E. Delpech, Marseilles.*)—(*Not proceeded with.*) 10d.

One of the essential features is the employment of double return flame tubes, whether the boiler has a single or double shell or barrel.

485. CONSTRUCTION OF ADVERTISING TABLETS, &c., *W. E. Fisher, Birmingham.—29th January*, 1883.—(*Not proceeded with.*) 2d.

The tablet is made of transparent or semi-transparent material, upon which the advertisement is painted or otherwise produced. The tablet is supported in a frame provided with gas jets.

486. RAILWAY BRAKES, *E. Edwards, London.—29th January*, 1883.—(*A communication from J. B. Charlier, France.*)—(*Not proceeded with.*) 2d.

This relates to the use of a frame with brake blocks, which are caused to bear upon the rails upon each side of the four outer wheels when the frame is forced down.

489. HEATING AND COOKING STOVES, *J. A. B. Bennett, King's Heath, J. Herd, and B. P. Walker, Edgbaston.—30th January*, 1883.—(*Not proceeded with.*) 2d.

This refers to that class of stove in which air is first made to pass in contact with surfaces heated by the combustion of fuel, and afterwards discharged into the room or other place to be heated.

490. SECURING WADS IN CARTRIDGES, *H. J. Haddan, Kensington.—30th January*, 1883.—(*A communication from O. F. Seibold, New York.*) 6d.

This consists in the combination with a cartridge shell and with the charge contained therein of a convex disc, the outside diameter of which is equal to the inside diameter of the shell, and which when placed on the wad is depressed in its centre and serves to retain the charge. The disc may be star-shaped.

491. COPPER AND OTHER METALLIC TUBES, &c., *T. B. Sharp, Smethwick.—30th January*, 1883. 6d.

This consists essentially in the use, in conjunction with a die or draw-plate in the manufacture of tubes, of a detached self-fixing plug in place of the cylindrical mandril or fixed bulbed rod ordinarily employed, such plug being of such size and configuration that it stations itself in the eye or hole of the die or draw-plate, and effects the drawing of the tube between itself and the said eye or hole. Modifications of the plug are described.

492. APPARATUS FOR WASHING, &c., WOVEN FABRICS, *E. J. Jones, Dumbarton.—30th January*, 1883.—(*Not proceeded with.*) 2d.

The woven fabric is passed in succession through separate compartments combined in one tank, being treated with water or soaping or other liquors in some of the compartments, and being subjected to an improved washing operation in compartments alternating with or following the other compartments.

494. SKATES, *E. K. Dutton, Manchester.—30th January*, 1883.—(*A communication from J. Sieper, Prussia.*) 6d.

This relates to that class of skates which are fastened through the gripping action of clamps actuated by means of a screw or screws.

495. APPARATUS FOR DRESSING FLOUR, *W. P. Thompson, Liverpool.—30th January*, 1883.—(*A communication from L. W. Pruss, Minneapolis, U.S.*)—(*Not proceeded with.*) 4d.

This relates to improvements in the construction of the reel, the beaters, the feed mechanism, and the driving gear, and also in means for producing a draught through the reel from the tail towards the head in an adjustable division board, and in various details of construction.

496. MACHINES FOR THE GRADUAL REDUCTION OF GRAIN, *W. P. Thompson, Liverpool.—30th January*, 1883.—(*A communication from W. D. Gray and E. P. Allis, Milwaukee, U.S.*) 6d.

This consists essentially in gradually reducing the grain by subjecting the same repeatedly to the action of grinding or crushing rolls, with intermediate treatments to effect the removal of the fine flour between each reduction and the next.

497. MANUFACTURE OF LIGNEOUS COMPOUNDS AND OF ARTICLES MOULDED THEREFROM IN IMITATION OF WOOD AND OTHER CARVINGS, *C. D. Abel, London.—30th January*, 1883.—(*A communication from B. Harrass, Germany.*)—(*Not proceeded with.*) 2d.

The composition consists mainly of sawdust or other small wood fibre, bullocks' blood, and glutinous flour, the whole being mixed and treated at the ordinary temperature, the use of a water bath in which the materials are boiled being obviated, the finished mass being pressed in a moist condition into moulds heated to from 150 deg. to 300 deg. Cent.

498. APPARATUS FOR CULTIVATING SOIL, *J. Cocke, Richmond, Yorkshire.—30th January*, 1883. 6d.

The object is by continuous action to cut a certain depth of soil and raising and tossing it behind the apparatus so as to disintegrate or loosen the same. A number of cutting discs are fitted at certain distances on a horizontal shaft revolving rapidly, and can be drawn across the field, whereby the soil is cut and thrown up behind.

499. AIR AND GAS MOTORS AND APPARATUS FOR THE PRODUCTION OF GAS THEREFOR, *G. W. Weatherhogg, Wandsworth.—30th January*, 1883. 8d.

This relates to several improvements in the general construction of the motors and apparatus.

500. APPARATUS FOR RAISING SUNKEN SHIPS AND OTHER SUBMERGED OBJECTS, *G. S. Dodman, Liverpool.—30th January*, 1883.—(*Not proceeded with.*) 2d.

This consists of a certain construction of inflatable vessel or buoy and its accessory appliances and connections, which are used in requisite numbers for raising the sunken structure or body.

501. APPARATUS FOR ELECTRIC LAMPS, CHIEFLY APPLICABLE TO STAGE PURPOSES, *J. G. Sanderson, Salford.—30th January*, 1883. 2d.

In "Maypole Dances" an arc lamp is fixed on top of the pole and the dancers carry incandescent lamps.

502. VICES, *A. W. L. Reddie, London.—30th January*, 1883.—(*A communication from W. H. Schofield, Brooklyn.*) 6d.

This relates to vices in which the sliding bar or sword which is adapted to slide in the fixed jaw of the vice is provided with a toothed rack which engages with a detent or pawl in the said fixed jaw, and prevents the outward movement of said sliding bar until the latter is slightly raised to liberate it from the detent, or is set free by moving the pawl.

503. MACHINERY FOR SPINNING AND DOUBLING COTTON, WOOL, &c., *J. Tatham, Rochdale.—30th January*, 1883. 6d.

This relates to improvements in ring and traveller frames for spinning and doubling cotton, wool, and other fibrous materials, and consists partly in making and applying an elongated traveller which when working adjusts itself and yields to the various diameters of the cop, thereby regulating the tension of the thread in passing to the cop from the traveller round which the yarn or thread is lapped.

504. ADJUSTING THE FOCUS OF LENSES, *E. Mallove, Birmingham.—30th January*, 1883.—(*Not proceeded with.*) 2d.

The adjustment is effected by taking two of the ordinary cases or tubes for holding the lenses and cutting through the face of the outer tube a spiral groove and having upon the face of the inner tube a pin or projection working within this groove, so that the act of withdrawing the one tube from within the other causes the pin or projection to travel along the groove and hold the tubes in any required relative position.

505. ATTACHMENTS FOR BRACKETS, ARMS, OR SHELVES TO THEIR STANDARDS, &c., *J. H. Norrington, Harlesdon.—30th January*, 1883. 6d.

This relates to bands or clips formed so as to surround the greater portion of the circumference of the upright or standard.

506. APPARATUS FOR OPERATING THE PROPELLING AND STEERING APPLIANCES OF VESSELS, &c., *E. P. Alexander, London.—30th January*, 1883.—(*A communication from J. Frazier, Searcy, U.S.*)—(*Complete.*) 8d.

The invention consists of three main parts, First, the machine for controlling the throttle valve of the propelling engine; Secondly, the engine whereby the wheels or propeller is moved; and Thirdly, the steering apparatus, all arranged so as to be under control from a central point, as, for instance, the pilot house.

507. FISHING RODS, *R. Anderson, Edinburgh.—30th January*, 1883.—(*Not proceeded with.*) 2d.

This refers specially to means of securing the reel and reel plate to the stock or butt of the rod, whereby the reel can be conveniently removed and replaced.

508. PRIMARY VOLTAIC BATTERIES, *G. G. André, London.—30th January*, 1883. 6d.

The object is to make the batteries regenerative by placing in an outer jar, charged with a saline solution, one or more inner porous cells, charged with solution of sulphate of copper. In the outer jar is placed a carbon and a metallic electrode, and in the inner cell a metallic electrode which is connected with the carbon electrode of the outer jaw.

509. ETCHING AND PRODUCING INEXTINGUISHABLE METALLIC DEPOSITS UPON BRIGHT METAL SURFACES, *E. Nienstaedt, Berlin.—30th January*, 1883. 4d.

This relates to the method of etching and producing inextinguishable metallic deposits upon bright metal surfaces by the use of dry hygroscopic metal salts, such as chloride of antimony, dichloride of platinum, perchloride of iron, nitrate of copper and the like, as also of chromic acid and the like, such salts being finely ground and printed or stamped directly upon the metallic surface.

510. CUTTING-UP PLASTIC OR YIELDING SUBSTANCES, &c., *J. H. Johnson, London.—30th January*, 1883.—(*A communication from J. G. Baker, Philadelphia.*) 6d.

The object is to cut up plastic substances into pieces of uniform size, and it consists in forcing them while under confinement through a perforated plate, and severing the part which enters the perforations from the mass. In one arrangement a screw forces the substances towards the end of a cylinder closed by a perforated plate, and against which a cutting blade or knife revolves.

511. MANUFACTURE OF RADIATORS FOR HEATING PURPOSES, *L. W. Leeds, London.—30th January*, 1883. 6d.

This relates to improvements in the details of construction.

512. AUTOMATIC FEED APPARATUS FOR STEAM BOILERS, *C. F. Trinks, Helmstedt.—30th January*, 1883.—(*Not proceeded with.*) 4d.

This apparatus consists of a float, lever, valve, and peculiar connections, and is placed inside the boiler.

513. MANUFACTURE AND PACKING OF MIXTURES OR COMPOUNDS OF ALKALINE AND OILY, FATTY, OR RESINOUS SUBSTANCES FOR SOAP MAKING, &c., *W. R. Lake, London.—30th January*, 1883.—(*A communication from T. C. Taylor, Philadelphia.*)—(*Not proceeded with.*) 2d.

This relates to the treatment of the alkalies of soda or potash when grinding or otherwise preparing them for use for the manufacture of soap or other purposes, and to compressing such alkalies into a convenient form and condition for transport, storage or use.

514. GAS BURNERS, *J. Rettie, London.—30th January*, 1883.—(*Not proceeded with.*) 2d.

This relates to the employment of a hollow receptacle over the ordinary burner.

517. CONSTRUCTION OF APPARATUS FOR FILING AND BINDING LETTERS, &c., *J. M. Delany, Manchester.—31st January*, 1883.—(*Not proceeded with.*) 2d.

The object is to facilitate the alphabetical arrangement, filing and binding of letters, &c.

515. MACHINERY FOR DIGGING OR CULTIVATING LAND, *E. Cobham, Stevenage.—30th January*, 1883. 6d.

The inventor claims, the combination of the engine, driving wheels and gear, and suspended frame and digging apparatus, with the supporting wheels or rollers arranged close to the digging implements, and the wheels or rollers upon the frame in front of driving wheel. Also, in combination with such apparatus, the method of raising the front wheels or rollers from the ground and lifting the entire frame and digging apparatus, for the purpose of travelling upon ordinary roads.

518. VESSELS AND APPARATUS FOR AERIAL NAVIGATION, *W. R. Lake, London.—31st January*, 1883.—(*A communication from E. F. Falconnet, Nashville, U.S.*)—(*Not proceeded with.*) 4d.

This relates to improvements in vessels for aerial navigation, to be actuated, handled, and steered by machinery arranged within the said vessel by means of screw propellers on the sides, as well as screws fore and aft, or aft only at the option of the builder, the forward screw being for steering purposes.

519. APPARATUS FOR THE MANUFACTURE OF GAS FROM OILS, *A. Jay and C. Hook, Kingswood Hill.—31st January*, 1883.—(*Not proceeded with.*) 2d.

This consists, First, in the construction of the retort in which the vapourisation or conversion into gas of the oils is effected; Secondly, in the arrangement and construction of a portable stove or furnace in combination with the retort or a series of retorts.

520. ELECTRIC ARC LAMPS, *A. Kryszat, Moscow.—31st January*, 1883. 6d.

This relates to a commutator arrangement for successively bringing into action pairs of carbons. One of each pair is held in fixed holders, and the others in movable holders, the circuits being completed in succession by a revolving contact piece.

522. DESICCATED EGG AND MACHINERY FOR ITS PRODUCTION, *H. J. Allison, London.—31st January*, 1883.—(*A communication from P. Cooper and C. A. La Mont, New York.*) 6d.

The objects are to conserve desiccated egg in its original purity, and to strengthen the rotating plates used in its desiccation. To conserve the egg salt is added and the egg then dried in a thin layer on revolving discs, which are strengthened by forming a groove in their peripheries and winding two or more coils of wire in such groove, the coils being covered and united with solder.

523. FOLDING OR SHUT-UP BEDS OR BEDSTEADS, *A. Eodgson, London.—31st January*, 1883. 6d.

This relates to a bedstead which, when folded up, has the appearance of a cupboard.

524. HARVESTING MACHINES, *B. Samuelson and W. G. Manwaring, Banbury.—31st January*, 1883.—(*Partly a communication from the Marsh Binder Manufacturing Company, Sycamore, U.S.*) 10d.

This relates to machines in which the cut crop falls on to a platform and is removed towards one side by endless webs with projections for the purpose of being bound, and it consists, First, in a device for making at will a portion of the projections either towards the front or back of the platform, so that either the butts or the heads of the crop may be moved laterally by the projections not masked, while the opposite ends remain comparatively at rest; Secondly, in a rotating device to take the place of the "buttor" for the purpose of adjusting the cut crop as it leaves the platform, so that it may be encircled by the hand at the proper place; Thirdly, of a rotating device with projections at its circumference to receive the crop from the platform and deliver it to the packers; Fourthly, in a modification of the ordinary "buttor;" Fifthly, in arrangements by which the pressure of the crop against the packers causes the needle and binding devices to be brought into operation; and Sixthly, to rotating packers.

525. EXHIBITING GOODS AND SAMPLES IN SHOP WINDOWS, &c., *F. McIlvenna, Manchester.—31st January*, 1883. 6d.

This consists in exhibiting fabrics by sewing the patterns together in an endless belt, which is mounted on rollers in a suitable case. Jewellery is exhibited on revolving shelves. Stands for hats and other articles are also described.

526. APPARATUS FOR ELECTRICAL COMMUNICATION ON RAILWAY TRAINS, *R. W. Vining, Liverpool.—31st January*, 1883.—(*Not proceeded with.*) 2d.

A fine wire, having suitable joints, runs the length of the train. Each carriage is provided with a semaphore, which is projected on pushing a button in any one compartment. The current is used to actuate the lever of the engine whistle.

527. SHUTTLES FOR SEWING MACHINES, *H. J. Haddan, Kensington.—31st January*, 1883.—(*A communication from E. Capitaine, Berlin.*) 6d.

This relates to the method of carrying or guiding the thread on its way from the spool. On the top side of the shuttle is a longitudinal opening running obliquely in the direction from the rounded part of the rear end towards the point of the shuttle, and from the front end of this opening an oblique slot is cut to the pointed side of the shuttle, and is also oblique to the side of the shuttle. The tongue thus formed has a row of holes united with the pointed side of the shuttle by slots perpendicular to the longitudinal axis of the shuttle. Along the top of the shuttle and over the tongue runs a guide spring divided into two arms united at both ends, one arm serving to retain the thread in the row of slotted holes, and the other to guide the thread.

529. DINNER PLATE AND COVER, *R. Jordan, Stafford.—31st January*, 1883.—(*Provisional protection not allowed.*) 2d.

A portion of the plate is divided into compartments, each to receive a separate vegetable, while small compartments are provided to receive the condiments. A flat metal cover is made to fit right over the plate, and has an internal flange which rests upon the edge of the plate.

530. LUBRICATING CERTAIN PARTS OF MACHINERY, *E. B. Petrie and W. A. Entwistle, Rochdale.—31st January*, 1883. 6d.

This relates, First, to lubricating bearings which surround rods or bars, and in which the latter can slide, and it consists in placing "metalline" or "oilless carbonate" in such bearings, and securing it in position by bushes screwed in the bearings; and, Secondly, to lubricating other bearings by forming grooves in the shafts or bearings and filling them with "metalline" or "oilless carbonate."

531. DRAIN TILES, *M. Benson, London.—31st January*, 1883.—(*A communication from J. Lynch, Washington, U.S.*)—(*Not proceeded with.*) 4d.

This consists in forming drain tiles, the lower part with a close or glazed surface, the upper part being porous, the object being to allow water to drain from the land through the upper part, and be conveyed away in the interior of the pipe.

532. TERRA-COTTA TILES, &c., *M. Benson, London.—31st January*, 1883.—(*A communication from J. Lynch, Washington, U.S.*)—(*Not proceeded with.*) 4d.

This consists in making the face of terra-cotta tiles and other articles glazed or close, and the back open or porous, the advantages claimed being that they are lighter and yet as durable as ordinary tiles, that they are less liable to warp or crack, and nails can be driven into the porous back without damaging it.

533. KNITTING MACHINES, *H. B. Barlow, Manchester.—31st January*, 1883.—(*A communication from O. Cazeneuve, France.*) 8d.

The inventor claims, First, the principle of bringing self-acting needles with two hooks into use wholly or partially by releasing them and seizing them again at will during their traverse in grooves in the bed; Secondly, the modes of application, arrangements, and forms of the parts composing the knitting machine, and also special adjustment for increasing, diminishing, or varying the stitches on the needles drawn or pushed; and, Thirdly, special mechanism and its application to the change of any continuous circular motion into an alternating rectilinear movement and without escapement.

534. STANDS FOR VESSELS CONTAINING MILK, ICES, &c., *F. A. Colley and J. Wingfield, Sheffield.—31st January*, 1883. 6d.

The object is to hold vessels containing milk, ices

and other refreshments so as to protect their contents from dust and flies, and also to allow the attendant to readily withdraw one or more of the vessels; and it consists essentially of a stand to receive the vessels, and a cover that can be raised and lowered so as to cover or uncover the mouths of the vessels.

536. Driving Gear of Bicycles, Tricycles, &c., *R. H. Froude and J. Jenner, Kensington.*—31*st January*, 1883.—(*A communication from W. Pilkington, Canada*)—(*Not proceeded with.*) 2*d.*

Treadles are connected to the driving axle or a countershaft connected thereto by a special ratchet arrangement.

537. Buttons or Dress-fasteners, *J. Imray, London.*—31*st January*, 1883.—(*A communication from W. Pilkington, Canada*)—(*Not proceeded with.*) 2*d.*

The button or fastener has a central bush, which is sewn to the garment and forms an axis round which the body of the button is free to revolve, such body being shaped so that it can be introduced edgewise through the button-hole and then turned partly round, so as to overlap the fabric on each side.

538. Cable Stoppers, *A. M. Clark, London.*—31*st January*, 1883.—(*A communication from J. B. Lynch, Leadville, U.S.*) 6*d.*

The invention consists of a door for the hawse-hole formed of two pieces or sections hinged together, one of which is secured to a shaft having means for oscillating the same, and the other is provided with a flaring slot in its free end for the anchor chain, and is adapted to be raised and lowered by the oscillation of the former piece to allow the chain to pay out or to stop the same at any desired position.

539. Tram, Rail, and Road Cars, &c., and Machinery for Driving Same by Electricity, *M. R. Ward, London.*—31*st January*, 1883. 6*d.*

This relates to mechanical appliances for changing the ratio of speed between the electric motor and the main driving axle, an arrangement of frictional gearing, a switch for varying the strength of the current, the use of a speed regulating governor, and to the combination of the steering appliance with a "fifth wheel" plate running on rollers.

540. Distilling or Refining Mineral Oils, &c., *N. M. Henderson, Broxburn, N.B.*—1*st February*, 1883. 8*d.*

The oil is fed continuously into a first still, from which there is a continuous transference to one or more stills in succession, the distillation being effected at graduated temperatures in the successive stills. The oil is fed in at a point higher than and remote from the outlet. The stills are suitably connected, and the inlets and outlets are fitted with safety valves. A spiral feed-heater and dishes or plates for promoting circulation in the still, and for receiving coke or matters deposited from the oil, are also described.

541. Coaling Steamships, &c., *S. Plimsoll, London.*—1*st February*, 1883. 2*d.*

This relates particularly to the construction and arrangement of the corve.

542. Breech-loading Small-arms, *H. Webley, Birmingham.*—1*st February*, 1883. 6*d.*

This relates to a method of controlling the opening and closing of revolving pistols, rifles, or other small-arms.

543. Metal Printing, Embossing, and Moulding Plates, Dies, or Moulds, &c., *D. Appleton, Manchester.*—1*st February*, 1883. 6*d.*

This relates to the coating of the working surfaces of plates or appliances with an electro-deposit of nickel.

544. Automatic Sanitary Flushing Apparatus, &c., *F. J. Austin, Hounslow.*—1*st February*, 1883.—(*Not proceeded with.*) 2*d.*

In or near the centre of, and running up through the bottom of a cistern, an outflow pipe is arranged for discharging the cistern, and over it is an inverted pipe closed at top and extending to near the bottom, a space being left between the two pipes. A ball valve supplies the water to the cistern.

545. Brakes for Carriages, &c., *M. Williams, Cardiff*—1*st February*, 1883.—(*Not proceeded with.*) 2*d.*

A partial strap or band of steel, brass, or other suitable metal is passed round the stock of the wheel, and is capable of gradual or sudden compression when actuated from the driver's seat.

546. Lamps for Mining, Tunnelling, &c., *S. Williams, Cornwall.*—1*st February*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to provide an oil lamp which can be placed in different positions.

547. Water Gauges, *J. Dewrance, Lambeth.*—1*st February*, 1883. 6*d.*

This relates to improvements in water gauges, by which the evils consequent on the breakage of the glass are very much reduced.

548. Sewing Machines, *W. E. Gedge, London.*—1*st February*, 1883.—(*A communication from B. Kohler, Oakland, U.S.*)—(*Not proceeded with.*) 2*d.*

This consists in such a construction and combination of the mechanism constituting the machine, as to enable the formation with it of a stitch from a single thread, which shall resemble and be equivalent to the over-and-over stitch used in sewing carpets and grain sacks by hand.

549. Electric Brushes and Composition of the Exciting Liquid, *M. McMullin, London.*—1*st February*, 1883. 6*d.*

The back of the brush contains the battery, alternate rows of the metallic bristles being connected to one pole, and the remaining rows to the other pole. The exciting liquid is composed of strong acetic acid, sulphur, and water.

550. Spring Hasp or Clip for Securing the Lids of Trunks, &c, *C. Mohr, Birmingham.*—1*st February*, 1883. 6*d.*

This consists of a hasp or clip made of sheet or cast metal, formed in two parts jointed together so as to form a hinge.

551. Manufacture of Artificial Hard and Soft India-rubber and Gutta-percha, *W. H. Harrison, London.*—1*st February*, 1883. 4*d.*

This relates to the employment of acetic acid in the treatment of the substances.

552. Furnaces, *H., W., and J. Martin, Coatbridge, N.B.*—1*st February*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to improvements in reverberatory furnaces for re-heating iron and steel, and other similar furnaces, and it consists in fitting in the back wall above the grate and the hearth of the heating chamber a narrow deep cast iron air flue to admit heated air to the rear end of the furnace above the grate, the air serving to support the whole length of the back edge or side of the arched roof. Other improvements relating to the use of steam, and to means for forcing heated air into the closed-in ashpit under the firegrate, are also described.

553. Obtaining Products from Coal, &c., *H. L. Pattinson, jun., Durham.*—1*st February*, 1883.—(*Not proceeded with.*) 2*d.*

Above an ordinary gas producer a cylindrical chamber is placed, and contains vertical retorts open at their lower ends and arranged in a circle, extending the whole vertical length of the chamber, and terminating about 9ft. from the bottom of the producer. The retorts are furnished with charging doors and pipes at the upper part, and pipes lead to a hydraulic main. The lower part of the producer and the retorts are charged with fuel, that in the producer being ignited, and steam or air injected into it at the bottom.

554. Coke Ovens, &c., *H. Simon, Manchester.*—1*st February*, 1883.—(*A communication from F. Carves, St. Etienne, France.*) 6*d.*

This relates to heating the air supply or the supply of combustible gas, or both, to the combustion chambers or flues of coke ovens, by means of the waste heat of the gaseous products of combustion, while passing from the ovens to the chimney or chimneys, the arrangement being such that the initial heating of the air to a considerable degree is effected in flues that are entirely out of contact with the brickwork of the ovens.

555. Electrical Conductors, *J. Imray, London.*—1*st February*, 1883.—(*A communication from Société Anonyme des Cables Electriques—Système Berthoud, Borel, and Cie., Paris.*) 4*d.*

The conductor is coated with a fibrous covering soaked in insulating material and enclosed in a lead sheathing tube having projecting ribs. This tube is placed in an external sheathing tube, and the space between them filled with pitch.

557. Cleansing or Washing Cereals, Coffee, &c., *C. D. Abel, London.*—1*st February*, 1883.—(*A communication from Dr. L. Mautner R. von Markhoff, Vienna*)—(*Not proceeded with.*) 2*d.*

The material to be cleaned is placed in a cylindrical casing with a conical bottom, through which liquid under pressure is caused to flow, and in which a spindle rotates and carries perforated or openwork vanes which agitate the material.

558. Marine Boilers with Under-grate Blast, *C. H. Ziese, Elbing.*—1*st February*, 1883. 6*d.*

This relates to tubular marine boilers to which an under-grate air blast is admitted by means of a flap regulator or other apparatus, and the objects are, First, to prevent the boiler tubes from becoming loose; Secondly, to protect engineers or firemen from being scalded when a tube bursts; Thirdly, to regulate the combustion according to the consumption of steam; and Fourthly, to allow such boilers with under-grate blast to be applied to open and undecked vessels. To prevent compressed or cold air passing directly through the fire-door, the current of air produced by the ventilator is introduced into a channel, which terminates directly under the grate, and which may be closed by mechanism connected with the fire-door, so that when the latter is opened, the draught beneath the grate is automatically closed.

559. Dynamo-electric Machines, *W. P. Thompson, Liverpool.*—1*st February*, 1883.—(*A communication from J. A. I. Craig, Montreal, Canada.*) 6*d.*

The armature has an annular core of non-magnetic material on which iron wire is concentrically wound, the insulated wire coils being wound transversely on this. The ring of coils is held between two end discs mounted on the shaft, the coils being separated at the periphery by bars of wood fixed at either end to the rims of the discs. The field magnets have a core of soft iron wire wound in a circular elliptical form continuously around or through separate polar extensions of solid metal curved to partly encircle the armature, the coils are wound on the core and connected in the usual manner. A "duplex commutator" consists of two sets of metal strips placed end to end, each separate strip being insulated from its neighbour. The strips of each set are connected alternately with the different sections of the commutator plate (and thus forming connection with the armature coils connected with each other and with the strips in any approved way.)

560. Manufacture of Sugar, and Apparatus therefor, *A. J. Boult, London.*—1*st February*, 1883.—(*A communication from J. P. Porry, Martinique.*)—(*Not proceeded with.*) 2*d.*

This relates to means for facilitating the use of sulphurous gas in the manufacture of sugar. Sulphur is burnt in a furnace, and the gas generated is led into a chamber containing the juice, which is caused to flow over a series of plates or boards, the gas being caused to flow through this chamber by connecting the latter with a chimney.

561. Looms, *A. J. Boult, London.*—1*st February*, 1883.—(*A communication from F. Rabache, France.*)—(*Not proceeded with*) 2*d.*

The object is to form a loom on which two similar or dissimilar fabrics may be woven simultaneously. The loom has two beams and two cloth rollers. The shuttle driving mechanism is placed at the centre of the loom and acts alternately to the right and left. Other shuttle driving mechanism is arranged at each end of the loom.

562. Water-level Regulators for Steam Boilers, *J. H. Johnson, London.*—1*st February*, 1883.—(*A communication from P. Gauchot and the Société Volpp Schwarz et Cie., Paris*)—(*Not proceeded with.*) 2*d.*

The valves controlling the passage of the feed-water are worked by a float contained in a chamber connected with the boiler, in such a manner that small fluctuations in the level of the water in the boiler are represented by relatively large fluctuations in the level of the water contained in the chamber.

565. Metallic Bedsteads, *H. Ferrer, Balsall Heath.*—1*st February*, 1883. 8*d.*

This consists in forming the ends of bedsteads in two or more parts so as to facilitate the packing for transit.

566. Projectiles for Ordnance, *A. Longsdon, London.*—1*st February*, 1883.—(*A communication from A. Krupp, Germany*) 6*d.*

This consists, First, in the combination of flat-headed projectiles with light conical or ogival points, which are crushed or thrown off on touching the warp or the water; and Secondly, in the application of a shoe to the rear end of the projectile, with a groove to receive a copper band for grinding and imparting rotation to the projectile, such shoe being stripped off as the projectile leaves the gun by the resistance of the air.

567. Preventing the Freezing of Water in Chemical Fire Engines, *W. Blakely, Bournemouth.*—1*st February*, 1883.—(*Not proceeded with.*) 2*d.*

This consists in the application of a non-conducting casing to chemical fire engines so as to prevent the water it contains from freezing in cold weather. The casing is preferably in two halves, and consists of wood lined with fibrous material impregnated with a solution of alum and mixed with powdered alum.

568. Apparatus for Supplying Water to Chemical Fire Engines, *W. Blakely, Bournemouth.*—1*st February*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to a portable apparatus to be applied in connection with chemical fire engines, for facilitating the supply of water to the tanks thereof.

569. Tricycles, *W. Blakely, Bournemouth.*—1*st February*, 1883.—(*Not proceeded with.*) 2*d.*

This consists, First, in steadying tricycles and increasing the propelling power by augmenting the adhesion of the driving wheels and equalising the application of the power thereto; the axle is extended beyond the wheels, and circular weights applied thereto; Secondly, to means for adjusting the rider's seat; Thirdly, to means for fixing an umbrella or a sail; and, Fourthly, to a brake which will remain applied, so that the driver can use his hands for other purposes.

570. Breech-loading Fire-arms, *W. Blakely, Bournemouth.*—1*st February*, 1883.—(*Not proceeded with.*) 2*d.*

This consists in a combined longitudinal sliding motion and swivelling side motion of the barrels, the two motions being performed independently.

571. Rudders, *W. Blakely, Bournemouth.*—1*st February*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to increase the efficiency of the rudders of small vessels by applying plates of sheet metal on both sides of the rudder, so as to overlap and extend beyond the rear bottom and top edge, leaving a space between the plates the thickness of the rudder for the water to play in.

572. Holding or Securing Globes on Lamp Burners, *W. Blakely, Bournemouth.*—1*st February*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to improvements in the holders which secure globes on lamp-burners by pins bearing on the inside of the globe, and it consists in means for preventing accidents happening by reason of the screw which acts upon the pivotted arms carrying the holding pins on one side being turned in the wrong direction. A spring is caused to bear on the globe and support it when the pins on one side are removed.

573. Apparatus for Pointing or Sharpening Picks or other Tools used by Quarrymen, Masons, &c., *R. Walton and F. A. Stansfield, Rawtenstall.*—2*nd February*, 1883. 6*d.*

The object is to enable picks and other tools to be pointed or sharpened by means of any of the known forging or stamping machines, and it consists in the construction of blocks, dies, or stamps to be attached to the top and bottom punch bars of such machines by means of a tang formed on them.

574. Tricycles, *A. Burdess, Coventry.*—2*nd February*, 1883. 6*d.*

The object is to enable the rider to readily obtain speed and power as circumstances may require.

576. Window-sashes, *D. F. W. Quayle, Isle of Man.*—2*nd February*, 1883. 6*d.*

This consists in providing window-sashes with obstructing bars, rods, or their equivalents, fitted to slide in a recess or recesses in the wall of the house, so as to be capable of being concealed from view when the window is closed, but which, when the window is opened, are automatically made to occupy the space previously occupied by the window when closed.

577. Manufacture of Pure Spirits of Wine, &c., *M. Bauer, London.*—2*nd February*, 1883.—(*A communication from J. A. Stelzner, Saxony.*) 6*d.*

This relates to the production of best refined neutral spirits of wine direct from raw spirit without preliminary treatment of the same and at one rectification, and it consists in continuously introducing the raw spirit in a finely divided state into the still along with steam, and there subjecting it to the action of water in a fine spray and steam, the spirit thus acted on and refined or partially refined, passing continuously to the distilling apparatus in the form of vapour, and the impurities passing continuously from the still with the water. Suitable apparatus is described.

578. Sawing or Cutting Stone, &c., *P. Gay, Paris.*—2*nd February*, 1883. 6*d.*

Wires are caused to pass over drums supported by nuts working on screwed rods, which are caused to revolve, so as to continuously feed the wires to the stone as it is cut by them. The feed may also be effected by an hydraulic arrangement.

579. Floats of Paddle Wheels for Propelling Vessels, &c., *J. Stewart, Blackwall.*—2*nd February*, 1883. 4*d.*

The objects are, First, to stiffen the floats of paddle wheels without increasing their weight; Secondly, to accelerate the speed of the vessel; and Thirdly, to diminish the wash of water on the banks of rivers or canals; and it consists in forming the floats with curved or dished bevelled edges so as to form a marginal frame all round the float.

580. Breaking Machine for all Kinds of Fabrics to Remove Surplus Dressing therefrom, *C. Garnier, France.*—2*nd February*, 1883. 10*d.*

The machine consists of a frame carrying a series of rollers that can revolve freely and are at greater distances apart than the diameter of each roller, the frame being capable of being raised and lowered by a rack and pinion. A second series of rollers are mounted on the main frame, and can be turned freely or be rendered stationary, the rollers being arranged to correspond with the spaces between the first set. The fabric is placed on a roller at one end and led over the rollers on the main frame. The other rollers are then lowered and the end of the fabric connected to a roller at the other end, with a crank to revolve it, so as to draw the fabric through the two sets of rollers, which are formed with projections on them to act on the fabric.

581. Slotting Machines, *H. J. Haddan, Kensington.*—2*nd February*, 1883.—(*A communication from L. J. Knowles, Massachusetts, U.S.*) 6*d.*

This relates to improvements in the general construction of the machine.

582. Coupling for Connecting Chains, Chain Cables, &c., *J. H. Vidal, Sunderland.*—2*nd February*, 1883. 6*d.*

This relates to a coupling consisting essentially of a pair of hooks or hook-shaped members pivotted side by side at their heel ends, and fitting the one within the other, so as to mutually close one another, and provided with means for retaining them in this position.

583. Locking Nuts upon their Screw Bolts, *G. A. Walker, near Retford, Nottingham.*—2*nd February*, 1883.—(*Not proceeded with.*) 2*d.*

A longitudinal groove is cut in the bolt across the threads, and when the nut has been screwed home a portion of the nut is forced into the groove by means of a punch.

584. Crucibles, &c., *H. L. Doulton, Lambeth.*—2*nd February*, 1883. 6*d.*

This consists in making the crucible or other article of potteryware by the use of a "jolly" or similar machine, which forms the piece of ware within a rotating mould by means of a shaping lever or tool. A bag of woven fabric is shaped to the mould and has a stiff sheet metal bottom and a rim at top. To prevent the flange cutting the fabric it is made of two thicknesses of metal and a layer of india-rubber interposed between the metal and the fabric. The bag is placed in the mould and the clay introduced and spread by means of a lever whilst the mould revolves.

585. Stamping and Bronzing the Endless Paper Employed in the Manufacture of Cigarettes, &c., *W. H. Beck, London.*—2*nd February*, 1883.—(*A communication from E. Abadie, Paris.*) 6*d.*

This consists in the application to endless papers or bobbins used in the manufacture of cigarettes of impressions in any colours, but more particularly by stamping, and in bronzing the impressions in variable shades. Suitable apparatus is described for effecting this.

586. Treatment of Brine Employed in the Manufacture of Salt, *E. P. Alexander, London.*—2*nd February*, 1883.—(*A communication from A. Braconnier, Paris.*)—(*Not proceeded with.*) 2*d.*

The invention consists in depositing the sediment of brine from which refined salt is to be manufactured by a cold process, employing for this purpose magnesia, carbonate of magnesia and dolomite, or magnesian limestone mixed in some cases with a proportion of lime.

587. Bichromate of Soda, *E. P. Potter and W. H. Higgin, Bolton.*—2*nd February*, 1883. 4*d.*

Chrome ore is furnaced with lime or carbonate of lime and a suitable sodium salt—preferably sulphate—in the same manner as in the potassium bichromate manufacture. The resulting material is lixiviated with water, and the liquor obtained treated with hydrochloric or other acid in sufficient quantity to neutralise it. The silica and alumina precipitated is removed by settling and filtration, and the liquor is concentrated in under-fired pans, whereby, as it loses its water, the chloride and residual sulphate of soda contained therein are thrown out in the crystalline form, while the chromates of soda remain in solution. The crystals are removed, and after draining are washed with neutralised vat liquor before concentration.

588. Drills for Boring Holes in Metal, &c, *A. A. Patterson, Nunhead.*—2*nd February*, 1883. 6*d.*

The drill stock has a screw thread working in a nut of conical form outside, and held by friction in its seat in a frame mounted between toggle arms connected to tongs or grasping devices which hold the article to be bored. A spring exerts pressure upon the upper side of the nut, a plate and antifriction balls being inserted between them. A cap piece screws on to the frame and compresses the spring.

589. Producing Combustible Gas for Steel-making, Glass-making, and other Purposes, *W. Crossley, Glasgow.*—3*rd February*, 1883. 6*d.*

This consists, First, in producing combustible gas for steel-making and other purposes by passing steam alone or with a small proportion of air through the coal or gas-producing fuel in a cupola or other vessel lined with fire-brick, the steam having been highly heated by passing through a heater containing fire-brick chequer-work in which combustible gas has been previously burned; Secondly, in the combination of two heaters with a gas-producing cupola, the heaters being constructed and fitted with valved connecting passages, inlet pipes, and valves for steam and air.

590. Furnaces, *J. P. Cotiart, Havana.*—3*rd February*, 1883. 6*d.*

The object is to construct furnaces in which green sugar-cane, refuse, and other waste material may be consumed for raising steam and other heating purposes. The fire bars are arranged in one or more layers so as to form an inclined plane, and are supported at the end near the fire doors on rollers carried by brackets capable of being raised and lowered by suitable mechanism. A horizontal tumbling plate and a small stationary inclined plate (both perforated with slots) are placed below and beyond the bars close to the bridge, which is built higher than usual, and its upper end inclined and projecting towards the furnace doors, so as to deflect the flame and heat on the material to be consumed.

591. Horizontal Steam Boilers or Generators, *A. H. B. Sharpe, Lincoln.*—3*rd February*, 1883. 6*d.*

This relates to means for producing constant circulation of water in horizontal boilers, and increasing their effective heating surface. Inside the fire-box above the fire doors a horizontal, cylindrical, conical, or elliptical water vessel is rivetted and contains horizontal or inclined fire flues or tubes which pass through a tube plate at the fire door end, and conduct the products of combustion to the smoke-box. Immediately opposite the smoke-box the fire-box is connected with the back plate of the boiler, part of which plate is cut away, the opening formed being provided with fire-brick doors. The lower part of the horizontal vessel is connected with the lower part and sides of the water space around the fire-box by means of water tubes, and it is also connected to the top of the fire-box by circular or elliptical water tubes.

592. Galvanic Batteries, *P. R. de F. d'Humy, London.*—3*rd February*, 1883. 6*d.*

The negative and positive elements are formed of "fluted," "corrugated or perforated tubes or plates," or of rings connected together by rods.

593. Obtaining and Treating certain Bases from Coal Tar, Naphthas, and Oils, *E. Sonstadt, Cheshunt.*—3*rd February*, 1883.—(*Not proceeded with.*) 2*d.*

This relates partly to the method of obtaining retained bases or certain of them, which method is also applicable to naphthas and oils that have undergone no acid treatment.

595. Bleaching, &c., *J. B. Thompson, New Cross.*—3*rd February*, 1883. 6*d.*

This consists in bleaching linen and cotton fibres by first boiling in a solution of cyanide of potassium, washing in water, bleaching in a closed vessel with a chloride of lime solution and carbonic acid gas, and subsequently treating with a solution of oxalic acid and triethylroseaniline in water, and finishing with a solution of oxalic acid, for giving a final enhanced whiteness to the fibres. Suitable apparatus is described.

596. Pressure Regulators for Gas, *J. Imray, London.*—3*rd February*, 1883.—(*A communication from H. Giroud, Paris.*) 6*d.*

This relates to pressure regulators for gas, in which a cone attached to a floating gasometer bell serves to throttle the opening through which the gas has to pass. The gas enters a chamber above the cone, and after passing through the opening regulated by the cone, a portion of it can ascend a tubular stem by which the cone is attached to the bell into a chamber formed in the upper part of the bell, and from which it issues into an annular compartment of the bell through two orifices, one being a small hole of constant area, and the other a small hole which can be adjusted by a screw plug from without. A central compartment of the bell is open to the supply, and consequently subject to the supply pressure, whilst the annular compartment is subject to the pressure of the gas after passing the cone. A smaller floating bell is attached to the underside of the regulating cone, and from it the gas passes through the tubular stem to the top of the larger bell, such small bell being attached to the cone by a branch from the main pipe having an adjustable orifice, a three-way cock, and a stop cock, also a by-pass pipe with a test burner.

598. Galvanic Batteries, *H. Thame, London.*—3*rd February*, 1883. 4*d.*

To prevent the emission of fumes the cells of Bunsen batteries are constructed with channels around their upper edges, in which well-shaped caps stand in water. Cloro-chromic acid is used as the liquid for charging the carbon cells.

599. Water-closets and Slop-sinks, &c., *S. S. Hellyer, London.*—3*rd February*, 1883. 6*d.*

This relates partly to improvements in and additions to what is known as the "Vortex closet," having for their object a quicker and more certain discharge of the contents of the basin.

600. Cooking Stoves or Ranges for Gas and Solid Fuels, *T. Fletcher, Warrington.*—3*rd February*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to adapt the ovens of the stoves or ranges for cooking by the simultaneous use of gas and the ordinary fuel, or by the independent use either of gas or of the ordinary fuel.

601. Indicators for Steam and other Engines, *A. Budenberg, Manchester.*—3*rd February*, 1883.—(*A communication from C. F. Budenberg, Buckau, Magdeburg.*) 6*d.*

This relates partly to the method of preventing the rotation of the card drum of an indicator after the completion of an engine revolution by means of a pin or lever fitting into holes formed in the lower part of the drum or of the pulley, and governed by a spring or springs and a cam inclined plane or similar device. Other improvements are described.

602. Device for Retaining or Holding Neckties in Position, *E. C. Wise, Belvedere.*—3*rd February*, 1883. 6*d.*

This consists in a device for retaining men's neckties in place, and is designed for use with stand-up collars.

603. Apparatus for Communicating between Passengers and Guards of Railway Trains, *W. Darby, Margate.*—3*rd February*, 1883.—(*Not proceeded with.*) 2*d.*

This consists of a series of indicators or signal apparatus and bells or gongs arranged in the guard's van, combined with special cords or connections which run along the train, one being appropriated to each carriage and furnished with as many pull handles as there are compartments in each carriage.

604. Construction of Certain Parts of Railways to Facilitate the Crossing of Navigable Rivers and Canals, *E. N. Molesworth-Hepworth, Manchester.*—5*th February*, 1883. 6*d.*

This consists in connecting the switching "points" of the railway (at the points of divergence) with the locking apparatus of the swing or drawbridges in such a way that it will be impossible to direct the train over either bridge until that particular bridge has been safely locked in position, and that it will be impossible to unlock and open either bridge until the "switching points" have been so moved as to direct the train over the other bridge.

605. Apparatus for Raising, Circulating, and Decanting certain Corrosive and other Liquors *J. Cross and G. I. J. Wells, Widnes.*—5*th February* 1883.—(*Not proceeded with.*) 2*d.*

This relates to a special construction of injector, and the combination of it with a drop syphon.

606. LETTING-OFF APPARATUS FOR LOOMS, *J. Schofield and J. E. Bentley, Littleborough.—5th February*, 1883. 6*d*.
This relates to the combination of parts applied to a loom for the purpose of turning the warp beam to let off the warp with a regulated movement.

607. MANUFACTURE OF BEATERS FOR THRASHING MACHINES, &c., *R. and F. Garrett, Suffolk, and J. D. Ellis, Sheffield.—5th February*, 1883. 6*d*.
This consists in forming the beaters with the operating ribs made right-handed on one side or face, and left-handed on the other side or face.

608. MACHINERY FOR REMOVING THE SUPERFLUOUS "BODY" AND GLAZE OFF ENAMELLED BRICKS AND TILES, &c., *T. Cliffe, Huddersfield.—5th February*, 1883.—(*Not proceeded with.*) 2*d*.
The improvements consist in the employment of a revolving belt, having pins or teeth thereon mounted upon suitable framework or tables.

609. COVERS FOR UMBRELLAS AND PARASOLS, *M. Hyam, London.—5th February*, 1883. 6*d*.
The cover is sewn at the centre to a ring of metal or other suitable material which is secured to the thimble or rib-holder. To the outer edge or periphery of the cover are attached at suitable intervals means for securing it to the extremities of the ribs. Small rings, loops, ties, or thimbles of metal or other suitable material may be employed for this purpose. Clips or ties, preferably of metal, are attached where required along the seams of the cover for the purpose of attaching the cover to the ribs where needed.

610. APPARATUS FOR LIGHTING BY GAS, *F. A. L. de Gruyter, Amsterdam.—5th February*, 1883. 6*d*.
The objects are to prevent access of inflammable matters to the flame, and to utilise much of the heat generated by combustion, by conducting it from the lamp to the gas that is on its way to the burner to be consumed, thereby producing a more luminous flame.

611. APPARATUS FOR PRODUCING MOTIVE-POWER, *A. E. Edwards, Walworth-road.—5th February*, 1883.—(*Not proceeded with.*) 2*d*.
This relates to an apparatus for producing motive power by the employment of weights.

612. MANUFACTURE OF COVERED WIRE FOR ELECTRICAL PURPOSES, &c., *W. Halkyard, Providence, R.I., U.S.—5th February*, 1883. 6*d*.
Relates to a machine for providing the insulated wire or conductor with a continuous metallic covering while it passes through the machine. The covering consists of a strip of metal, the edges of which overlap and are secured by solder, so as to form a seam longitudinal to the wire.

613. CRUTCHES, &c., *H. J. Haddan, London.—5th February*, 1883.—(*A communication from G. N. Thurzo, Vienna.*)—(*Not proceeded with.*) 2*d*.
The base of the crutch or other support is constructed of two parts, viz., a box—preferably cylindrical—open at the bottom and pivotted at the top to a cap or sleeve, also preferably cylindrical, attached to the base of the crutch or other support.

614. ELECTRIC GENERATORS, *J. A. Fleming, London.—5th February*, 1883. 6*d*.
This consists in a primary galvanic battery, the positive electrode of which is formed of two openwork frames of carbon filled with pieces of carbon. These are placed in a cell of non-conducting material, and separated by suitable distance pieces, the negative plate being placed between them.

615. APPARATUS FOR OPENING AND CLOSING CURTAINS, *T. Webster, Edinburgh.—5th February*, 1883.—(*Not proceeded with.*) 2*d*.
This relates to an apparatus sliding the curtains backwards and forwards.

616. GLOBES OR SHADES FOR CANDLES, *J. B. Goodwin, London.—5th February*, 1883. 6*d*.
This relates to the combination with a globe or shade of a support formed integrally therewith, and adapted to rest upon the upper edge of a candle and to descend as the candle burns away, with or without a cap or upper portion.

617. BREECH-LOADING FIRE-ARMS, *E. A. Brydges, Berlin.—5th February*, 1883.—(*A communication from C. Garbe, Berlin.*)—(*Not proceeded with.*) 2*d*.
This relates to the construction of the mechanism of the sliding breech.

618. MANUFACTURE OF METAL FOIL OR TINSEL, *F. Wirth, Frankfort.—5th February*, 1883.—(*A communication from F. Haenle, Munich.*)—(*Not proceeded with.*) 2*d*.
According to this invention the vellum leaves can be entirely dispensed with, and the use of the second light hammer also becomes unnecessary, inasmuch as the first heavy hammer can execute the whole operation.

619. HINGES FOR DOORS AND THE LIKE, *G. W. von Nawrocki, Berlin.—5th February*, 1883.—(*A communication from O. A. Ludewig, Stettin.*) 4*d*.
The object is to enable the pivot pin of hinges to be readily and safely cleaned and oiled.

620. TREATMENT AND APPLICATION OF CERTAIN MATERIALS AFTER HAVING BEEN FOULED IN THE PROCESS OF PURIFYING COAL GAS FOR THE PROTECTION OF PLANTS OR TREES FROM THE ATTACKS OF INSECTS, *J. Walker, Leeds.—5th February*, 1883. 4*d*.
This relates to the treatment and utilisation of the materials which have been used in purifying coal gas, as described in patents 5269, A.D. 1881; 387, A.D. 1882; and 1561, A.D. 1882.

622. PERCUSSION CAPS, *T. Nordenfelt, London.—5th February*, 1883.—(*Not proceeded with.*) 2*d*.
The inventor makes a recess or reduces the thickness of the cap metal in its centre, where the striker or firing pin has to strike the cap, while he leaves the thicker metal all round, or increases the thickness all round this recess, or thinner part of the cap.

625. MANUFACTURE OF MATERIAL SUITABLE FOR USE AS A SUBSTITUTE FOR LEATHER, CLOTH, HORN, TORTOISE-SHELL, &c., *W. L. Wise, London.—5th February*, 1883.—(*A communication from E. Bauer, Vienna.*) 4*d*.
This relates to the process of manufacturing a compound by mixing albuminous animal matters with glycerine, fat, or oil, and also with a solution of caoutchouc, and treating the same with tannic substances, the tanning process being accelerated by electric currents.

626. SELF-ACTING OR FOUNTAIN PENS AND HOLDERS, *J. J. Ridge, Enfield.—5th February*, 1883. 6*d*.
This consists essentially in forming a reduced aperture in the neck of a holder to act as a check valve to prevent an unnecessary flow of ink to the nib or other writing point.

627. APPARATUS FOR COUPLING SHAFTS AND SECURING WHEELS, &c., THEREON, *J. J. Purnell, Lambeth.—5th February*, 1883. 6*d*.
This relates to coupling together cylindrical shafts by means of a split or divided taper-ended sleeve with helical external lugs, in combination with a pair of sockets having corresponding internal lugs.

630. SELF-PROTECTING PORTABLE SAW, *N. W. Wallace, Clifton.—5th February*, 1883. 6*d*.
The saw is similar to a cross-cut saw in the form of the blade and handles, but the latter instead of being rigidly fixed to the blade are pivotted to the ends thereof by rule or other joints, so as to be capable of being turned to positions at right angles to the front or to the back edge of the blade, or to any intermediate position for use, or of being folded down along the serrated edge, the handles, which are each equal to half the length of the saw, being grooved longitudinally to embrace and sheathe the saw teeth, which are thereby protected and prevented from injuring the person carrying the saw.

637. RENDERING EXISTING WALLS DAMP-PROOF, &c., *W. White, London.—6th February*, 1883. 4*d*.
This relates partly to the method of rendering existing walls damp-proof, the said method being the creating a face of tiles for the wall, and the pouring a composition into the space between the said tiles and the said wall.

638. GAS MOTOR ENGINES, *C. W. King, Manchester, and A. Cliff, Forest Gate.—6th February*, 1883. 6*d*.
This relates to certain means or methods of introducing the charge of combustible mixture, or of air and gas separately, into the motor cylinder, either while undergoing compression or partly at atmospheric pressure and partly while undergoing compression; also in certain means or methods of exhausting or driving out of the motor cylinder the products of combustion, and in washing or flushing out the motor cylinder with pure air, either to drive out or partially drive out the products of combustion, or to cool the sides of the cylinder to prevent premature explosion.

639. ELECTRIC LAMPS, *J. G. Lorrain, London.—6th February*, 1883. 6*d*.
Refers to patent 3575, of 1882, and consists in employing a pivotted solenoid, having its coil in the main or a shunt circuit, to establish the arc and regulate the feed, its movable core acting directly on one of the carbons. In a modification a combined armature and electro-magnet are employed, the pivotted feed-controlling armature of the latter carrying a gripping device acting on one of the carbons to regulate the feed; a second armature controlling the carbon-separating mechanism brings the gripping device into a position to separate the carbons and form the arc on the passage of current.

640. MACHINES FOR MAKING ENVELOPES, &c., *J. C. Mewburn, London.—6th February*, 1883.—(*A communication from A. T. Howard, Brooklyn.—(Not proceeded with.*) 2*d*.
This relates to a machine adapted for taking the blanks from which the envelopes are to be made, folding down the end flaps, applying gum or paste for sealing down the bottom flap on to the end flaps, folding down and sealing the bottom flap, applying gum or paste to the sealing flap, delivering the envelope thus completed into the carrier, and after the gum is dried, delivering the envelope into a box or receptacle.

641. BOTTLE STOPPERS, *H. E. G. Luyties, New York.—6th February*, 1883.—(*Not proceeded with.*) 2*d*.
This relates to a cork stopper provided with an elastic ring.

642. FURNACES AND BOILERS, *D. Caddick, Middlesbrough.—6th February*, 1883.—(*Not proceeded with.*) 2*d*.
This relates partly to the employment of an overhead railway for feeding the fuel.

643. HYDRAULIC ENGINES, &c., *J. C. Etchells, Chester.—6th February*, 1883.—(*Not proceeded with.*) 2*d*.
This consists in the engine using the motive water only in proportion to the power developed.

644. REGULATING APPARATUS, APPLICABLE FOR ORGAN BLOWERS, &c., *W. Ainsworth, Blackburn.—6th February*, 1883.—(*Not proceeded with.*) 2*d*.
This relates to a device for regulating the pressure of air.

645. MOTIVE-POWER ENGINES, *J. Robson, Birmingham.—6th February*, 1883. 10*d*.
In the drawing 1 is the cylinder with main piston 2, with its rod 3, with connecting-rod to crank and shaft 4; 5 is a secondary piston, and 6 its rod working through a stuffing-box 7, on the main piston-rod; the secondary rod has a pistou 8 on its outer end and working in the vacuum cylinder 9, attached to end of main piston-rod 10; an outward air shifting valve to permit any leakage air to pass out when the piston 8 cushions at the bottom of

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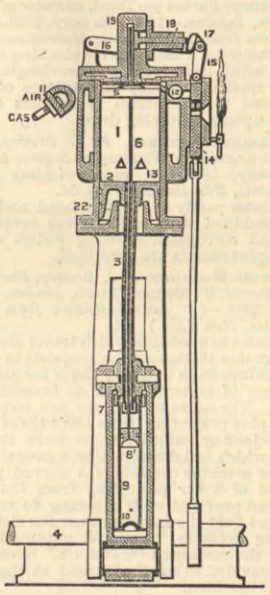

its cylinder; 11 is a valve for feeding gas and air into the cylinder by way of tube and port 12 whenever there is a pressure in the cylinder; 13 are the exhaust ports. An excentric on the shaft works the igniting slide 14 and is connected by a link 15 to a lever 16, which has a cam wedge-shaped piece on it, 17, for moving the piece 18, and grips the upper end of the secondary piston-rod in the box 19 on cylinder end.

646. MEANS FOR SECURING GAS RETORT LIDS, COVERS, OR DOORS, *H. E. Newton, London.—6th February*, 1883.—(*A communication from A. Klönne, Dortmund.*)—(*Not proceeded with.*) 2*d*.
This relates to a device for effecting a sound sealing of the mouthpiece of the retort.

647. PLATE PRINTING PRESS WITH APPARATUS FOR LAYING ON AND THROWING OFF THE SHEET, FOR MONOCHROMATIC OR SIMULTANEOUS POLYCHROMATIC PRINT, *H. Luetke, Berlin.—6th February*, 1883. 6*d*.
This invention relates to platen machines for monochromatic and polychromatic printing, and according thereto the inking rollers travel in a path around a bed-plate fixed to a stationary hollow shaft, and each inking roller is guided to its appropriate ink duct over an ink distributing disc and over the forme in such a manner that for polychromatic work the respective inking rollers receive only the proper colour of ink intended for them, and with this ink roll over the corresponding ink distributing disc and forme, and the rollers intended for one colour do not touch the duct or the ink distributing disc or the forme intended for another colour.

649. PISTONS, *W. Rowan, Belfast.—6th February*, 1883. 6*d*.
This relates to the employment of a curved helical spring for pressing the packing ring apart and outward against the side of the cylinder.

650. DRILLS FOR SOWING TURNIP, MANGOLD, AND OTHER SEEDS, *P. Pierce, Wexford.—6th February*, 1883. 6*d*.
This relates to improvements in the general construction of the machine.

651. RAISING, LOWERING, AND HOLDING WEIGHTS APPLICABLE TO WATER-CLOSET VALVES, &c., *H. C. Symons, Southwark.—6th February*, 1883. 6*d*.
This relates to a device or apparatus for automatically lowering weights and for sustaining a weight, and has for its object the employment of this device for regulating the closing of valves or cocks applicable to water-closets and other analogous operations, and for flushing and preventing by self-acting means the waste of water.

652. GAS CLUSTERS OR BURNERS, &c., *M. Pinder, London.—6th February*, 1883.—(*Not proceeded with.*) 2*d*.
The gas supply tubes are placed at an angle to one another, and in such a manner that the flames strike one with the other, so that the air passing up between the flames must come in contact therewith, and consequently thus produce much more perfect combustion than heretofore.

653. MACHINERY FOR SPINNING WOOL AND OTHER FIBROUS MATERIALS, *J. T. Nelson, Leeds.—6th February*, 1883. 6*d*.
The improvements consist of a pair of rollers which deliver the material to be spun, an intermediate revolving eye through which the yarn passes, and of a spindle and flyer by means of which the yarn is drawn, twisted, and wound on bobbins or tubes.

654. APPARATUS FOR THE PREVENTION OF EXPLOSIONS, &c., IN STEAM BOILERS, *T. C. Fawcett and J. C. Hargreaves, Leeds.—6th February*, 1883. 6*d*.
A steam chest D is fitted on the boiler, and is in direct communication with the furnace A by pipe E. In the steam chest is a weighted valve F, which, when the pressure is excessive in the boiler, will be raised and allow steam to pass to the furnace. So as to check

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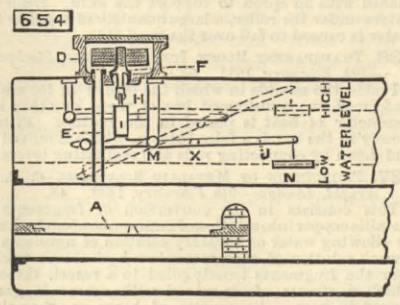


the generation of steam when the water in the boiler is above or below a given level, a lever H passes through an opening in the weight I attached to valve F, and a second lever J is pivotted at M, and has a float N, and it bears against the weight I so as to open valve F when the float is lowered, while a pin X acts upon lever H and raises the valve F when the float is raised.

655. FASTENINGS AND ATTACHMENTS FOR WEARING APPAREL AND OTHER TEXTILE FABRICS, &c., *W. M. and J. C. Newey, Birmingham.—6th February*, 1883. 6*d*.
The object is the complete protection of the material with which the hooks or clasps come into contact from damage arising from contact with the points of such hooks or clasps.

657. LAMPS, *R. Ogden, Manchester, and R. J. Anderson, Liverpool.—6th February*, 1883. 6*d*.
The object is to extinguish the lights of lamps automatically if the lamp be upset or moved to any fixed degree out of the perpendicular, thereby preventing accidents caused by explosion or fire.

660. COMBUSTIBLE COMPOUND OF CARBONACEOUS AND OTHER MATERIALS, &c., *W. R. Lake, London.—6th February*, 1883.—(*A communication from J. C. Cooper, Brooklyn.*) 4*d*.
This relates to the method of ensuring the practically complete combustion of carbonaceous fuel by burning the same in connection with a compound composed of alumina (as the same is contained in alum, aluminous cake, or aluminous earths), common salt or chloride of sodium, and sulphate of soda.

662. ARTIFICIAL STONES, &c., MADE FROM CORK SHAVINGS, *F. Wirth, Frankfort.—6th February*, 1883.—(*A communication from K. Grünzweig and P. Hartmann, Ludwigshafen.*) 4*d*.
This relates to the manufacture of artificial cork by the admission of the pulverised grains or shavings of cork with a hot paste, drying being effected immediately thereafter at a high temperature.

663. GAS PRODUCERS AND GAS FURNACES, *C. W. Siemens, Westminster.—6th February*, 1883. 6*d*.
This relates to improvements in the details of construction of gas producers and gas furnaces for the manufacture of steel.

665. COMBINED ENVELOPE AND NOTE PAPER PACKET, *A. M. Clark, London.—6th February*, 1883.—(*A communication from S. J. Spurgeon, Houstonia, U.S.*)—(*Provisional protection not allowed.*) 2*d*.
This relates to a combined envelope and paper packet for travellers' use.

666. APPARATUS TO FACILITATE HEARING AND SPEAKING SIMULTANEOUSLY, *H. Marlow, Shepherd's Bush.—6th February*, 1883. 4*d*.
This relates to the combination of an ear bell and speaking bell or mouthpiece as one article.

667. CONSTRUCTION OF FURNACES, *T. Robinson, Preston.—7th February*, 1883. 6*d*.
The principal feature of novelty in the invention is that the flame, smoke, and other products of combustion arising from the burning fuel are drawn to the front of the furnace, and passed again through the fire before reaching the flue.

668. MANUFACTURE OF A SUBSTITUTE FOR COFFEE, &c., *E. J. T. Digby, Brussels.—7th February*, 1883.—(*Not proceeded with.*) 2*d*.
This relates to a process and apparatus for treating carob fruit or pods.

669. PREVENTING OR LESSENING DAMAGE TO SHIPS ARISING FROM COLLISIONS AT SEA, *S. Heimann, Hamburg.—7th February*, 1883.—(*Not proceeded with.*) 2*d*.
This relates to the employment of fenders.

670. PIRN AND SPOOL WINDING MACHINES, *P. H. Marriott and J. Hall, Stockport.—7th February*, 1883.—(*Not proceeded with.*) 2*d*.
The object is to secure a more evenly wound pirn or spool, and to reduce the friction caused by the rubbing of the yarn against the interior surface of the slotted cup at present generally employed.

671. LUBRICATORS, *H. J. Haddan, London.—7th February*, 1883.—(*A communication from A. W. Swift, Elmira, U.S.*) 6*d*.
This consists in a novel construction of a lubricator which automatically supplies the lubricant to the parts to be lubricated, and exposes to view the rate of the flow of the lubricant, and thus effectually guards against the neglect of applying the necessary lubrication.

672. INTEGRATING ANEMOMETER, *W. F. Stanley, London.—7th February*, 1883.—(*Not proceeded with.*) 2*d*.
This relates to an integrating anemometer by which the direction and velocity of the wind may be indicated at one operation.

673. TILTING APPARATUS FOR BARRELS, CASKS, AND OTHER RECEPTACLES, *W. Greenwood, T. Delamere, and S. Greenwood, Liverpool.—7th February*, 1883.—(*Not proceeded with.*) 2*d*.
The apparatus is designed to act as a portable tilter to be placed as desired under any cask or other receptacle, and automatically raise it as the cask empties.

674. PREPARING AND FINISHING CASTINGS, *D. P. G. Matthews, Newport.—7th February*, 1883. 4*d*.
This relates to the means of cleansing and freeing castings of grit, &c.

677. BOILER FURNACES, *A. Pinkerton, Glasgow.—7th February*, 1883. 6*d*.
This relates to the combination with a boiler furnace of an air-heating box, provided with an inclined nozzle or nozzles fitted behind the fire bridge and directed towards the furnace, the box being also provided with a door to regulate the admission of air.

675. OVEN FURNACES AND COPPER FURNACES, *J. D. Kemp, London.—7th February*, 1883.—(*Not proceeded with.*) 2*d*.
This relates to the construction of the furnaces so as to direct the air and products of combustion.

679. SAFETY LAMPS, *L. T. Wright, Beckton.—7th February*, 1883. 4*d*.
This relates to improved means whereby, First, the flashing of the flame through the wire gauge of safety lamps is more or less prevented; and Secondly, whereby the heating of the wire gauge to a certain degree automatically effects the enclosure of the same, so as to prevent access of the fire-damp thereto.

680. MULTIPLE-CYLINDER COMPOUND ENGINES, *R. Matthews, Hyde.—7th February*, 1883. 6*d*.
The inventor claims, First, constructing each cylinder in two parts, an outer smaller part and an inner larger part, fitted with a differential piston or plunger, and provided with suitable passages and reservoir, so as to work as a compound engine; Secondly, in combination with a set of cylinders arranged and operating in the manner referred to in the preceding claim, a set of double piston slides worked from a single excentric on the crank shaft; Thirdly, in combination with a set of cylinders arranged and operating in the manner referred to in the first claim, an excentric rotating double slide.

683. FIBROUS PADS OR BATS FOR SURGICAL AND OTHER PURPOSES, *W. R. Lake, London.—7th February*, 1883.—(*A communication from D. Goff, Rhode Island, U.S.*) 6*d*.
The pad consists of a sliver of carded fibrous material enclosed in a seamless braided jacket, the strands of which extend beyond the sliver to form strings for fixing the pad in position.

684. APPARATUS FOR SUPPLYING, FLUSHING, DISCHARGING, AND TRAPPING ARRANGEMENTS FOR SANITARY AND SEWERAGE PURPOSES WITH BOXES AND GRATINGS, &c., *J. G. Stidder, London.—7th February*, 1883.—(*Complete.*) 6*d*.
The object is to provide means and appliances in connection with household sanitary apparatus for rendering the same clean, sightly, preventing offensive effluvia, and rendering the same accessible for cleansing and for removing obstruction.

685. APPARATUS FOR DRYING GRAIN, SEED, &c., *J. J. Turner, Kington.—7th February*, 1883. 6*d*.
The inventor claims an apparatus for drying grain, seed, or similar materials, wherein a screw conveyor is arranged to be rotated within a tube wholly or partially enclosed by one or more flues or tubes, each connected with a stove, or with a steam boiler.

686. PLOUGHS, *T. Walker, Whitstable.—7th February*, 1883. 6*d*.
The inventor claims, First, the combination with a plough or similar implement of means for supplying water to the plough breast or other part of the implement; Secondly, a device for attaching the nozzle to the coulter of a plough.

688. DEVICES TO FACILITATE THE HANDLING OF DRIVING REINS, *W. R Lake, London.—7th February*, 1883.—(*A communication from L. Nevière, Paris*) 6*d*.
This relates to devices to be attached to horses' reins, and permitting of supporting, holding-in, or checking and guiding the horses, and consequently avoiding their falling and injury.

689. PRINTING MACHINERY, *W. W. Colley, London.—7th February*, 1883. 6*d*.
This consists, First, in the combination of rotary printing apparatus whereby two continuous webs running in opposite directions are simultaneously printed each on one side by the same set of type or one type cylinder, and are concurrently therewith simultaneously perfected or printed on their other sides by two other type cylinders; Secondly, the construction, combination, and arrangement of gathering and delivery mechanism, whereby pairs of sheets are detached, gathered on a drum, and delivered in alternately unequal numbers.

690. MANUFACTURE OF ORDNANCE, *W. L. Wise, London. 7th February*, 1883.—(*A communication from C. T. M. V. de Bange, Paris.*) 6*d*.
This relates to a method of hooping designed to afford resistance not only to longitudinal fracture, but also to transverse fracture, and a distinct feature of the invention is the employment of hoops or rings of bi-conical form in transverse section.

691. MACHINES FOR COMBING WOOL, &c., *F. Fairbank and J. Robertshaw, Allerton.—8th February*, 1883. 6*d*.
In the case of a Noble's combing machine the object of the invention is accomplished by mounting immediately above one or both circles at each side of the machine a rotating sectional brush, so constructed that the bristles of each section enter and leave the combs perpendicularly, by which means the fibre is pressed between the teeth, and the bristles of the brush do not become "fish-hooked" as in the case with rotating brushes as ordinarily constructed when used for this purpose.

692. APPARATUS FOR PRODUCING "POPPED CORN," *T. B. Kinder and E. R. Southby, London.—8th February*, 1883.—(*Not proceeded with.*) 4*d*.
The object is the construction of apparatus by which large quantities of popped corn can be manufactured by mechanical means.

693. INSTRUMENT FOR TAKING AND PLOTTING LEVELS, *F. Low. London.—8th February*, 1883.—(*A communication from A. T. Fraser, Madras.*) 6*d*.
This relates to a surveying instrument constructed to measure its own distances and heights, and simultaneously to plot a section of the ground it is run over to a suitable scale on a web of drawing paper, the operation of the instrument being based upon the ratio which subsists between a curve, its tangent angle, and its radius vector.

695. WINDOW SASHES, *J. Hay and G. Robertson, Glasgow.—8th February*, 1883. 4*d*.
This relates to the combination of devices for suspending and securing window sashes in their frames, so that they can be readily withdrawn for cleaning or for other purposes.

697. TOOLS FOR ETCHING UPON GLASS, &c., *J. G. Sowerby, Gateshead-on-Tyne.—8th February*, 1883. 6*d*.
This consists in the use of a tool or apparatus for etching upon glass or other material, of a bar, movable on a pin or stud, and having springs holding the etching tool.

700. RAILWAY CHAIRS, *J. Lindley, Walkley.—8th February*, 1883. 6*d*.
This relates to the construction of the chair, so as to dispense with the ordinary key or wedge.

701. FILE-CUTTING MACHINES, *P. Ewens, Cheltenham.—8th February*, 1883.
This relates to improvements in the general construction of the machine.

703. MANUFACTURE OF GROOVED TIRES FOR WHEELS, *W. H. Carmont, Manchester.—8th February*, 1883. 4*d*.
The object is to produce tires grooved in the form of a dovetail, for the purpose of holding or securing india-rubber or other yielding substance.

705. KITCHEN AND COOKING RANGES AND STOVES, *W. Russell, Pendleton, near Manchester.—9th February*, 1883. 8*d*.
The object is the combinations and arrangements of kitchen and cooking ranges and stoves, whereby the heat from the combustion of gas is or may be combined when desired with the heat from the combustion and products of combustion of coal or other solid fuels in the ordinary fire grate.

708. STEERING GEAR FOR SHIPS, *G. D. Davis, Stepney.—9th February*, 1883. 6*d*.
This relates to combined hand and steam power steering gear capable of being disconnected so as to be actuated by hand power alone, and it consists

essentially in so combining the hand-steering wheel with the steering mechanism that when turned to port or starboard the wheel shall act upon the valves and admit steam to the engine, but when in the midway position the steam is cut off.

711. Machinery for Combing Wool, &c., *J. Holden, J. Burnley, and J. Fawell, Bradford.—9th February*, 1883. 6*d*.

This consists in the construction and application to a "Nobbe's" comb or other kindred combing machine of a stop motion or self-acting apparatus, whereby the stoppage of the combing machine is automatically effected upon the breakage of the sliver through a lap forming on the drawing off rollers, or through the sliver adhering to and running down the leather, or through any other cause.

712. Fireplaces, &c., *G. Ermen, Dawlish.—9th February*, 1883. 6*d*.

The flue or chimney is partly closed up a certain distance above the grate, a sufficient space being left for the passage of a pipe, through which the smoke passes. The lower end of the pipe is enclosed by a cover, which causes a draught of air to pass below it. In the pipe a damper is fixed. A pipe is fixed inside the grate in direct contact with the fire, and draws air from the room; such air then passing to the chimney and becoming heated, is utilised to heat any other room in the building.

718. Manufacture and Treatment of Crystallised Sugar from Starch, *G. W. von Nawrocki, Berlin.—9th February*, 1883.—(*A communication from T. von K. Sakovicz and D. Rosenblum, Warsaw.*) 4*d*.

A solution of starch-sugar is produced containing about 95 per cent. of starch sugar to every 100 parts by weight of solid matter, by preparing a starch milk of 10 parts water to each part of anhydrous starch, with an addition of $4\frac{8}{10}$ per cent. or 2, 1, 0·36, or 0·15 per cent. of anhydrous sulphuric acid, according to whether the boiling is effected at ordinary pressure and in eleven hours, or at a pressure of 1, 2, 3, or 4 atmospheres and in $5\frac{1}{2}$, 5, $4\frac{1}{2}$, or 4 hours respectively. The starch-sugar solution produced is decolorised or bleached by permanganate of potassa.

721. Machines and Apparatus for Felting Wool, *A. Monchablon, Paris.—9th February*, 1883. 6*d*.

The object is to produce felted threads of regular thickness for use in the manufacture of various kinds of cloth and woven fabrics, and it consists essentially in causing the sides of the trough over which the felting roller rotates to travel at the same speed as the surface of the roller, and in the same direction as the thread to be felted, whereby the latter is drawn along without jerk or twitch, and a perfectly regular thread is obtained.

722. Springs and Fittings for Stoppers for Bottles, &c., *J. S. Davison, Sunderland.—9th February*, 1883. 6*d*.

The stopper is connected to the bottle by means of an india-rubber or other spring secured to the neck of the bottle, the elasticity of the spring keeping the stopper well over the mouth, and yet allowing it to be readily removed and replaced.

723. Roundabouts, *W. and W. Meeds, and T. Blinkhorn, Boston.—9th February*, 1883. 6*d*.

The object is to impart to horses on roundabouts galloping and jumping movements, and it consists in imparting a rocking motion to the horses by means of wheels running on the track and connected to the horses by a crank and rod. Inclines on the track impart the jumping motion to the horses, such inclines being capable of being raised and lowered as required.

724. Cartridges for Breech-loading Fire-arms, *W. Gardner, London.—9th February*, 1883. 6*d*.

The object is to provide means whereby cartridges can only be fired in the instrument for which they are made, and is especially designed to prevent cartridges in magazine fire-arms from being discharged by the impact of the cartridge behind. A guard or shield is placed outside or above the cap or priming, and has sufficient strength to resist a blow or pressure from a blunt object, but is perforated or reduced in thickness at the centre, so that the pin or needle of the gun will easily penetrate such shield and strike the cap or priming.

725. Lamps for Bicycles and other Velocipedes, &c., *T. B. Bladon, Birmingham.—9th February*, 1883. 6*d*.

The tube by which the lamp is hung to the wheel axle is open at front, and the front of the lamp when shut closes this opening, so that to remove the lamp the front has to be turned upwards.

726. Furnace Bars, &c., *F. Livet, London.—9th February*, 1883. 6*d*.

The bars are formed in two pieces, the upper piece on which the fuel rests resting upon the lower one which rests on the bearing bar. The whole bar tapers down to a sharp edge, and is as deep as the ashpit will allow, so as to present a large heating surface over which air passes before entering the fuel. Lugs or guides are formed on the sides to keep the bars apart, and the front ends of the top piece are rounded downwards towards the dead plate above which they project, and the lugs terminate some distance below the top, so as to leave a continuous air space about 2in. deep A special slicer can be pushed along this groove to split up and lift the clinker.

727. Breech-loading Small-arms, *W. M. Scott, Birmingham.—9th February*, 1883.—(*Not proceeded with.*) 2*d*.

This relates, First, in improvements on patent No. 1968, A.D. 1878, whereby the closing movement of the gun is utilised to assist in cocking the hammers on opening the gun; and Secondly, to several arrangements for adjusting the "fore end" to or tightening it upon its abutment or bearing on the body of the gun, to compensate for the wear of the bearing parts of the point and loop.

728. Hand Rakes, *W. R. Lake, London.—9th February*, 1883.—(*A communication from T. Carlsson, Sweden.*) 4*d*.

A plate of iron or steel is stamped so that the divided parts will each form a rake, the teeth of which are bent to the required form, a rib extending along the back of the rake to strengthen it. A socket is rivetted to the back of the rake, and receives the handle.

729. Fastenings for Gloves, Boots and Shoes, Stays, &c., *J. Pitt and J. Wormington, Birmingham.—9th February*, 1883. 6*d*.

An arm is hinged to a loop, and has one or more holes through which the glove button passes. The ends of the arms of the loop are pivotted to a plate attached to the other side of the glove, and when the button has been inserted in the hole in the arm the loop is turned back, thereby chasing the arm to pull the button forward, and so close the opening in the glove.

731. Preparing Malt and other Amylaceous Substances for Brewing or other Purposes, *J. H. Johnson, London.—9th February*, 1883.—(*A communication from E. Kokosinski and R. Bernet, Paris.*) 6*d*.

This consists in disintegrating the malt or amylaceous matter in a moist condition by mechanical treatment, whereby it is thoroughly disintegrated, without destroying the pellicle, thus ensuring a superior yield, and at the same time facilitating the filtration. The malt in a moist condition is acted upon by a toothed conical crusher revolving within a toothed case.

732. Treatment of Mineral Phosphates to obtain Products therefrom, *W. G. Strype, Wicklow.—9th February*, 1883. 2*d*.

This relates to the treatment of mineral phosphates with an excess of dilute sulphuric acid.

733. Wheels for Railway Carriages, &c., *R. R. Gubbins, New Cross.—9th February*, 1883. 6*d*.

This consists in forming the web of the centre of the wheel from a wrought corrugated or angularly crimped metal sheet, the ends of which are then brought together, so as to form a circular fan-like corrugated plate, the inner edge of which is secured in a groove in the hub, and the outer edge to the rim of the wheel by slotting the outer edge for a certain distance at each bend or corrugation, and turning the slit parts alternately in opposite directions, and rivetted to the rim.

734. Unhairing Skins by Means of a Water Stove, *W. H. Beck, London.—9th February*, 1883.—(*A communication from A. Laure, Paris.*) 4*d*.

The skins are hung by the feet in a water stove, which is filled with water, so as to entirely cover the skins, and after a prolonged stay the water is drawn off, and the skins then peel easily. The water may be cold, tepid, or hot, and soap, soda crystals, strained bran, or other suitable material added to accelerate the operation of peeling.

735. Rinsing the Wool upon the Skins of Sheep when they are Ready for Peeling, in order to Obtain the kind of Wool called "Laine Lavee a dos Veloutee," *W. H. Beck, London.—9th February*, 1883.—(*A communication from A. Laure, Paris*) 4*d*.

When the skin is ready for peeling it is passed, before detaching the wool and quite open, under two presser rollers, which are caused to rotate, and are furnished with an apron to support the skin. Before it enters under the roller, a large quantity of tepid or hot water is caused to fall over the wool side.

736. Transparent Block Ice, *M. Mutter, Stockport.—9th February*, 1883. 6*d*.

Inside the moulds in which the blocks of ice are to be formed an open-topped box of wood or other bad conductor of heat is placed in the bottom. Fitting loosely in the box is a false bottom, which is moved up and down by connecting rods and oscillating levers.

737. Production of Metallic Solutions, *C. R. A. Wright, London.—9th February*, 1883. 4*d*.

This consists in the conversion of fragments of metallic copper into solution of cuprammonium hydrate, by allowing water or a watery solution of ammonia or a weak solution of cuprammonium hydrate to trickle over the fragments loosely piled in a vessel, through which a stream of air mixed with ammonia gas is caused to pass. Fragments of brass or other zinc-copper alloys can be similarly converted into solutions containing both zinc ammonium and cuprammonium hydrates.

739. Treatment of Alkali Waste, *J. Simpson, Liverpool.—10th February*, 1883. 6*d*.

This relates to apparatus for subjecting alkali waste to the action of water and direct steam pressure for the purpose of extracting the sulphur in the liquid or gaseous form. The alkali waste and water or a solution of a salt, such as chloride of calcium, are fed into a vessel and the feed opening closed by a valve. Steam is admitted below the surface of the mass, and after about twenty or thirty minutes the liquid containing the soluble sulphur is drawn off through a pipe at bottom, after which the residue of the charge is withdrawn by opening the movable bottom of the vessel.

740. Jacquard Machines, *I. Thomis, Eccleshill, and M. Priestley, Wibsey, Yorkshire.—10th February*, 1883. 6*d*.

The objects are to reduce the power required to work the machine, the wear-and-tear of the harness threads, to enable the loom shuttle to make two or more picks without the warp changing until required in order to alter the pattern of the fabric, and to enable the loom to run at a greater speed than hitherto. In the jacquard frame double or single upright bars are mounted and raised by reciprocating knives actuated in the ordinary way. Each upright has one or two bends, which, on passing through the needle eye or against the cross bar, as the case may be, causes the hooked end or ends to be moved clear of the ascending knife, and to retain the raised threads until required to change a hook on each upright which takes on to a stationary cross bar, and is held until released by the action of the card cylinder and needle.

744. Hydrants Used for Water, Gas, &c., *T. Suffield, London.—10th February*, 1883. 6*d*.

This consists, First, of a sheath cylindrical metal liner inserted in the upper part of the body of the hydrant, in combination with two cupped leathers or equivalent shaped valves on the same stem, one to shut off the liquid from the upper part, and the other to sit on a seating, shaped so that no grit can lodge thereon and prevent a proper closing of the valve. A frost or relief valve is so arranged as to be closed when the hydrant is open.

745. Points for Tramways, &c., *H. Scott, Liverpool.—10th February*, 1883. 8*d*.

The object is to automatically actuate the points of tramways by the action of the tramcar, and it relates to improvements on patents No. 3859 and No. 4870, A.D. 1882. A weight or spring tends to keep the point in a normal and automatically recoverable position.

747. Treating Iron Ores and other Mineral Substances for Extracting Sulphur and Phosphorus, &c., *A. Adair and W. Thomlinson, Durham.—10th February*, 1883. 4*d*.

This consists, First, in treating tap or mill cinders containing sulphur and phosphorus with solutions of soda and potash; Secondly, in treating iron ores, stones, precipitated iron phosphate, or tap or mill cinders containing sulphur and phosphorus, with a solution of ammonia; Thirdly, in treating phosphatic slags as obtained in the basic process of steel-making, and phosphatic iron ores or minerals with carbonates of soda, potash, or ammonia, all for the purpose of converting the phosphorus into useful phosphates; and, Fourthly, in treating phosphatic iron ores, stones, tap or mill cinders and similar substances with lime, when they contain much silica, before subjecting them to any of the above processes.

748. Bichromates of Potash and Soda, *J. H. Johnson, London.—10th February*, 1883.—(*A communication from O., A., and A. Neuhaus, Germany.*) 4*d*.

This consists in the manufacture of bichromates of potash or soda by acting with carbonic acid upon chrome melts obtained by furnacing a mixture of chrome ore with lime and carbonate of (or caustic) potash or soda.

750. Manufacture of a White Pigment, *T. Griffiths, Oxton.—10th February*. 1883. 4*d*.

This consists, First, in the manufacture of pigment containing calcined sulphide of zinc by calcining the sulphide with or without other substances, mixed with sulphate of ammonium or other salt having no chemical or colouring action on the sulphide or mixture, and that volatilizes at a little below the degree of heat at which the sulphide becomes coloured in air or steam, or both, and thus forming a protecting atmosphere round the sulphide or mixture; and, Secondly, in the manufacture of a white pigment by precipitating zinc as a sulphide from its solutions by means of a purified ammonia liquor.

751. Coloured Marking Inks, *J. Hickisson and H. W. Langbeck, London.—10th February*, 1883. 2*d*.

This consists in adding to the colours employed a solution composed of india-rubber and gutta-percha dissolved in bisulphide of carbon or other suitable solvent.

752. Coloured Marking Inks, &c., *J. Hickisson and H. W. Langbeck, London.—10th February*, 1883. 4*d*.

A composition is employed to serve as a vehicle, to which the various colours in combination with an albumen are added, such composition consisting of from 5 to 8 grains arsenious acid, 10 drops oil of turpentine, 6 drachms glycerine, and 1 ounce water.

754. Landaus and all Open-headed Carriages, *W. H. Bailey, Long acre.—10th February*, 1883. 6*d*.

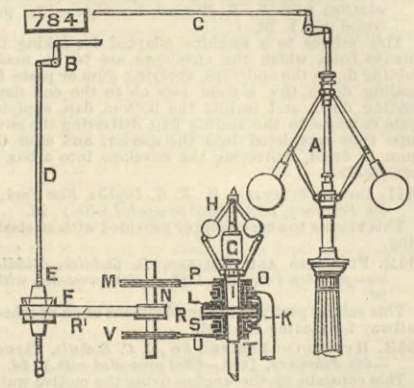
This relates to a lever lock-head, in which a spring is connected to one end of a lever which runs up the back of the pillars of landaus and behind the front end of the hoopsticks of open-headed carriages. The free end is turned inwards towards the pillar, and has a small friction roller which runs on a bridge with checks to guide it, and the ends of which act as catches to retain the roller either in the closed or open position. A cam serves to raise the end of the lever on to the track of the bridge when desired to unlock the head.

777. Apparatus for Grinding Corn or Grain, &c., *H. H. Lake, London.—12th February*, 1883.—(*A communication from H. M. Rounds, Iowa, and R. K. Noye, Buffalo.*) 8*d*.

This relates to the combination of a pair of rollers, each composed of several sections having the working faces more closely approaching each other and increasing in length in the several successive pairs of sections, a separate feed and discharge compartment, and a separate sifting device for each pair of sections.

784. Governing Steam Engines and Apparatus for Effecting the same, *W. Knowles, Bolton.—13th February*. 1883. 6*d*.

A is the ordinary governor, connected in any convenient way by the shafts and levers B and the rods C and D; on the rod D is placed the adjusting coupling E, in which are the right and left-hand threads for receiving and connecting the screwed ends of the rod D. On the coupling pulley E is the strap pulley F made sufficiently long to allow of the motion of the rod D when actuated by the ordinary governors A; G is the supplementary governor driven from any convenient position from the engine; H is the governor spindle on which the sliding bush I works with the friction plate on disc K, the same being raised or lowered according to the speed of the engine. When the engine attains too great a speed the friction disc K



is brought into contact with the disc L, and causes it to revolve and communicate motion to the pulley M on the counter or carrier shaft N by means of the pulley O and band P. On the carrier or counter-shaft N is placed the strap pulley R, which works by the belt R^1 the strap pulley F on the adjusting coupling E, thus working the right and left-hand screws outwardly, which gives an earlier effect to the cut-off. When the engine is at its normal speed, the disc K does not operate the discs L and S, the same working clear of both as shown; if the speed of the engine is retarded the governors drop, and the friction disc K works the disc S, the action of the coupling E being reversed by means of the pulley T, band U, and pulley V on the counter-shaft N.

799. Smutting or Finishing Blackened Leather, *F. J. Drewry, Burton-on-Trent, executor of W. Morgan-Brown, London.—14th February*, 1883.—(*A communication from C. B. Bryant, Massachusetts.*) 6*d*.

This consists of a machine for cleaning and finishing skins to which lamp-black and an oleaginous material has been applied, whereby the surface of such skins is subjected to the action of rubbers and brushes mounted upon a revolving drum.

800. Planing Machines, *F. J. Drewry, Burton-on-Trent, executor of W. Morgan-Brown, London.—14th February*, 1883.—(*A communication from H. F. Campbell, New Hampshire.*) 6*d*.

This relates partly to a cutter head and elastic bed roller, combined with india-rubber covered drawing rollers and corrugated drawing rollers above them. Other improvements are described.

801. Sewing Machines, *F. J. Drewry, Burton-on-Trent, executor of W. Morgan-Brown, London.—14th February*, 1883.—(*A communication from O. R. Van Vechten, New York.*) 6*d*.

This relates to machines which travel along the work, which remains stationary, and consists in constructing such machines so as to adapt them for use in sewing long pieces of material (such as breadths of carpet) together. The edges to be sewn are impaled upon a series of pins projecting from the edge of a table, the edges projecting sufficiently to form the seam, the width of which is determined by a gauge. The presser foot of the machine consists of a curved plate hinged to the end of a bar projecting from the needle bar carrier, and provided with a spring to press the foot inward and hold the fabric against the cloth plate with a yielding pressure. A special guiding frame is provided for the machine to travel on. Severing mechanism is provided to cut the thread at the end of the run of the machine.

827. Governors for Steam Engines, &c., *J. Whitley, Leeds.—15th February*, 1883. 2*d*.

The inventor claims, First, the introduction of mercury or other suitable material as a weighing medium for the increasing or diminishing of the speed and power of steam engines, and for other purposes; Secondly, the introduction of a scale indicating the ascertained speeds and powers of the engine motor or other machine in conjunction with the rise and fall of the governing material contained in a vessel or apparatus.

893. Furnaces and Stoves for Burning Bituminous Fuels, *J. C. Mewburn, London.—17th February*, 1883.—(*A communication from L. C. Voorhees, New York.*) 8*d*.

This relates to a furnace or stove having two fire chambers, separated by a dividing wall with a draft aperture through the said wall at one end thereof, and a grate in each chamber at the opposite end.

896. Production of Printing Plates or Blocks by Photographic Means, *J. R. Meihe, London.—19th February*, 1883.—(*A communication from J. Allgeyer and C. Bolhoevener, Bavaria.*) 4*d*.

The object is to produce by photographic means blocks or types which may be used in printing presses simultaneously with letter type.

922. Continuous Pipes or Tubes of Concrete, *C. A. Day, London.—20th February*, 1883.—(*A communication from W. M. Campbell, E. W. Bond, R. Brown, R. D. Radcliffe, and C. Detrick, U.S.*) 6*d*.

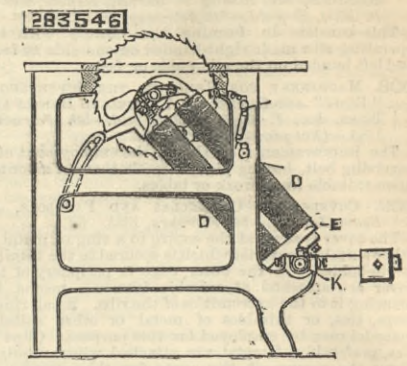
This relates to apparatus for forming continuous pipes or tubes of concrete of that class in which the concrete while in a plastic or granular mass is rammed into a casing and around a core, and it consists in improvements in the means for imparting pressure to the concrete, and in the construction of the core. A plunger operated by toggle mechanism exerts the required pressure, the core employed being collapsible, and free from the control of the casing or the plunger.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

283,546. Electro-magnetic Motor, *Edward Weston, Newark, N.J.—Filed March 16th*, 1883.

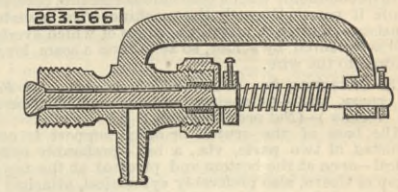
Claim.—(1) The combination of an electro-magnetic motor, a cutting or similar tool fixed directly to the shaft, a bench or table, and means for shifting or adjusting the position of the motor with reference to the bench, as set forth. (2) The combination, with a bench or table, of an electro-magnetic motor mounted or supported in a manner to be moved or adjusted toward or from said bench, and a cutting or similar tool fixed to the shaft of the motor and projecting through the bench, as set forth. (3) The combination,



with a bench or table, of an electro-magnetic motor mounted or supported in a manner to swing toward or from the said bench, and means for retaining the motor in proper position for use, as set forth. (4) The combination, with a bench or table, of the magnets D D, cross-piece E, shaft K, the armature mounted between said magnets, the saw or cutting tool fixed to the armature shaft, and means for adjusting the position of the magnets with reference to the bench, as described.

283 566. Cylinder Cock, *James N. Chamberlin, Marietta, Ohio.—Filed May 31st*, 1883.

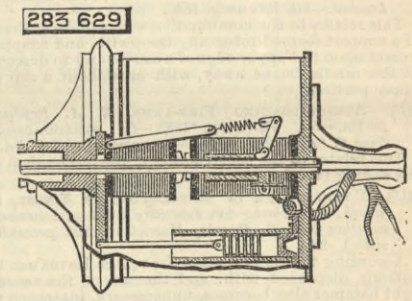
Claim.—In a relief cock for steam cylinders, the combination, with the hollow shell provided with an open branch pipe and a longitudinal valve rod having a valve at its inner end, of the bracket extending from



said shell, through the forward end of which bracket the forward end of the valve rod passes, the spiral spring surrounding the valve rod, and the adjustable collars secured to the valve rod, the whole arranged to operate substantially as and for the purposes specified.

283,629. Electric Lamp, *Hiram S. Maxim, Brooklyn.—Filed September 7th*, 1881.

Claim.—(1) The combination, in an electric lamp, of an electro-magnet in the main or arc circuit, an electro-magnet in a shunt or derived circuit, pivotted in a position to oscillate in front of the poles of the main magnet, and feed regulating devices connected with and operated by the movement of the pivotted



electro-magnet, as described. (2) The combination, in an electric lamp, of an electro-magnet in the main or arc circuit, an electro magnet in a shunt or derived circuit, pivotted above the main magnet, with similar poles opposed to one another, and feed regulating devices connected with and operated by the movement of the pivotted magnet, as set forth.

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