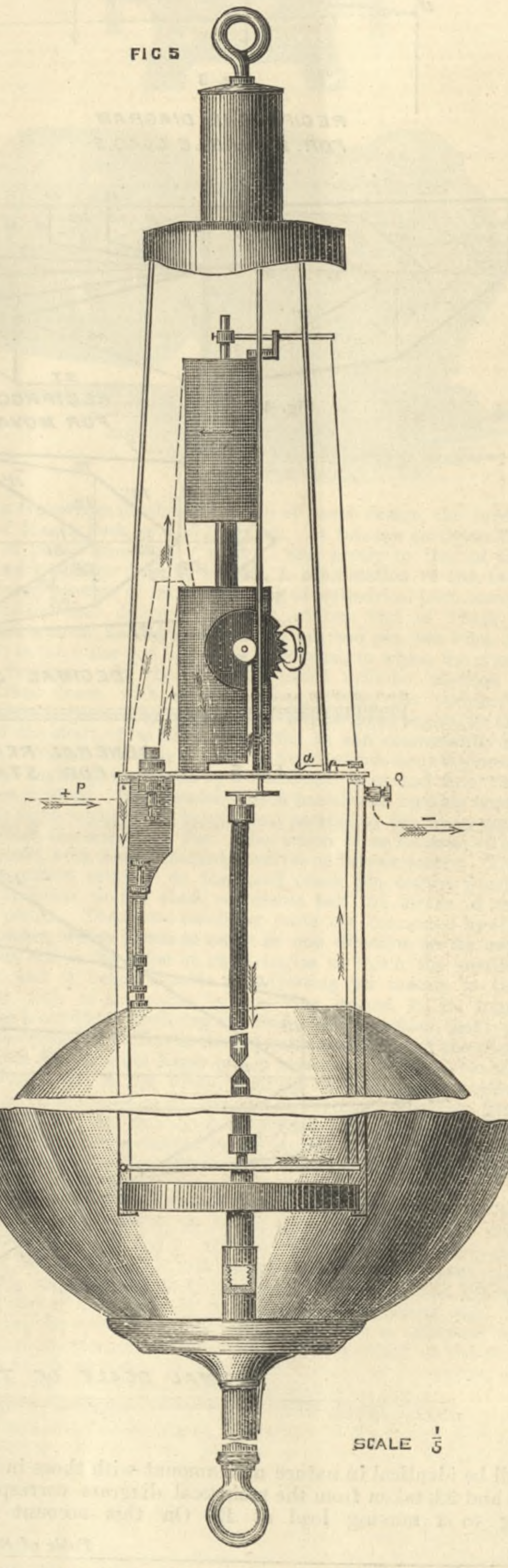
ARC LAMPS AT THE VIENNA EXHIBITION.

No. III.

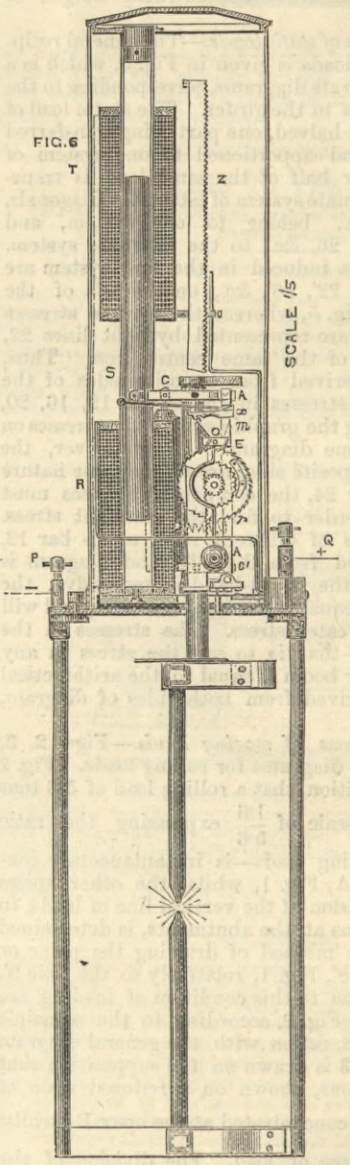
We have mentioned before that the arc lamps of L. E. Schwerd, of Carlsruhe, give as steady and pure a light as any in the Exhibition. No doubt this is partly owing to the excellent workmanship and steady running of his dynamo machines, which we will illustrate in a later article, but we also consider that much of the efficiency of the lamp is due to the good design of the regulating mechanism. Electrically the principle of this regulation is the same as that of Siemens and Halske, but there is a mechanical difference, which is in favour of the Schwerd lamp. This is, that in the Schwerd the lower carbon, and in the Siemens and Halske the upper carbon, is floated by the balance of the attractions of the two electro-magnets. The accompanying Fig. 5 shows most of the details, and is drawn to scale. The courses of the main and shunt currents are indicated by arrows. The positive current enters at P and leaves by Q. From P there is a small branch leading downwards, and connecting with a short upright wire spindle, moving vertically in guide brackets attached to the left-hand frame pillar. This wire bears a button on its upper end, and is pushed downwards by a small spiral spring surrounding its lower end. When thus pushed down, the button touches a flat spring, and thus makes contact for a short circuit to Q. This prevents the current passing the carbons until all is ready, and the glass globe fixed in place, because this wire and button is lifted in opposition to the spiral spring by a little piece of wood, attached to the upper rim of the globe. As soon as the globe is pushed up into place, the short circuit is broken and the current is sent through the carbons. There are two electro-magnets, one directly above and in line with the other. The main current is passed through the upper, and the shunt through the lower, coil. A soft iron core hangs in the axis of these two electro-magnets, its length stretching from the centre of the one to that of the other. At its upper end this core is suspended from one end of a horizontal lever, from the other end of which hangs a wire that reaches to the bottom of the frame, passing down by the right-hand frame pillar. Here the wire is attached to the end of a second horizontal lever, which has its fulcrum in the left-hand pillar of the frame, and which bears at its middle point the lower carbon holder. Thus, when the soft iron core of the electro-magnets sinks, the lower carbon rises, and *vice versa*. The ratios of the lengths of the lever arms are such that the up or down motion of the carbon is half the reverse motion of the iron core. The upper carbon holder is fixed to a long rack moving in vertical guides, and supported or moved downwards by a small pinion, whose teeth gear with it. The rack has forty-five teeth, to 100 mm. length, and the pinion has sixteen teeth. On the same arbor with this pinion is fixed a ratchet escapement wheel having fifty teeth. The pawl escapement permitting this to turn is like that of a clock, and is simple in construction. Its speed of oscillation is regulated by a miniature fly-wheel attached to the pallet axle. Projecting from the lower rim of this wheel hangs a little pendulum. This is caught and prevented from oscillating by the cup-shaped extremity of the short lever *a*. This lever is pivotted at its middle point, and its right-hand end is the heavier, so that the cup always catches the pendulum, except when the outside end of the lever is lifted. This is done by a small wooden tappet fastened to the wire connecting-rod previously mentioned. This happens when the iron core in the electro-magnets reaches its lowest position. Suppose that the carbons are far apart when the current is turned on. The shunt circuit magnet has all the current passing through it, and draws the iron core to its lowest position. This disengages the pendulum of the escapement, and the upper carbon-holder falls slowly by its own weight until the two carbons touch. Nearly the whole current now passes through the carbons and through the upper electro-magnet. The core is at once drawn up, the pendulum caught so that the upper carbon cannot slide further downwards, and the lower carbon is drawn downwards the distance the points require to be separated to make the desired arc, this length being about 2½ mm. This amount of separation depends on the rise of the iron core—is, in fact, half that rise—and this rise is determined, not by any mechanical stop, but by the core rising to such a position that the magnetic upward and downward attractions of the two coils balance each other. At the first instant of lighting the upper coil exerts the greater attraction, because the current through the shunt is very small. As the core rises—if the two currents through the two coils remained the same—each of the two magnets would attract the core with varying forces, in consequence of the variation of the distances between their centres and that of the core. The attractive force between a coil-current and a core placed axially inside the coil increases up to a certain limit with the distance between the centre of the coil and that of the core. At what exact relative position the maximum force is reached has not as yet been exactly determined, but it occurs when the end of the core is somewhere near the centre of the coil. At this position the attractive force does not vary rapidly with change of position of the core. In the lamp under notice the core stretches from centre to centre of the two coils, so that if the two currents remained constant while the core moved this latter would move freely through a small range in nearly neutral equilibrium, the resultant attraction of the two coils upon it varying very little with small changes in its position. But as the core rises the carbon points separate, the arc resistance increases, and the arc-current decreases, while the shunt-current increases. Thus, as the core rises, the attraction of the upper magnet becomes feebler because of the decrease of its current, while that of the lower magnet increases, until a point of equal attraction is reached, which point is one of stable equilibrium for the core. The equilibrium is thus one between two increasing and decreasing currents, and is reached when the two currents have attained a certain definite ratio to each other, this ratio depending chiefly on the relative number of windings in the two coils, and only very slightly on the exact position—within a small range—of the core. The carbon points now begin to burn away, and the length of the arc would in consequence increase, causing greater arc resistance. But this would—and does to a very small extent—change the ratio of the two currents, the lower magnet increasing in strength. This draws down the iron core and raises the lower carbon so as to correct the increase of length of the arc due to the burning. If the mechanism were quite frictionless this regulation might be absolutely continuous and gradual, the ratio of the current remaining perfectly steady. But this is not so. The correcting movement does not occur until this current ratio has varied to such a degree that the excess of the shunt magnet's attraction is sufficient to overcome the frictional resistance to movement in the joints of the mechanism. The regulation thus takes place by small jumps or starts. Also this being so, at the beginning of each start the parts of the mechanism have to acquire a certain small velocity and momentum. The force necessary to generate this being supplied by the difference of the magnetic attractions, the beginning of each start is still further delayed by this



inertia resistance to motion. It is, therefore, of prime importance to make the mechanism as frictionless and as light as possible. Again the change in the intensity of each branch of the current is retarded by self-induction to a small extent. This regulating action continues for some time, the lower carbon rising and the iron core lowering in position, until the long wire connecting-rod has risen so high that its wooden tappet has raised the little lever and lowered the catch *a*, so as to disengage the escapement, and allow the upper carbon to descend by at least the distance corresponding to the passage of one tooth of the escapement wheel. In the lamp described this distance is $\frac{100}{45} \times \frac{16}{50} = \frac{7}{10}$ mm. The arc current becomes momentarily stronger, and the upper magnet, being thus strengthened, the iron core is again drawn up, and the lower carbon lowered, so as to correct this sudden approach of the points by the above $\frac{7}{10}$ mm. This sudden movement of the suspended parts must produce a certain amount of swinging, which, although imperceptible to the eye, is undesirable. It would be less if the above dimension, $\frac{7}{10}$ mm., were diminished. The core will not rise now quite so high as it did at the first moment of lighting, because, while it starts its upward motion from the same position as before—its lowest as regulated by the mechanical stop—the arc is not now zero in length as before, for this lowest position of the core. As the core now occupies an equilibriated position slightly nearer the lower—shunt—magnet, the lamp burns a little less brightly than it did at the first moment of lighting. But owing to the approximate equilibrium of the core, so long as the ratio between the currents remains the same this dimming of the lamp is unappreciable. A second period of slow "floating" regulation now begins, which is quite similar to the first described above, but not exactly the same, in consequence of the slightly altered position of the core. The third similar period is almost exactly the same as the second, and the fourth still more exactly the same as the third, and so on. A second shunt circuit leads a small portion of the current through another electro-magnet. This actuates a safety short circuit. When the current from any cause rises above a certain limit, an armature is attracted, which makes contact for the short circuit, thus cutting out the one special lamp in danger without interfering with the supply of current to other lamps. The weight of the swinging system, composed of the core, the lever gear, the carbon holder and carbon, is balanced in the proper position by a small suspending spiral spring, which can be adjusted to the required tension by a thumb-screw on the top of the frame. The two electro-magnets are each about 3in. diameter by 7in. long. The iron core has about $\frac{7}{10}$in. diameter. The length of arc varies from 2 to 2½ mm. The electro-motive force used varies from 45 to 50 volts for the different sizes of lamps. The electrical dimensions of three sizes have been furnished us by the makers. They are:—

Candle-power.	Dia. of Carbon. mm.	Resistance. Ohms.	Current. Ampères.	E.M.F. Volts.	Volt-ampères.	Volt ampères per candle power.
1000 to 1200	10	5	8½	42½	360	·36
2500 to 3000	12	3	14	42	590	·24
4000	14	2·5	20	50	1000	·25

The differential arc lamp of Siemens and Halske is designed on exactly the same principle as that of Schwerd described above. Nearly all the details of its construction are shown in Fig. 6 annexed. The shunt circuit magnet T lies above that of the main circuit R. The current passes from P to Q through the two branches, the routes being clearly indicated in the figure. The core S hangs on one end of the lever *c*, to the other end of which, and to the corresponding end of the lower parallel suspending link C[1], is attached by knife-edge joints the frame A. This frame is thus free to swing vertically through a small range, in which swing it is guided always parallelly to itself. This frame has guide surfaces formed in it, up and down which may slide the rack Z. This rack is in one piece with the upper carbon holder. The rack is prevented from slipping downward by a small pinion gearing with it, this pinion and the ratchet escapement wheel *r* being on one arbour which has its bearings in the frame A. The escapement E, when allowed to oscillate, permits the gradual rotation of *r*, and the downward sliding of Z and of the upper carbon. The speed of this oscillation is regulated by an ordinary pendulum bob. This bob, the escapement E, and the little segment *m* are all in one piece, oscillating on an axle with bearings in A. In A also is hinged at *x* a short lever, a notch in which catches in a corresponding projecting tooth on the segment *m*, and prevents the above escapement motion until the lever is lifted. This lifting is effected by the striking of the end of the lever against a peg fixed at a definite level. As the carbon points burn away, in order to keep the balancing ratio of the two currents constant, or nearly so, the frame A and *r* E *m* *x*—all of which have their bearings in A—sink, and consequently the core S rises. At the higher limiting position of S, and the lower limiting position of A, in this adjusting motion, the lever *x* catches on the above-mentioned peg and disengages the escapement. Comparing this arrangement with Schwerd's, it is evident that the parts that move up and down are much heavier in the former. The advantage of reducing to the utmost the weight of these parts may be readily recognised when it is considered that at each escapement feed movement there must be a



sudden "recovery" of level of the parts. The carbon, its holder, and the rack suddenly drop from the frame and gearing attached to it. Immediately afterwards, when the attachment between them is again made fast, the two rise together again until the new equilibriating position is reached. Although the range of this "jump" down and up may be extremely small, it is not to be forgotten that the speed at which it is performed may be great, and it must throw the parts beyond their eventual position of equilibrium, and thus produce a certain amount of unsteadiness.

An example of the electrical dimensions of these lamps is as follows :—

Candle-power.	Carbon diameter. mm.	Consumption of carbon per hour, mm	Resistance of arc between carbon points ohms	Current amps.	E.M.F. Volts.	Volt-amps.	Volt-ampères per candle-power.
880	11	53	4 5	11	49 5	545	·62

Mr. O. Fröhlich has been experimenting with Messrs Siemens and Halke's lamps for three years, on the relation between the arc resistance and the length of arc and the current. He gives the following formulas as representing as nearly as possible the results of these experiments—

$$E = 39 + 1{\cdot}8\,L$$

$$R = \frac{E}{C} = \frac{39 + 1{\cdot}8\,L}{C}$$

Here E is the electro-motive force in volts, R the resistance in ohms, C the current in ampères, and L the arc length in millimetres.

EXAMPLES OF THE GRAPHIC TREATMENT OF STRESSES IN FRAMEWORK.

By Robert Hudson Graham, C.E.

No. III.

The Neath Bridge.—This example of a lattice girder is treated both for static and rolling loads. The static load is distributed over the lower boom of the girder by apportioning a load of 1·6 tons to each of the five apices A B C D E, Fig. 1. The rolling load is distributed over the same joints, each of which may be called upon to carry when loaded an instantaneous concentrated weight of 5·6 tons.

(1) *Reciprocal diagram of static loads.*—The general reciprocal diagram for static loads is given in Fig. 5, which is a combination of two separate diagrams, corresponding to the double system of lattices in the girder. The static load of 1·6 tons at any apex B is halved, one part being transferred to the upper boom and apportioned to one system of lattices, whilst the other half of the same load is transmitted through the alternate system of lattices. Diagonals, such as 22′, 26′, &c., belong to one system, and diagonals, such as 22, 26, &c., to the alternate system. The compressive stresses induced in the first system are shown by shaded lines 22′, 26′, &c., on the left of the vertical line of loads, Fig. 5, whereas the tensive stresses of the alternate system are represented by light lines 22, 26, &c., on the right of the same centre line. Thus, diagonal stresses are derived from opposite sides of the diagram, Fig. 5; but stresses in the struts 12, 16, 20, &c., are found by taking the graphic sum of the stresses on both sides of the same diagram. If, moreover, the stresses furnished by opposite sides are of the same nature or sign, as occurs in bar 24, the component stresses must be added together in order to find the resultant stress. But if the stresses are of different sign, as in bar 12, where the stress derived from the left-hand diagram is tensive, and that on the right-hand compressive, the resultant stress will be equal to the algebraic sum, and will take the sign of the greater stress. The stresses in the flanges are cumulative—that is to say, the stress in any member 15 of the lower boom is equal to the arithmetical sum of the stresses derived from both sides of diagram, Fig. 5.

(2) *Reciprocal diagrams of moving loads.*—Figs. 2, 3, and 4 are the reciprocal diagrams for rolling loads. Fig. 2 is drawn on the supposition that a rolling load of 5·6 tons—shown on a reduced scale of $\frac{1{\cdot}6}{5{\cdot}6}$ expressing the ratio between static and rolling loads—is instantaneously concentrated at the apex A, Fig. 1, whilst the other apices are unloaded. The division of the vertical line of loads, in the ratio of the reactions at the abutments, is determined by the ordinary graphic method of drawing the polar or funicular polygon, 9′ 6″ 8′, Fig. 1, relatively to the pole 0′, Fig. 2. The stresses due to this condition of loading are scaled off the diagram Fig. 2, according to the principle already explained in connection with the general diagram of static stresses. Fig. 3 is drawn on the supposition that a rolling load of 5·6 tons, shown on a reduced scale of $\frac{1{\cdot}6}{5{\cdot}6}$, is instantaneously concentrated at the apex B; whilst the other apices are free of load. The division of the vertical line of loads, in the ratio of the reactions at the abutments, is determined by the ordinary graphic method of drawing the polar or funicular polygon 9″ 5″ 8″, Fig. 1, relatively to the pole 0″, Fig. 3. Fig. 4 is drawn on the supposition that a rolling load of 5·6 tons, shown on a reduced scale of $\frac{1{\cdot}6}{5{\cdot}6}$, is instantaneously concentrated at the centre of the span C, whilst other apices are free of load. In this case, owing to the symmetrical position of the load, the vertical line of loads is halved, and the reactions at the abutments are equal to each other, and to half the rolling load.

(3) *Table of stresses.*—The stresses, induced in the various members of the Neath Bridge outside girder, are tabulated in the annexed table.

In the first column, under the headings W_6—W_2, are given the stresses brought to bear upon the diagonals, in virtue of the separate static loads, each of 1·6 tons, distributed over the joints A, B, C, D, E, Fig. 1, and derived directly from diagrams Figs. 2, 3, 4, by aid of the given decimal scale of tons. It will be observed that the independent loads at D and E furnish reciprocal diagrams, which are the inverted forms of Figs. 2 and 3; that is to say, the stresses in bars 14 and 18, derived from Fig. 2, will be identical in nature and amount with those in bars 26 and 22, taken from the reciprocal diagram corresponding to a moving load at E. On this account it is unnecessary to construct the reciprocal diagrams for rolling loads at D and E. The column headed "Resultant permanent stress" includes the algebraic sums of the terms in the five columns preceding it, and therefore furnishes the resultant stresses in the various diagonals due to general static loads. In the next column is given the coefficient of reduction for rolling loads; that is, the number of times the lines of the reciprocal diagrams Figs. 2, 3, and 4, must be magnified, in order to furnish the stresses due to rolling loads. The following two columns furnish the resultant stresses in the diagonals, due to the most unfavourable conditions of loading of the different apices of the girder. In the next column are found the

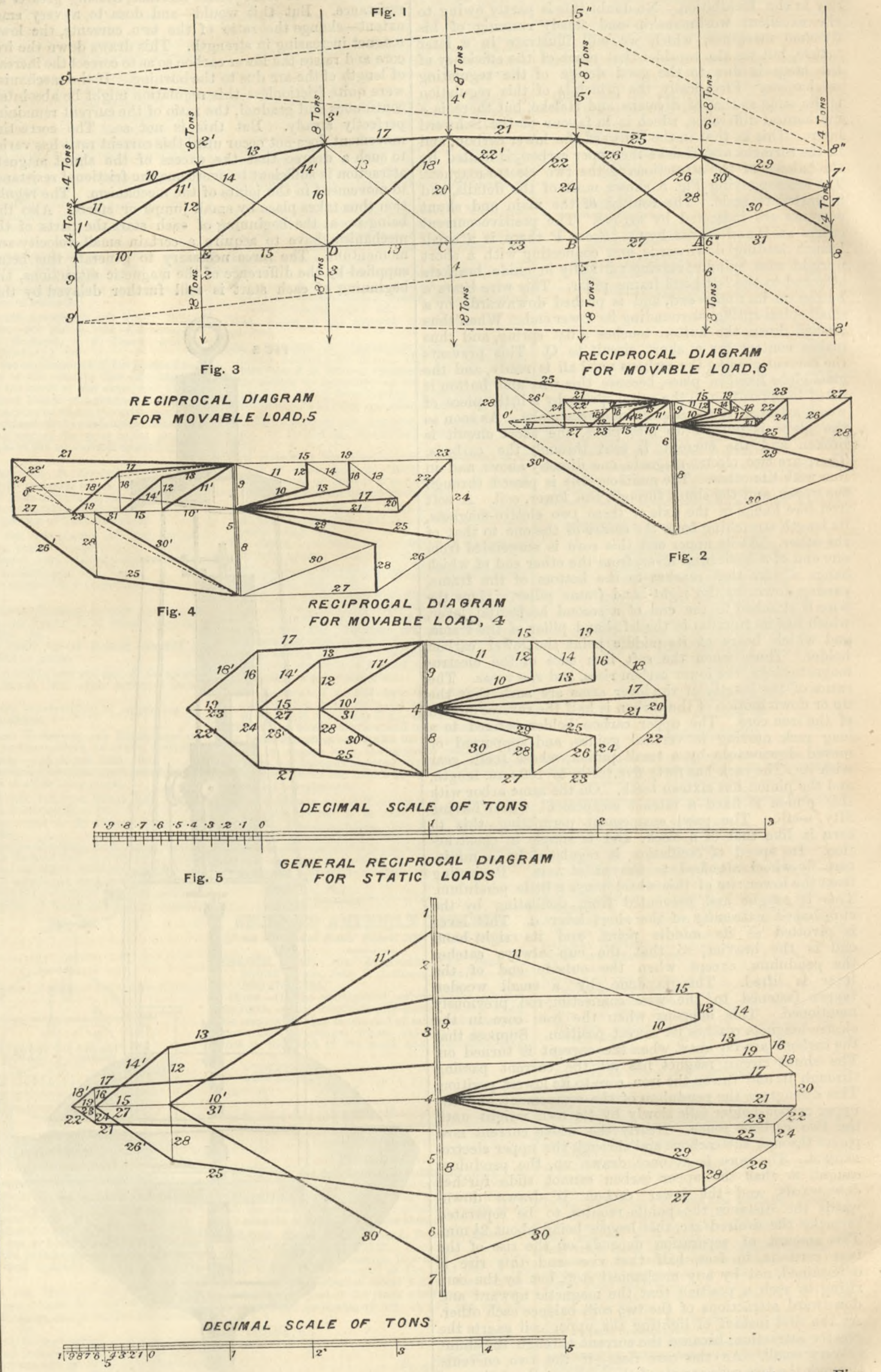


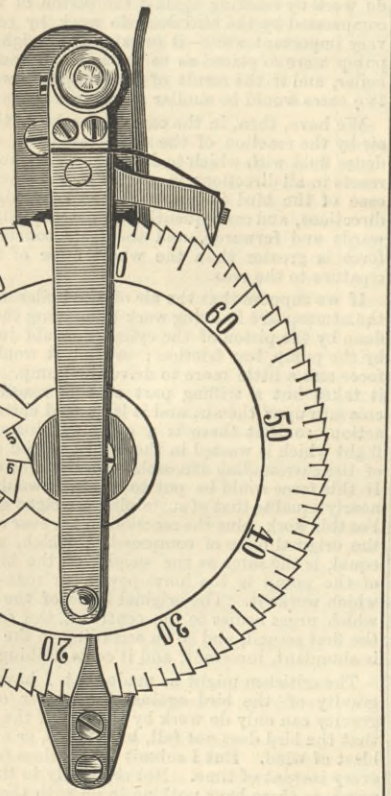
Table of Stresses in Neath Bridge.

Diagonals.	Component stresses due to the separate static loads. W6.	W5.	W4.	W3.	W2.	Resultant permanent stress in tons.	Coefficient for rolling load. $\frac{5{\cdot}6}{1{\cdot}6}=3{\cdot}5$	Resultant stress due to rolling load. Due to loads.	Nature and amount	Maxima—stresses in tons.	Flanges.	Coefficient of reduction, $\frac{5\,6+1{\cdot}6}{1{\cdot}6}$.	Maxima—stresses due to both loads.
11	·225–	·45 –	·66 –	·875–	1·11 –	3·32 –	3·5	6–2	11·62–	14 94–	10	4·5	14·67 +
11′	·250+	·50 +	·735+	·975+	1·24 +	3·70 +	3·5	6–2	12·95+	16·65+	10′	4 5	14·4 –
14	·150–	·30 –	·45 –	·55 –	·45 +	1·00 –	3·5	6–3	5·08–	6·08–	13	4 5	32·63 +
14′	·170+	·325+	·485+	·625+	·512–	1·10 +	3·5	6–3	5 61+	6·71+	15	4·5	32·C0 –
18	·175–	·365–	·530–	·45 +	·25 +	·37 –	3·5	6–4	3·74–	4·11–	17	4 5	37·8 +
18′	·175+	·375+	·55 +	·475–	·25 –	·375+	3·5	6–4	3 85+	4·22+	19	4·5	37·44 –
Flange, 19												8·341–	—
Static stresses	·821–	1·64 –	2·46 –	2·26 –	1·16 –	8·341–						29 230–	37·571–
Rolling stresses	2·87 –	5·74 –	8·61 –	7·91 –	4·10 –	29·23 –							

algebraic sums of the resultant diagonal stresses, due to general static and most unfavourable rolling loads. The last column furnishes the cumulative stresses in the flanges of the girder, as derived from the general reciprocal diagram Fig. 5, in which each line is magnified $\frac{5.6+1.6}{1.6}=4.5$ times, in order to obtain the combined or cumulative effects of rolling and static loads. These maxima-stresses can be found in another way, as exemplified at the end of the table for member 19 of the lower flange. Here, in the first horizontal line, the stresses in 19 due to the separate static loads on the joints A B C D E are derived directly by measurement off the reciprocal diagrams, Figs. 2, 3, and 4. Each of these stresses is then multiplied by the factor $\frac{5.6}{1.6}$, in order to find the stresses due to the separate rolling loads at the same joints, which are given in the second horizontal line. The sum of all these stresses, viz., 8·341 + 29·23 = 37·571, represents the resultant or maximum stress in bar 19 arising from the double system of loads. The difference (37·571 — 37·44) = 0·131 is a measure of the divergence between the results of the two methods. Assuming, therefore, that the truth lies between these two results, we find the absolute error to be $\frac{0.131}{2}$ = 0·065 tons; or only 0·17 per cent. of the total stress in the member of the flange considered.

NEW STROKE COUNTER.

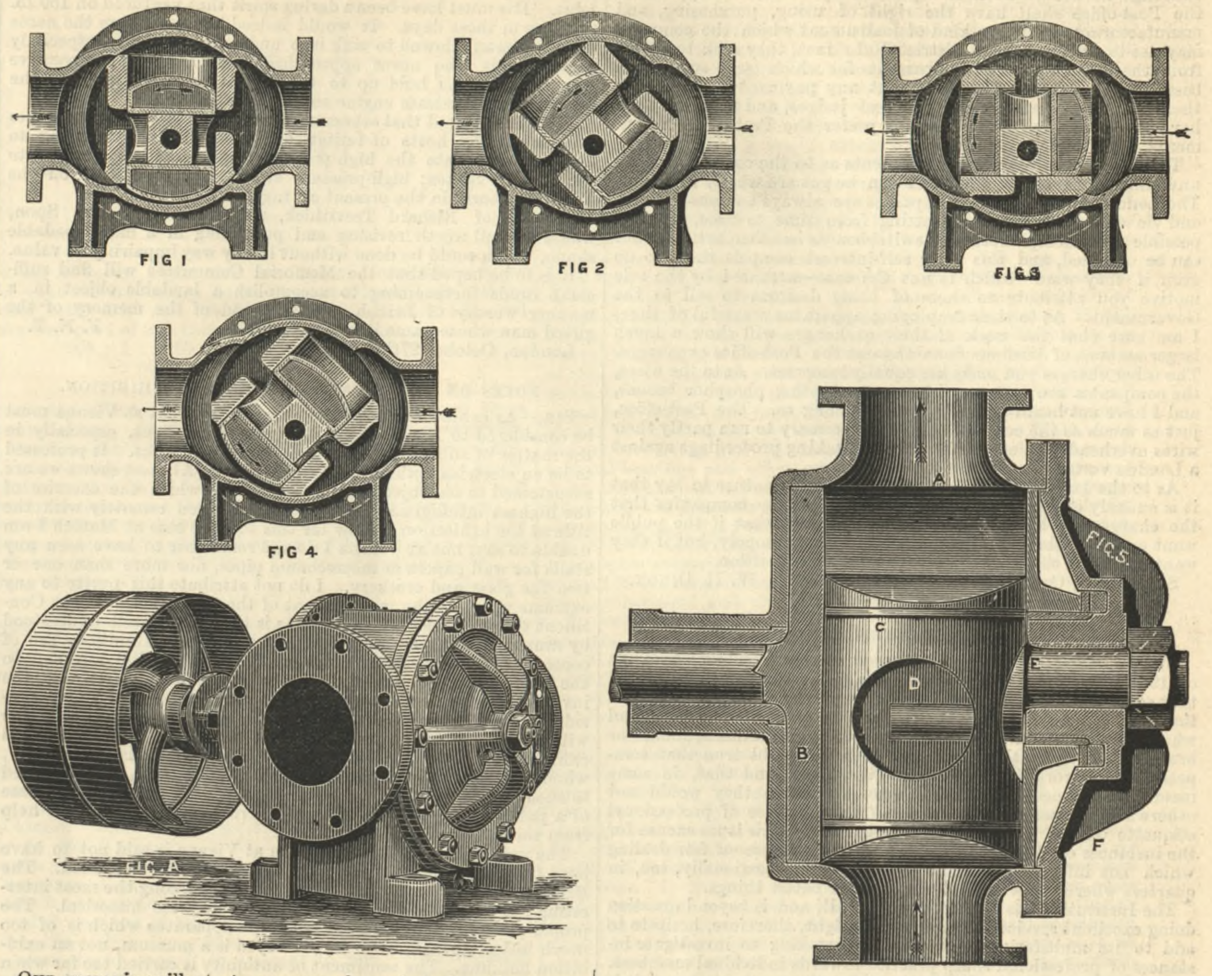
Having occasion some short time since to record the speed of a rather unsteady steam engine, making from 600 to 900 turns per minute, at which speed there was some chance of the ordinary revolution counter missing some turns by jumping out of the centre mark on the main shaft, we ordered a special stroke counter, which would serve as a check on the revolution counter, or independently, and which would record a full minute's work. We got the instrument shown in the cut. It consists of a stiff bar carrying a



rotating dial, graduated to hundredths, and correspondingly notched for a spring pawl. This pawl is driven by a lever vibrating in front of the dial, and attached by an inelastic cord or wire to any reciprocating part of the engine, or to the indicator rig. A torsion spring returns the vibratory lever when not drawn by the cord. This spring may be twisted either way, so that the counter can be used either right or left hand, and yet drive the dial "watch-wise." The main dial bears a graduated star wheel with ten ratchet teeth, and the index pointer at the bottom of the central back bar or frame, gives it one-tenth of a revolution for each complete rotation of the main or units dial. The pawl may be thrown in or out of gear by a handle above. The higher the speed the stiffer should be the spring of the vibratory lever and the pawl.—*The American Journal of Railway Appliances.*

Dinner to Sir Robert Rawlinson.—On Saturday, 27th October, the engineering inspectors of the Local Government Board entertained the head of the department, Sir Robert Rawlinson, C.B.—at the Café Royale—on the occasion of his recent knighthood by the Queen. The party, which numbered eight, consisted of Sir Robert Rawlinson, C.B., Mr. Arnold Taylor, Mr. John Thornhill Harrison, Major Hector Tulloch, Captain R. C. T. Hildyard, Mr. Stephen H. Terry, Mr. Thomas Codrington, and Mr. Samuel J. Smith. The health of Sir Robert and Lady Rawlinson having been given by Mr. Arnold Taylor, Sir Robert briefly replied, thanking his colleagues for the practical token of their gratitude and esteem. He then alluded to the length of his official connection with Mr. Arnold Taylor, dating as it did from the time of the Crimea. Sir Robert next called attention to the vast national importance of the works of sanitation and water supply, &c., carried out under the sanction of the Local Government Board inspectors, involving annually some 600 inquiries, public and informal, throughout the length and breadth of England and Wales. The works thus sanctioned affecting, as he hoped for good, not only the present generation, but probably many future generations, and undoubtedly improving the general health of the community, as is shown by the decreased death-rate, amounting to 4½ per cent. of the total number of deaths per annum in the decade ending 1881 since the adoption of the Public Health Act of 1848. He also referred to the beneficial results which had been attained by those districts in Lancashire which carried out relief works during the cotton famine of 1863. By these works employment was given to many thousands of people who would otherwise have become paupers. Towns were sewered and supplied with water; road improvements, paving, flagging, &c., were carried out to an extent that the total mileage of roads so treated amounted to 400, whilst the acreage was over 800. The total expenditure was £1,850,000, nearly all of which is now repaid by equal annual instalments.

PECK'S REVOLVING PISTON PUMP.



Our engravings illustrate a pump of novel design, the invention of Mr. E. Peck, of Old Charlton. It belongs partly to the type of pump known as "rotary," and partly to that of the "ordinary plunger;" it is, in fact, a combination of the two. The pump consists of an outer casing of cylindrical form, carrying suction and delivery branches, at one end of which is attached a cover, having an internal crank and pin, see Figs. A, and 5; at the other end, a bearing or journal, in which the crank shaft revolves. In the above-described cylinder revolves a cylindrical drum, with shaft attached, fitting the periphery. The drum is pierced by a cylindrical bore at right angles to the axis of the shaft, of as large a diameter as can conveniently be got in. Within this bore a piston is fitted, which again is pierced at right angles to its length by a cylindrical bore, and into this a piston is fitted. This smaller piston has also an opening bored in it at right angles to its length, and parallel to the main shaft into which the crank pin fits. The action is as follows:—The main shaft, with drum attached, revolves on its own centre. The smaller piston revolves on the fixed crank pin centre, which, being excentric to the shaft, represents half the stroke of the pump piston. These two revolving parts are connected by the main piston, which is free to move in one direction in its own cylinder, and in the other at right angles to it, on the smaller piston, and is hence capable of adjusting its motion to the circular path of the crank by revolving around it; in doing so it has a combined revolving and reciprocating motion, that is to say, the consequent effect is that at every revolution of the shaft and drum the main or larger piston traverses up and down the cylindrical bore in the drum, and up and down the smaller piston at right angles to its own axis, revolving at the same time with the drum, and as, at each revolution, the alternate ends of these cylinders are presented to the suction and delivery pipes, the contents of the two cylinders are transferred from one to the other without disturbing them.

Suppose the pipe connections to the cylindrical casing to be in a horizontal position, as shown in the accompanying diagrams—Figs. 1, 2, 3, and 4—that at the right hand being the suction, and that at the left the delivery, and the crank pin vertically below the centre of the casing, the main piston will be at the end of its stroke at the bottom, as shown in Fig. 1. Supposing the drum to revolve towards the left, as indicated by the arrow, at one-eighth of a revolution the position of the two pistons will be as shown by Fig. 2; at one-fourth revolution as shown by Fig. 3; at three-eighths revolution by Fig. 4.

It will be seen that in Fig. 1 the smaller piston is drawing in on one side and discharging on the other; in Fig. 2 both pistons are in action; in Fig. 3 the larger is in mid-stroke, drawing in and discharging, the smaller one having completed its stroke; in Fig. 4 both are in action. The next eighth of a revolution would complete one half-turn, and would be represented in Fig. 1, but each piston would be reversed in position. Revolved quickly, the motion of the pistons much resembles that of an ordinary excentric, and as both pistons discharge twice in a revolution, the flow of the fluid is nearly constant, and is extremely steady, hence the pump is brought forward as well adapted to pumping wort, oils, ammoniacal liquors, &c. Made on a large scale, and of lighter dimensions, it would form a gas exhauster or an air pump for light pressures. It would not require a machine of large dimensions—about 3ft. by 3ft. by 2ft. stroke—to discharge 50 cubic feet per revolution, and as the motion is steady and easy, and all wheels or gearing dispensed with, it could be revolved at 100 per minute, or 5000 cubic feet per minute, or 300,000 cubic feet per hour, and this quantity could with ease be doubled.

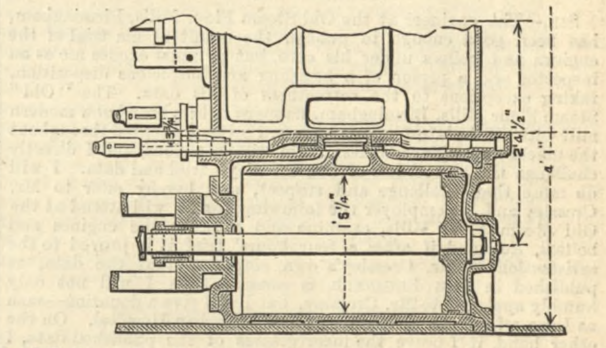
In adapting these machines to gas exhausting purposes, Mr. Okes, of Queen Victoria-street, E.C., who is the owner of the patent, proposes making them on the original plan as first designed, viz., with square pistons with the crank pin fixed in an excentric position in the cover. For light pressures, such as exhausting gases, where absolute tightness is not required, this form of construction possesses advantages, as it allows the internal working parts to be readily removed by simply taking off the front cover, whereas in the case of the circular pistons, as arranged for pumps, it is necessary to partly withdraw the drum from the casing for purposes of examination. Mr. Okes has applied the same principle to a compound high-speed steam engine which on a small trial engine developing about 2-horse power has given good results. We are told that at 800 revolutions per minute it is perfectly steady and quiet. The steam is expanded in the smaller or high-pressure cylinder before being exhausted into the larger or low-pressure cylinder, thus forming a compound engine.

LETTERS TO THE EDITOR.

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

THE "GLADSTONE."

Sir,—Allow me to corroborate the statement made by "Young Engineer" in your impression of last week, respecting the diameters of cylinders, with slide-valves between them, used in inside frame locomotive engines, and to add that several lines have engines so constructed, with cylinders from 17½in. to 18in. diameter inclusive, among which are the London, Chatham, and Dover Railway, Great Northern Railway, Lancashire and Yorkshire Railway, Mid-



land Railway, South-Eastern Railway, and North British Railway. Besides these are the new passenger engines on the Glasgow and South-Western Railway, with cylinders as much as 18½in. in diameter, the slide-valves being placed between them, as shown in the accompanying tracing.

F. A. Field.

London, W.C., October 27th.

TELEPHONES.

Sir,—Referring to your article on "The Defects of our Telephone System" in yours of the 19th inst., I venture to think you have not fairly stated the facts either as regards the telephone companies or the Post-office. You would make it appear that the Post-office have (1) the best instruments, (2) the best switchboards, (3) the best telephonic apparatus, and, in fact, have an almost perfect system, whilst the private telephone companies are held up as the very reverse of this picture, and as being unwilling to adopt any improvement in apparatus or wire, and that their main or only object is to get their system taken over by the Government by purchase; and you sum up the shortcomings of the telephone companies thus:—(1) Employing apparatus that is wasteful of time, (2) that does not allow of secrecy, (3) that tends to increase outside sounds; (4) wires obtrusive to the sight, and in some cases obstructive to traffic, (5) and the whole without systematic arrangement, whilst the charges are excessive. The only foundation for the praise of the one system, on the one hand, or the condemnation on the other, is that Mr. Preece stated so in a paper read by him at the British Association, and that no one ventured to dispute the correctness of the conclusions.

Not having read the paper, I am not in a position to say whether it bears out or not the very sweeping praise and condemnation of the Post-office and the private companies; but I should very much doubt it, and I hope to show that neither the one nor the other are at all justified. I feel confident Mr. Preece would not and could not claim perfection for the Post-office, and whilst no doubt he believes in the superiority of the system over which he presides, and for which he is responsible, I believe he would be the first to admit that the companies are not so bad as you have printed them, and further, that they are not so careless of the interests of their customers as you would make out.

First, as to the best instruments—that is, transmitters and receivers. If those of the Post-office were the best, it is rather curious that they should use Blake transmitters—those of the company—in their own offices at St. Martin's-le-Grand, and still more curious that they are so anxious to get power to use the instruments over which the companies have exclusive control. That they are so anxious is shown by the condition—a most unfair and iniquitous one it is—that they insist upon inserting in every exchange licence which is now granted by them, namely, "That the Post-office shall have the right of using, purchasing, and manufacturing the same kind of instrument which the company may use in such exchange district." In fact, they seek to obtain from the company use of instruments for which large sums have been paid for patent rights without any payment whatever by them; but the customers are the best judges, and wherever they have the opportunity they do not prefer the Post-office instruments, but those of the company.

Then as to apparatus, your statements as to the companies being unwilling to have the best that can be got are wholly incorrect. The London and provincial companies are always anxious to have, and vie with each other in getting from time to time, the best possible apparatus, whether in switchboards or other articles that can be obtained, and this their self-interest compels them to do even if they were—which is not the case—actuated by the sole motive you attribute to them of being desirous to sell to the Government. As to their employing apparatus wasteful of time, I am sure that the work of their exchanges will show a much larger amount of business done than at the Post-office exchanges. The other charges you make are equally incorrect. As to the wires, the companies are in many instances adopting phosphor bronze, and I have not heard of the Post-office doing so. The Post-office, just as much as the companies, find it necessary to run partly their wires overhead, and are at this moment taking proceedings against a London vestry to enforce such wires.

As to the last charge of excessive charges, I venture to say that it is entirely owing to competition of the private companies that the charges are being gradually reduced, and that if the public want excessive charges they may go in for a monopoly, but if they want moderate charges they must support competition.

Sunderland, October 24th. W. H. Dixon.

PROFESSIONAL ETIQUETTE.

Sir,—I have read with much interest an article in The Engineer of 19th inst. under the above heading. It is much to be desired that some course should be initiated whereby those in the profession who are members of the Institution of Civil Engineers, and who are guilty of unfair conduct towards their brethren, should be brought to book for their actions. It is no doubt true that competition for work is more than ever keen, and that, in some instances, engineers are forced into a position they would not otherwise have assumed by reason of an ignorance of professional etiquette on the part of their clients. Still, this is no excuse for the instances of flagrant injustice and the absence of fair dealing which not infrequently come to light—and occasionally, too, in quarters where one would have looked for better things.

The Institution has its hands pretty full, and is beyond question doing excellent service. The Council might, therefore, hesitate to add to its multifarious duties by undertaking to investigate instances of professional sharp practice towards individual members. Nevertheless, unless the Institution takes the matter in hand, it is difficult to see how the state of things to which reference is made in your article can be coped with. Is it not reasonable that, if a member is proved to have acted in an unfair manner towards a fellow member, that he should be called upon to retract, or to withdraw from the Institution? The fear of deprivation of membership would alone be sufficient to cure half the offending spirits in the profession.

How often do we find that, when an engineer is employed to design a work, after spending a vast amount of thought, worry, and the expenditure of a life-long experience, having finally piloted the scheme into smooth water, some local midget, by reason of influence or other questionable motive, is employed to carry into effect—and not infrequently to make a mess of—what his professional brother has fought so hard to attain. In medicine an analogous case would be brought before the Society of Physicians, but with the engineers there is no such body to fall back upon for redress. If your article succeeds even in ventilating this subject it will, in my view, have performed a signal service. X.

Westminster, October 24th.

TESTING ENGINES.

Sir,—The engineer at the Old Steam Flour Mills, Birmingham, has been good enough to publish the result of his trial of the engines and boilers under his care, but he must excuse me as an inspector and a person of a haggling and suspicious disposition, taking exceptions to the correctness of his data. The "Old" Steam Flour Mills, Birmingham, happens to be a brand new modern mill with all the latest improvements, I believe, adopted throughout the machinery. Nevertheless, I am still suspicious, and I directly challenge the correctness of Mr. Crossley's trial and data. I will do more than challenge and suspect, and hereby offer to Mr. Crossley and his employer the following, viz., I will attend at the Old Steam Flour Mills, examine and indicate the engines and boilers, &c., and if after a four hours' trial it is proved to the satisfaction of Mr. Crossley's own employer that the data, as published in The Engineer, is correct, then I will not only humbly apologise to Mr. Crossley, but I will give a donation—such as I can afford—to Mr. Jaffray's new Suburban Hospital. On the other hand, if I prove the incorrectness of the published data, I will leave it to Mr. Crossley to make amends for publishing false data, and to his highly respected employer an opportunity of contributing to the said benevolent institution. If my proposition is declined with thanks—as probably it will be—you may perhaps allow me just to say that, taking it for granted that the mean indicated horse-power is 249·00—why the two last figures are put in I am not sufficiently well learned to know—and the total coal burnt, 2128 lb.—the coal per horse-power per hour, 2·016, is certainly not correctly calculated. I dispute both, however, because I know there is not an engine in Birmingham, fairly tested, but what is taking double 2 lb. per horse-power per hour, and the great majority of engines working here are consuming 5, 6, 7, and up to 10 and 12 lb. per horse-power per hour.

Ayrfield, Stanmore-road, Edgbaston, John Swift.
October 23rd.

RICHARD TREVITHICK.

Sir,—Since reading your notice of the Trevithick memorial pamphlet, I have referred to the larger work published by Messrs. Spon, and although as you have said, it is "very badly put together," containing much needless repetition, it well repays perusal to those who can spare the time. No one can read the particulars given therein without being convinced that Trevithick was no ordinary schemer, but a man of original and brilliant genius as an inventor and engineer. When we consider the difficulties he had to contend with in the then backward state of mechanical art, his achievements appear in a still more favourable light. He had no previous store of experience of the accumulated knowledge of years to draw upon as engineers now have; all that he accomplished was the result of his own native talent and indomitable energy. It is not too much to say that as an inventor he ranks far above either Watt or Stephenson, although unfortunately he did not reap the reward of his labours.

The memorial pamphlet does not mention the Wheal Prosper, or Herland mine, pole plunger engines in which a plunger was substituted for a piston, probably on account of the difficulty in then getting a truly bored cylinder. The Wheal Prosper plunger engine was 16in. diameter, 8ft. stroke, working at a high pressure; it had an air pump and condenser. The Herland engine had a plunger 33in. diameter, 10ft. 6in. stroke, using steam on the up stroke only at a pressure of from 120 lb. to 150 lb. on the square inch, and exhausting into the air; she made from twelve to eighteen strokes per minute. This engine was heard working three miles distant, and the steam was said to blow off from the safety valves "like blue fire," but these boilers were so badly made that "the place was in a cloud of steam"—no wonder, considering the state of boiler making at that time; no plates to be had larger that 3ft. by 2ft., and packed with rope yarn between them to make a tight joint. His must have been a daring spirit that ventured on 150 lb. pressure in those days. It would indeed be wrong were the name of such a man allowed to sink into undeserved oblivion, especially when others who never approached him in genius or inventive power have been held up to the admiration of the world as the inventors of the steam engine and the locomotive.

Trevithick sowed that others may reap; his high-pressure engines were copied by hosts of imitators. It would be interesting to know at what date the high-pressure engine was introduced into the United States; high-pressure steamboats were used on the Mississippi early in the present century.

The life of Richard Trevithick, published by Messrs. Spon, would be well worth revising and publishing in a more readable shape, which could be done without in any way impairing its value.

It is to be hoped that the Memorial Committee will find sufficient funds forthcoming to accomplish a laudable object in a manner worthy of British engineers, and of the memory of the gifted man whose name it is to preserve. F. N. T.

London, October 27th.

NOTES ON THE VIENNA ELECTRICAL EXHIBITION.

Sir,—As exhibitions go at the present day, that at Vienna must be considered to have been in many ways excellent, especially in the matter of adhering closely to its professed object. It professed to be an electrical exhibition, and it was so. At most shows we are accustomed to see objects displayed for sale which the exercise of the highest intelligence fails to connect even remotely with the title of the exhibition. How far this was the case at Munich I am unable to say, but at Vienna I do not remember to have seen any stalls for wall papers or meerschaum pipes, nor more than one or two for glass and crockery. I do not attribute this purity to any extreme virtue in the management of the exhibition. On the Continent the utilisation of exhibitions is thoroughly well understood by municipal authorities and others, and local exhibitions are of constant occurrence whose only merit lies in the relief afforded to the local ratepayers, arising from the gate money taken and the invariable lottery. An appearance of completion is, of course, considered important, and stalls are readily assigned to applicants who will cover them with something. But in the matter of electrical exhibitions the management can afford to be virtuous. Electricity, when unhampered by departmental shortsightedness, can be applied to such a multiplicity of uses that there is little danger in the case of a judiciously-conducted show of there being any need of help from the highways and hedges.

The importance of this exhibition at Vienna is said not to have been fully appreciated in England at the time it was opened. The British section was certainly not at any time among the most interesting; it gave one the impression of being too historical. The proper place for old-fashioned telegraph apparatus which is of too much historical interest to be destroyed is a museum, not an exhibition building. The sentiment of antiquity is carried too far when apparatus, which the owners do not take the trouble to keep in decent repair, is introduced as padding, and backed up by flags. It would save the visitor some trouble if it were replaced by a good homogeneous vacuum. English residents in Vienna have expressed to me the general feeling of disappointment in the British section.

Mr. Killingworth Hedges has indeed done something to modify this impression by the exhibition of his very ingenious safety foils, and apparatus connected with them, with which he has done so much to relieve the domestic supply of electricity of the imputation of increasing fire risk with which some people have sought to saddle it. The simplicity of these foils, and the accuracy with which they come into action have caused them to be very largely adopted in the Exhibition building itself.

I do not propose to describe apparatus in detail; that has already been done by others. Nor was there so very much that was new in the Exhibition. The most striking features are the improvement in the workmanship and design of instruments, the principles of which have been well known for some time, and the attention shown to particular developments of apparatus. The celebrated Philadelphia verdict, "Billig aber schlecht"—Cheap but bad—applied to German manufactures, has had an excellent effect in Germany. The attention now paid to details abroad enables foreign manufacturers to beat English productions, even when working with an inferior material. The care bestowed on a particular application is exemplified in the number of instruments exhibited, for giving, recording, or controlling the temperature from a distance. In many manufactures, notably in those of beer and wine, the greatest attention should be paid to temperature in order to avoid loss. The German does not spare the necessary attention, nor are his pains thrown away; for his countrymen, in whatever other virtues they may fail, have certainly the gift of taste in matters of drinking, and it is often a surprise to Englishmen how quickly a German will detect when his beer is below the proper standard of quality. This he owes to his palate not having been vitiated by the poisonous fluids which pass among us and down our throats as malt liquor.

It is not generally known in England how carefully temperature is regulated even in private houses abroad. In some schools it is a rule to close if the temperature rises above a certain point; notwithstanding which hiatus in their education the inhabitants actually sometimes grow up understanding their business in life better than many of the "Red-tape Army" at home.

Thus there were many instruments in the foreign sections at Vienna for giving the temperature at a distance, or for recording it at any particular moment, or for raising an alarm automatically when it rises above or falls below certain points. Some of these are extremely accurate in action, and this subject deserves greater attention than has been paid to it in England, when we consider how useful such instruments would be in our ships and our mines, and also in our hospitals, if in England any two doctors were agreed as to the due degree of temperature to be maintained, and how and when it should be varied. Abroad they seem to have settled such details; it is at home that we are abroad about them.

Another apparatus of which one could see several good forms at Vienna is the optical speed indicator, by which the apparently stationary portion of the image of a revolving disc coloured radially gives the speed at once.

The controlling of systems of clocks by one pendulum through the action of an electrical current has received great attention abroad, and has met with very general application in public places, as at railway stations; and it is wonderful that this use of electricity has received so little encouragement in England. How advantageous it would be if, for instance, the clocks on the underground railway were under the control of the Westminster pendulum; that is to say, if the company consented to refrain from that other electrical application, the sheet of the *Daily Telegraph*, which is so often posted across the clock faces.

There can be no doubt that before long electricity will find a field of work in the actuation of musical instruments. Dr. v. Dvorak, of Agram University, showed at Vienna what may be called the germs of an electrical organ, in his resonance forks.

I cannot go through the numerous other applications of electricity, from warming Samovars to protecting cash-boxes, which were to be seen at Vienna, but there was one extraordinary apparatus mentioned in the catalogue which I was not fortunate enough to discover, though I made anxious inquiries after it—I mean that of an enterprising Frenchman, M. Albert de Balmas, for combatting the *Phylloxera Vastatrix*. Perhaps the patents are not quite perfect yet. B.

London, October 27th.

THE PROBLEM OF FLIGHT.

Sir,—I have not entered into the question of what might be called the philosophy of soaring, for the reason that I mistrust my ability to put the matter into the best form of words, and am very sure that others are better qualified to do this than myself. Relying, however, on the indulgence of the reader for any slips which may be made in this somewhat new field, I will state what seems to me to be the underlying truth of this subject, hoping that the task will be better performed by some more competent hand.

The facts of soaring as exhibited by the birds, as well as the explanatory theory giving significance to those facts, I have elsewhere given, and refer to the letters containing them which have been published in this journal.

Soaring I conceive to be a corollary from the law that fluids acted upon by mechanical forces exert reactive forces in all directions. The flowing river, steam engine, air pump, and hydraulic works are examples of this law of the dynamics of fluids. Given the force of gravity acting through some rightly-constructed mechanical device upon the highly-elastic fluid, atmospheric air, and soaring follows as a matter of course.

I believe that there is no phase of this subject which cannot be referred to this law, though it must be admitted that there are so many seeming contradictions running through the whole matter that the task of removing the difficulties is not an easy one.

As a soaring bird will be found to be an atmospheric engine of the most economical character, it will greatly assist this explanation to take some analogous mechanism of a familiar sort and compare the two, standing the unknown by the side of the known, so that their likeness and differences may be seen at a single view. I will take then an ordinary high-pressure steam engine with an empty boiler, which we will fill with compressed air by means of an air pump. We can then drive the engine with this air instead of steam. We have then the fluid air of the boiler acted on by the mechanical force of the air pump. It reacts in all directions, not only on the shell of the boiler, but on the piston of the pump, which being fastened to secure support, maintains its position, and forces or condenses the air into the boiler. This compressed air, or air acted on by a mechanical force, passes into the cylinder of the engine, against which it reacts in all directions, and forces the piston into action. The pump does work by condensing the air. The condensed air does work by moving the piston. So far there does not appear to be anything hard to understand, and the presumption is that everyone would see this part of the matter in the same way substantially.

Let us now take the soaring bird, and what have we? A surface of certain weight, shape. and inclination. with a current of horizontal air moving against it. The bird is the pump compressing the air. It is more than the pump, it is the piston of the engine. The bird compresses the air by forcing it down an inclined plane. The pump pushes it with a piston. The air of the boiler does not do work by reacting against the piston of the pump, but the air compressed by the bird does do work by reacting against it, and very important work—it sustains the weight of the bird. If the pump were so placed as to be sustained upon the dense air of the boiler, and if the result of such support were valuable, then the two cases would be similar as regards this reaction.

We have, then, in the case of the bird, the weight sustained in air by the reaction of the compressed air, and we still have the dense fluid with which to do work. This, in the case of the engine, reacts in all directions in the cylinder, driving the piston. In the case of the bird it reacts at the rear edge of the wings in all directions, and consequently against the edge, driving the bird upwards and forwards, and the facts conclusively prove that this force is greater than the whole force of the wind carrying the creature to the rear.

If we suppose that the air of the boiler falls to the pressure of the atmosphere in doing work by moving the piston, then the work done by the piston of the cylinder would just equal the work done by the pump, less friction; so that it would take all this reactive force and a little more to drive the pump. In the case of the bird it takes but a trifling part of this reactive force to drive the creature upon the air, and it is buoyed entirely by the original reaction, so that there is a great surplus of force not required by flight which is wasted in the return of the dense air to the tension of the surrounding atmosphere in the rear of the soaring creature. If this force could be put to work, it would plainly do an amount nearly equal to that of sustaining a weight equal to that of the bird. For this work, plus the reaction on the rear edge of the wings, equals the original force of compression, which, as action and reaction is equal, is the same as the weight of the bird. The original force of the pump is the horse-power, or man-power, or steam-power which works it. The original force of the bird is that of gravity, which urges bodies to the centre of the earth at the rate of 16ft. the first second, and so on according to the terms of that law. It is abundant, incessant, and it costs nothing.

The criticism might be made that I have set off the action of gravity of the bird against the power of the pump, and that gravity can only do work by the fall of the body exhibiting it; and that the bird does not fall, but stands, or even rises in a horizontal blast of wind. But I submit that it does fall, and rapidly, during every instant of time. Not relatively to the earth nor of any fixed point, as these have nothing to do with the matter, but in relation to the moving air it does unquestionably fall. The horizontal force is changed to vertical by the inclination of the surface of the wings according to the law of the composition of forces, so that the fall is as complete as it would be if the air were blowing from the surface of the earth directly toward the zenith. There is a portion of force lost in making the change, and this is measured by what is restored to the rear edge of the wings by the reacting atmosphere. Everyone must have noticed the extreme pliability of the tips of the large feathers of a bird's wing. I have repeatedly observed the gannet in the act of soaring at the distance of a foot from my eyes, and the rear ends of the feathers of the wings were curved upwards for at least an inch of their length through the entire wing expanse, a distance of nearly 6ft., and the force required to bend their feathers in this shape would account completely for the impulse holding the creature in the wind.

If I am in error here, criticism is certainly able to point it out; but I am disposed to insist that the soaring bird exhibits no phase which does not obey the law of the action and reaction of elastic fluids as completely as the atmospheric engine of our supposition. Soaring is a condition of *equilibrium mobile*, as a French mathematician would be likely to term it. Say that the adjustments of the surface determining the two reactions are such that it will remain in one place relatively to the earth in a breeze of twenty miles an hour moving horizontally. Now, if the adjustments of the second reaction remain unchanged, while those of the first are changed for a breeze of, say, twenty-one miles, the surface would rise vertically or move away from the wind until a velocity of twenty miles was restored; and the upward flight would then continue at the same rate as long as those conditions remained. If the second reaction adjustments continued unchanged, while those of the first were made for a current of nineteen miles, the surface would fall or move against the air until the twenty-mile rate was restored. If both adjustments were for nineteen miles an hour the surface would move to the rear; if for twenty-one miles it would pass to the front, and so on, for every movement made in every direction.

Equilibrium is at once sought after any change in the adjustments. I have not the most remote idea to what velocity of air current these adjustments may be carried. It seems reasonable to suppose that a limit would be found somewhere, though theoretically equilibrium seems as easily established with one rate of speed as with another. I believe that I have witnessed a frigate bird adjusted to a wind of 200 miles an hour. If any one should dispute this, I would not defend it, for the reason that no accurate measures were used, and I might be in many ways deceived. It would be likely to confuse the objector, however, if he were asked to give a reason for his distrust. I also think an artificial device can be used which will give better results than is possible with any bird. Of course it can be seen that direction of wind relatively to the earth's surface, or whether there be any at all, is indifferent to the soaring device. Its aptitude for sliding down the air is something marvellous, and any relatively zephyr-like breeze of forty or fifty miles an hour is hardly worth counting.

Strictly speaking, a soaring bird is a weight or gravity engine cut loose from all ground supports, and utilising reactions which are lost in earth-fixed machines. There must be given it an initial momentum, after which the inevitable reactions sustain and translate it. It obeys the well-known laws of mechanics as completely through all its phases as do all other familiar machines, and I am unable to discover any necessity for even a different interpretation of those laws to fit the case.

It has been objected that this theory of flight commits me to the statement that a device of proper construction could go on for ever after the initial start was given. I admit that it does, and am disposed to defend that position. But wherein does any machine differ from this—is it not true of a steam engine? As long as the conditions of steam engine running are complied with, the supply of steam kept up and the working parts in order, it would go for ever. So would the soaring device. It would beat the engine by just as much as the force of gravity was more economical than steam. Allow me to add for the benefit of those who may employ the sailing effigy described elsewhere, what I should have mentioned before, that in many conditions of air a paper tube an inch in diameter, parted along the upper rear edge of the surface, is beneficial. It gives a base for the second reaction.

Chicago, Ill., October 14th. I. LANCASTER.

ENGINE DRIVING IN AMERICA.

SIR,—Engine driving heroism has evidently entered on a new phase, as the following will testify:—An American contemporary says: "John Bull, of Galion, Ohio, ought to have his name recorded in an enduring way, for few have ever behaved so nobly as that gallant engine driver of the New York, Pennsylvania, and Ohio Railroad. As he was driving a passenger train last month he found that, through somebody's blunder, a freight train was approaching on the same track, and a collision was inevitable. He could have saved his own life by leaping from the engine; but, dismissing all thought of himself, he resolved to try and save the passengers committed to his care. So he reversed the engine and set the air brakes, and then put on full steam, started the locomotive ahead, broke the coupling attached to the train, and dashed on to receive the shock of the collision. The passengers escaped all injury, while the brave engineer was so badly hurt that he died in a few hours. Such heroism as this should not go unnoticed. The *Cincinnatti Inquirer* says: 'He remained in the car until the engine leaped into the air and was dashed into the ditch, when he attempted to spring to the ground, but had his foot caught between the frames of the engines and tender, striking his head on the ground and causing the fatal injuries. Railroad men say that the act of detaching the engine as he did, not even derailing the baggage car with his engine at the high rate of speed, and all in 150ft., is without parallel in railroading. A purse of 500 dols. was raised by the grateful passengers. The body has been shipped to Galion for burial.'" Why didn't he jump sooner? X.

October 29th.

THE TREATMENT OF SEWAGE.

SIR,—Mr. Howard Kidd, in advocating "quiescence" as a means of obtaining sewage sludge for manurial purposes, has, I venture to think, overlooked one important factor. This is that the chemically valuable constituents of sewage are precisely those which are held in solution and not in suspension, and that, therefore, quiescence does not as he states render the effluent "as pure, if not purer, than the effluent obtained by the use of precipitation;" nor is the resulting sludge of any great value. The Rivers' Pollution Commissioners give the value of the constituents dissolved in 100 tons of town sewage at 15s., and the value of the suspended matters at 2s.; so that from each ton of sewage manure worth one farthing may possibly be obtained by natural deposition. In practice the disposal of sludge is seldom remunerative, and where purification by means of filtration through land is adopted, the sludge obtained by deposition is usually dug into the land to get rid of it.

RODOLPH DE SALIS, Assoc. M. Inst. C.E.

1, Westminster-chambers, Victoria-street,
London, S.W., October 29th.

MACHINE TOOLS.

SIR,—Kindly allow me a little space in your next issue for the following. In your issue of the 26th instant, you give a brief description of a large lathe made by the firm of Messrs. W. Muir and Co., of Manchester, for the British Government Dockyard at Malta, in which this passage appears:—"In the place of the ordinary V strips to the bed and slides of the carriage and compound slide rest, right angled strips have been introduced, which, whilst being stronger than the V strips, bring the pressure to act direct, and not like a wedge as in the V strips."

I fully endorse this opinion, having in my experience in heavy lathes, found it an impossibility to prevent "lift" when V strips are used. The method adopted by the above firm is indisputably an improvement in the right direction, and I have no doubt so far as Manchester is concerned a wise and new departure from the old groove. But it is not altogether original, inasmuch as the well-known firm of Messrs. T. Shanks and Co., of Johnstone, near Glasgow, have constructed their heavy lathes and other machine tools on that sound principle for some years past, with the most satisfactory results, and I think it but fair to them that this should be generally known. W. NOBLE.

83, High-street, Johnstone, near Glasgow, October 29th.

RAILWAY SPEEDS.

SIR,—I think that "M. M." has rather understated the speed of English railways in his letter published in your issue of the 19th inst. Allowing, like him, three minutes for loss of time in stopping and starting, and one minute for each stop where the time is not stated, it appears from the time-table that the Great Northern, Midland, and Great Western, are the fastest lines out of London, all having trains which travel fifty miles per hour for 200 miles: for example:—The 10 a.m. from King's-cross to York, with one stop in 188 miles; the 10 a.m. from St. Pancras to Leeds, with three stops in 204 miles; the 4.45 p.m. from Paddington to Birkenhead, with five stops in 228 miles. This last does the distance to Birmingham in three minutes less time than the fastest North-Western train, although it goes 129½ miles instead of 113, but it only stops once to the other three times. Also having to travel forty miles further to make one extra stop, it only takes twenty-four minutes longer to get to Chester than the 8.25 p.m. Irish mail from Euston. The two fastest trains in the world are the 11.45 and the 3 p.m. from Paddington to Exeter. They average fifty-two miles per hour for the whole 194 miles, and fifty-five miles per hour for seventy-seven miles, doing seventeen and three-quarter miles on one nearly level portion in eighteen minutes. The South-Western get to Exeter in fifteen minutes less time, but then the distance is twenty-three miles less, and there are not such long stops. Their speed for the whole distance is forty-eight miles per hour. RICHD. PARKINSON.

29, Victoria Park-road, London, E.,
October 29th.

SIR,—In THE ENGINEER of the 26th inst., your correspondent, Mr. E. Stretton, complains of "some inaccuracies" in my table of railway speed, "which," he says, "unfortunately render the conclusion at which I have arrived incorrect." He says that the Midland 5.15 a.m. newspaper train is practically a Manchester express, and that the connecting train from Trent to Leeds is only of secondary importance. He also says that there are by this train nine stops between St. Pancras and Leeds—not eight, as stated by me; and that the distance is 197 miles 68 chains, and not 204 miles. Now, I have very often travelled by that particular train, and know it well as far as Sheffield, and I have always arrived there with great punctuality, direct from St. Pancras, and without any change whatever at Trent. If, however, your correspondent will refer to Bradshaw's Railway Guide he will find the time, distance, and stops as follows:—

Miles.			Stops.
	St Pancras	5.15 a.m.	
49¾	Bedford..	6.18 ,,	1st
99	Leicester .. .. .. arr.	7.18 ,,	2nd
	,, ... dep.	7.23 ,,	
119¾	Trent .. .. arr.	7.50 ,,	3rd
	,, ... dep	7.57 ,,	
152¼	Chesterfield..	8.35 ,,	4th
164½	Sheffield .. .. .. arr.	8.51 ,,	5th
	,, ... dep.	8.58 ,,	
170	Masbro	9. 8 ,,	6th
183¼	Cudworth Junction	9.29 ,,	7th
193¼	Normanton . .. .. arr.	9.51 ,,	8th
	,, ... dep.	9.57 ,,	
204	Leeds	10.15 ,,	

There is, however, I perceive, a stop of four minutes at Sheffield—not one minute as I took it—and this will account for my divisor being 1·24 and not 1·22 minute as it should be, and will make the speed of this train 49 miles per hour.

$$204 : 1 :: 250 : 1{\cdot}22$$

$$\frac{60{\cdot}00}{1{\cdot}22} = 49{\cdot}18 \text{ miles per hour.}$$

Your correspondent also states that there is a stop of three minutes at Bedford. That, however, I had no means of ascertaining, as the time-table does not give any "departure" from Bedford. Your correspondent also disputes the time being five hours, but if a train leaves at 5.15 and arrives at 10.15, I think it is only reasonable to assume that the journey occupies five hours.

I may add that the primary object of my letter was to show that the speed on our English railways is still in advance of those on the Continent, and that, I think, I have sufficiently proved.

London, October 30th. M. M.

DESIGNS, SPECIFICATIONS, AND INSPECTION OF IRONWORK.

SIR,—Mr. Pendred has asked me such a number of questions in his reply to my criticisms of his paper, that I must ask you to kindly grant me a little space for reply, but I will be as brief as possible.

In the first place, Mr. Pendred accuses me of discourtesy. I regret very much that he should have considered any part of my letter as discourteous, for nothing was further from my thoughts or intentions, and I wished simply to discuss fairly and honestly the question raised in his paper. He feels hurt that I should have accused him of "cooking" his sketch and objects strongly to the "adjective." As he lays the blame upon you, Mr. Editor, for the incorrectness of his drawings, I suppose, then, that you are responsible for the sketch of the angle iron joint cover; and I now ask if the enclosed sketch is not more like what the result would be if anyone were stupid enough to attempt to put the covers, as Mr. Pendred says, "in the manner which such covers are usually put on."

I maintain that no sensible man would attempt such a thing.

I have nothing further to add to my remarks about bending the angle irons, and am still of opinion that it makes better work in every way than packing, except in small girders. Mr. Pendred does not explain his meaning of "tensile or lateral strain;" a tensile strain describes the nature of the strain, and a lateral strain the direction, so I don't see how they can be coupled by the conjunction or. Mr. Pendred's interpretation of the clause about plates being drilled in their place is certainly literal, but is not what is actually meant and generally accepted. Mr. Pendred's burst of virtuous indignation about my doubting the quality of plates from respectable firms is amusing. Why have inspectors at all? If he is so sure of the quality of the subsequent deliveries of plates, why not trust the makers for the first delivery? I have inspected many hundred tons of plates, and have always found it necessary to inspect each delivery. The makers themselves are no doubt anxious to supply the best materials, but they cannot answer for the action of their servants. Mr. Pendred next makes capital out of what he must know was either a clerical or a printer's error, when I spoke of dirt and cinder being pressed in by the rolls. I may remind Mr. Pendred that it is not necessary to spoil a large plate to obtain test bars, and experienced inspectors never attempt it. I maintain that Mr. Pendred's test of iron by hammering the corner down is perfectly useless, and a report on such a test would be interesting.

Messrs. Cockerill and Co., no doubt, as Mr. Pendred says, know their business, but I prefer to quote the practice of British manufacturers, and I maintain that the practice of first punching and then drilling holes in plates is very expensive, and only adopted in rare instances, and not always by Messrs. Cockerell and Co. Mr. Pendred's illustration of the tilting of the hoop is so similar in all its conditions to the action of a load on the edge of a main girder, that it quite settles the question, and nothing further need be said on the matter. Then Mr. Pendred does not approve of drifting. I quite thought he said it was absurd to forbid it. For drawing plates together in position a long taper-ended spanner should be sufficient.

I come now to the last and very important point of heating rivets. In the first place I may mention that I am well aware that the holes have to be much larger than the rivets, but I have always been accustomed to seeing the clearance vary with the diameter of the rivet, and not the universal $\frac{1}{16}$ mentioned by Mr. Pendred. I mentioned in my letter, as a possible objection to the heating of the rivet the whole length, that if the plates were not bolted together, the powerful action of an hydraulic rivetter might squeeze the metal of the rivets between the plates, and so prevent a tight joint from being made, and I made a sketch illustrating my meaning. The idea was immediately ridiculed by Mr. Pendred, and also by Mr. Dornton, who propounded a pretty theory about a skin forming on the rivet by contact with the plates. Facts, however, are stubborn things, and since writing, I have been able to prove practically the truth of what I said, and I have to-day forwarded to you the result of the experiment, for the inspection of Mr. Pendred, Mr. Dornton, or anybody who takes an interest in the matter. I bolted four plates together with a thin packing between, and having a ¾ rivet hole in the centre. The rivet was then heated all over and rivetted with a Tweddell's hydraulic rivetter. When cold, I cut the plates in two, through the centre of the rivet, and drew out the plates, when I found a distinct collar on the rivet, which had been pressed between the plate—just as I had anticipated. The section of the rivet shows the wonderful closing power of the hydraulic rivetter, and the evident superiority over any hand rivetting. But Mr. Pendred must not suppose that this is my first experience of hydraulic rivetters. I used one of the first that was made, and know their value full well. JOHN J. WEBSTER.

Stephenson-chambers, Liverpool,
October 30th.

CAST IRON *v.* WROUGHT IRON SHAFTS.

SIR,—Your correspondent "Ironfounder," in last week's issue, judging from the tone of his statements, has been rather unfortunate in his experience of wrought iron shafts, as also in his knowledge of their manufacture. The practice of the best forges is not to mix scrap iron heterogeneously together in the manner indicated by "Ironfounder," though it may be the case with some. By requiring every piece to pass through a man's hand for examination before going into the pile, its nature to a practised eye can be detected, and some classification of the scrap be made prior to its use. This, with efficient supervision by some one directly interested in the results, avoids the danger which "Ironfounder" would have your readers believe attends the first step in the manufacture of a wrought iron shaft from scrap. Bad practice must not be allowed to condemn every maker; but those who take the extra precaution must, of course, be paid the extra cost it entails by those who are wishful to secure good forgings.

I agree with "Ironfounder" when he says that iron can be overworked in shaft manufacture, and that short of the "fifty or a hundred heatings" which he states the iron in some shafts is subjected to. Herein lies much of the skill of one forgeman over another, in that after he gets his iron prepared as beforenamed, he will finish his forging with that amount of heating and hammering as will bring out the maximum strength of the iron he is working, and only use such as secures this. In all ordinary forgings, straight shafts especially, this is easily attained by good workmen with appliances proportionate with the various sizes and descriptions of work, and what is essentially necessary, sufficiently large and heavy for correspondingly heavy forgings. There is more difficulty I grant with large throw crank shafts, but these are not referred to by "Ironfounder," who after all would hardly have the boldness to advocate these for the mail service, being of cast iron. Building a throw crank up in the solid with a shaft of 20in. diameter or upwards does require more than the ordinary amount of repeated heatings, &c., and leads to some deterioration in the fibrous quality of the iron, but we need not necessarily give up wrought iron on this account. Our substitute is to build up shafts of this size in separate shaft pieces, webs and pins, by the various methods now in vogue, patent and otherwise. "Ironfounder" seems to overlook the fact that there are other than torsional strains to which shafts are subject in actual work. What about the ever recurring and alternate bending strains set up through unequal bearings and other causes, especially in screw steamers? Even steel has lost some of its boasted superiority over wrought iron—as I will presently show in one case only—under such adverse circumstances. But even with regard to the torsional tests quoted, will "Ironfounder" for the benefit of your readers be good enough to state his authority for the same? Should there not be a difference of 50 per cent. in favour of wrought iron, according to other good authorities? and which he has omitted giving.

To revert to cast iron because of the faulty manufacture of wrought shafts by those who, ground down to low unremunerative prices, go in for what Charles Kingsley styled in relation to another trade, "the cheap and nasty," is to set back the clock of the world by fifty years. If there is to be any change let it be in the direction of reliable steel or ingot iron; but just as there are the various gradations in quality of cast iron and wrought iron, so there are in steel. As exhibiting this, and bearing in mind the bending strains before alluded to, I give you the following:—A large ventilating fan shaft, 16in. diameter and 25ft. between bearings, repeatedly broke, the two last Bessemer steel ones only lasting a few months each—under eighteen months for the two. The owners applied to my firm for a wrought iron one, and this we made and finished to precisely the same dimensions as the previous steel ones. It has now been running three and a-quarter years under the same conditions, and is apparently no worse, though from the very nature of the strains some change must have taken place in the molecules of the iron, and if it broke, would without doubt show some of that crystalline or granular appearance which "Ironfounder" thinks is attributable to the mode of manufacture. I would not claim superiority for wrought iron over mild open-hearth steel, *well wrought*, but the reverse. Still I give the above to show that wrought iron shafts are not yet played out.

Ince Forge, Wigan, October 26th. SAMUEL MELLING.

ELECTRICAL CONTACTS.

SIR,—Will you permit me to announce in your columns one of the results of some electrical experiments on which I have been engaged in the Cavendish laboratory during the past summer? After endeavouring to measure the electrical resistance of imperfect metallic contacts under varying pressures with only indifferent success, I determined to multiply the number of contacts by using a chain with a pan attached so that different weights could be suspended by it. In this way I was able to vary at will the pressure at the contacts between the adjoining links. The results obtained with a small brass chain showed that the resistance of the contacts varied inversely as the weight in the pan or the tension of the chain. I afterwards tried stronger chains of different makes and metals, and obtained a remarkable confirmation of the same law through wider ranges. One curious observation was that when an additional weight was placed in the pan the resistance of the chain did not decrease immediately, but, on the contrary, increased suddenly and then decreased gradually for a minute or two until the permanent value was attained. This suggests that a sudden increase of pressure in a microphone may in some cases increase the resistance during the short time it acts.

Other work prevents my collecting all the results and following out the conclusions for the present, but I hope to do so shortly, as I believe they may help to illustrate some of the properties of metals. I should say that in calculating the resistance of the contacts I allow for the resistance of the material of the chain, and take into consideration its weight; but these corrections in several of the experiments are of little importance.

University College, Nottingham, JOHN RYAN.
October 30th.

THE DEFINITION OF FORCE.

SIR,—As Mr. Eddy appears to be familiar with the letters I have written on the laws of motion, and kindly published by you in THE ENGINEER, I think it will be unnecessary to do more than refer him to those letters for further information on the cause of motion.

If Mr. Eddy will hold a plate in his hand under a tap from which water issues with moderate force, or if he will endeavour to keep an oar blade in the water while a boat is forging ahead, he will learn that pressure may be caused by motion, a point on which he seems to have confused notions. If we assume with Le Sage that gravity is caused by a rain of ether atoms on the earth, it will be seen that the pressure of a weight on the earth, or of an engine on a railway bridge, and so on, may be due to motion. Φ. Π.

London, October 30th.

CATECHU AS A DISINCRUSTANT.

SIR,—The Disincrustant Marseillais Company, of Knowsley Works, Cheetham, Manchester, for whom I act as solicitor, have drawn my attention to an article in your issue of the 26th inst., page 327, entitled "The Use of Catechu in the Removal and Prevention of Incrustation in Boilers." The right to prepare and sell the catechu referred to is the subject matter of letters patent granted in the United Kingdom and several other of the European nations, which are now existing, and is duly vested in the company, the patent having been granted in the United Kingdom in 1874. A perusal of the article may lead your readers to conclude that the right to use and sell the catechu is open to any one who chooses to do so, which is not the case, as the right is still protected by the letters patent, and in order that they may not fall into error on this point, perhaps you will kindly give this a place in your next issue. W. R. MINOR.

26, Brown-street, Manchester,
October 30th.

COMPOUND ENGINE DIAGRAMS.

SIR,—In my letter on the above subject which you published last week, a part, I fear, will be quite unintelligible owing to your omission of some proportion brevity signs which would make the part read: "The authors usually instruct us to make the length of the low-pressure *is to* the length of the high-pressure diagram *as* the area of the large *is to* that of the small cylinder."

JOHN WHITEHEAD.

9, Glasgow-street, Hillhead, Glasgow, October 29th.

[Our correspondent would have had no reason to complain if he had written the signs to which he refers legibly.—ED. E.]

THE FERRANTI DYNAMO ELECTRIC MACHINE.

MESSRS. FERRANTI, THOMPSON, AND INCE, LONDON, ENGINEERS.

(*For description see page 341.*)

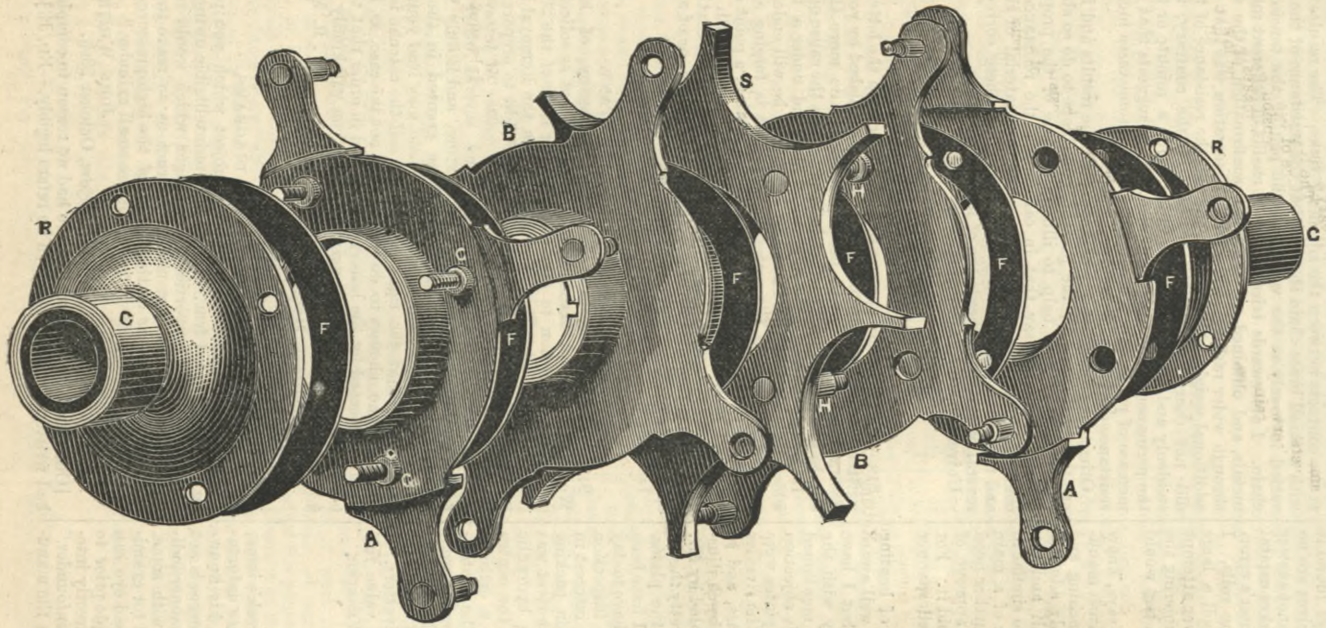


Fig. 22.—EXPANDED BOSS.

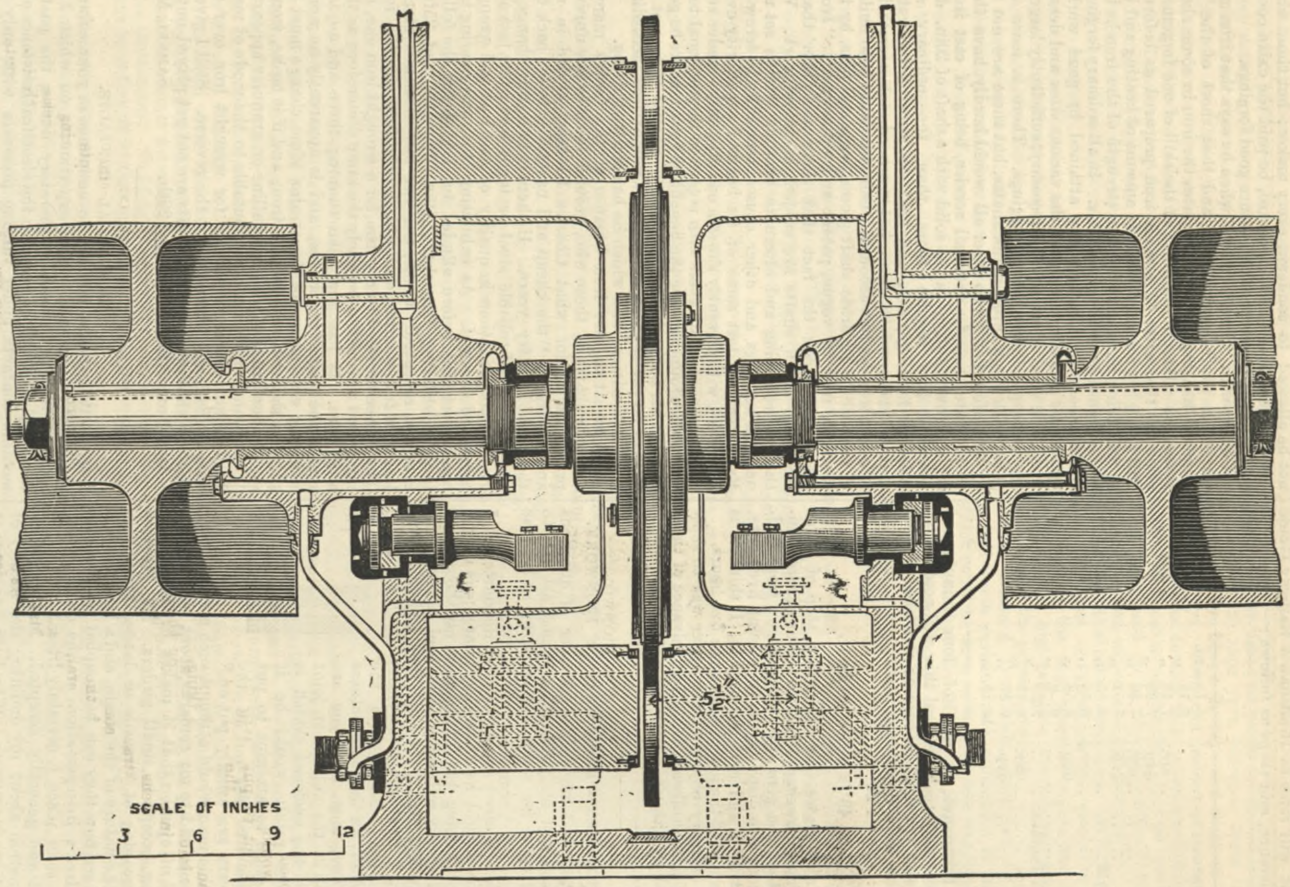


Fig. 16.—LONGITUDINAL SECTION.

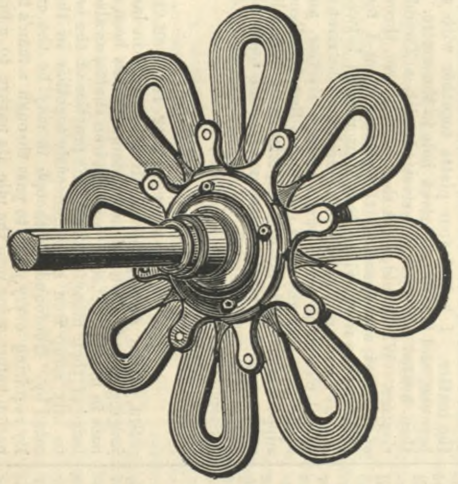


Fig. 21.—ARMATURE.

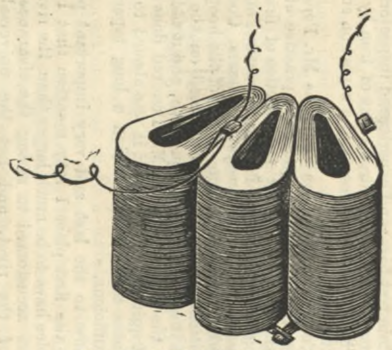


Fig. 17—FERRANTI COILS.

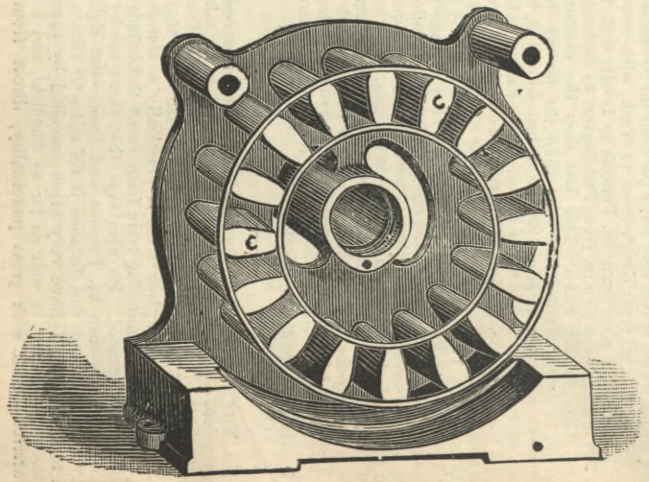


Fig. 15.—VIEW SHOWING MAGNET CORES.

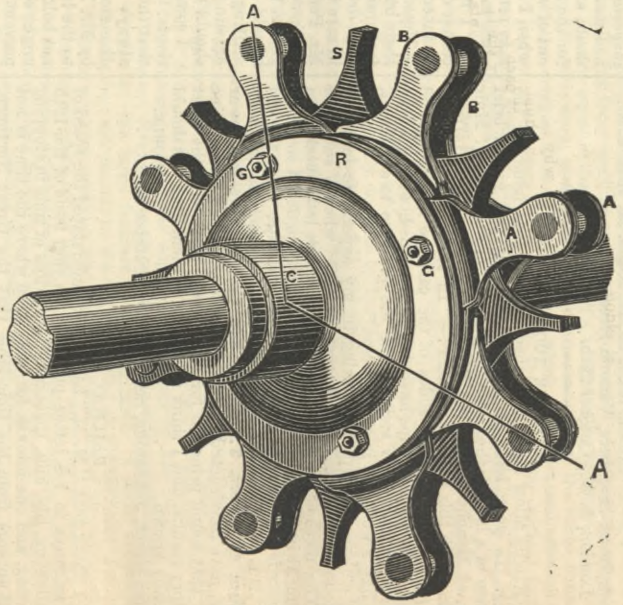


Fig. 19.—ARMATURE BOSS.

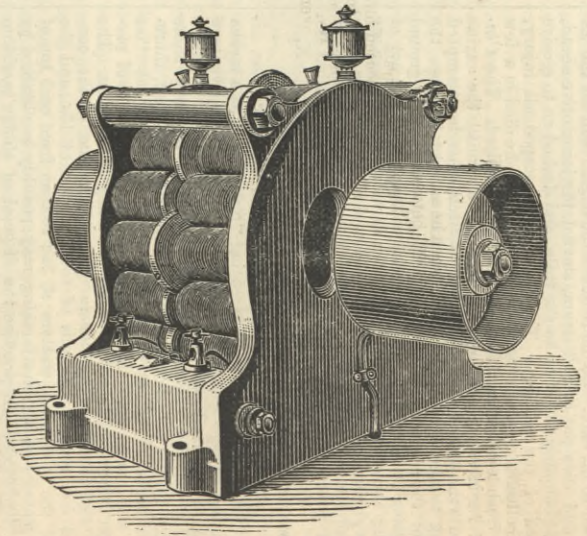


Fig. 14.—FERRANTI DYNAMO.

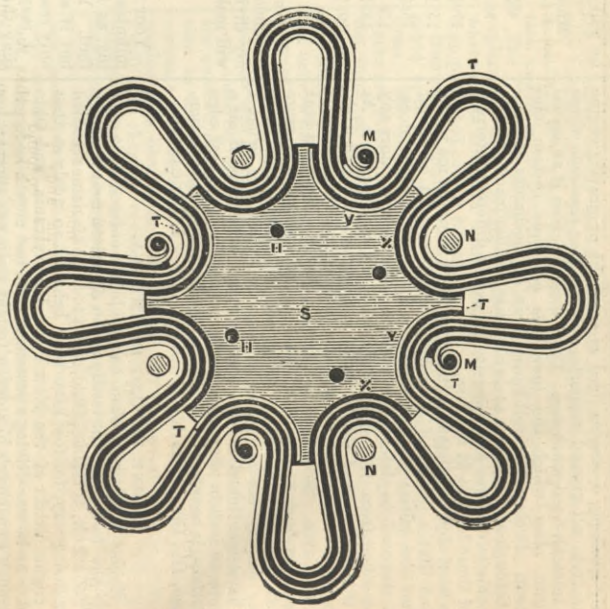


Fig. 18.– ARMATURE WINDING.

THE FERRANTI DYNAMO ELECTRIC MACHINE.

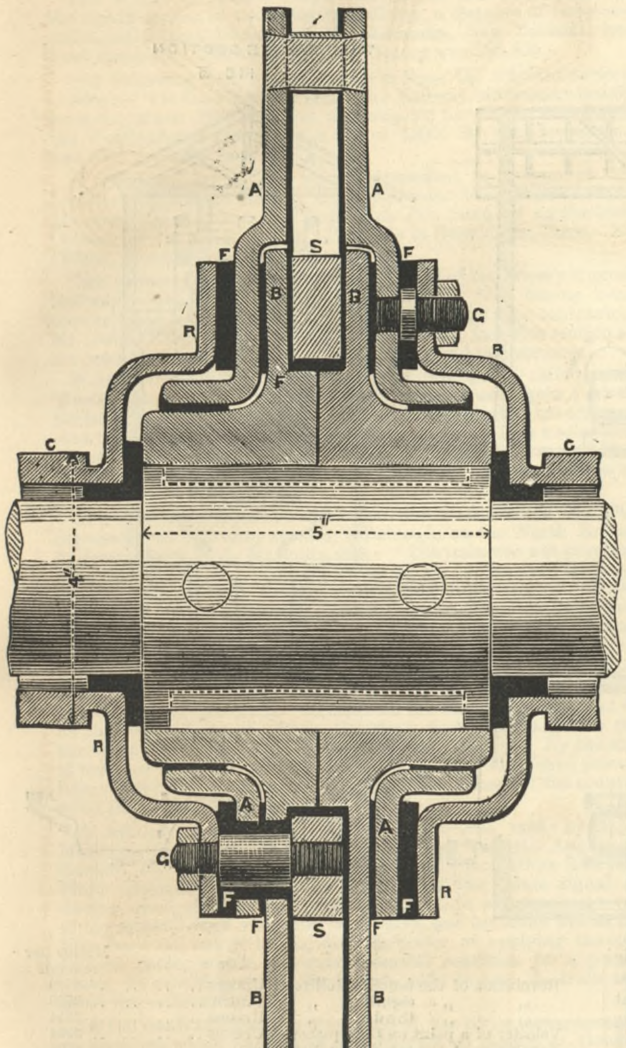
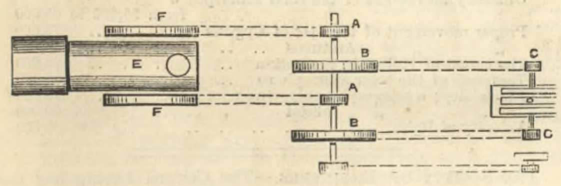


Fig. 20.—ARMATURE BOSS.

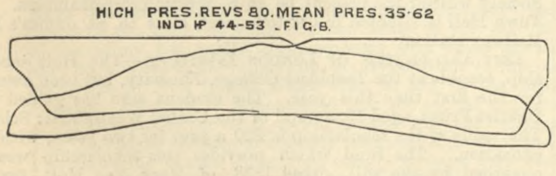
On the 17th ult. Messrs. Ferranti, Thompson, and Ince carried out a series of tests of a thousand-light Ferranti generator, about to be fixed in the First Avenue Hotel, in the presence of a number of electricians and electrical engineers, at whose disposal the arrangements for the tests were placed, with a view of showing the efficiency of this generator. Arrangements were made for lighting 960 Swan lamps, almost all of which were placed in one large group, only forty being placed outside the group. As, however, there was some mechanical difficulty in transmitting the power necessary for this number of lamps, 120 of the lamps were cut out of the circuit, leaving 840 in use. The engine, shafting, and dynamo-electric machine were placed as shown in the annexed sketch plan, Fig. A.

FIG. A

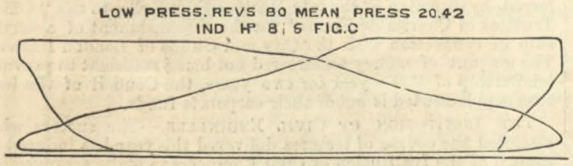


The engine E is a Fowler's semi-portable compound, with cylinders 13in. and 23in. diameter, and a stroke of 24in. The machine was set to run at 1400 revolutions per minute. The engine fly-wheels F are 9ft. in diameter, the pulleys A 2ft. 7·5in., the large pulleys B 7ft. 6in. diameter, and the generator pulleys 1ft. 3in. The main belts F A are 12in. in width, and the second belts B C 10in. width. The exciter used was a Siemens' D 2 machine, giving a current of 20 ampères. During the tests numbers of diagrams were taken. Of the former the annexed are examples.

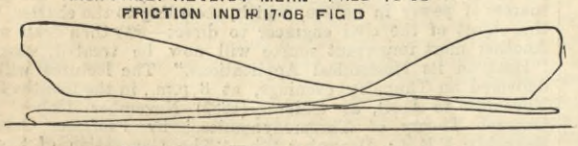
HIGH PRES. REVS 80. MEAN PRES. 35·62 IND HP 44·53. FIG. B.



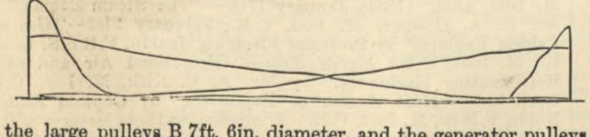
LOW PRESS. REVS 80 MEAN PRESS 20.42 IND HP 81.5 FIG. C



HIGH PRES. REVS. 84 MEAN PRES 13·65 FRICTION IND HP 17·06 FIG D



LOW PRES REVS. 84 MEAN PRES. 5.0 FRICTION IND HP 20·0. FIG. E



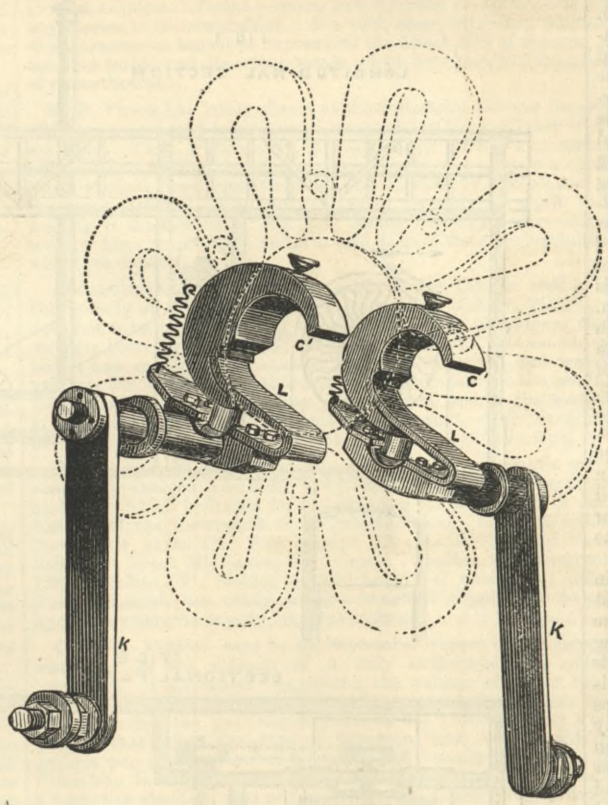
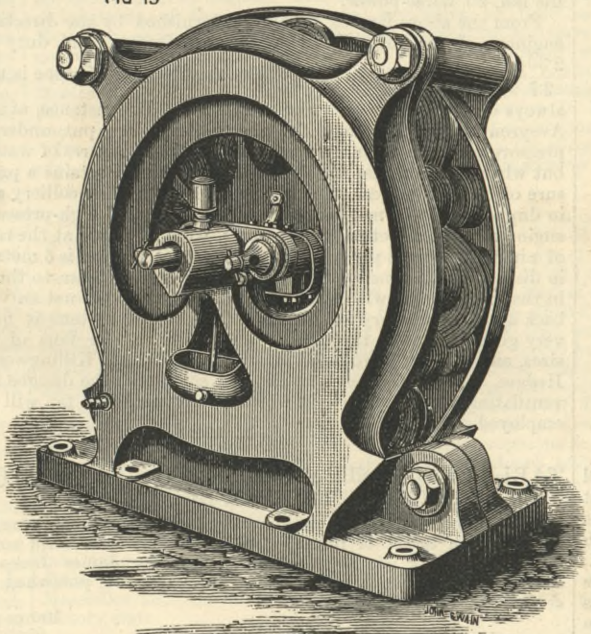


Fig. 23.—COLLECTORS.

From the diagrams, Figs. B and C, the gross indicated horse-power is found to be 126·13 horse-power, and from the friction diagrams, Figs. D and E, the power taken to work the engine and the shafting carrying the large pulleys B is found to be no less than 37·06 indicated horse-power, the net horse-power used in driving the generator and its belts being 88·07. These two pairs of friction diagrams were, however, taken when the engine was regulated by hand and running at 84 revolutions per minute, as the governors will not hold the engine at anything like normal speed when doing about one-fourth work. To allow for this difference in the speed, and for the excess of power used when running at 84 revolutions as compared with that at 80, it may be taken that the indication should be reduced in proportion to the difference in the squares of the relative velocities, which will give us a reciprocal of 0·914, reducing the indicated horse-power of the friction diagrams to 33·87. This quantity taken from the gross horse-power indicated gives us 92·26 indicated

FIG 13



500-LIGHT SHIP MACHINE.

horse-power transmitted to the generator and its two large belts. Assuming the large link leather belts B C to absorb five horse-power, then the net horse-power absorbed by the machine was 87·26.

It must, however, be assumed that the consumption of a large quantity of power is inseparable from the machinery employed in driving a dynamo-electric machine, and that as far as its results in current are concerned, a machine must be debited with the cost of the power used in this way. The percentage of indicated power given to the dynamo was, however, but 73 per cent. of the gross indicated power, which, it must be remarked, was very low. A loss of 27 per cent. is to begin with high; and this will be greater when the whole load is on the engine. Under better conditions, therefore, there is little doubt that the figures would be more favourable than those which follow. The large pulleys B are, however, uncovered. They are fitted with a large number of double spokes, and without doubt take up a good deal of the 33·87-horse power above indicated. For the purpose of comparison, it may be assumed that the engine itself, of the 33·87 indicated frictional horse-power took about 16, and the belts 10, leaving 7·87-horse power as consumed by the large pulleys B and the shafting, of which not more than about 6-horse power can be assigned to the big pulleys acting as fans. If the machine had been one of several driven by one large engine, the power absorbed per machine for shafting and straps would probably not have been so high; but inasmuch as a machine must be driven by some motor and transmitters, it must be debited with the losses attending this. We must therefore charge the 1000-light machine, supplying 840 lamps, with 126·13 — (6 + 5) and we have 115·13, or say 115 indicated horse-power as necessary to work the machine on the assumption that one set of straps can be dispensed with and the air friction of the large pulleys can be avoided. The net horse-power put into the machine remains, however, 92·26 indicated. Per lamp, therefore, we have on the one hand 840 ÷ 92·26 = 9·13 as the number of lamps per indicated horse-power in the generator, and 840 ÷ 115 = 7·217 per gross indicated horse-power consumed. The number of lamps per gross horse-power are not usually given as thus stated; but if they were, there is no doubt that these results would compare well. The conditions, moreover, as far as lamp connections are concerned, were not as favourable as they would generally be in practice, as owing to the temporary nature of the lamp attachments, the resistance in the leads was high, and about six times as much current was passed through the branch circuit wires as would, under ordinary working, be considered proper and safe. The following electrical measurements may here be given:—

The total resistance of lamps and leads as tested cold was	·343 ohms.
Total resistance of helix, collectors, and oil on collectors, as tested cold	·005 „
Resistance of one lamp, as tested cold..	292· „
„ field magnets „	7·57 „
„ exciter „	2·75 „
„ lamp, as tested hot	150·8 „
Current for lamp to give 20-candle power	·63 ampères.
Electro-motive force of lamp	95 volts.
Total main current	630 ampères.
Exciting current	20 „
Candle-power of lamps	20 candles.

From the above data we have—

The total hot resistance of the lamps alone.. ..	·1508 ohms.
The total resistance of the leads cold, ·343 – ·292 =	·051 „
The external resistance is ·051 + ·1508 = ...	·2018 „

After the tests the resistance of the lead was again taken and found to have fallen very low indeed, or to about 1 per cent. of the resistance of the lamps in the main circuit, while the resistance of the leads in the lamps in the test circuit was 11 per cent. of the resistance of the lamps; these being up to power the lamps in the main circuit were probably giving about 23 candles. The contacts, which were bad at first, soon became better after the passage of an alternating current.

When the lamps are working this resistance is probably higher, but we cannot tell how high, as there is no means of measuring it at present. The internal resistance is ·005, which would remain almost constant, for as the resistance of the helix rises on account of heating, the resistance due to the oil on the collectors would fall, the rotation giving them a better bearing on their rings; thus we have the ratio of internal to external resistance as 1 to 40·36. The electro-motive force at the terminals is ·2018 × 630 = 127·134 volts.

On this page and on pages 344 and 340 we illustrate two forms of the generator. Figs. 1 to 13 illustrate a new 500-light machine specially designed for ship lighting, and the remaining figures illustrate the 1000-light machine, to which the preceding figures relate, and of which we may now give a description. The base plate of this machine is 39·5in. by 16in., the pulleys projecting over the base plate by about 14in. on each side. The total breadth, therefore, is 44in., that is 2 by 14 by 16. The height of the machine is 34in. Roughly speaking, the machine may be said to be constructed of two similar halves, between which the armature revolves. The complete machine is shown in Fig. 14. The shaft is of steel, 2·25in. diameter, and 42in. in length, with bearings of phosphor bronze, the bearings being 9·75in. long. The pulleys are 15in. diameter and 12in. face. Fig. 15 shows one half of the cast iron frame of the machine. The ends of the magnets C C are faced up, and the holes for shaft and bolts bored out. Two rings encircle the ring of magnet cores, as shown in Fig. 15 and in section at Fig. 16. These latter are of brass, and fastened by screws to each core, the latter being cut away slightly to fit the brass ring. The use of the brass ring is to keep the magnet cores in position. A piece of vulcanised fibre sheet with holes is cut to allow the fibre to pass over the cores, and the shaft to pass through. This forms an insulation between the coils and sides. Before use it is well varnished with shellac and baked. This process has been found to get rid of various difficulties which others have met with in the use of the fibre. The coils for the cores are wound separately in the lathe. A movable core piece slightly taper is taken, and flanged with removable flange pieces at each end. In the flange is cut a small groove, the use of which will be seen directly. A short connecting piece of tin-covered copper wire is soldered to the wire to be used in winding the coil, and laid in the flange groove, which it fits exactly. Before the winding is commenced, a thin sheet of vulcanised fibre is put upon the core. The winding then goes on, each layer being shellaced, and the complete coil has also a coat of shellac; the other end of the coil has a connecting piece soldered on, and the whole coil is slipped off the core then and put upon the cores of the machine. The connections are made so that all the magnet coils are in series, and that alternate poles are N and S. The total resistance of the field magnets of the machine under notice is 7·57 ohms. When the two halves of the machine are brought into position opposite poles are opposite in sign, that is, a north pole is opposite a south pole, and so on. In this machine there are 32 such coils, weighing altogether 6 cwt. 3 qr. 20 lb. They are wound with wire 3·5 mm. diameter, or about No. 10 B.W.G. Each coil has seven layers of wire, and each layer forty-eight convolutions. Fig. 17 shows three coils. Fig. 18 is an illustration of the armature to show the type-form, and assist partly to make them the description of the building up of the armature. The black lines are to represent the insulative-vulcanised fibre, the white lines represent the copper strips, the shaded portion represents the star-shaped piece of brass which forms the centre of body and should have a hole through the centre. The middle convolution on the right side of the figure shows the beginning T of one strip and M the end of a strip. Tracing the white line from T to T T T, it will be found to pass from the inside to the No. 2 strip; at the second bend from the starting point, and after another similar interval it becomes No. 3 strip, and finally the outside strip being connected to the rivet M. In this figure the phosphor bronze rivets M M are those connected to the collecting ring, while those indicated by N N are insulated. H H indicate the bolt holes—see G, Figs. 19 and 20. X X indicates insulation, which again should be indicated in the bend where are the insulated rivets N N. The armature in Fig. 21 is shown separately; it is 30in. in diameter. Fig. 20 is a section through the whole boss. The top rivet in this corresponds to M in Fig. 18, while the lower rivet corresponds to N in Fig. 18. The boss part A is insulated, as shown at F F by vulcanised fibre, and is connected by means of the rivet M to the ferrule at the end of the copper strip. A is, however, connected by the bolt G to the collector ring R. The collector ring is insulated from the shaft by two rings of papier maché, held in position by screws encircling the shaft—see Figs. 5 and 9. Looking at the lower parts, the other end of the strip is connected to the star piece

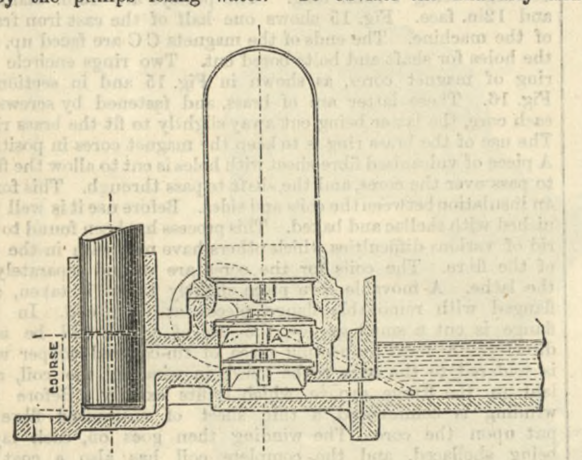
S—Fig. 20—and through the bolt G, which screws into S, to the other collector ring. The inner boss B B slips on to a feather key for ease in construction. Fig. 22 shows various important parts of the boss in an expanded form. S is the star piece upon which the armature is wound; B B the inner boss with rivets N insulated; A A the outer boss with rivet M connected, as explained above; C C, R R, the collector rings and connections; the whole held together by rivets A and B and bolts G. Here, as elsewhere, F F shows the vulcanised fibre for insulation. At the end of the shaft is a screw pressing insulation against C, and keeping the whole in position. The two upper bolts holding the machine together are 1·5in. diameter, the two lower being 1·75in. diameter. The total weight of the machine is 32 cwt. The path of the current generated from the beginning of a copper strip to the collector ring may thus be traced. The armature of the 1000-light machine is made by three copper strips, two of which are ·75in. wide and 1·5 mm. thick, while the third is 1·75in. thick, the total depth of copper thus being 4·75 mm. Each slip is separated by ·02in. strips of fibre. The length of each strip is 13ft. 10in., and as each strip makes ten turns there are altogether thirty layers. The total weight of the armature is 3 qr. 12 lb., of which the star piece weighs 11 lb. The resistance is given at ·005 ohm. Fig. 23 shows the collectors. The diameter of the collecting rings is 4in. and width 2in. They are 2in. wide, and fastened by universal joints, and are provided with a spring to allow of automatic adjustment. In order to ensure good conduction the collectors are connected by strips of copper 38 mm. by 25 mm., forming altogether strips 2ft. by ⅜in. to a copper bar 1·5in. diameter, and hence to strip V, 2·5in. by ·5in. and terminals.

In the new 500-light machine the armature is 36in. in diameter, and is the same size as in the ordinary 2500-light Ferranti machine. It is, however, intended to run the machine we illustrate at about 300 revolutions per minute, thus making it a slow speed machine. The armature helix has sixteen coils or loops, as shown at Figs. 10 and 11, the construction of this part being clear from the description already given. The loops are of copper, 2 mm. in thickness and 1in. wide, separated by thin asbestos paint covered paper. Each loop has eighteen layers, and the strip is 470ft. in length. The bobbins are shorter than in the 1000-light machine, and weigh 3 cwt. 3 qr. 12 lb., and are wound with 3·5 mm. wire—No. 10—and have four layers and twenty-six convolutions.

Fig. 3 shows the insulated connection between the two bobbin castings. Fig. 6 is an enlarged view of the connecting piece between the terminal and the collector holder seen at Fig. 5, Figs. 7 and 8 being details of the collector and terminals. Fig. 9 is a section of part of the machine, and shows the completeness of the design in devices for oiling and keeping oil away from the armature and bobbins. Figs. 1, 2, show parts of the side frames carrying the bearings. From our engravings it will be seen that it is a most simple machine. The armature is very strong, and the manufacturers have some fine special tools for its construction.

AUTOMATIC AIR RELIEF FOR PUMPS.

The accompanying engraving shows a very simple and ingenious device for expelling the air from the valve chamber and clearance space of a pump barrel, described before the *Société des Ingenieurs Civiles* be M. Auguste Normand. In ordinary pumps the pet cock serves this purpose; but when the capacity of the pump is much larger than the quantity of water usually passed through it, as with surface condensing engines, the collected air is not so easily expelled, and much trouble is sometimes caused by the pumps losing water. To obviate the difficulty and



make pet cocks unnecessary, M. Normand attaches a small pipe to the pump, so as to communicate between the highest place where air accumulates and the tank from which water is pumped. When the plunger descends, the air is driven through the pipe, which is very small in diameter, only from ⅛in. to $\frac{3}{16}$in., and when the plunger rises a small quantity of water enters the pipe and helps to prime the pump. The position of the little pipe is shown by the dotted lines. It will be seen that the pipe must be very small, so that the volume of its capacity and that of the space between the valve shall bear a small proportion to the volume of the pump plunger, and the pipe must be so small that no material reduction of the quantity of water thrown by the pump shall take place.

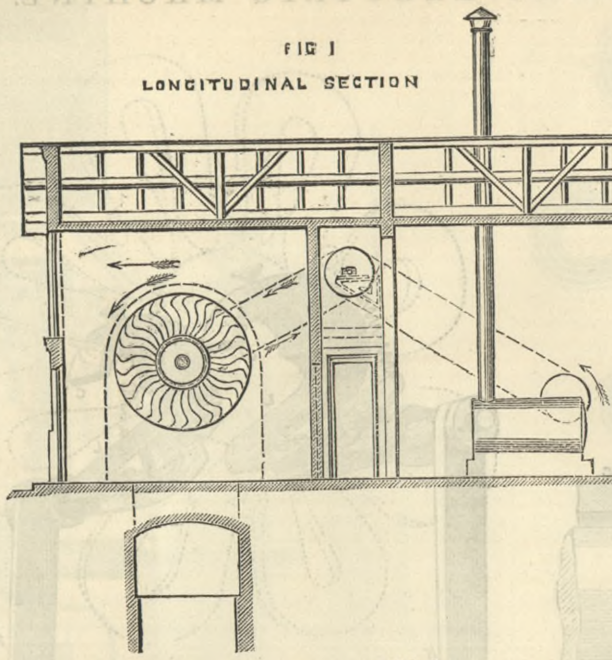
FARCOT'S FANS AT THE CHAMPAGNAC COLLIERY.

The Farcot fan differs from those more generally known in this country chiefly in the form of the blades. These are not straight or bent in a regular curve, in such manner as the openings and exit of the air or gases are of the same sectional area, but are of the arrangement and form shown in elevation at Fig. 1. The admission of the air by the central orifice is effected at about an angle of 45 deg., so that the blades will not suddenly strike the air on entering, but simply divide it. After this curve of 45 deg., the blade is bent back in the opposite direction, so as to coincide with the radius of the fan, the outer ends being suddenly bent again in the opposite direction, so as to cause the escape of the air to take place only in the direction opposite to that of the rotation of the fan. The air is, as a rule, taken in by the openings on each side of the fan, so as to prevent any side thrust; the leakage between the top of the intake and the orifice of the fan is prevented in a simple and effective manner by providing grooves of sheet iron in each of the faces which interlock without friction. This plan of baffling the air, which may be compared to the turned grooves in a piston, is found to work very well. The system of construction adopted by M. Farcot enables a very much lighter and consequently cheaper fan to be employed than that of Guibal or Schiele. The casing is made of wrought iron plates, and the fan blades of steel, the entire weight of an 8ft. fan and shaft being under a ton. Figs. 1 and 2 show the general arrangement of the ventilating plant at the Champagnac Colliery, Cantal, France, the fan having pulleys on each end of its shaft, which are driven by means of a countershaft actuated by a portable engine. Fig. 4 shows a sketch plan of the mine, the fans placed over the shaft at C, the depth of which is about 197ft. The orifices of the air intakes are at about the same level, the distance from A to H being 756ft., B to H 492ft., and H to D 1213ft. The diameter of the fan is 2 mm. 50, or 8·2ft.; number of revolutions per minute, 170; horse-power used by the fan (French), 2 7; depression in the water gauge at bottom of shaft C, 0·7in. = 0 m. 18; velocity of the air at D, 13ft.; volume of air at D per minute, 20,300 cub. feet = 9·6 m. 3. Duty, useful work, 9·6 m 3 × ·018 = 172·8 kilogrammetres = 2·304 French horse-power. Power taken by the fan, 2·7 horse-power.

From the above figures, which are furnished by the directing engineer of the mine from actual experiments, the duty is $\frac{2·304}{2·7}$ H.P. = 85 per cent. Colliery ventilation in France is not always carried out by means of exhaustion. For instance, at the Aveyron Colliery, Decazeville, the workings are put under a pressure which in ordinary work is about 30 millimetres of water, but when the galleries are obstructed sometimes attains a pressure of 80 millimetres. The engine and fan in this colliery are in duplicate, the former being a vertical compound high-pressure engine coupled direct to the fan shaft, which it drives at the rate of ninety-five turns per minute. The disc of the fan is 6 metres in diameter, and consists of a number of blades similar to those in the exhaust fan, with the exception that they are not curved back at the periphery of the fan. The Farcot system is now very generally used throughout the Continent for fans of all sizes, and is being introduced into England by Mr. Killingworth Hedges, of Westminster, who has just completed the designs for ventilating a large colliery, in which a Farcot exhaust fan will be employed.

FARCOT FANS AT CHAMPAGNAC COLLIERY.

FIG 1
LONGITUDINAL SECTION



TRANSVERSE SECTION
FIG 3

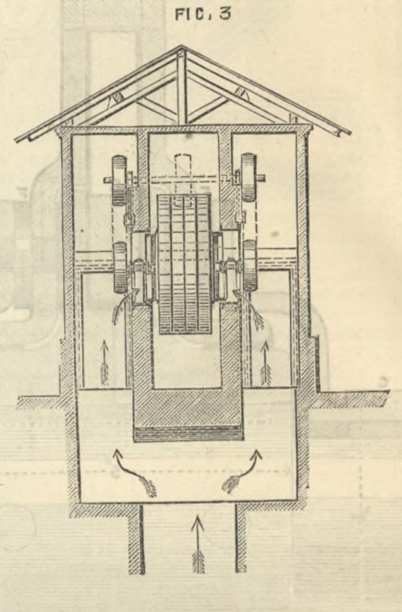


FIG 2
SECTIONAL PLAN

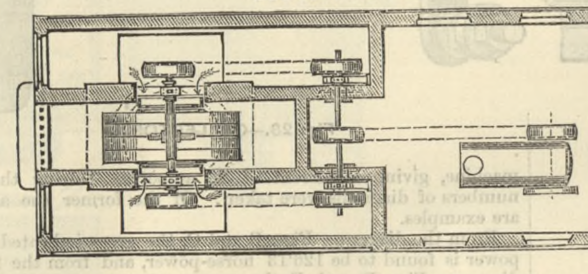


FIG 4

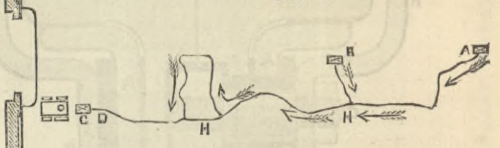


TABLE OF DIFFERENT VELOCITIES EXPRESSED IN METRES PER SECOND.

The following table, if cut out and put into the reader's most-used book of tables or formulæ, will be found to contain some useful data. It has been drawn up by Mr. James Jackson, librarian to the Paris Geographical Society, and published in *Nature*:—

	Metres per second.
A man walking 4 kilometres an hour	1·11
,, ,, 5 ,, ,,	1·40
The comet of Halley in aphelion	3·25
A ship going 9 knots an hour (9 × 1852 metres)	4·63
Ordinary wind	from 5 to 6
A ship going 12 knots an hour (12 × 1852 metres)	6·17
A wave 30 metres in magnitude with a depth of 300 metres	6·81
A ship going 17 knots an hour (17 × 1852 metres)	8·75
A fresh breeze	10
A torpedo boat going at 21 knots an hour (21 × 1852 metres)	10·80
A race-horse trotting an English mile in 2 min. 14 sec.	12
,, ,, galloping 900 metres a minute	15
An express train running 60 kilometres an hour	16·67
Flight of a falcon, or a carrier pigeon	18
A wave in a tempest at sea	21·85
An express train running 60 English miles an hour (60 × 1609 metres)	26·81
A tempest	from 25 to 30
The transmission of sensation by human nerves	33
A hurricane	40
Flight of one of the swiftest birds	88·90
Velocity of a point on the equator of Mercury	146·87
Propagation of the tide caused by the earthquake of Arica on August 13th, 1868 (Arica to Honolulu), according to Hochstetter	227·38
Velocity of a point on the equator of Mars	244
,, sound in the air (+ 10° C.)	337·20
,, a point on the equator of Venus	454·58
,, ,, ,, the Earth	463
A cannon ball	500
Propagation of the movement of tides (North Pacific Ocean); maximum according to Whewell	922
The moon's revolution round the Earth	1012
Velocity of a point on the equator of Mercury	1034
Revolution of the second satellite of Mars	1157
Concussion of the earthquake of Viège (July 25th, 1855); from Turin to Geneva in 126 seconds	1368
Velocity of sound in water (+ 8°·1 C.)	1435
Revolution of the first satellite of Mars	1833
Velocity of a point on the equator of the Sun	2028
Revolution of the fourth satellite of Uranus	3300
,, ,, eighth ,, Saturn	3738
,, ,, third ,, Uranus	3814
Velocity of a point on the equator of Uranus	3904
Revolution of the satellite of Neptune	4505
,, ,, second satellite of Uranus	4906
,, of Neptune round the Sun	5390
,, of the first satellite of Uranus	5763
,, ,, seventh ,, Saturn	5794
,, ,, sixth ,, ,,	6398
,, of Uranus round the Sun	6730
Proper movement of Vega	7000
Displacement of the Sun towards the constellation of Hercules	7642
Revolution of the fourth satellite of Jupiter	8359
,, of Saturn round the Sun	9584
,, of the fifth satellite of Saturn	9741
Velocity of a point on the equator of Saturn	10 541
Revolution of the third satellite of Jupiter	10,869
,, ,, fourth ,, Saturn	11,516
Velocity of a point on the equator of Jupiter	12,491
Revolution of Jupiter round the Sun	12,924
,, of the third satellite of Saturn	13,038
,, ,, second ,, Jupiter	13,999
,, ,, ,, ,, Saturn	14,568
,, ,, first ,, ,,	16,425
,, ,, ,, ,, Jupiter	17,667
,, of Mars round the Sun	23,863
,, of the Earth ,, ,,	29,516
,, of Venus ,, ,,	34,630
Proper movement of Capella	40,000
Revolution of Mercury round the Sun	47,327
Proper movement of Sirius	51,000
Ordinary movement of the solar atmosphere	from 30,000 to 65,000
Proper movement of the 61st of Cygnus	71,600
,, ,, Arcturus	85,000
The comet of Halley in perihelion	393,260
Tempests of the solar atmosphere	402,000
Electricity; a telegraph submarine wire	4,000,000
,, ,, aërial ,,	36,000,000
Velocity of light	300,400,000

The Society of Engineers.—The Council having had under consideration for some time the desirability of removing from the present hall and offices of the Society to others of a more suitable character, we are happy to be able to announce that arrangements have been made for holding the ordinary meetings at the Westminster Town Hall. The offices, library, and reading-room of the Society will for the present be at 6, Westminster-chambers. The Town Hall is situated in Caxton-street, close to St. James's Park Railway station.

City and Guilds of London Institute.—The Holt scholarship, tenable at the Technical College, Finsbury, has been awarded for the first time this year. The student who has gained it is Charles Priest, aged 15, a pupil of the United Westminster Schools. The value of the scholarship is £20 a year for two years, with free education. The fund which provides this scholarship was bequeathed by the will, dated 1838, of Mary Ann Holt, for the benefit of a school she had established at Genoa, and was transferred, by direction of the late Master of the Rolls, to the "Official Trustees of Charitable Funds," for the establishment of a scholarship in connection with the City and Guilds of London Institute. The amount of money transferred not being sufficient to provide a scholarship of £20 a year for two years, the Council of the Institute supplemented it out of their corporate funds.

The Institution of Civil Engineers.—The success which attended the course of lectures delivered this year has induced the council of the Institution of Civil Engineers to make arrangements for a similar series next session. Electricity—one of the great sources of power in nature, which, according to the charter, it is the object of the civil engineer to direct—was then dealt with. Another most important source will now be treated, namely, "Heat in its Mechanical Applications." The lectures will be delivered on Thursday evenings, at 8 p.m., in the months from November to April, as under:—(1883) November 15th—"The General Theory of Thermodynamics," by Professor Osborne Reynolds, F.R.S.; December 6th—"The Generation of Steam, and the Thermodynamic Problems Involved," by Mr. W. Anderson, M. Inst. C.E. (1884), January 17th—"The Steam Engine," by Mr. E. A. Cowper, M. Inst. C.E.; February 21st—"Gas and Caloric Engines," by Professor Fleeming Jenkin, F.R.S.S. L. and E., M. Inst. C.E.; March 20th—"Compressed Air and other Refrigerating Machinery," by Mr. A. C. Kirk, M. Inst. C.E.; April 3rd—"Heat Action of Explosives," by Captain Andrew Noble, F.R.S., M. Inst. C.E. Admission to these lectures will be as to the ordinary meetings of the Institution, that is to say, members, associates and students will have the right of personal admission, and every corporate member will have the privilege of introducing one friend.

RAILWAY MATTERS.

THE Government of Queensland is calling for tenders for the construction of the first section of the railway from Cooktown, 31½ miles.

THE tender of Messrs. Garget and Co. for the construction of the eighth section of the Western Railway, a distance of forty-one miles, including a bridge over the Maranora, New Zealand, has been accepted. The amount of the tender was £86,850.

THE following item of intelligence is from the *Anglo-American*—Nice:—"On the Paris and Marseilles Railway, sixty-eight trains, including about 1500 carriages and wagons, have been fitted with the Westinghouse brake at the cost of 1800f. for each locomotive and 500f. for each 'coach.'"

A "PUNCH," which had been inaugurated in honour of M. Laguerre by French railway servants, under the guidance of *Le Moniteur des Employés de Chemins de Fer*, came off on the 25th October at the Café Central, Place de la Republique, Paris. M. Pichon, municipal councillor, presided.

THE property necessary for the junction of the Mersey Tunnel Railway with the Birkenhead and Chester line having been acquired, the houses demolished and cleared away, the contractor, Mr. John Waddell, is pushing on the works, and this section of the work will probably be completed by the end of February.

WITH reference to the schemes for land-grant railways in Western Australia, from Beverley to Albany, and from York to Eucla, the Legislature, by a majority of eleven to nine, has affirmed that the latter scheme is of primary importance. It is understood that the subject is now finally disposed of by the House. and that the Government is empowered to negotiate for the construction of the two lines.

IN concluding a report on a collision which occurred on the 29th September, at Waverley station, Edinburgh, on the North British Railway, Major F. A. Marindin says: "The train was not provided with sufficient brake power, considering that there were fourteen vehicles and only one braked vehicle besides the engine. If the driver had had a continuous brake at his command he could certainly have stopped his train when he found that he was running in too fast."

THE Agent-General for the Cape of Good Hope—Captain Mills—has recently been advised that 100 miles of new railway have been recently opened for traffic—36 miles on the Eastern system, and 64 on the Midland system, where Colesberg, and practically also the border of the Orange Free State, have been reached. By the end of the year 1884 the colony will have—including 40 miles of private line—1540 miles of railway, costing the Government of the country some thirteen millions sterling.

A REPORT to the Board of Trade has been made by Major Marindin on a collision which occurred on the 24th August at Retford, on the Manchester, Sheffield, and Lincolnshire Railway. Major Marindin says:—"The guard saw the home signal at danger when probably 500 yards away from it, and the brake van of the mineral train very soon afterwards, and his brake was at the time hard on, but if he had had the power of applying the continuous brake, which is a most essential condition for a proper brake, he would probably have been able to stop the train and avert the collision."

IN the small talk running the round of the Swiss newspapers, is an anecdote which appears in the *Journal de Geneve* of October 25th, as well as in several other Swiss journals. Mons. Petitpierre-Steiger, Neuchatel Councillor of State, and director of finances, met, in a railway carriage full of people, Mons. Ladame, the cantonal engineer, and demanded where he was going. An evasive answer was given. Whereupon "his majesty the director of finances," to quote the report, exclaimed, "Understand that I am a Councillor of State, consequently your superior, and that I have the right to demand how my subordinates employ their time." The *Val de Ruz* considers this censure "decidedly very scandalous."

AT one of the Northern States depôts lately an old lady, whom an inward train had just deposited, timidly approached a brakeman and asked if he knew whereabouts on the line her nephew was employed. "Abner?" said the railroad man, "Oh, he's been changed about considerably lately. He fired the John Edward till she ditched the graves and he got stove in. When he came out they gave him the Owl for a while, then he broke the two-eight passenger till she jumped a know-nothing, and he got pinched somewhere, and now I believe he's spare round the yard. You see, he's had hard luck." The old lady stood speechless for a moment, as if trying to digest the idioms of the railroad, and then said softly, as if at a hazard, that she "thought he had."—*Boston Globe.*

OF the various railways of South Australia we find that the best paying one is that from Adelaide to the Semaphore, which yielded £25,641 2s. 7d. over working expenses, upon a total cost of construction, &c., of £263,918 6s. 9d. The North line gave a net revenue of £69,459 12s. 7d. on a cost of construction of £2,107,215 2s.; Port Pirie, Terrowie, and Quorn gave a balance revenue over working expenses of £25,836 12s. 8d. on a total cost of construction of £820,632 14s. 8d. All the other lines gave lower returns, the Strathalbyn and Middleton, Goolwa and Victor Harbour, and Port Broughton and Barrunga Range showing an excess of working expenditure over revenue of £533 1s. 7d., £499 15s. 4d., and £358 1s. 11d. respectively on a grand total cost of construction, &c., of the three lines of £251,456 19s.

NEW SOUTH WALES has nothing to complain of in the results of her railway enterprise. Indeed, we find, says the *Colonies and India*, that during recent years these railways have paid very handsome returns. In 1881 the return paid was 5½ per cent.; in 1882, with the large capital of £14,760,500, and notwithstanding the large increase made to the mileage open, the return paid was nearly 5¼ per cent.—a result due not alone to the vast resources of the colony, but partly to the economy with which the railways have been worked, the proportion of expenditure to the earnings being less in New South Wales than in any of the Australian colonies. When it is remembered that the capital expended was raised at about 4½ per cent., it will be seen that the railways occupied the unique position of actually returning a profit to the State. The following figures show more clearly perhaps than words the extent of these railway transactions:—In 1882 the total earnings were no less than £1,698,863. The number of tons of goods hauled was 2,619,000, and the number of passengers' journeys made was nearly 9,000,000.

A PULLMAN dining car of the 5.40 express to Leeds has been lit by six Swan incandescent lamps, supplied with electricity from one primary battery of twelve cells, the dimensions of the battery being—Length, 4ft.; breadth, 8in.; and depth, 8in. The battery is of zinc and carbon, with a new depolarising arrangement, the details of which have not been made public. The lamps diffused a bright, warm, and perfectly steady light, which was at no moment affected by the oscillation of the carriage, and which made it not only possible, but perfectly easy, to read a newspaper or book printed in small type. The result of other preliminary trials of the system has been that several railway companies, including the Great Eastern, the South-Eastern, and the London and South-Western, have shown a desire to adopt it. The light can be turned on or off at pleasure, and it can therefore be used in the day when a train is passing through a tunnel. The inventors of the battery express a belief that they will be able to supply private dwellings with electric light for less than the estimate lately put forward by the Edison Company and the Golcher Company. The battery which was used on Thursday week weighed under 150 lb., and one capable of supplying eighteen lights for eighteen continuous hours would weigh about 3 cwt. The inventors of the system are Mr. G. C. V. Holmes and Mr. F. E. Burke. Mr. F. Cheeswright, who is connected with the Sykes block system, has also taken an active share in the introduction of the light, which was on Thursday week under the management of Mr. E. Travers Zohrab.

NOTES AND MEMORANDA.

THE substance known as anthracene has been found by Dr. Tommasi to possess a new property, namely, a sensitiveness to light, which will doubtless prove of value. Anthracene on exposure to light acquires different physical and chemical properties without any change in its composition. If a cold, clear, saturated solution of anthracene in benzol is exposed to the direct rays of the sun, it becomes turbid and deposits crystals, which have received the name of paranthracene.

M. P. TIHON has lately shown at the Industrial Science Society of Lyons a new semi-incandescent lamp, giving the brilliancy of an arc light. This, *Nature* says, is attained by having two carbon rods, slightly inclined to one another, brought down on to a small prism of chalk, and separated from one another by a small rod of the same material. The current passes through the chalk rod, making it incandescent. By this means the light is rendered steadier than an arc light, and it is said to have the same brilliancy, which we doubt.

ACCORDING to a communication made to the London section of the Society of Chemical Industry, by Mr. W. Weldon, F.R.S., it does not seem that we are much nearer to cheap aluminium than we have been for a long time. A short time since it was announced that a new method of production had been invented and was in use, but Mr. Weldon says this invention only relates to the production of anhydrous alumina from potash alum, and if the method of obtaining this were 50 per cent. cheaper that of M. Pechiney, of Salindres, it would only cheapen aluminium by 5 per cent.

THE number of miles of streets which at present contain mains constantly charged, and from which constant supply can be given, and upon which hydrants for fire purposes could be fixed, in each district of the metropolis, is as follows:—Kent, about 85 miles; New River, about 218; East London, 120; Southwark and Vauxhall, 119; West Middlesex, 90½; Grand Junction, 49; Lambeth, 136¾; Chelsea, 68; making a total length of about 886¼ miles. The companies are ready to give constant supply and to affix hydrants whenever legally required to do so.

COLONEL BOLTON says in his September report on the London water:—"In the absence of a duly authorised and official 'standard of filtration' regulating the volume of water to be passed through a given area of sand in a given time, it has been found, during the past eleven years by the London Water Companies, that when the rate of filtration does not exceed 540 gallons per square yard of filter-bed each twenty-four hours, the filteration is effectual, and this has been generally recognised as a tentative standard rate of filtration. The filters have, however, different thicknesses of filtering material."

A VINEYARD proprietor near Nimes having had several complaints made to him about his wines, requested M. Barthélemy, Professor of the Faculty of Sciences at Toulouse, to analyse them for him. In some of them a rather large proportion of arsenic was found, larger than the trace sometimes found in certain red wines. The wine from one barrel tested contained no arsenic at all, and in this instance the cask containing the wine was a new one; it had not been previously used. The other barrels had been cleaned after use with "drogue," which, in point of fact, is diluted sulphuric acid, and the sulphuric acid of the central districts of France has of late years contained so much arsenic that M. Barthélemy has sometimes used it to obtain a supply of that material.

"BRADSHAW'S RAILWAY GUIDE" map of Great Britain which accompanies that indispensable manual is now ruled with meridian lines at every 1¼ deg. of longitude, or every 5m. of time from Greenwich, so as to show at a glance, sufficiently nearly for practical purposes, the difference between the local time at every town in the United Kingdom, and Greenwich or railway time. The difference, it is true, is small enough to be neglected in the eastern counties; but is considerable enough to require to be remembered in the western half of these islands. There is, *Nature* remarks, an advantage which will be realised whenever these time meridians replace meridians of longitude on school maps, as they are bound to do by degrees. It is that they tend to give clear ideas of longitude, of the earth's diurnal revolution, of time itself. Meridians, as such, are mere co-ordinates of position, and have no necessary connection with time, and the ideas of many even educated people are extremely hazy on their mutual relations. Messrs. Blacklock, of Manchester, probably make no pretension to be educational reformers, but in taking the initiative in this improvement, they are in fact, thanks to the great circulation of "Bradshaw," helping to prepare the public mind for the adoption of a universal first meridian, and giving great assistance to the schoolmaster.

MARSEILLES is supplied with water from the Durance by a canal constructed at a cost of nearly two millions sterling. It is 81,625 metres in length, and after it was completed the death-rate of the port, which amounted during the ten years previous to the construction of the canal—1840-9—to 39·23 deaths per 1000 of the population, was reduced in the ten following years—1850-9—to 30·60 per 1000. Yet even in 1882 it was ascertained that out of the 39,727 houses existing in Marseilles only about 18,000 had a water supply from this source. There are some quarters where the mortality reaches an apalling figure. In the Ninth Arrondissement, for instance, it amounts to 48·67 per 1000, and in the Thirteenth, or Belle-de-Mai district, to 50·90. A state of insalubrity that can produce snch a death-rate must be most propitious to the propagation of cholera if once the germs are introduced, and the statistics show this to be the case. There died at Marseilles from Asiatic cholera, 865 persons in 1834, 2576 in 1835, 1526 in 1837, 2211 in 1849, 3069 in 1854, 1410 in 1855, and 2037 in 1865. The population increased in that period of time from about 150,000 inhabitants to 250,000; while it has now reached 336,099, with a death-rate for the year 1882 of 30·31 per 1000. The sewage of Marseilles and the house drainage is generally in a most unsatisfactory state.

IN "Notes on some recent Astronomical Experiments at High Elevations on the Andes," described to the British Association by Mr. Ralph Copeland, made during the first half of this year at the cost of the Earl of Crawford, some figures are given which are of interest. At La Puz, in Bolivia, 12,000ft., with the full moon in the sky, ten stars were seen in the Pleiades with the naked eye, and also two stars in the head of the Bull that are not in Argelander's *Uranometria Nova*. The rainy season lasted roughly until the end of March, after which there was a large proportion of fine sky. At Puno, on Lake Titicaca, 12,600ft., with a 6in. telescope mounted on a lathe headstock, a number of small planetary nebulæ, and some stars with very remarkable spectra, were found by sweeping the southern part of the Milky Way with a prism on Professor Pickering's plan. Observations were also made at Vincocaya, 14,360ft. Attempts to see the corona proved futile, nor were the prominences seen otherwise than in the spectroscope, the only difference being that the slit could be opened far wider than down at the sea level. A most careful examination of the zodiacal light failed to show even the slightest suspicion of a line in its spectrum, which was continuous although short. Both at Puno and Vincocaya the air was very dry, the relative humidity there and at Arequipa, 7700ft., being as low as 20 per cent. At Vincocaya the black bulb at one time stood above the local boiling point, while the wet bulb was coated with ice. The author was of opinion that an observatory might be maintained without discomfort up to 12,000ft., or even a little higher—the night temperature falling only slightly below the freezing point. At greater elevations the thermometer falls 1 deg. for every 150ft. of height, the barometer sinking about 0·1in. for the same change. At 15,000ft. it will thus be seen that arduous winter conditions are reached without any very material gain in the transparency of the atmosphere.

MISCELLANEA.

MR. JOHN C. TRAUTWINE, a well-known American engineer and writer, died recently at seventy-three years.

A USEFUL and interesting paper on magneto and dynamo-electric machines, read before the Institution of Civil Engineers of Ireland, is now published as a separate pamphlet by Mr. Falconer, Dublin, and by E. and F. N. Spon, London.

THE Paris *Figaro* says that the eminent French chemist, M. Basset, has discovered a method of producing currents of electricity at a fabulously cheap rate, and is working with M. Bazin, an engineer, to bring his discovery into practical use.

M. E. CAZELLS the new prefect of the Bouches-du-Rhone, is a scientific man versed in English literature. He has translated most of the works of Herbert Spencer, Grote, and others, into French; also Liebig's "Letters on Chemistry," from the German.

THE Electrical Power and Storage Company is withholding the supply of its accumulators until January next, when it is expected that an improvement will be affected, which will, we are told, dispense with metallic connections in the battery from cell to cell, and will dispense with boxes.

DURING the week ending October 20th the new mill just opened by the Barrow Hematite Steel Company turned out no less than 2580 tons of rails and 119 tons of blooms, total 2699 tons. It has been calculated that of the time worked one rail was rolled in every thirty-two seconds. The mill worked eleven turns.

THE Municipal Council of Boulogne, the Chamber of Commerce, and the Geographical Society of that town, are in favour of tunnelling the Alps at the Great St. Bernard, that route being the best for the trade of Boulogne; Dunkirk, Calais, and the ports of the North of France are seconding the endeavours of Boulogne to get this route selected.

THE demolition of the palace of the Tuileries having been decreed by the Parisian authorities, it has been resolved to preserve those portions which are interesting from an artistic and historical point of view. Consequently some porticos from the ruins of the Tuileries are now being re-erected on the left side of the Seine, in the park of the Trocadero.

LAST year, at this time, parts of Southern Europe began to be deluged by rain brought down by the Alps. This year there may possibly be a reaction in the other direction. At Cannes there are already complaints of inadequate rainfall, and at Zurich, north of the Alps, the weather is fine and warm, although in some seasons the district is under snow before the end of October.

ON Wednesday afternoon Messrs Robert Thompson and Sons, of Southwick and Bridge dockyards, launched from their former yard an iron screw steamer—dimensions, 350 by 43.3 by 26.9; total tonnage of about 6200. She will be fitted with engines of 300-horse power by the Wallsend Shipway and Engineering Company, Wallsend-on-Tyne. As the vessel left the ways she was named the "Regian" by Miss Conaway.

MONS. BREGUET, who was noted in France for his improvements in ships' chronometers, died in Paris on the evening of October 27th. His father was a maker of chronometers. He was an early worker in the improvement of telegraphic instruments, and was an honorary member of the Bureau des Longitudes. He obtained several gold medals for his improvements in clocks; obtained the medal of the Legion of Honour in 1878, and was made a member of the Academy of Sciences in 1874.

IN this column in our impression of the 19th ult., reference was made to a new system of producing door and other name plates, panels, &c., invented by Mr. C. L. H. Summers, of Gosforth. It should have been said that the letters were stamped through the brass plate for the receipt of glass letters, instead of wax filling, and not that the lettering is cut through. The name plates are thus produced by a process very much cheaper than engraving, and the filling may last as long as the plate.

THE Nice Exhibition is in a backward state, and will probably not be opened till the middle of December. A characteristic feature of it will be the display of articles of luxury. The glass-painting industry will be largely represented. The firm of Veuve, Lorin, and Co., of Chartres, will fill the large semicircular window of the transept—39ft. long—with a magnificent specimen of their work; the subject is the car of the Sun, driven by Apollo, an appropriate allegory for the sun-favoured shores of the Mediterranean.

ON the 24th ult. a fine new passenger steamer, named the Dart, built by Messrs. Raylton Dixon and Co. for the Royal Mail Steam Packet Company, for service between Southampton and the West Indies, Brazil, went to sea from Middlesbrough. The vessel is in length 332ft.; breadth, 38ft.; depth of hold, 26ft. The engines were constructed by Messrs. Thomas Richardson and Sons, of Hartlepool, to indicate 1600-H.P., and drive the vessel a guaranteed average of eleven knots; but on her trial trip, we are informed, she maintained a speed of thirteen knots.

ON Wednesday afternoon Messrs. Schlesinger, Davis, and Co. launched from their shipbuilding yard at Wallsend a finely-modelled screw steamer, named the Dalmatia, 248ft. in length; breadth moulded, 34ft. 6in.; depth of hold, 20ft. 4½in., with a carrying capacity of 2300 tons dead-weight. Her engines, of 150-horse power nominal, have been constructed by the North-Eastern Marine Engineering Company at Wallsend, and will at once be put on board. The cylinders are 29in. and 56in. diameter respectively, with a stroke of 42in. The boilers, which have a total heating surface of 2700 square feet, will work at a pressure of 90 lb. per square inch.

A FEW days ago a fire occurred on the premises of M. Rousselot, a banker in Nantes, and the iron safe of the bank was for ten hours subjected to furnace heat. The calcined safe was afterwards dug out, removed, and opened in the presence of the banker, his cashier, and the Mayor of Nantes. It was long and tedious work to remove the remains of the outer part of the safe, and the excitement of the operation was great, the banker being uncertain whether he was a ruined man or not, for it was possible that notes and securities worth six or eight millions of francs had been destroyed. By the aid of oil and a key the inner safe was opened, and the papers found intact.

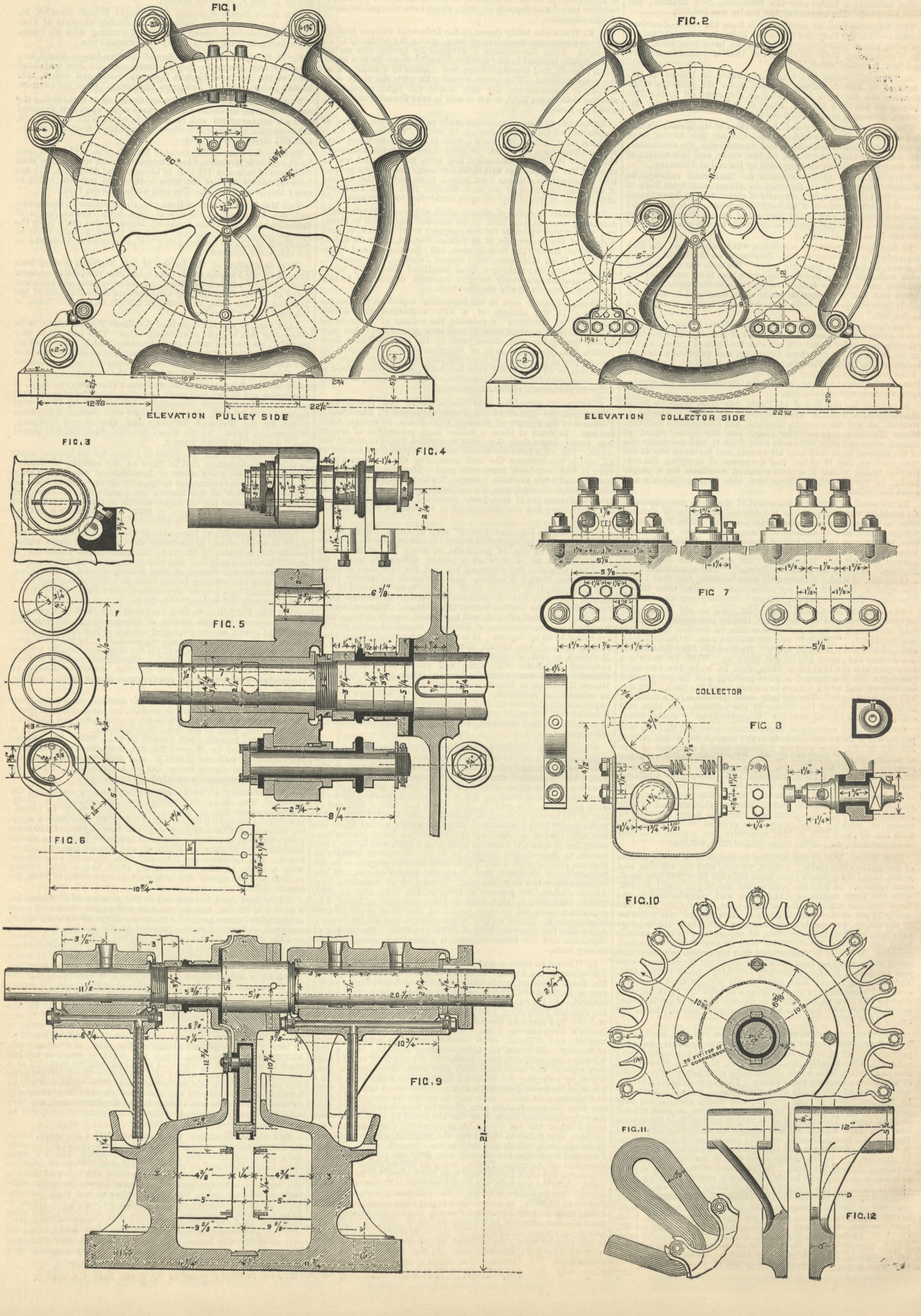
IN the course of the execution of the works at Rome for the improvement of the flow of the Tiber, it has been decided to employ dynamite to disintegrate the foundations of ancient works in the bed of the river. The dynamite will not be used within 20 m. at least of any bridge, and within less than 10 m. of the river bank, and will be employed only where the depth of water is not less than 1·5 m. Only one charge of dynamite will be exploded at a time, and one minute before each explosion three clarion notes will be sounded as a warning to the public; the spectators will be kept at a safe distance by the municipal guards. The charges of dynamite will not exceed a quarter of a kilogramme each, and they will be prepared outside the city. The dynamite store will be placed far from any human habitation.

THE electric lighting of the Manchester Royal Exchange, which for something like a couple of years has been carried out successfully by the British Electric Lighting Company, has this week come to a sudden and extraordinary collapse. With the improvements, which have been gradually worked out here and there in the arrangements, the system had been got into thoroughly satisfactory working order, but with the close of last week the company's servants, for some reason of which there does not appear to be any definite explanation at present, were withdrawn, and since then the whole of the plant has been lying idle. Fortunately, this had no more serious results than a compulsory return to the old system of lighting by gas, the fittings for which the Exchange directors have very wisely maintained intact as a reserve in view of any possible eventualities.

THE FERRANTI DYNAMO ELECTRIC MACHINE.

MESSRS. FERRANTI, THOMPSON, AND INCE, LONDON, ENGINEERS.

(*For description see page 341.*)



FOREIGN AGENTS FOR THE SALE OF THE ENGINEER.

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

TO CORRESPONDENTS.

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

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

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

STEEL LIFEBOATS.—*Mr. Skelton's address is Longden House, Millwall*

J. R. (Side Copse).—*Molesworth's "Pocket-book," published by Messrs. Spon.*

T. F.—*Patent drawings must be 29½in. by 21½in, or 21½in. by 14½in., leaving a margin of 1½in. all round.*

J. W.—*Standing Orders may be obtained from Mr. P. S. King, Canada-buildings, King-street, Westminster.*

P. BROS. AND W.—*The application will be completed under the old Act down to the sealing of the patent. After that the patent will be governed by the new law.*

A. M.—*Cranes and hoisting gear are made in the United States by Messrs Copeland and Bacon, New York; Lidgerwood and Co., Chicago; the Industrial Works, Bay City, Michigan, and many other firms.*

H. H. (Bathurst).—*Railway signals have been worked to a limited extent in Great Britain by hydraulic power. It does not appear that the system possesses such prominent advantages over existing arrangements that its adoption is likely to extend rapidly.*

H. VON ENGELMANN (Rostoff-on-Don).—*For tin-plates of the kind you want you may apply to Messrs. Leach, Flower, and Co., 4, Cullum-street, E.C., or the Ystalyfera Iron and Tin-plate Company, Austinfriars, E C.; and for iron plates, to Messrs. Samuel Groucutt and Sons, Bilston, Staffordshire, or to Mr. E. D Till, Lombard-street, E.C.*

H. B.—*You say nothing concerning the speed at which the load is to be drawn. At a moderate pace a horse can exert a pull of about 250 lb., which would suffice to haul a gross load of 3 tons up a railroad incline of 1 in 30. The resistance due to the rails may be taken at 10 lb. a ton, and that due to gravity at 75 lb., or 85 lb. per ton total, and 85 × 3 = 255 lb.*

ERRATUM.—*Page 327, Tenders: The first one named should have been flood works at Leicester, not Worcester; and it should have been stated that J. Gordon, C.E., Borough Surveyor, is the engineer for both contracts.*

SPEED INDICATORS.

(*To the Editor of The Engineer.*)

SIR,—I should be obliged to any reader who could furnish me with the address of a firm making a speed indicator—Napier's system. It is one in which a column of mercury is used.

C. G. N.

Manchester, October 29th.

AQUARIUM BUILDERS, AND USING THE HEATED WATER FROM GAS ENGINES.

(*To the Editor of The Engineer.*)

SIR,—Can any reader give me the names of some of the best aquarium makers, and the means of supplying the tanks, and getting rid of the dirty and waste water? Can any reader tell me the best means of utilising the heated water from the Otto engine after it has done its duty, so that it might be used again after being cooled?

W. W. H. W.

Peckham, October 30th.

MEETINGS NEXT WEEK.

SOCIETY OF ENGINEERS.—The next ordinary meeting will be held on Monday, November 5th, at 7.30 p.m., at the Westminster Town Hall, Caxton-street, Westminster. A paper will be read "On Dundee Street Improvements, and Drainage of Lochee," by Mr. Andrew Greig, the leading features of which are as follows:—Necessity for improving parts of the town; course adopted in purchasing properties; removal of old buildings; description of new buildings; feuing plans; feu duties and conditions of sale; formation of streets; general notes on laying out of streets. Drainage of Lochee.—Sewerage works: Outfall, catch-pits, manways, gulleys, gradients, ventilation.

CLEVELAND INSTITUTION OF ENGINEERS.—The first meeting of the session will be held in the Hall of the Literary and Philosophical Society, Corporation-road, Middlesbrough, on Monday, November 5th, at 7.30 p.m. A paper "On the Education of Mechanical Engineers," by Mr. Wm. Ripper, of Sheffield, will be read, of which the following is a syllabus:—(1) Mechanical engineers and their work. (2) The training required to render them efficient, including a description of continental methods of training. (3) The means already at their disposal in this country for obtaining a proper training, including a description of one or two typical English engineering schools, and a consideration of the subject of school workshops. (4) Suggestions for the direction of future efforts to promote the welfare of engineers and engineering in this country.

SOCIETY OF TELEGRAPH ENGINEERS AND ELECTRICIANS.—Thursday, November 8th: Council meeting at 7 p.m.; ordinary general meeting at 8 p.m. "Volta-electric Induction," illustrated by experiments, by Mr. Willoughby Smith, President.

DEATHS.

On the 25th inst., at Bude, in her 81st year, EMMA JOAN, widow of the Rev. George Harrison, M.A., Rector of Sutcombe, and only surviving child of Sir Marc Isambard Brunel, Civil Engineer.

On the 28th inst., at Bromsgrove, Miss CATHERINE IRENE FINCH, in her 82nd year. She was a granddaughter of the late Dr Joseph Priestley, LL D., his daughter Sarah—the mother of the deceased—having married the late Mr. William Finch.

THE ENGINEER.

NOVEMBER 2, 1883.

FURTHER AMALGAMATION OF LONDON GAS COMPANIES.

THE amalgamation of the South Metropolitan Gas Company with the Chartered, which has been spoken of in some quarters as an assured transaction, will leave only one more company to be absorbed in order to subject the gas supply of the metropolis to one homogeneous system. As for the certainty of this event, the process has gone so far that the two companies are agreed upon the terms as between themselves. The Board of Trade have now to see that the terms of the compact are such as can be endorsed on behalf of the public. If all is well in this respect, the Board of Trade have only to approve, an Order in Council will complete the legal procedure, and the South Metropolitan will follow in the wake of the eleven other companies which have been absorbed by the same ambitious and successful corporation. Earliest in the field, the Chartered Company was at one time by no means the largest of the organisations which supplied London with gas. When Parliament addressed itself anew to the subject of the metropolitan gas supply in 1868, the capital employed by the Chartered Company was only about one-sixth of the total, and the Imperial alone far excelled it in magnitude. But absorption soon followed, being distinctly promoted by the legislation of 1868, in accordance with the opinion which then prevailed, both in and out of Parliament, that amalgamation was favourable to economy. Obviously it should be less expensive to have a district supplied by one company than by a dozen; but some controlling power outside the companies is necessary, otherwise the shareholders may be expected to reap the benefit rather than the consumers. How far this has been secured may be judged by the financial results. In 1869 the management charges of all the London gas companies, taken in the aggregate, amounted to 19·24d. per ton of coal, or 2·28d. per 1000ft. of gas sold. In 1882 these items were reduced to 11·56d. per ton, and 1·21d. per 1000ft. The London Company, which down to the close of last year remained separate, shows a very different result, the management charges merely falling from 15·93d. per ton of coal to 15·45d., and from 1·95d. per 1000ft. of gas to 1·64d. The management charges of the Chartered Company fell in the meantime from 18·26d. per ton to 10·19d., and from 2·21d. per 1000ft. of gas to 1·05. The diminution of expense is still more marked when we look at the amount absorbed by the directors and auditors. The fees for these authorities, taking the aggregate of all the companies, amounted to £22,788 in 1869, and fell to £17,584 in 1882, although the quantity of coals carbonised had risen in that period from less than 1,200,000 tons per annum to more than 2,000,000. The fees to the directors and auditors of the Chartered Company have fallen in three years from 4·61d. per ton of coal to 1·47d., while the proportion for the London Company scarcely shows any diminution. The disadvantages connected with the manufacture and supply of gas on a comparatively small scale are shown by the position of the Ratcliffe Company in 1869. This was the smallest of all the companies, its consumption of coal being less than 20,000 tons per annum. Its management charges exceeded 2s. 1d. per ton, and amounted to 3·34d. per 1000ft. It was subsequently absorbed in the Commercial, which has otherwise remained in its original condition down to the present time, with management charges which *pro rata* considerably exceed those of the Chartered, though in 1869 the balance was the other way.

The economy of amalgamation is, however, to be represented by something more than a reduction on account of directors' fees and the like. If affairs are properly administered, consolidation should have an effect on every class of outlay. One remarkable result which presents itself in the accounts of the London gas companies is that the net cost of coals—that is to say, the cost after deducting the receipts for the residual products—is absolutely less in 1882 than it was in 1869, although the actual quantity consumed is not very far short of being doubled. The companies spent for coals at the earlier date the sum of £955,618, whereas last year the total had risen to £1,466,771. But the net cost had fallen from £581,955 to £531,756. So far as coals were concerned, the companies were making 21 million thousands of gas last year for £50,000 less than it cost them to make half that quantity in 1869. In other words, while paying £511,000 more for coals, they received last year £561,000 more for residuals. The difference represents more than 7½d. per 1000ft. of gas. The improvement is especially marked in the case of the Chartered Company, which incurred a net cost for coals at the rate of nearly 1s. 8d. per 1000ft. of gas in 1869, falling to 7¼d. in 1882. The reduction is thus more than a shilling per 1000ft., and it is instructive to observe that the reduction in the charge for the Chartered gas, as supplied to the consumer, has been 10d., the price coming down from 4s. per 1000ft. to 3s. 2d. Next year the price is to be lowered to 3s., thus representing, within a fraction, the full difference in the net cost of coal. Comparing the state of affairs at the two dates, 1869 and 1882, we find the receipts for residuals rising rather more than 2d. per 1000ft. of gas, while the gross cost of coal has fallen by about 5d. on the average, but nearly 10d. in the case of the Chartered. The actual cheapening of coal to the Chartered at first hand has been nearly 5s. per ton.

For much of the foregoing data we are indebted to Mr. Field's excellent yearly "Analysis," a work which may be profitably studied by all who wish to understand the progress of the London gas supply. The magnitude of the amalgamation now on the *tapis* is an interesting feature. By its absorption of the London Company a few months ago, the Chartered has now an employed capital amounting to nearly eleven millions. The employed capital of the South Metropolitan exceeds two millions. If the latter should be absorbed in the former, the united capital at the beginning will be £13,352,000. The sole remaining company, the Commercial, has a capital of about three-quarters of a million. The outstanding company will therefore be a pigmy by the side of a giant, if the great amalgamation takes place. The terms on which the South Metropolitan is to be absorbed have been skilfully devised with a view to reconcile conflicting interests, if possible. It has long been thought that there would be considerable difficulty in uniting the South Metropolitan with the Chartered; but it happens that the arrangements have been made at last with singular swiftness. The refusal on the part of the Commercial to join in the fusion has been the act of the directors without consulting the shareholders, and seems to have been a somewhat abrupt and hasty decision. Possibly a different feeling will prevail on a subsequent occasion. With respect to the public interest, some objection appears to lie against the present scheme, seeing that the initial price of gas in the South Metropolitan district is 3s. 6d., and in the Chartered 3s. 9d. The sliding scale governs both, so that the consumer has an obvious advantage in the southern district. The South Metropolitan Company is supplying gas at 2s. 10d. per 1000ft., whereby the limit of the statutory dividend becomes 12 per cent., being a quarter per cent. extra for each penny below the initial price. The Chartered Company might divide three-quarters per cent. more than the South Metropolitan, and hence it has been argued that when the amalgamation takes place the initial price should be made 3s. 6d. for the whole undertaking. This point will doubtless be laid before the Board of Trade; but there appear to be some counterbalancing elements in the well-contrived scheme which now awaits the approval of the Department. The answer to the appeal is that the capital of the South Metropolitan, so far as it comes under the sliding scale, will henceforth receive a fixed dividend equal to that which is now being received. Hence, however much gas may be cheapened in the future, the dividend on the old South Metropolitan capital will not rise, and the profit thus saved will help to bring down the price of gas. On the whole, the scheme has much to recommend it, though it meets with opposition from the local authorities in the present South Metropolitan district. It is even questioned whether the initial price for gas in that district can be ignored without the direct authority of Parliament.

DOWSON'S GAS AS A MOTIVE POWER.

IN our impression for October 5th, p. 260, we illustrated the plant devised by Mr. Dowson for utilising water gas as a motive power. It has since been publicly stated that Messrs. Crossley Brothers have recently made a test at their Openshaw Works, Manchester, of the fuel consumed by Crossley gas engines worked with Dowson's gas; that the engines indicated an average of 90-horse power for seventeen days, and that the fuel consumed was 8 tons, equivalent to a consumption of 1·3 lb. per indicated horse-power per hour. This is a very remarkable statement. We do not know how many engines were employed, but we have no authentic record of a steam engine indicating but 90-horse power working with so small an allowance of fuel. No detailed information has been supplied by Messrs. Crossley as to the conditions under which the engines were worked; and we have consequently no means of testing the accuracy of the statement. We have not the least doubt that it has been made in perfect good faith. In other words, we are sure that Messrs. Crossley believe that they have during seventeen days obtained 90-horse power, and that they have burned but 8 tons of coal. Concerning the last point there is no room for doubt; but so much cannot be said of the power exerted. Everything depends, when the work done is variable, on the frequency with which diagrams are taken. In the Openshaw Works the gas engines are employed in driving shop tools, the power expended must vary continually, and nothing would be easier than either to over or under estimate its amount. Our readers can attach their own value to the statement we have quoted. To us it seems that, even if we make considerable allowances, there must inevitably remain so large a difference between the consumption of coal for a 90-horse engine, and that apparently demanded by the engines referred to, that Dowson's gas may claim to be the most economical source of power yet brought into actual use. Before proceeding to investigate the questions on which its economy hangs, it will be well to explain what the Dowson gas engine system is. Instead of using ordinary coal gas, Mr. Dowson employs what is commonly known as "water gas." He manufactures this gas as the engine wants it; and the space occupied by the generating apparatus is about equal to that which would be taken up by a boiler developing equal power. The Dowson gas plant consists first, of a small steam boiler; secondly, of a stove in which coal or anthracite is burned; and, thirdly, of a gasholder, which is an ordinary gasholder in miniature. When the stove has been charged with coke and is fully alight, superheated steam is turned from the little boiler to which we have already referred, into a small air injector or blower, and by this means sufficient oxygen is supplied to the coke to maintain its slow combustion in the stove, now shut close. The gas given off is conveyed by a pipe to the gasholder, where it is washed and is then ready for use in the engine. The air injector maintains a pressure equal to 2in. or 3in. of water in the coke stove, so that the gas passes freely from the latter into the gasholder. The steam is used to secure this end for one thing, but it also serves another purpose, and thus performs two duties.

When everything is proceeding as it ought, that is to say, after the few adjustments necessary have been made, about 6 lb. of air ought to be supplied for every pound of coke or anthracite burned. This weight of air contains 1⅓ lb. of oxygen, which unites with the carbon of the coke, forming 2⅓ lb. of carbonic oxide—CO. The steam blown in, is decomposed by the hot coke, which takes the oxygen, making with it CO, and leaving the hydrogen free. We have no data as to quantity of steam used, but it is comparatively very small. Attempts have been made over and over again to make "water gas"—so called because steam is used in its manufacture—rich in hydrogen, by blowing in plenty of steam; but the heat absorbed in breaking up H_2O into its separate gases is so great that the coke is quickly cooled down and extinguished if more than a very moderate quantity indeed of steam is used. The heat given out when two atoms of hydrogen combine with one of oxygen to produce water, is the precise equivalent of that which disappears when the gases are dissociated in the furnace. It appears, however, that Mr. Dowson can blow in enough steam to supply all the air needed, without too much lowering the temperature of his furnace; and this is one of the reasons why he has succeeded where others have failed. The gas which leaves the producer is theoretically $2\frac{1}{3}$ lb. of carbonic oxide, $4\frac{2}{3}$ lb. of nitrogen, and an unknown quantity of hydrogen per pound of carbon burned. But in practice, more air than enough finds its way in; some of the coke, too, is burned to carbonic acid—CO_2. This is to be avoided as much as possible, because it represents a direct waste of fuel, carbonic acid being unable to combine further with oxygen, or to give out any heat, or do any work in the cylinder of the engine. It and the nitrogen serve only to dilute the CO and H, and are so far alike harmful; but the carbonic acid tends to retard or prevent combustion in any gaseous mixture in which it is present. The hydrogen set free from the steam, renders the mixture more inflammable when air comes to be present, and so plays a very useful part. When the water-gas is admitted to the engine cylinder with the proper quantity of air, the carbonic oxide, during explosion, takes up another atom of oxygen and becomes carbonic acid. The hydrogen also combines with oxygen and becomes steam. There is some reason to believe that the effect of the hydrogen may be almost omitted in dealing with the efficiency of Dowson gas; indeed, it is not impossible that the temperature throughout the explosion is too high to permit of the oxygen and the whole of the hydrogen combining. As to the actual work done, the coke developes in the producer in being converted into carbonic oxide 4400 units, which is all expended in providing for loss by radiation; heating the air introduced; heating the fresh fuel added, and breaking up the steam into its constituent gases. Any heat left passes away with the gas into the holder, where it is got rid of by the water used for washing, &c. In the cylinder each $2\frac{1}{3}$ of carbonic oxide combines with $1\frac{1}{3}$ lb. of oxygen, and in so doing developes 10,100, or, in round numbers, 10,000 units of heat. This, then, may be regarded as the maximum return that can be had from 1 lb. of coke burned in Dowson's apparatus.

Now, $10,000 \times 772 = 7,720,000$ foot-pounds; a horse-power exerted for one hour equals 1,980,000 foot-pounds, and $\frac{7,720,000}{198,000} = 3{\cdot}9$, that is to say, the heat developed by the combustion of 1 lb. of coke in one hour in the way stated would suffice to develope 3·9-horse power, if there were no loss, and $\frac{3{\cdot}90}{1{\cdot}33} = 2{\cdot}932$. Thus Messrs. Crossley's statement that they have obtained a horse-power with $1\frac{1}{3}$ lb. of coal—anthracite or nearly pure carbon we presume—implies that the efficiency of the whole Dowson apparatus is, in round numbers, one-third. This is a very high coefficient undoubtedly, but the margin left is so large that we see, so far, no reason why their statement should not be perfectly true. As to the losses, we think we may neglect those connected with the generation of the gases, believing, as we must, that they are fully provided for by the heat developed in the generator during the production of CO. The remaining sources of loss must all be sought for in the gas engine. Owing to the dilution of the Dowson gas with nitrogen, a very much greater quantity of it must be employed than would suffice when ordinary coal gas is used. This renders a larger engine for the same power necessary, and the quantity of products of combustion discharged from the cylinder at a comparatively high temperature is augmented, and with it the waste. It may be taken for granted, therefore, that Dowson gas is not nearly so efficient pound for pound as coal gas, the waste of heat attending its use being far greater, thanks to the quantity of useless nitrogen and carbonic acid present; but the cost of the gas is, of course, a mere trifle as compared with that of coal gas. As regards the actual waste in the engine, we are not aware that any investigation, theoretical or practical, has ever been carried out with water gas; certainly none has been made public. Mr. Dugald Clerk read a very able and elaborate paper on "The Theory of the Gas Engine" before the Institute of Civil Engineers on the 4th of April, 1882, to which we must refer such of our readers as desire to go further into the matter, but it deals only with coal gas.

It must be clearly understood that water gas or Dowson gas is a very different thing from coal gas. The latter is produced by distillation from bituminous coal, and contains of hydrogen about 50 parts, marsh gas about 32 parts, and of carbonic oxide only about 10 parts in 100, the remainder are complex compounds. One pound of it will measure about 35·5 cubic feet, and can on combustion develope energy to the amount of 17,370,000 foot-pounds; while, as we have seen, a pound of coke converted into Dowson gas represents but 7,720,000 foot-pounds. But a pound of Dowson's gas represents only at most $\frac{1}{7}$ lb. of coke, or 1,102,857 foot-pounds. On the other hand, the pound of coal gas represents nearly 8 lb. of coal, and it must not be forgotten that after all the coal gas, properly so called, has been got out of the mineral, Mr. Dowson can get his gas out of the coke which remains. It is interesting, however, to note how much less efficient than coal gas is water gas, and the fact must be carefully borne in mind when carrying out any investigation based on the *weights* of the respective gases used. It appears that the Crossley engine, working on coal gas, converts about 18 per cent. of the total heat generated into useful work. That is to say, for each pound of coal gas consumed he obtains about 3,126,600 foot-pounds. Now if the efficiency of the engine working on Dowson's gas is the same, then each pound of Dowson's gas will develope about 198,500 foot-pounds, and each 1·3 lb. of coke will give $9{\cdot}1 \times 198,500 = 1,806,350$ foot-pounds; but a horse-power per hour represents 1,980,000 foot-pounds, so that the efficiency of an engine working on Dowson gas must be more than that of an engine working on coal gas in order that the result stated by Messrs. Crossley may be reached.

We need, we think, hardly point out that a satisfactory motor, occupying a moderate space and developing a horse-power for one-half as much fuel as a very good steam engine, ought to have a great future before it. The question is, Can an engine be made to develope, say, 100-horse power in this way? and can engines of the kind, if made, be depended on to last? Time alone, we suppose, will answer these questions; but the problem ought at all events to be attacked as soon as possible.

THE WEAKNESS OF THE VACUUM BRAKE.

A noteworthy example of the weakness of the vacuum brake is supplied by a railway accident which took place at Brinnington Junction on the Cheshire Lines Committee Railway on the 12th of September. Colonel Rich's report sets forth the facts very fully. An excursion train, from Doncaster to Liverpool and Chester, broke loose while running between Bredbury and Brinnington Junctions, and the leading portion of the train was twice run into by the portion that had broken loose. The excursion train consisted of two engines and tenders, a brake coach with a guard, five third-class carriages, a bogie, a composite, four third-class carriages, two third-class carriages with brakes—the guard in charge was riding in the leading brake coach of these two third-class carriages—a saloon, a first-class carriage, two third-class carriages, a saloon, a third-class carriage, and a third-class brake coach with a guard. The vehicles were coupled together in the order in which they are given. Three coaches were detached from the rear of the train at Woodley and were sent to Macclesfield. The train on leaving Woodley consisted of two engines and tenders, and nineteen coaches, with three guards in three brake coaches. It was stopped at Bredbury Junction as the signals were at danger, and after waiting there for about twenty minutes it proceeded on its journey. The Bredbury advance signal was at danger, and the train was slightly checked before reaching it, but the signal was then lowered and the train went forward at a speed variously estimated at from eight to twelve miles an hour towards Brinnington Junction, which is about a mile and a-quarter from Bredbury Junction. All the vehicles of the train were fitted with Smith's vacuum brake, but the vacuum brake pipe on the leading engine was not connected with the rest of the train, although the brake was effective on its own engine. The engine-driver on the second engine had control of the vacuum brake on all the other vehicles, and the guards had screw brakes in the coaches in which they rode. The engine-driver of the second engine, immediately after passing Bredbury Junction advance signal, observed that the indicator on his vacuum gauge showed that the brake was out of order. He looked back, but could not ascertain the cause, and therefore he drew gently down towards Brinnington Junction. As the train reached the first tunnel, which is about 1100 yards from the advance-signal, the servants in charge felt a shock. The guards looked out, but could not ascertain the cause. Both the guards in the tail portion of the train which had broken loose applied their brakes, as soon as they recovered from the shock, but the tail portion of the train was not stopped before it ran into the leading portion, at a point about 1280 yards from the Bredbury advance signal, and while the train was between the two tunnels. A second slight collision occurred when the leading portion of the train pulled up at the Brinnington Junction signals, which were at danger. No vehicles left the rails, the permanent way was not damaged, and the only damage to the rolling stock was that the drawbar, at the leading end of the twelfth carriage from the rear of the train, was pulled out, and one door of this carriage was broken. The line from Bredbury Junction to Brinnington falls on an incline of 1 in 63 and 1 in 80, with a short interval of nine chains in the centre, which is 1 in 144. The two collisions occurred on the gradient of 1 in 80, and fourteen passengers were injured. The breaking away was caused by the failure of a draw bar, the collision was due to the inefficiency of the brake. Colonel Rich says: "When the train parted the vacuum brake pipe was broken, and, consequently, the only brake power that remained on the train was the vacuum on the leading engine and the screw brakes on the tender of the second engine and in the guard's brake vehicles, which appear to have been used, under the circumstances, in a proper manner. If the continuous brake had been of an automatic kind the accident would, probably, have been prevented, by the brake applying itself to the rear portion of the train as soon as the air pipe was broken." Why Colonel Rich uses the word "probably," it is not easy to see; the accident would have been certainly prevented had the train been fitted with the Westinghouse brake.

ACCIDENTS AND OFFENCES.

It appears to be probable that we shall have to institute a weekly article under the heading "Accidents and Offences," if matters proceed as they have done this week. To say nothing of minor events, on Tuesday night two explosions, apparently of dynamite, took place one, on the Metropolitan District Railway and another on the Metropolitan Railway. The first explosion occurred near Praed-street about 8 p.m., and the second a few minutes later between Charing-cross and Westminster. The particulars have been so fully given in the columns of the daily press that we need not further refer to them here, no scientific evidence on the subject being yet available. There can be no doubt that both explosions were the work of the miscreants who have done so much to render dynamite infamous, and for whose chastisement some new form of punishment adequate to their iniquities may be devised and applied with the best effects. For the moment we are tempted to regret that we do not live in the good old times of the rack and the stake. Penal servitude is not properly appreciated, because those who have not undergone it fail, we are told by prison authorities, to realise its horrors. A railway disaster of a different kind occurred at Watford on Wednesday evening. The 5.40 p.m. train from Euston dropped, as usual, three carriages at Watford station, the train itself passing through. These carriages were attached to an engine just outside Watford station, in the direction of London. The signals were made for clear, and as the carriages were being shunted back through the station the express train from Liverpool, which was running through Watford station at the rate of over fifty miles an hour, dashed into the carriages, which were fortunately empty at the time, and completely smashed them. The engine attached to the carriages kept the rails, but the tender was partially torn away. The driver and stoker, realising the danger, jumped off and escaped with a few bruises. The engine of the express train left the rails and turned over on its side. The driver, named Langstaffe, an old servant of the company, was shockingly mutilated, and died shortly afterwards. The stoker, whose name has not yet been stated, was also seriously injured, and died about an hour after removal into the town. Most of the carriages left the rails, the first two lying on the top of the engine. The Clark-Webb emergency brake, pronounced not so very long ago by Mr. Moon as almost perfect, has apparently failed again when wanted, as it always does fail. The run into Watford is straight, and, the view uninterrupted; the driver cannot have failed to see the three coaches in his way at some distance off, and a good brake would have enabled him either to pull up in time, or at all events, to mitigate the violence of the shock. The last disaster which we have to record is the sinking of the London and North-Western Company's fine twin screw steamer Holyhead. This vessel has only been a few months on the line between Dublin and Holyhead. She was a cargo and cattle boat of the best modern type, and of considerable dimensions. A nearly sister ship, the North Wall, has just been put on the same service. The Holyhead ran, it is said, on Tuesday night, into the German ship Alhambra, twenty miles off Holyhead. The German ship sank almost immediately. Seven of the crew were saved by the steamer's boats. The steamer afterwards sank. All the passengers and crew, except one sailor and a boy, were also saved by the steamer's boats, and arrived safely at Holyhead. Until the Board of Trade inquiry has taken place, it would be improper to pronounce an opinion on the merits of this case; but it is at least worth notice that the collision bulkhead of the steamer seems to have been useless.

A PORTUGUESE ATLANTIC CABLE.

Mons. Pierre Giffard publishes in the Paris *Figaro* of Oct. 25th, a plan of new Atlantic cable projected by a Dutch engineer, Mr. De Braam, who has obtained from the Portuguese Government the exclusive right for twenty years of landing cables from Europe in the Azores, with branches thence in various directions on the American side. The author says that the shorter the length of submarine cables the less they cost to establish, and adds that the rapidity of signalling through short cables is much greater than through long ones, the retardation caused by electrical induction being greatly diminished. Mr. Braam says that the present rate of transmission by Atlantic cables is eight or ten words per minute in their practical working, but that twenty-five words per minute can be sent over his shorter lengths. The line, with its two branches, he says, will not cost more than 35 millions of francs, and he has estimated that the cost of the two sections of his trunk line will amount to but 10 million francs, so that less capital will be required to lay it than has been expended on existing cables, and the charge to the public for each word can be reduced to half a franc to begin with. As the other companies cannot profitably reduce their charge to this, a rush of work to the new line is expected. The southern branch from the Azores is planned to touch at the Bermudas, Cuba, and Panama. This line, he says, will be of special value to Spain, giving it direct communication with Havana, instead of the present roundabout communication *viâ* North America. The English naval station in the Bermudas being reached by the branch line, the project, he thinks, should find favour in England. The question, he adds, has been often raised whether cables to the Azores can be laid and repaired, but he has encouraging information on this point. By the new direct American cable, under the auspices of Mr. Bennett, now also proposed, it is contemplated to reduce the price of messages to but one shilling per word. The question as to the practicability of these lines is one chiefly of depth of water, gentle inclines, and of good landing places at the Azores. In one of the earliest books printed under the auspices of the first Atlantic Telegraph Company, diagrams are given showing a kind of railway embankment between Ireland and Newfoundland, for the reception of their first cable, which was then in the realms of hypothesis; whilst another diagram in the book shows frightful inclines in the way of any bold projector who might contemplate an Azores competing route. The advantages of a half-way station to America cannot be denied by electricians, and the chief question is whether the gradients at the bottom of the ocean on the route proposed are so great at particular places as to render the Portuguese scheme impossible. Independent surveys and official Government charts are the sources whence information on these points should be drawn. The depths given in book of the Atlantic Telegraph Company are doubtlessly accurate, but the gradients nevertheless may be of less importance than they appear to be when represented on a map of the sea-bed but a few inches long.

THE TEES-SIDE WATER QUESTION.

We have previously referred in The Engineer to the question of the water supply of the Tees-side district. The half-yearly report of the Water Board just issued furnishes some facts that are of interest. In the past half year 1,626,175,000 gallons of water have been pumped from the Tees by the Board, the weight of coals used for the work being 3044 tons 11 cwt., or about 4·194 lb. of coal for every thousand gallons pumped. The total revenue of the Board has been £56,546 for the financial year ending in August, and the expenditure £12,878, so that there has been a handsome surplus to pay the interest on the borrowed money. For the half year the cost of the pumping has been for coals ·201d. per thousand gallons; the maintenance of works has cost ·185d.; and the total cost, with salaries, collection, rents, rates, &c., was ·972d. per thousand gallons, an increase over the previous half year, but a slight reduction on the amount for the corresponding half of the past year. It is worthy of remark that in six years the income of the Board has increased by £16,000, whilst the working expenditure has been stationary. It is now a profitable undertaking, but it is evident there will be a need for further works. Already the Board is pumping weekly from the river Tees 2,000,000 gallons more than it has legal power for; and thus it must be expected that it will speedily have to take steps to increase its supply. Indeed, with other extensions of its mains before it, that increase early is imperative, and a prolonged drought or a sharp frost would call forth such a demand that it would be almost impossible to meet it from the present source, so that there is a pressing need for additional supplies to be procured. The difficulty of the Board is that it is unable to carry out the works for which it has power, and one of the greatest problems of the North is how the demand for water on the Tees is to be met. The present supply is already taxed beyond the legal limit; none of the neighbouring companies can help the district to any great extent, and if the demand for water grows as it has of late, there will be a check to the prosperity of the district till the works are undertaken and carried out that will meet the growing demand.

THE FISHERIES EXHIBITION.

The Fisheries Exhibition was closed without much ceremony on Wednesday by the Prince of Wales. The whole number of visitors on that day was 13,859, making a total for Monday, Tuesday, and Wednesday of 122,704. The total number from the opening of the Exhibition until its close has been 2,703,051. It must be understood that the above numbers do not include the opening day, May 12, when it is computed that over 20,000 persons were present. The Exhibition has been an unqualified success. It was estimated that an attendance of one million would make it pay. It must not be supposed, however, that the funds derived from the extra 1,700,000 are all clear profit. The expenses kept pace with the attendance, or rather preceded it. It would be difficult to account for the popularity of the Exhibition if we did not bear in mind the skill with which it was worked. Arrangements were made, for example, with a large advertising contractor, under which he was paid not for the work he did but for the number of people who paid at the turnstiles, so much per head; need we say what was the result? Again, special arrangements were made with railway companies, and thousands upon thousands of handbills were circulated, with the results familiar, during the last couple of months, to those Londoners who went to the Exhibition. Nor is it to be denied that every effort was made to make the Exhibition enjoyable. The clerk of the weather smiled on the undertaking, and it was not difficult to fancy oneself in Paris or Vienna when the gardens were lighted up and the bands performed such perfect music as after all is only provided by a first-rate English military band. Minus the band, the electric light, the efforts of Mr. Willing, the patronage of Royalty, and the fine weather, the International Fisheries Exhibition would have been a failure instead of a well-deserved success, reflecting infinite credit on all concerned, and demonstrating that the British public can fully appreciate good things provided for their entertainment.

THE FRENCH TELEGRAPHIC SERVICE.

On the 25th October M. Cochery, French Minister of Posts and Telegraphs, attended before the Budget Commission of the Chamber of Deputies with models of the underground cables now in use in the French telegraphic service. He produced maps of the completed underground lines and those yet to be finished, and he laid emphasis on the utility of these wires, because of their greater freedom from interruption than those suspended in air. A lively discussion followed about the completion of the plans, because subterranean lines cost from 4000f. to 12,000f. per kilometre, whereas aerial lines cost but 300f. He was accompanied by General Saget, inspector of military telegraphs and president of the mixed commission on subterranean lines. It was argued before the financial commissioners that the military value of underground lines justified the extra expenditure, and M. Cochery, in justifying the credit of three million francs demanded for the Budget of 1884, promised to go on with the work planned, but not to make arrangements for anything further. On this understanding the credit of three million francs was voted. The commissioners next considered the Algerian Budget, and gave attention to the increase in expenses, in the form of salaries, connected with the postal and telegraphic services of Algeria. M. Letellier pointed out that much of the increase in Algerian expenses was due to the guarantees of interest on the expenses of the construction of railways, which interest, since 1882, had risen from six millions to twelve millions of francs. The consideration of these Algerian expenses was adjourned.

LITERATURE.

The Concepts and Theories of Modern Physics. By J. B. Stallo. London: Kegan Paul, Trench, and Co. 1882.

[Concluding Notice.]

We have dealt at some length with Dr. Stallo's attack on the atomic theory. We would gladly follow him were it expedient through the large portion of his book which deals with metaphysical speculations. To do this, however, in anything like a satisfactory way, would take up more space than we feel justified in devoting to a subject which is, perhaps, a little beyond the purview of this journal. We must content ourselves, therefore, with the statement that in certain respects we are completely at variance from Dr. Stallo. While it is impossible to dispute the skill with which he destroys, it is equally impossible to avoid the conclusion that he cannot construct. When he is driven to frame a theory to support his own views, the result of his labours is not quite satisfactory. Thus, for example, he lays it down as metaphysical truth that the human mind is quite incapable of forming a concept which is not based on the differentiation of the things concerned—that is to say, we know nothing by or of itself; we only know it by its differences from other things. For example, light is only cognisable by the difference which we perceive to exist between it and sound, colour, bread and butter, coals, horses, and so on. At first sight this proposition seems to be manifestly untrue. Now we believe it to be untrue, yet it is not so obviously untrue as at first it seems to be. For example, it is impossible to recognise the existence of motion unless we have bodies at rest with which to compare that which moves. We are not sensible of the rotation of the earth, although we are moving through space with an angular velocity of about 1000 miles per hour; and we only know that we are so moving because, for one thing, the sun, relatively at rest, rises and sets. If two stars alone occupied a given area of the heavens, and it was noticed that the distance between them augmented or diminished, it would be impossible to say which moved and which remained at rest, unless a third star was available with which to compare the two; and it will be readily understood that if this third star also moved an entirely erroneous impression might be conveyed to the mind. Thus, until comparatively recent periods it was held that the sun went round the earth, not the earth revolved on its axis. Such a line of reasoning as this implicitly supports Dr. Stallo's views; but it is, we think, improper to deduce too much from it, and we hold that the mind is capable of recognising peculiarities of individualisation which are entirely independent of comparison. We recognise a thing for itself, not for its differences; but the point raised by Dr. Stallo is one of considerable interest. The deductions which he draws are not alarming.

The thesis maintained by Dr. Stallo throughout his book is that nothing is really known with any certainty concerning physics, and it is impossible to deny that he has made out a most powerful case. It must not for a moment be supposed that he has any objection to urge against all mathematical deductions from experimental inquiries. Thus, for example, the statement that the formula $\frac{W v^2}{2g} = E$, where W is the weight of a body moving at the velocity v and $2g = 64{\cdot}2$, is quite accurate. In like manner, when we say that light diminishes in intensity as the square of the distance between the light-giving body and the point illuminated, nothing is taught which is not sound science. When, however, a college professor tells his classes that the pressure of a gas is due to the motion of perfectly elastic atoms moving at tremendous velocities in absolutely straight lines, without interfering with each other, he teaches, according to Dr. Stallo, not only what is presumably uncertain, but what is demonstrably false; and it is highly improbable that any ordinary lecturer will explain to his class, first that the kinetic theory of gases is simply a convenient working hypothesis, probably far removed from the truth. It is still less likely that he will go on to say that the inconsistencies and defects of the theory are so great, that the most able men who have dealt with it have been driven to make almost ludicrous assumptions in order to shore it up, and keep the miserable structure of assumptions from toppling about our heads. "There is," says Dr. Stallo, "another very extraordinary, and in the light of all the teachings of science unwarrantable, feature in the assumption respecting the movements of the alleged solid constituent particles. I allude to the absolute discontinuity between the violent mutual action attributed to these particles during the few instants of time before and after their collisions and their total freedom from mutual action during the comparatively long periods of their rectilinear motion along 'free paths;' and this leads me to say a few words in regard to certain subsidiary assumptions made by Maxwell and others in order to account for the anomalies exhibited by gases of different degrees of coercibility in their deviations from Bayle's and Charles' Law. Maxwell assumes that the gas molecules are neither strictly spherical nor absolutely elastic, and that their centres repel each other with a force inversely proportional to the fifth power of their distance,* while Stefan endeavoured to adjust the hypothesis to the phenomena in question by postulating that the molecules are absolutely elastic and perfect spheres, whose diameters are inversely proportional to the fourth roots of the absolute temperatures of the gas." A theory which requires to be thus supported is better dismissed. We quite agree with Dr. Stallo that both assumptions are "mere stop-gaps of the hypothesis—peace offerings for its non-congruence with the facts—pure inventions to satisfy the emergencies created by the hypothesis itself." In another place he says:—"The delusion that the elasticity of a solid atom is in less need of explanation than that of a bulky gaseous body is closely related to the conceit that the chasm between the world of matter and that of mind may be narrowed, if not bridged, by a rarefaction of matter, or by its resolution into 'forces.'" It will be seen that Dr. Stallo hits hard, but it was quite time that some hard knocks were bestowed.

The chapter on transcendental geometry will open a new, and we fear a very foolish, page in the book of so-called science to Dr. Stallo's readers. He sets forth at some length the views held by mathematicians concerning the nature of space, which has come to be regarded by many of them as a thing, the shape of which may vary in different places, and in which may exist many dimensions as well as three. So long as investigations into the influence of a fourth dimension, &c., were made the subject of a mathematical game with impossible quantities, no harm was done; but what are we to think when we find grave and sober mathematicians actually asking astronomers to ransack the heavens in search of a place where space is curved? "The astronomer," says Dr. Stallo, "would at once meet every suggestion of the sort with the objection that an inherent curvature of space pre-supposes differences between its several parts—heterogeneity in its internal constitution—and that the hypothesis suggested therefore involved nothing less than the attribution to space of the very properties by the absence of which alone it is distinguishable from matter."

The fifteenth chapter of this book is devoted to the slaughter of certain cosmological speculations. Dr. Stallo pursues his usual plan. He first sets forth the authoritative statement of some one who is regarded as a trustworthy exponent of scientific truths; and he then proceeds to show how this statement has been supported or disputed by others, the result usually being disastrous for the reputation of the original statement. Here, for example, he takes for one thing Sir William Thomson's celebrated paper "On a Universal Tendency in Nature to the Dissipation of Mechanical Energy." We fancy that there is no tolerably advanced student in any of our engineering colleges who is not familiar with the nature of Sir William Thomson's well-known theory of the dissipation of energy, and no doubt students, and to a considerable extent teachers, have accepted his dictum as true, and have not known or cared to know that its acceptance involves stupendous difficulties. Professor Rankine early pointed out that if there be a limit to the space occupied by what is known as the universe, there must also be a limit to the degradation of energy. It is clear that if, on the other hand, there is no such limitation, then in process of time there must be an end of the universe; the processes of nature eventuating in a thorough homogeneity, and a complete absence of all the attributes and differences which constitute the attestation of its existence. Again, dealing with the nebular theory, Dr. Stallo shows that it is entirely unable to explain the motion of the planets, and that the origin of these motions has not as yet been accounted for by any satisfactory hypothesis.

The sixteenth is the last chapter of the book. It is devoted principally to a discussion of the mechanico-chemical theory, on which the author is much less severe than he is on others; and so the book closes.

We may be asked, What good can such a book do? and we reply much. In the present day there is a growing tendency to exalt physical science to a position to which it is in no sense entitled. The progress of discovery in chemistry and electricity has been so rapid and extensive that the unlettered or half-taught world has been inclined to pronounce men of science gods, and to regard all that they have said as infallible utterances. It is well known that all the scientific teaching of the present day—which must not be confounded with the scientific work—is due to a very small number of men. Probably not more than twenty have had weight enough to make a mark or influence the current of thought. Among these may be mentioned Dalton, Davey, Faraday, Rankine, Clerk-Maxwell, Clausius, and Thompson, nearly in the order of their periods of influence. Around these luminaries have circulated a host of minor planets. Each great man has had his following, aiding in the dissemination of his views, and supporting his theories with all their own powers of invention. During the last fifty years the world has taken the dicta of a few men as enunciations of absolute truth, in this respect usually going a great deal further than the authors of the theories in question; and it is no uncommon thing to find what is put forward as a thing of doubt and hesitation by a master mind, is coolly set forth on the lecture platform as absolute truth. Mr. Stallo has done good service by coming forward and lifting a veil which has too long shrouded the truth. It was time that the rising generation should be taught that we know nothing at all with certainty of the ultimate constitution of matter. It is well that every young chemist should know that the atomic theory has little or no basis in fact. The engineer will be none the wiser for knowing that the kinetic theory of gases is a sham, reconciled to a certain limited extent with the results of experiment, and so made to carry itself well in text books. Nor will the rising astronomer be injured by knowing that the theory of light is of the most unsatisfactory. The good which Dr. Stallo may effect will be great. Much will be gained if teachers, whether in the class-room or in books, take care to explain that the theories they enunciate are not necessarily truths, but are to be used as a carpenter might use a 2ft. rule. The rule does not pretend to be an accurate measure of length; but it is good enough for its purpose. In the same way the atomic theory, for example, is essential to the chemist; but to assert that it really tells us what goes on when a chemical combination takes place is distinctly wrong. What would be thought of a man who taught that a carpenter's rule was a perfectly accurate measure of length? He who asserts that it is quite true that molecules of air bombard the inside of a bladder and so swell it up when we hold it before the fire, is not more accurate. It is conceivable that one carpenter's rule out of hundreds might chance to be neither too long nor too short; but it is not conceivable that the physical theory of the atom and the chemical theory of the atom can both be true.

The fact is that concerning what goes on around us in nature we know next to nothing, and are so constituted that it is unlikely we ever shall know. We cannot tell why an apple falls off a tree, in spite of the story about Newton. Nor can we tell why the sun is hot, or why a magnet produces electricity; how mechanical effect is transformed into heat, or how a man can lift his hand to his head. This ignorance should teach us above and beyond all things to be modest; but modesty is the last thing practised now-a-days by the man of science, falsely so called in many cases. There are and there have been glorious exceptions. If Dr. Stallo augments the number by even one he will have done good service. We have called "Physical Concepts" a most remarkable work. Those who read it will, we feel sure, be repaid for the task, and will be disposed to agree with us in the concept we have formed of it.

* Maxwell subsequently abandoned this hypothesis.

BOOKS RECEIVED.

Professional Papers of the Corps of Engineers. Edited by Major R. H. Vetch, R.E. Royal Engineer Institute Occasional Papers. London: Ed. Stanford. 1883.

Graphic and Analytic Statics in Theory and Comparison: their Applications to the Treatment of Stresses in Roofs, Girders, &c. By R. Hudson Graham, C.E. London: Lockwood and Co. 1883.

The British Navy: its Strength, Resources, and Administration. By Sir Thomas Brassey, K.C.B., M.P. Vol. 5. Part V. British Seamen. London: Longmans and Co. 1883.

Recent Locomotives: Illustrations, with Descriptions and Specifications and Details of Recent American and European Locomotives. Reprinted from the *Railroad Gazette.* London: E. and F. N. Spon. 1883.

Electricity and its Uses. By J. Munro. London: Religious Tract Society. 1883.

Proceedings of the United States Naval Institute. Vol. 8. Annapolis: The Institute. 1883.

Zeitschrift des Electro-technischen Vereines in Wien. Redigert von Josef Kæreis. Heft VI. Wien. 1883. R. Spies and Co.

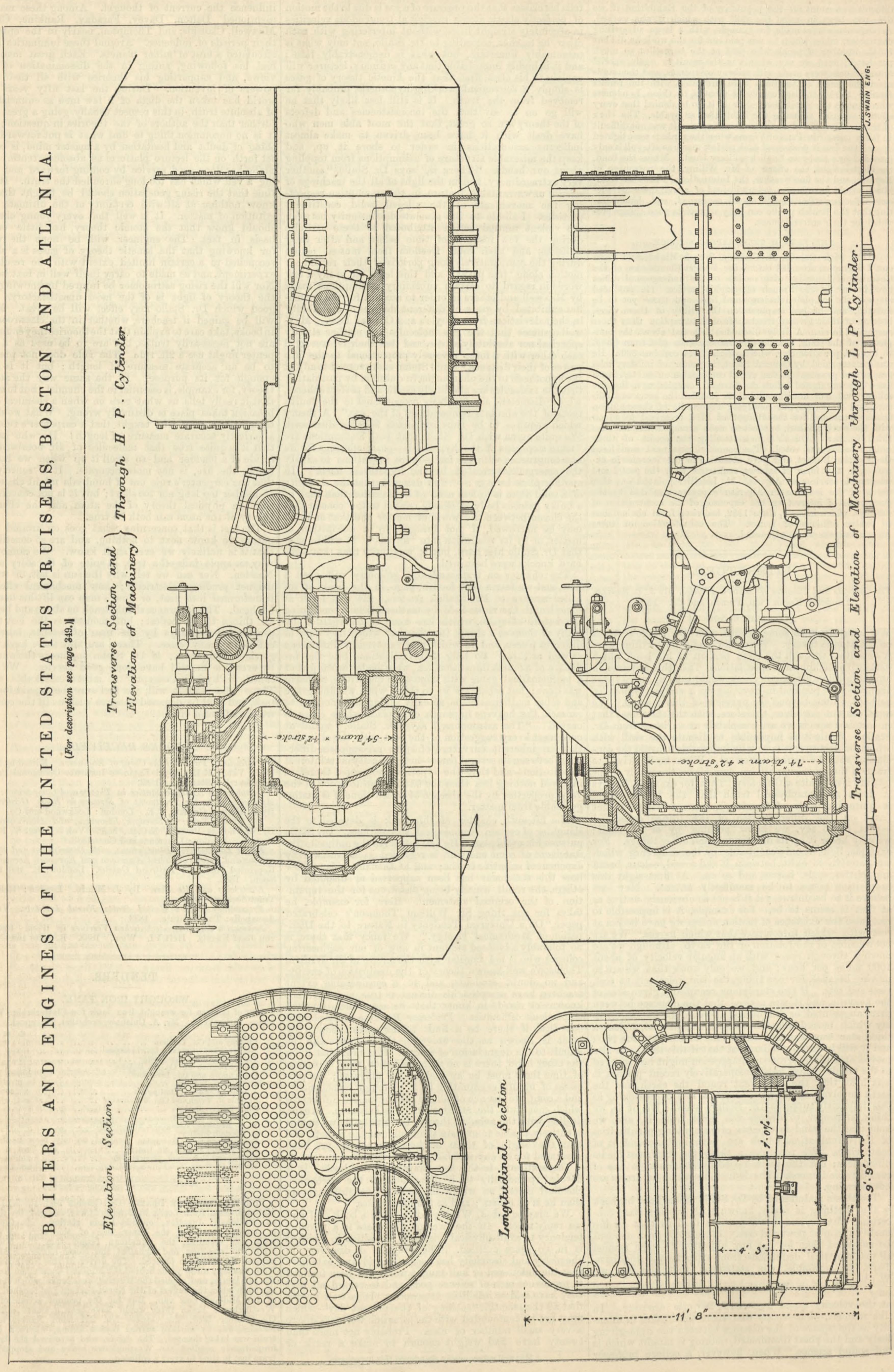
TENDERS.

WROUGHT IRON TANK.

List of tenders for wrought iron tank for Clatterbridge Workhouse, Birkenhead. Mr. A. Culshaw, architect, Liverpool.

	£	s.	d.
Lindsay and Co., London	875	0	0
Walker, Pendleton, and Co., Liverpool	475	0	0
Tangye Brothers, Manchester	350	0	0
Robert Daglish and Co., St. Helens	327	0	0
Caleb Smith and Co, Liverpool	325	0	0
H. Gielgud, London	310	0	0
J. Shewell and Co., Darlington	297	10	0
Francis B. Welch and Co., Manchester	288	0	0
John Walley, Derby	285	0	0
J. Brettell, Worcester	254	10	0
W. R. Renshaw, Kidsgrove, Staffordshire	253	10	0
S. Woodall, Dudley	248	5	6
Ratcliffe and Sons, Hawarden	228	0	0
John Forster and Co, St. Helens	220	0	0
Russell and Robertson, Workington	210	0	0
Warren Brothers, Newhall—accepted	188	18	6

The Westinghouse Brake.—On October 24th the 5.13 p.m. Midland train from Leeds to Bradford was stopped by signals at Whitehall Junction, outside Leeds station. As the line is curved, and on the inner side of the curve a goods train was standing, the signalman forgot that the Midland train was standing, and signalled the North-Eastern 5.20 p.m. express for Ilkley to proceed. The driver of the North-Eastern train was only a few yards behind the Midland train when he saw the tail lamps, and applied the Westinghouse brake, which stopped the train when the buffers of the North-Eastern just touched those of the Midland rear van. But for the prompt action of the Westinghouse brake there would have been a smart collision. On October 23rd, the express No. 251 from Nantes to St. Nazaire was by mistake turned into a siding, where a goods train was being shunted. The driver, who perceived the danger, immediately applied the Westinghouse brake and stopped the train just in time to avert a collision.



BOILERS AND ENGINES OF THE UNITED STATES CRUISERS, BOSTON AND ATLANTA.

(For description see page 349.)

parties to drive the gas up the downcast shaft resulted on Wednesday in the explosions mentioned, since the gas was driven to that part of the pit which is on fire. The damage to property was considerable. It has now been determined to attempt to drown the fire out.

NOTES FROM LANCASHIRE.

(*From our own Correspondents.*)

Manchester.—The condition of the iron trade in this district certainly does not improve, nor does it get very much worse. Pig iron makers manage to keep pretty well supplied with work, and as there is really no margin on the present low basis of prices for further concessions, they prefer to go on from hand to mouth with the small orders they are able to secure at current rates rather than accept offers for forward sales at lower prices. Viewed from this point the market may be said to be steady, for although the actual business doing at full current rates is only small, and buyers still hold back any orders of weight for lower prices, it is only in very exceptional cases that they are able to find makers who will meet them with any concessions. Where there is any underselling it is chiefly in outside brands, such as Scotch and Middlesbrough, which are being offered through dealers in some cases at considerably under makers' prices. In the finished iron trade old orders appear to be running out faster than new ones are coming in, but the leading makers are still kept busy.

Tuesday added another to the long succession of quiet iron markets at Manchester. The actual business report was again very small, but there was no great pressure to sell. For Lancashire pig iron makers were very firm at full rates, 45s. 6d. less $2\frac{1}{2}$ being quoted for both forge and foundry qualities delivered equal to Manchester. It is only on a few odd sales that makers are getting this figure; offers at about 1s. less have been pending for the last week or so, but makers do not seem disposed to close, and even where buyers have come within 6d. of the list price local makers have declined. For the present they are pretty well off for orders, and the opinion is evidently entertained that prices will improve. For Lincolnshire iron delivered here the average price is about 44s. 10d. to 45s. 6d. less $2\frac{1}{2}$ for forge and foundry qualities respectively, and occasional orders sufficient to keep makers going are obtained on the basis of these figures. For Middlesbrough iron prices are irregular; choice brands cannot be bought from makers under about 47s. 4d. net cash delivered equal to Manchester, but iron out of store is to be bought from merchants at considerably under this figure.

Hematites continue bad to sell, and it is difficult to get at actual prices. Recently a tolerably large quantity was bought in this district at an extremely low figure—very far below the basis of 58s. to 58s. 6d., less $2\frac{1}{2}$ per cent., which makers are asking for good foundry brands delivered equal to Manchester.

The slackening off in the pressure for finished iron for shipment is beginning to make itself felt, as it is evident that home requirements are not sufficient to keep up the recent activity. There is not as yet any actual scarcity of work, but makers are not getting new orders on their books at the same rate as they are clearing them off, and this is tending towards a slightly easier tone in the market. Bars are still quoted at £6 2s. 6d. to £6 5s. per ton, delivered into the Manchester district; but hoops are getting back to the minimum rates, and can be bought at £6 10s. to £6 12s. 6d., and the same may be said of sheets, which scarcely average more than £8 for good ordinary qualities, whilst sales have been made as low as £7 15s. per ton.

With regard to the engineering trades there is not much to add to what I reported last week. In some special branches there is still plenty of activity, but in the general class of work trade continues to quieten down. The leading cotton machinists in the Oldham district, such as Messrs. Platt Bros. and Co., Asa Lees and Co., are very busy, and working overtime to keep up with their orders. Work, however, has to be taken at prices which do not leave any great margin of profit, and any real activity in the cotton machine trade seems to be almost entirely confined to the town of Oldham. Reports from nearly all the other districts are unsatisfactory as to the condition of trade, apart from the new machinery being put down in Oldham, which is, of course, supplied locally. The home demand is very quiet, and it is chiefly with foreign work that machinists are kept going.

The condition of the coal trade shows no appreciable improvement. Notwithstanding the advanced season of the year, house fire coals still move off only moderately, and other classes of fuel for manufacturing purposes meet with only a slow sale. Supplies continue ample for all requirements, and except that one large Manchester firm has advanced furnace coal, nuts, burgy, and slack 5d. per ton, there has been no further announced upward movement in prices with the commencement of the month, and at the pit mouth prices remain about as under:—Best coal, 9s. 6d. to 10s.; seconds, 7s. 6d. to 8s.; common coal, 5s. 6d. to 6s.; burgy, 4s. 6d. to 5s.; good slack, 3s. 6d. to 4s.; and common about 3s. per ton.

Notwithstanding the unsatisfactory state of trade, the men seem determined to persist in their agitation for an advance of wages, and at the Manchester Conference this week it was decided to send in notices.

Barrow.—The hematite pig iron market is still in a quiet position, and no advancement has taken place in the business doing for some weeks past. I can hear of but few orders, either on home or colonial account, coming to hand, and makers have few, if any, heavy contracts on the books. The production of metal has been very large for some time past, and the deliveries having been very small, the stocks have now become of some magnitude. The prices obtained are so small that makers find it impossible to realise any profits on the transactions. It is becoming more and more evident that the output of the furnaces will have to be reduced, and several furnaces will have to be blown out till there is a decided change in the state of the market. If this is not done it will be necessary for the makers to accept orders at lower prices than are now ruling, to enable them to lower their stocks. This they have refused to do up to the present, many of them preferring to stock the metal in the hopes of a speedy change. The prices generally accepted are No. 1 Bessemer, 49s. per ton net at works; No. 2, 48s.; and No. 3, 47s. per ton, but a few orders have been accepted at a trifling reduction.

Steel makers are still well employed both in the merchant and rail departments. Ordinary heavy sections of rails are at present selling at from £4 10s. to £5 per ton, prompt delivery. The consumption of mild steel for spring and cutlery purposes is increasing. The minor branches of the iron and steel trades are fairly well employed. Shipbuilders are quiet with few inquiries. Iron ore is in fair demand at unchanged prices, quotations being from 9s. to 11s. per ton at mines. Stocks are very heavy all round the district. Coal and coke are steady. Shipping quiet.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

There is no change in the condition of affairs in the coal trade. The miners are to meet again on the 2nd and 3rd of this month, and there is very little doubt that they will continue in the course they have indicated, by ordering notices to be served for an advance of 15 per cent. They have been joined in this step by the miners of Derbyshire. At a meeting at Chesterfield last Saturday, at which 20,000 miners were represented, it was decided to take similar decisive steps. The employers are determined to resist this agitation, believing that any advance in wages would have a most detrimental effect, not only upon the coal trade of South Yorkshire, but upon the iron and steel industries and general commerce of the country. An attempt is being made to have the dispute referred to arbitration, but both employers and employed do not seem to regard the proposition with favour. At the present time the outlook is excessively gloomy.

The lighter trades of the town are at present well employed, a considerable accession of Christmas orders being now in course of completion. We hear of some good orders of saws, engineers' tools, and similar goods, having recently been received both on home and foreign account. Sheep-shears are stated to be very dull, and there is no improvement in files. In the heavy branches, such as armour-plates, boiler-plates, steel castings, railway wheels, tramway wheels, and colliery gear generally, there is considerable activity, particularly in the former departments. It is questionable, however, if Sheffield will much longer retain her important monopoly of armour-plates. The Germans have constructed three Chinese ironclads, all armoured with compound plating; and the manufacture has been for some time carried on in France. I hear it is not improbable that Russia may be soon found following in the example of these two great Powers. In that case the heavy orders which have come for armour from Russia will cease, and the Russian Government will by-and-bye build not only their own ships, but plate them as well.

Messrs. Charles Cammell and Co. intended to have invited their shareholders to see the new works they have planted at Workington. The intention was that this should have been done early in November, but owing to the shortness of the days and the uncertainty of the weather, the directors on Wednesday resolved to postpone the visit until spring, when pleasure can be combined with business. I understand that these works are now producing nearly to the full extent of their output—4000 tons per week, and not a single hitch has taken place since the start.

At the quarterly public ivory sales, which commenced in London on the 25th October, a total weight of 101 tons of this valuable material was offered. The lot comprised 45 tons East India and Zanzibar, 24 tons Egyptian, 2 tons Cape, 20 tons West Coast, with 6 tons mammoth, 2 tons waste, and 2 tons sea horse teeth, against a total of only 67 tons in October, 1882. A good demand for all descriptions of teeth, and full prices were realised. Billiard ball and other cut kinds went off flatly at rather reduced rates.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

The Cleveland pig iron trade is in a depressed condition, and the prospect for the winter months is far from encouraging. At the market held at Middlesbrough on Tuesday last prices were fully 3d. per ton lower than a week previously, and it is thought that the minimum has not yet been reached. No. 3 g.m.b. for prompt delivery was offered by merchants at 38s. 3d., and makers were willing to take 38s. 6d. per ton. Buyers were shy, however, and little business was done. For forward delivery orders for No. 3 can be placed at 38s. No. 4 forge iron has been sold as low as 36s. 6d. per ton.

Warrants are offered at 38s. to 38s. 3d., but they are not in demand.

The stock of Cleveland pig iron in Messrs. Connal's store at Middlesbrough decreased 865 tons during the past week, the quantity held on Monday last being 66,562 tons.

The exports have fallen off somewhat during the last few days. Still the figures compare not unfavourably with those for last month. Up to Monday night 89,381 tons of pig iron had been shipped from the Tees, as against 94,367 tons in September. In October last year the quantity was 95,112 tons.

Prices are much easier in the finished iron trade. Nevertheless, only a small amount of business is being done. Manufacturers are anxious to secure orders for forward delivery, and are prepared to take £5 17s. 6d. to £6 per ton for ship plates in quantity. Shipbuilding angles are offered at £5 10s. to £5 12s. 6d., and common bars at £5 12s. 6d. to £5 15s. per ton, free on trucks at works less $2\frac{1}{2}$ per cent. discount.

Puddled bars are still about £3 12s. 6d. per ton net. The steel rail trade continues dull, and buyers are not tempted even by such prices as £4 10s. to £4 12s. 6d. per ton.

Mr. Charles Wood, of Middlesbrough, has receivsd an order for a quantity of his patent wrought iron sleepers, rails, and rolling stock for light railways, to be sent out to the West Indies.

Messrs. Bolckow, Vaughan, and Co., Limited, paid off about 100 men at the Eston Steel Works on Monday last. and one of the rail mills is now idle. This is owing to the depression in the steel rail trade, and it is not unlikely that this firm will have to stop other mills shortly.

Messrs. Bell Bros. are about to blow-out two of their hematite blast furnaces at Low Walker, in order that they may be re-lined. This will reduce the output by about 1000 tons per week.

The accountants' certificate under the Durham and Northumberland collieries sliding scale was issued last week, showing that the net average selling price of coal for the three months ending September 30th was 4s. 11·48d. per ton. The present rate of wages will remain unaltered.

The Cleveland blast furnacemen have formulated the details of their proposed new sliding scale, which they submit for the mineowners' acceptance. The men ask an advance of 5 per cent. on standard rates, and are willing that the sliding scale should be framed, so that $1\frac{1}{4}$ per cent. be given or taken uniformly for every shilling increase or decrease of selling price of pig iron. They also ask for an extra half-shift for working after one o'clock on Saturdays.

Most of the Sunderland engineer apprentices who came out on strike last week have returned to work again. The Sunderland magistrates, before whom some were summoned, ordered them to return to work at once and pay the damages—10s. each—and costs.

The report that Messrs. Allhusen and Co.'s salt boring operations had been suspended turns out to be incorrect. Progress was interrupted for a few days by an accident, but all has now been put right, and boring is proceeding as usual.

A mass meeting of the ironworkers of Stockton, Middlesbrough, and district, was held at Stockton on Monday last, to consider the question of a new sliding scale. The following resolution was unanimously carried:—"Notice having been given by the Board of Arbitration for the reconsideration of the wages question, we the ironworkers of the Stockton district, consider the present rate of payment is unsatisfactory, and would recommend in its stead a minimum rate of 8s. per ton, imperial weight, with a basis of half-a-crown above shillings for pounds." This means an advance of 10 per cent. on present rates, and under no circumstances any reduction below. Should the ironworkers obtain their wishes, which is unlikely, it would lead at once to widespread suspension of operations among the northern ironworks.

The ideas of the employers upon the same subject are at present very clear and very unanimous. They say that Mr. Dale, Mr. Shaw-Lefevre, Sir J. W. Pease, and other referees have again and again pointed out that the increase of confidence which is the natural offspring of a sliding scale has a certain commercial value. They agree with this view, and are willing to pay the full value of peace and quiet. This they estimate at 5 per cent. They say, as regards basis rates, that nothing above Dale's scale, or one shilling above shillings for pounds, can in the present state of trade be for one moment entertained, and that if the scale is to come to an end they will require a reduction of at least 5 per cent. upon the rates which otherwise would be payable. Time will show whether the employers' views or those of the workmen will prevail. But the present indifferent trade prospects would seem to indicate that the alterations brought about by the immediate future are more likely to be downwards than upwards.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

Since last report a further decline has occurred in the pig iron market, warrants having been down on Tuesday as low as 44s. $7\frac{1}{2}$d, per ton. Subsequent buying imparted a little strength to the market, but there is still a great want of interest in the warrant market. The shipments of pig iron were a good average, and the home consumption appeared to be well maintained in the course of the week. There is scarcely any addition to stock in the warrant stores, and the impression is that makers cannot at present be adding to their holdings.

Business was done in the warrant market on Friday forenoon at 45s. $1\frac{1}{2}$d. to 45s. cash, and in the afternoon at 45s. $0\frac{1}{2}$d. to 45s. $11\frac{1}{2}$d. cash, and 45s. $2\frac{1}{2}$d. to 42s. 2d. one month. On Monday forenoon transactions occurred at 44s. $10\frac{1}{2}$d. to 44s. 11d., and down to 44s. $9\frac{1}{2}$d. cash; and from 45s. 1d. to 45s. $0\frac{1}{2}$d. one month. In the afternoon the quotations were 44s. $9\frac{1}{2}$d. to 44s. $8\frac{1}{2}$d. cash, and 44s. $11\frac{1}{2}$d. one month. The market was dull on Tuesday at the opening, when 44s. $7\frac{1}{2}$d. cash was quoted, but there was a subsequent improvement to 44s. 11d. cash. On Wednesday business took place at 44s. $8\frac{1}{2}$d. to 44s. $10\frac{1}{2}$d. cash. To-day—Thursday—transactions were effected from 44s. 8d. to 44s. 10d. cash, and 45s. one month.

The values of makers' iron, which are lower, are subjoined:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 54s.; No. 3, 51s.; Coltness, 57s. and 51s. 6d.; Langloan, 56s. 6d. and 51s. 6d.; Summerlee, 55s. 6d. and 50s.; Chapelhall, 54s. and 51s.; Calder, 56s. 6d. and 48s. 6d.; Carnbroe, 54s. and 48s.; Clyde, 49s. and 47s.; Monkland, 46s. 6d. and 44s. 6d.; Quarter, 46s. 3d. and 43s. 9d.; Govan, at Broomielaw, 46s. 6d. and 45s.; Shotts, at Leith, 56s. 6d. and 53s.; Carron, at Grangemouth, 49s. (specially selected, 56s. 6d.) and 47s. 6d.; Kinneil, at Bo'ness, 48s. and 47s.; Glengarnock, at Ardrossan, 53s. 6d. and 46s. 6d.; Eglinton, 47s. 6d. and 44s. 3d.; Dalmellington, 47s. 6d. and 46s. 6d.

The imports of Cleveland pig iron into Scotland are on a liberal scale, showing to date a comparative increase of 23,190 tons, the whole arrivals since the first of the year being 218,679 tons.

At present the ore trade from abroad is not quite so active; still, there are good arrivals of iron ore at Glasgow from Bilbao.

In the malleable iron department the main feature of interest this week is the action of the workmen with reference to the question of wages. It was stated in this correspondence last week that the puddlers, millmen, &c., were dissatisfied with the reduction made in their pay, following upon a curtailment of wages in the North of England. The cause of this dissatisfaction is that the agreement, whereby the wage is regulated by those across the border, has on the present occasion operated to produce a reduction at a time when the works are fully employed, and but for the English award there might have been no talk of reducing pay here. Of course, in accordance with the agreement, employers are quite justified in the action they have adopted. Large numbers of the men were idle in the principal manufacturing districts of Lanarkshire on Monday, and they held a mass meeting at Coatbridge on the afternoon of that day, when it was resolved that representatives of both parties be asked to confer on the subject.

The coal trade in most districts continues fairly active, and considerable interest is felt in the efforts which are now to be made to obtain a further increase of prices. At Glasgow the past week's shipments have been good; 5841 tons were shipped at Troon, 8578 at Ayr, and fair cargoes were despatched from other places.

The sale and other coalmasters of Lanarkshire give an advance of 6d. a day to the colliers in their employment, the increase dating from the 1st inst. Unless the condition of the iron market should improve it is not believed that the advance will long be maintained. The miners, however, are likely to continue the agitation, with the object of rendering the increase general throughout the country.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

It is not to be wondered at that strenuous efforts are being made to secure all untaken coal property of the best kind. Sir George Elliott is well represented in inquiries as to deep measures in the Monmouthshire district at Tirphil, where there is a fine property for disposal.

The Ocean Colliery Company has secured the Ffald Colliery in the Garw Valley, and it is a moot point in the colliery world whether the closer proximity to the Ogwr may not tend to further dock schemes. The Barry promoters are understood not to be pledged to Barry, but, for want of something better, mean resolutely to go to work, and, if possible, win.

Two good dredgers have been bought from the Cork Harbour Commissioners by Mr. W. T. Lewis, for the use of the Bute Docks, and will soon clear a wide channel. I see, further, that it is intended to go to Parliament next session for a supply of water to the docks from a new source.

Mr. Nelson is doing good work at the new docks, Cardiff, and in order to push on the work, has brought the electric light into requisition.

I note that notwithstanding storms and untoward winds, the exports at all the ports are well sustained, prices, too, are firm for best coal, but in some cases a little slackness has prevailed principally in districts supplying coal for the ironworks, such as the Bedlinog Valley. Here the slackness of Dowlais works is felt very much, especially as the deep sinking is not attended with the best results. Bedlinog and the Treharris Colliery are amongst the least successful ventures of recent years. It is estimated that at the latter an output of 2000 tons a day would only yield a reasonable return, now the output rarely exceeds 600 tons. The coal is, however, there in abundance, and the difficulty would only seem to be temporary and mechanical.

An indication of colliery prosperity is to be seen in the spread of telephonic arrangements. A trunk wire between Cardiff and Newport, the first of the kind in this country, has long been in active use. It is now increased to three. This year a new one was started up the Monmouthshire valleys, and this week, one of forty-seven miles in length connecting Cardiff and Swansea. This will give in length eighty-two miles, the longest yet formed.

A very large meeting of the Rhondda colliers was held this week, when it was decided to support the claimants of the Gelli explosion inquiry. This means a fight in the law courts, which will accordingly take place. It will be remembered that the jury found a defective system of ventilation as the chief cause of the explosion at this place. In such a case, arbitration assessing amount, and not a conflict, would seem to be the wiser course.

The colliery enginemen have now started a protective society, and this week met in private to arrange a code of rules.

I cannot as yet report favourably of the iron and steel trade, though there are not wanting some promising indications. It is known that Messrs. Bolckow, Vaughan, and Co. have reduced make at their rail mills, finding that they cannot compete with the Welsh makers as to price, and it is likely that some business may now be done by our ironmasters after the relief of the last reduction.

Wages in the iron trade are regarded as fixed now for the next three months. They are sufficiently low to meet present quotations, and I do not despair of seeing something done. It is notorious that rails are wanted both for home and colonial requirements, and the only difficulty is financial.

At Swansea general industries are in a favourable state, and the only complaint is that the iron trade shows such little buoyancy. Preparations are on foot for a banquet to Dr. Siemens.

The tin-plate trade has shown diminished activity in the last week. Makers, however, are well placed for orders, and prices still keep up.

I am told an interesting anecdote of the sagacious contractor of the Severn tunnel. Previous to beginning operations Mr. Walker carefully sought for evidence of highest known tides, and finding that one a hundred years ago was up to a certain point, made his openings accordingly, and so arranged his defences that when the late unusually high tide occurred he was "a few yards to the good." But for this—and many thought him too fearful—the present work would have been ruined.

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.

23rd October, 1883.

5024. Printing Telegraphs, H. J. Allison.—(*S. D. Field, New York.*)
5025. Checking Visits of Watchmen, J. W. Fletcher, Stockport.
5026. Twisting Yarns, W. Cunningham, Dundee.
5027. Umbrella Sticks, T. Hetherington.—(*J. T. Smith, New York.*)
5028. Shoddy Pickers, S. Pitt.—(*C. Dodge, Lowell, U.S.*)
5029. Corking Bottles, J. J. H. Schultz, Hamburg.
5030. Obtaining Vegetable Wool, J. F. Phillips.—(*J. L. Allagnon, Paris.*)
5031. Electro Motors, A. Reckenzaun, Forest Gate.
5032. Fastenings for Travelling Trunks, W. B. Williamson, Worcester.
5033. Recovering Tin from Tin Strap, E. L. Cleaver, London.
5034. Lawn-tennis Bats, C. Malings, Woolwich.
5035. Iron, &c., Vessels, J. Imray.—(*A. Baude, Paris.*)
5036. Illumination, O. E. Woodhouse, F. L. Rawson, and A. R. Molison, London.
5037. Making Silos, F. Lindsay, London.
5038. Splitting Leather, W. H. Stevens, Leicester.
4039. Volatile Hydrocarbons from Coal Gas, E. Drew, London.
5040. Dental Plates, E. A. Schmid.—(*E. Doerr, Germany.*)
5041. Sewing Button Holes, W. R. Lake.—(*C. M. Banks and St. J. W. Mintzer, Philadelphia, U.S.*)
5042. Electrical Igniting Apparatus, W. R. Lake.—(*N. de Kabath, Paris.*)
5043. Electrical Accumulators, W. P. Thompson.—(*K. W. Zenger, Austria.*)
5044. Carbonic Acid Gas, A. J. Boult.—(*C. Lauer, France.*)
5045. Rings, A. J. Boult.—(*E. Liament, Budapest.*)
5046. Spile for Casks, A. J. Boult.—(*J. P. Schönig, France.*)
5047. Time-controlling Systems, W. F. Gardner, Baltimore, U.S.

24th October, 1883.

5048. Blanks for Horseshoe Nails, R. H. Brandon.—(*F. Myers, U.S.*)
5049. Setting Buttons upon Boots, R. H. Brandon.—(*S. L. Pratt, Ingham, U.S.*)
5050. Finishing Horseshoe Nail Blanks, R. H. Brandon.—(*F. Myers, U.S.*)
5051. Propellers, B. W. Maughan and S. D. Waddy, London.
5052. Mechanical Lamps, H. J. Allison.—(*G. Haseltine, Broadway, U.S.*)
5053. Preserving Milk, &c., O. E. Pohl, Liverpool.
5054. Traction Rope Tramways, J. Y. Johnson.—(*A. Bonzano, U.S.*)
5055. Self-acting Apparatus for Igniting Cotton, T. Meekham, Canonbury.
5056. Tricycles, &c., Sir D. Salomans, Tunbridge Wells.
5057. Workmen's Tallies, J. H. Northcott, Plymouth.
5058. Sifting Ballast, R. and G. Neal, and C. R. Whitmee, Battersea.
5059. Chaining Warps, W. Hurst, Rochdale.
5060. Automatic Car Couplers, H. J. Haddan.—(*E. N. Gifford, Cleveland, U.S.*)
5061. Getting Coal, W. F. Hall and W. Low, Durham.
5062. Perspectographs, G. Macaulay-Cruickshank.—(*H. Ritter, Germany.*)
5063. Bleaching Fibres for Paper-making, G. Mackay, Edinburgh.
5064. Calcining Peat, B. J. B. Mills.—(*A. Zwillinger, Vienna.*)
5095. Electric Railways, M. H. Smith, Halifax.
5066. Furnaces, C. J. Chubb, Cliffton.
5067. Sheet-metal Cans, W. R. Lake.—(*E. Norton and J. G. Hodgson, Chicago, U.S.*)
5068. Name-plate for Plants, A. Still, Liverpool.
5069. Secondary Batteries, J. S. Sellon, London.

25th October, 1883.

5070. Obtaining Sulphur, C. F. Claus, London.
5071. Horseshoes, J. George and J. J. Walker, Highgate Hill.
5072. Insulators, E. Roe, Surbiton.
5073. Preparing Fish for Cure, J. Ross, jun., Muchalls.
5074. Treating Porcelain, &c., E. P. Evans and S. Ranford, Worcester.
5075. Valve Gear for Steam Engines, A. Paul, Dumbarton.
5076. Vehicles, H. J. Haddan.—(*N. B. Clinch, U.S.*)
5077. Loading Slag, &c., J. Wood, Wigan, and J. Abbott, Ince.
5078. Electro Motors, W. R. Lake.—(*H. Walter, U.S.*)
5079. Motor Engine, F. C. Glaser.—(*L. Heinrici, Germany.*)
5080. Neck Protection for Hair Cutting, L. W. Thomas, London.
5081. Switch Apparatus, J. Imray.—(*T. A. Connolly, Columbia, U.S.*)
5082. Dynamo-electric Machine, R. E. Dunston, A. Pfannkuche, and J. Fairlie, London.
5083. Tobacco Pipes, W. A. Ross, Acton, and H. Lawson, Clapham.
5084. Couplings, S. Roberts, Tunbridge Wells.
5085. Gas Motor Engines, C. A. Bullock, Blackheath.
5086. Valves for Steam Engines, T. Lewis.—(*P. H. Stangaard, Germany.*)

26th October, 1883.

5087. Metallic Pens, D. Cameron, Edinburgh.
5088. Distributing Electricity, J. Beeman, London.
5089. Muscular Force for Propelling Boats, L. Bellefonds, London.
5090. Dyeing Textile Materials, F. C. Glaser.—(*E. Rümmelin, Germany.*)
5091. Deep Sea Fishing, H. Brooks, Great Yarmouth.
5092. Cross-cutting Tickets, &c., J. Black, London
5093. Moulding Threads in Plastic Material, D. Rylands.—(*H. Brooke, U.S.*)
5094. Gas for Melting, D. Rylands.—(*R. Good, New York.*)
5095. Heaving up Slips, T. Summers and A. J. Day, Southampton.
5096. Unalterable Cartridges, L. G. Bachman, Brussels.
5097. Ash-pans, &c., G. Asher, Balsall Heath.

27th October, 1883.

5098. Supporting Knapsacks, &c., J. C. Mewburn.—(*A. Mendel, Saxony.*)
5099. Making Bricks, T. Whittaker, Accrington.
5100. Generating Steam, H. J. Haddan.—(*A. Goupil, France.*)
5101. Metallic Bedsteads, R. G. Hodgetts, Birmingham.
5102. Stoves, &c., G. Davies.—(*F. Jackson, San Francisco, U.S.*)
5103. Electric Gas Lighters, T. & J. Taylor, Oldham.
5104. Metallic Compound, H. Lawrence and J. L. Ryott, Durham.
5105. Variable Expansion Gear, J. T. Marshall, Gainsborough.
5106. Reservoir Penholders, T. A. Hearson, Blackheath.
5107. Pen, &c., Cases, S. Dünkelsbühler, Bavaria.
5108. Cut-out for Telephones, A. M. Clark.—(*O. B. Carter, J. T. Fouche, C. A. Fisher, and C. D. Wright, Petersburgh, U.S.*)
5109. Generation, &c., of Electricity, J. S. Williams, Riverton, U.S.
5110. Generation, &c., of Electricity, J. S. Williams, Riverton, U.S.

29th October, 1883

5111. Magnetic Garments, G. Carron, London.
5112. Ventilators for Ships, &c., J. W. Gibbs, Liverpool.
5113. Gas Engines, H. C. Bull, Liverpool.
5114. Keys for Locks, J. Legget, Edinburgh.
5115. Rims for Wheels of Velocipedes, &c., A. B. Woakes, London.
5116. Forming Shells of Steel, A. Maclean, Glasgow.
5117. Pipe or Tube, J. Gaskell and G. G. Exton, Chippenham.
5118. Trouser Suspenders, J. B. Fournier and J. B. Thoully, France.
5119. Treating Wool Fabrics, J. Woodcock, Huddersfield, and H. Webster, Dewsbury.
5120. Blue Colouring Matter, F. Wirth.—(*E. Oehler, Germany.*)
5121. Mincing Machines, T. Williams, London.
5122. Couplings for Railway Trucks, I. Davies, Manchester.
5123. Ships' Berths, C. J. Fox, Birkenhead.
5124. Thrust Bearings, G. Davies.—(*F. Jackson, San Francisco, U.S.*)
5125. Extraction of Metals from Ores, A. P. Price, London.
5126. Clarifying Beer, H. H. Lake.—(*Drs. H. Kunheim and W. Raydt, Germany.*)
5127. Electrical Generators, T. J. Handford.—(*T. A. Edison, Menlo Park, U.S.*)
5128. Fastenings for Lacing Boots, &c., J. Paton, Johnstone.
5129. Producing Steam, J. Millén, London.
5130. Fastenings for Covers of Umbrellas, E. G. Brewer.—(*O. Triquet, Paris.*)
5131. Sewing Machine, W. F. Thomas, London.
5132. Electric Lamps, S. Z. de Ferranti, London.

Inventions Protected for Six Months on Deposit of Complete Specifications.

5028. Shoddy Pickers, S. Pitt Sutton.—A communication from C. S. Dodge, Lowell, U.S.—*23rd October*, 1883.
5047. Time Controlling System, W. F. Gardner, Baltimore, U.S.—*23rd October*, 1883.
5048. Making Blanks for Horseshoe Nails, R. H. Brandon, Paris.—A communication from E. Myers, U.S.—*24th October*, 1883.
5049. Setting Buttons upon Boots, H. H. Brandon, Paris.—A communication from S. L. Pratt, Hingham, U.S.—*24th October*, 1883.
5050. Finishing Horseshoe Nail Blanks, R. H. Brandon, Paris.—A communication from F. Myers, U.S.—*24th October*, 1883.
5060. Automatic Air Couplers, H. J. Haddan, Kensington, London.—A communication from E. N. Gifford, Cleveland, U.S.—*24th October*, 1883.
5084. Couplings, &c., S. Roberts, Tunbridge Wells.—*25th October*, 1883.
5090. Dyeing, &c., Textile Materials, &c., F. C. Glaser, Berlin.—A communication from E. Rümmelin, Erstein, Germany.—*26th October*, 1883.

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

4321. Fluffing Leather Skins, S. Haley, Bramley.—*23rd October*, 1880.
4394. Spool Tubes, W. Ambler, Bradford.—*27th October*, 1880.
4323. Purifying Gas, A. Ford, Stockton-on-Tees.—*23rd October*, 1880.
4326. Horseshoes, L. A. Groth, London.—*23rd October*, 1880.
4363. Suspenders, H. J. Haddan, London.—*26th October*, 1880.
4379. Detecting Corrosion in Steam Boilers, G. and J. Weir, Glasgow.—*27th October*, 1880.
4406. Spinning, &c., Fibrous Substances, F. and A. Craven, Bradford.—*28th October*, 1880.
4348. Excluding Air from Empty Casks, F. Baxter, Burton-on-Trent.—*25th October*, 1880.
4353. Combined Iron and Steel, J. H. Johnson, London.—*25th October*, 1880.
4368. Holding Cartridges, &c., H. H. Lake, London.—*26th October*, 1880.
4399. Packing Permanent Way of Railways, F. Jackson and E. R. Austin, Manchester.—*28th October*, 1880.
4404. Sewing Machines, G. Browning and S. Mort, Glasgow.—*28th October*, 1883.
4413. Feeding Bottle for Infants, E. O. Day, London.—*28th October*, 1880.
4463. Preservative Compositions for Ships' Bottoms, W. Renney, London.—*1st November*, 1880.
4473. Printing Machinery, A. Sauvée, London.—*2nd November*, 1880.
4602. Printing Fabrics, J. Kerr and J. Haworth, Church.—*9th November*, 1880
4352. Making Ice, &c., W. R. Lake, London.—*25th October*, 1880.
4365. Domestic Baths, W. T. Sugg, London.—*26th October*, 1880.
4403. Mashing Malt, G. G. Cave, Dowlais.—*28th October*, 1880.
4430. Sewing Machines, S. Keats, Leeds, and A. Keats, London.—*29th October*, 1880.
4448. Fire-grates, E. R. Hollands, London.—*30th October*, 1880.
4649. Working Chain Cables, S. Baxter, London.—*11th November*, 1880.
4650. Anchors, S. Baxter, London.—*11th November*, 1880.
4362. Potato Diggers, J. Wallace, Glasgow.—*26th October*, 1880.
4409. Screens, T. Davids and C. Weiss, Hanover.—*28th October*, 1880.
4426. Bearing Springs, I. A. Timmis, London.—*29th October*, 1880.
4511. Furnaces for Chemical Purposes, J. Mactear, Glasgow.—*4th November*, 1880.
4683. Gas Lamps, C. W. Siemens, London.—*13th November*, 1880.
4884. Lead Holders, J. H. Johnson, London.—*24th November*, 1880.
4412. Breech-loading Fire-arms, A. J. Boult, London.—*28th October*, 1880.
4672. Twist Lace Fabrics, G. Bentley, Nottingham.—*13th November*, 1880.

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

4413. Caloric Engines, J. and W. T. Buckett, London.—*14th November*, 1876.
4137. Artificial Stone, J. E. Greatorex and T. P. Hall, Portsmouth.—*25th October*, 1876.
4139. Safety Valve, J. O. Wilson, Bristol.—*25th October*, 1876.
4170. Engraving of Rollers, G. Moulton, Manchester.—*27th October*, 1876.
4311. Railway Wheels, J. D. Garrett, London.—*7th November*, 1876.
4517. Armour Plates, W. Rowlinson, Fallbarrow.—*21st November*, 1876.

Notices of Intention to Proceed with Applications.

(*Last day for filing opposition, 16th November*, 1883.)

3047. Lawn-tennis Balls, R. S. Moss, Manchester.—*20th June*, 1883.
3049. Breech-loading Small-arms, T. Perkes, London.—*20th June*, 1883.
3052. Hopper Dredgers, A. Brown and W. Simons, Renfrew.—*20th June*, 1883.
3065. Plain Metallic Felloes, &c., T. Fox, Sheffield.—*20th June*, 1883.
3078. Tanks for Melting Glass, E. Brooke, Huddersfield.—*21st June*, 1883.
3087. Mechanical Retorts, J. Lyle, London.—*21st June*, 1883.
3097. Gas Motor Engines, J. Dougill, Manchester.—*22nd June*, 1883.
3098. Oil Burners, J. C. Morrison and R. Smith, London.—*22nd June*, 1883.
3102. Telephone, S. J. Coxeter and H. Nehmer, London.—*22nd June*, 1883.
3110. Apparatus for Raising and Lowering, H. Reichardt, London.—*22nd June*, 1883
3117. Blast Fans, &c., G. M. Capell, Passenham.—*22nd June*, 1883.
3120. Targets for Rifle Practice, K. Morris, Blackheath.—*23rd June*, 1883.
3129. Drying Kilns, E. Edwards, London.—A communication from J. Beumier.—*23rd June*, 1883.
3147. Supplying Charges, R. Morris, Blackheath.—*25th June*, 1883.
3164. Making Paper, A. O. A. Feret, C. L. V. Ladame, and A. H. Feret, Paris.—*26th June*, 1883.
3172. Making Yarns, W. R. Lake, London.—A communication from T. Waring.—*26th June*, 1883.
3176. Forging Horseshoe Nails, A. J. Boult, London.—A communication from W. Werts.—*26th June*, 1883.
3178. Facilitating the Action of Fire-arms, H. S. Maxim, London.—*26th June*, 1883
3197. Fire-arms, W. R. Lake, London.—A communication from J. H. Brown.—*27th June*, 1883.
3233. Electric Arc Lamps, C. Wuest, Zurich.—*29th June*, 1883.
3272. Gas Motor Engines, G. J. Kirchenpauer and L. H. Phillippi, Hamburg.—*2nd July*, 1883.
3276. Clocks, A. M. Clark, London.—A communication from V. E. Versepuy.—*2nd July*, 1883.
3378. Feed Apparatus, J. Imray, London.—A communication from A. de Dion, G. T. Bouton, and C. Trépardoux.—*7th July*, 1883.
3535. India-rubber Bearing Springs, G. Spencer, London.—*18th July*, 1883.
3666. Ships, &c., W. P. Thompson, Liverpool.—A communication from H. Le Roux.—*26th July*, 1883.
3878. Crank-shafts, J. Russell, Cardiff.—*9th August*, 1883.
3946. Generating Electric Currents, P. Higgs, Leith.—*14th August*, 1883.
4026. Lawn Tennis Markers, W. N. Hutchinson.—*20th August*, 1883.
4350. Numbering Tickets, &c., J. M. Black, London.—*11th September*, 1883.
4509. Stop Valves, J. Tate, Bradford.—*21st September*, 1883.
4526. Road Engines, R. Peacock and H. L. Lange, Gorton.—*21st September*, 1883.
4580. Packing Fringes, &c., J. McCallum, Manchester.—*25th September*, 1883.
4584. Extracting Oil from Metal Finings, &c., A. G. Brookes, London.—A communication from G. W. Gregory.—*26th September*, 1883.
4962. Bearing Blocks, M. Frenkel, Berlin.—A communication from W. Ulffers.—*17th October*, 1883.

(*Last day for filing opposition, 20th November*, 1883.)

3138. Velocipedes, W. Wright, Droylsden.—*25th June*, 1883.
3143. Regulating Pressure of Gas, H. Devine, Manchester.—*25th June*, 1883.
3148. Granulating, &c., Liquid Hydrocarbons, A. M. Clark, London.—A communication from L. Roth.—*25th June*, 1883.
3151. Fire-proof Safes, &c., W. Corliss, Providence, U.S.—*26th June*, 1883.
3152. Air Brakes, A. G. Evans, Manchester.—*26th June*, 1883.
3157. Making Tiles, &c., T. H. Rees, London.—*26th June*, 1883.
3159. Planing Metal Plates, J. Imray, London.—A com. from E. Bouhey.—*26th June*, 1883.
3171. Automatic Couplings, J. T. Roe, London.—*26th June*, 1883.
3184. Exhibiting Advertisements, C. F. Pollak, London.—*27th June*, 1883.
3187. Candles, W. H. Beck, London.—A communication from La Société Anonyme de Machines à Bougies et Chandelles systemo Royau.—*27th June*, 1883.
3195. Rollers for Machines, W. Lockwood, Sheffield.—*27th June*, 1883.
3203. Loading Steamers, G. Taylor, Penarth.—*27th June*, 1883.
3204. Ventilating Closets, J. Farrimond and J. Whittaker, Southport.—*28th June*, 1883.
3206. Ships' Berths, E. Hoskins, Birmingham.—*28th June*, 1883.
3208. Bobbin Net, &c., Machines, A. C. Henderson, London.—Com. from J. Lateux.—*28th June*, 1883
3210. Propelling Ships, J. Stewart, London.—*28th June*, 1883.
3218. Mounting Electric Lamps, W. R. Lake, London.—Com. from J. Languereau.—*28th June*, 1883.
3221. Corkscrew, R. W. Bradnock, Moseley.—*29th June*, 1883.
3223. Hooks or Pegs, W. Allison, Glasgow.—*29th June*, 1883.
3244. Automatic Electric Signalling Apparatus, H. J. Haddan, London.—A communication from H. C. Reher.—*30th June*, 1883.
3248. Combing Wool, J. H. Whitehead, Leeds.—*30th June*, 1883.
3250. Safety Saddle Bars, H. R. Phillips, Birmingham.—*30th June*, 1883.
3257. Boilers employed in the Treatment of Fibrous Materials, I. S. McDougall, Manchester.—*30th June*, 1883.
3261. Coupling for Shafts, &c., J. Jamieson, Wincobank.—*2nd July*, 1883.
3285. Stoppering Bottles, A. Kempson, Tunbridge Wells.—*3rd July*, 1883.
3301. Furnace Fronts, W. Douglass, Blaydon-on-Tyne.—*3rd July*, 1883.
3316. Shaping Ends of Bolts, &c., W. R. Lake, London.—A com. from G. W. Bruce.—*4th July*, 1883.
3318. Horse Girths, J. C. Odell, Coventry.—*4th July*, 1883.
3320. Anti-fouling Paints, A. M. Clark, London.—A communication from C. Dubois.—*4th July*, 1883.
3328. Frames for Preserving the Edges of Paper, A. C. Henderson, London.—A communication from H. T. Brunet and J. C. Devèze.—*5th July*, 1883.
3341. Metal Casks, A. Dunn and A. Liddell, London.—*5th July*, 1883.
3423. Applying Electricity, J. N. Aronson, London.—*11th July*, 1883.
3482. Bicycles, W. A. Rudling and J. F. Coffin, Southsea.—*14th July*, 1883.
3538. Obtaining Fibres from Vegetable Substances, A. W. L. Reddie, London.—A communication from J. Kennedy.—*18th July*, 1883.
3548. Expressing the Juices of Various Matters, A. C. Henderson, London.—A communication from A. Désgoffe and L. A. di Giordio.—*19th July*, 1883.
3726. Organs, T. C. Lewis, London.—*30th July*, 1883.
3894. Steam, &c., Pistons, A. MacLaine, Belfast.—*11th August*, 1883.
3933. Treating Lead, P. M. Justice, London.—A com. from J. Clamer.—*14th August*, 1883.
3976. Producing Carbonic Acid from Carbonate of Calcium, &c., W. L. Wise, London.—A communication from H. Grouven.—*16th August*, 1883.
3997. Terminal Ornaments, T. Causnett, Birmingham.—*17th August*, 1883.
4059. Galvanic Batteries, G. C. V. Holmes and S. H. Emmens, London.—*21st August*, 1883.
4061. Commercial Products resulting from the Operation of Galvanic Batteries, G. C. V. Holmes and S. Emmens, London.—*21st August*, 1883.
4141. Printing Machines, C. P. Huntington, Darwen.—*28th August*, 1883.
4253. Starting Vehicles, E. E. Cook, Brighton.—*4th September*, 1883.
4284. Gas Burners, T. Fletcher, Warrington.—*6th September*, 1883
4312. Reed Organs, J. B. Hamilton, London.—*7th September*, 1883.
4353. Combing Fibres, W. Dobson, Douglas.—*11th September*, 1883.
4554. Safety Catch for Brooches, &c., D. MacGregor Perth.—*24th September*, 1883.
4563. Armatures, H. J. Haddan, London.—A communication from C. F. Brush.—*25th September*, 1883.
4593. Glycerine, J. Imray, London.—A communication from I. A. F. Bang.—*26th September*, 1883.
4634. Ascertaining Ships' Courses, G. C. Lilley, London.—*28th September*, 1883.
4635. Constructing Beds, J. S. Hill, Clifton.—*28th September*, 1883.
4644. Treating Carbonaceous Substances, H. Aitken, Falkirk.—*29th September*, 1883.
4645. Ships, &c., A. E. Fairman, Glasgow.—*29th September*, 1883.
4657. Secondary Voltaic Batteries, H. F. Joel, Dalston.—*1st October*, 1883.
4667. Unions for Pipes, N. Thompson, London.—*1st October*, 1883.
4671. Alarm Bells, H. Serrell, Plainfield, U.S.—*2nd October*, 1883
4699. Drying Sugar, &c., C. A. Day, London.—A com. from G. M. Newhall.—*3rd October*, 1883.
4752. Chain Cables, C. H. Reed, Sunderland.—*6th October*, 1883.
5028. Shoddy Pickers, S. Pitt, Sutton.—A communication from C. S. Dodge.—*23rd October*, 1883.
5048. Making Blanks for Horseshoe Nails, R. H. Brandon, Paris.—A communication from F. Myers.—*24th October*, 1883.
5049. Setting Buttons upon Boots and Shoes, R. H. Brandon, Paris.—A communication from S. L. Pratt.—*24th October*, 1883.
5050. Finishing Horseshoe Nail Blanks, R. H. Brandon, Paris.—A communication from F. Myers.—*24th October*, 1883.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the 26th October*, 1883.)

1869. Permanent Way, G. Wilson, London.—*12th April*, 1883.
1954. Telegraphic Apparatus, E. J. Houghton, Peckham.—*18th April*, 1883.
2150. Carpets, &c., J. W. Walker, Kidderminster.—*28th April*, 1883.
2170. Fastenings for Doors, J. Edwards, London.—*30th April*, 1883.
2171. Stopper for Bottles, J. Jackson, jun., London.—*30th April*, 1883.
2188. Removing the Hair, &c., from the Skins of Animals, &c., J. Palmer, London.—*1st May*, 1883.
2223. Oil Lamps, J. Fyfe, Glasgow, T. B. Smith, Birmingham.—*2nd May*, 1883.
2228. Cartridge Pouches, T. H. Kinvig, Castletown.—*2nd May*, 1883.
2229. Refining Oils, &c., A. C. Tichenor, Alamada, U.S.—*2nd May*, 1883.
2250. Dynamo-electric Machines, O. Williams, Liverpool.—*3rd May*, 1883.
2278. Couplings for Tubes, W. R. Lake, London.—*4th May*, 1883.
2286. Self-acting Switches, &c., R. F. Edbrooke, Liverpool.—*5th May*, 1883.
2317. Embroidery Machines, A. W. L. Reddie, London.—*8th May*, 1883.
2343. Packing for Joints, E. Marechal, London.—*8th May*, 1883.
2345. Repeating Fire-arms, C. D. Abel, London.—*8th May*, 1883.
2349. Transforming Fats into Fatty Acids, &c., A. Marix, Paris.—*9th May*, 1883.
2352. Artificial Stone, &c., E. S. Shepherd, London, and J. L. Aspinwall, Carnarvon.—*9th May*, 1883.
2353. Fish Joints, A. S. Hamand, London.—*9th May*, 1883.
2357. Locomotives, M. Benson, London.—*9th May*, 1883.
2376. Preventing Corrosion of Pipes, J. B. Hannay, Glasgow.—*10th May*, 1883.
2401. Cartridge Holders, T. Nordenfelt, London.—*11th May*, 1883.
2432. Carding Engines, G. and E. Ashworth.—*15th May*, 1883.
2447. Hydraulic Pumping Apparatus, J. Moore, San Francisco.—*15th May*, 1883.
2448. Electric Light Buoys, E. C. G. Thomas, London.—*15th May*, 1883.
2526. Apparatus for Blasting Rocks, H. N. Penrice, Norwich.—*21st May*, 1883.
2531. Making Type, F. Wirth, Frankfort-on-the-Main.—*21st May*, 1883.
2595. Hauling Engines, D. and A. Greig and R. H. Shaw, Leeds.—*24th May*, 1883.
2801. Caloric Engines, C. Ingrey, Fulham.—*6th June*, 1883.
2968. Spanners, &c., J. C. Bauer, London.—*14th June*, 1883.
3013. Stench-traps, W. Ayres, London.—*18th June*, 1883
3241. Gas-burners, H. H. Lake, London.—*29th June*, 1883.
3268. Reservoir Penholder, L. B. Bertram, Bayswater.—*2nd July*, 1883.
3375. Jointing Pipes, T. P. Wilson, London.—*7th July*, 1883.
3387. Baking by Steam, H. E. Newton, London.—*9th July*, 1883.
3619. Glass Ware, A. G. Brookes, London.—*24th July*, 1883.
3727. Packing, &c., Abrasive Plates, A. G. Brookes, London.—*31st July*, 1883.
3733. Type-matrice Machine, M. H. Dement, London.—*31st July*, 1883.
3734. Apparatus for Putting Stereotyped Line Strips in Column, &c., and Justifying the Same, M. H. Dement, London.—*31st July*, 1883.
3777. Producing Golden Sulphuret of Antimony, &c., A. G. Brookes, London.—*2nd August*, 1883.
3831. Distilled Liquors, W. Clark, London.—*7th August*, 1883.
3838. Boats and Oars, A. J. Boult, London.—*7th August*, 1883.
3856. Producing Soda Crystals, C. D. Abel, London.—*8th August*, 1883.
3864. Making Tunnels, G. Edwards, Hanwood.—*9th August*, 1883.
3875. Sewing Needles, R. H. Brandon, Paris.—*9th August*, 1883.
4136. Electric Railways, &c., S. Pitt, Sutton.—*28th August*, 1883.
4192. Dynamo-electric Machines, H. H. Lake, London.—*30th August*, 1883.
4254. Ornamenting Metallic Tubes, J. Earle and G. Bourne, Birmingham.—*4th September*, 1883.
4298. Telephonic Apparatus, E. George, F. A. Pocock, J. S. Muir, and J. S. Muir, jun., London.—*7th September*, 1883.

(*List of Letters Patent which passed the Great Seal on the 30th October*, 1883.)

2056. Working Brakes, J. Armstrong, New Swindon.—*23rd April*, 1883.
2199. Materials for Making Cement, T. Smith, Sunbury.—*1st May*, 1883.
2200. Indicating Divergence of Magnetised Needles, G. C. Cooke, Sutton.—*1st May*, 1883.
2219. Pulleys for Transmitting Motion, W. R. Lake, London.—*1st May*, 1883.
2225. Weaving Fabrics, E. Crossley and R. Cochrane, Halifax.—*2nd May*, 1883.
2233. Looms, F. Leeming and R. Wilkinson, Bradford.—*2nd May*, 1883.
2236. Axles, J. Rigby and I. M. Morgan, Stafford.—*9nd May*, 1883.
2238. Domestic Fire-escape, G. Nobes, London.—*2nd May*, 1883.

2240. Sewing Machines, W. R. Lake, London.—2nd May, 1883.
2243. Making Nickel, &c., A. M. Clark, London.—2nd May, 1883.
2251. Sizing Paper, &c., C. Weygang, London.—3rd May, 1883.
2252. Treating Blast Furnace Slag, E. G. Colton, London.—3rd May, 1883.
2259. Making Oxide of Strontium, W. Moody, West Ham.—3rd May, 1883.
2265. Producing Designs on Glass, J. T. King, Liverpool.—4th May, 1883.
2266. Producing Designs on Glass Ware, J. T. King, Liverpool.—4th May, 1883.
2272. Life-boats, &c., J. R. Hodgson, London.—4th May, 1883.
2282. Open-fire Portable Cooking Ranges, T. J. Constantine, London.—4th May, 1883.
2311. Controlling Flow of Liquids, G. P. Lemprière, Balsall Heath.—7th May, 1883.
2312. Making Gas, H. C. Bull, Brooklyn, U.S.—7th May, 1883.
2325. Pedal Harp, H. J. Haddan, London.—8th May, 1883.
2326. Purifying Glycerine, H. J. Haddan, London.—8th May, 1883.
2377. Apparatus to be Applied to Roller Mills, G. Davies, Manchester.—10th May, 1883.
2394. Distilling Apparatus, A. Marix, Paris.—11th May, 1883.
2398. Moulding Wheels, E. de Pass, London.—11th May, 1883.
2437. Differential Gearing, F. Wynne, London.—15th May, 1883.
2467. Gumming Apparatus, C. Pieper, Berlin.—17th May, 1883.
2481. Substitute for Ivory, F. Greening, Southall.—17th May, 1883.
2492. Gas Motor Engines, G. G. Picking and W. Hopkins, London.—18th May, 1883.
2541. Knitting Machinery, H. J. Haddan, London.—22nd May, 1883.
2665. Screw Stocks, &c., W. J. McCormack, Paignton.—29th May, 1883.
3039. Fan Wheels, W. Schmolz, San Francisco.—19th June, 1883.
3121. Saddle-bar, J. Passmore and E. C. Cole, Exeter.—23rd June, 1883.
3252. Purification of Sewage Water, &c., J. Bock, Silesia.—30th June, 1883.
3867. Barring Engines, W. Hargreaves and W. Inglis, Bolton.—9th August, 1883.
4009. Weighing, &c., Parcels, W. Tozer, London.—18th August, 1883.
4017. Stop Valves, J. A and J. Hopkinson, Huddersfield.—18th August, 1883.
4137. Electric Railways, &c., S. Pitt, Sutton.—28th August, 1883.
4145. Cleaning Fibrous Materials, H. H. Lake, London.—28th August, 1883.
4177. Dynamo-electric Machines, H. H. Lake, London.—29th August, 1883.
4211. Metal Tubes, G. H. Fox, Boston, U.S.—31st August, 1883.
4237. Toothed Implements, A. M. Clark, London.—3rd September, 1883.

List of Specifications published during the week ending October 27th, 1883.

6241, 1s.; 426, 10d.; 967, 4d.; 980, 6d.; 987, 6d.; 1078, 6d.; 1146, 4d.; 1162, 6d.; 1168, 2d.; 1169, 6d.; 1170, 6d.; 1171, 2d.; 1178, 6d.; 1185, 2d.; 1186, 6d.; 1190, 6d.; 1194, 6d.; 1195, 2d.; 1196, 2d.; 1197, 2d.; 1198, 6d.; 1201, 8d.; 1203, 6d.; 1205, 8d.; 1210, 2d.; 1214, 8d.; 1216, 2d.; 1217, 2d.; 1220, 2d.; 1222, 4d.; 1225, 6d.; 1231, 6d.; 1233, 6d.; 1234, 2d.; 1236, 2d.; 1237, 8d.; 1238, 8d.; 1239, 6d.; 1240, 4d.; 1242, 6d.; 1243, 8d.; 1244, 2d.; 1246, 4d.; 1247, 2d.; 1248, 2d.; 1249, 2d.; 1250, 2d.; 1251, 2d.; 1252, 6d.; 1253, 6d.; 1255, 8d.; 1257, 6d.; 1258, 6d.; 1259, 6d.; 1260, 6d.; 1263, 2d.; 1264, 6d.; 1265, 2d.; 1266, 6d.; 1267, 6d.; 1268, 2d.; 1269, 2d.; 1270, 6d.; 1271, 6d.; 1272, 2d.; 1273, 6d.; 1274, 6d.; 1275, 2d.; 1276, 6d.; 1277, 6d.; 1378, 6d.; 1279, 2d.; 1280, 2d.; 1281, 6d.; 1282, 8d.; 1283, 6d.; 1284, 2d.; 1285, 4d.; 1286, 6d.; 1287, 6d.; 1288, 6d.; 1289, 2d.; 1290, 8d.; 1291, 2d.; 1293, 8d.; 1294, 6d.; 1295, 6d.; 1296, 6d.; 1297, 6d.; 1298, 6d.; 1299, 6d.; 1300, 6d.; 1301, 6d.; 1302, 6d.; 1303, 6d.; 1305, 2d.; 1306, 2d.; 1307, 2d.; 1308, 2d.; 1309, 2d.; 1310, 2d.; 1311, 6d.; 1312, 2d.; 1314, 6d.; 1315, 2d.; 1316, 4d.; 1317, 6d.; 1319, 6d.; 1321, 2d.; 1323, 8d.; 1324, 2d.; 1325, 6d.; 1326, 2d.; 1328, 2d.; 1329, 6d.; 1330, 2d.; 1331, 6d.; 1333, 6d.; 1135, 6d.; 1336, 8d.; 1337, 2d.; 1338, 1s. 6d.; 1341, 6d.; 1342, 2d.; 1344, 6d.; 1348, 2d.; 1350, 6d.; 1352, 6d.; 1353, 6d.; 1354, 2d.; 1358, 6d.; 1360, 8d.; 1363, 4d.; 1365, 4d.; 1366, 2d.; 1368, 6d.; 1369, 6d.; 1372, 8d.; 1374, 2d.; 1379, 2d.; 1382, 4d.; 1388, 2d.; 1404, 4d.; 1409, 4d.; 1412, 6d.; 1414, 8d.; 1415, 6d.; 1430, 4d.; 1437, 6d.; 1510, 6d.; 1595, 6d.: 1686, 6d.; 2006, 6d.; 3473, 6d.; 3494, 6d.; 3499, 8d.; 3501, 6d.; 3504, 6d.; 3506, 6d.; 3509, 6d.; 3518, 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.*

426. Preservation of Milk, &c., *E. A. Brydges, Berlin.—26th January, 1883.—(A communication from E. Scherff, Wendesch Buchholz, Germany.)* 10d.
This relates to the mode of preserving milk in bottles.

967. Extracting Sugar from Molasses, Syrups, and the Juice of Plants, *C. Steffen, Vienna.—22nd February, 1883.* 4d.
This relates to a process of extracting sugar from molasses, syrups, and the juices of plants, and consists in treating an aqueous solution of calcareous saccharite, so that calcareous saccharite, insoluble at a temperature varying from 0 to 35 Cent. (32 deg. to 95 deg. Fah.) is won without employing artificial warmth or alcohol.

980. Apparatus for Treating Steel Ingots, *G. J. Snelus, Workington.—22nd February, 1883.* 6d.
This relates to improvements in soaking pits or apparatus for treating steel ingots, which improvements consist essentially in lining the said pits with steel and providing them with cast iron tops, with or without separating layers of fire-clay and tar.

987. Tip Vans or Wagons, *E. Burton, Nine Elms.—23rd February, 1883.* 6d.
This consists, First, of a tip van or wagon having its tilting body pivotted by a transverse shaft or bar in bearings upon the side pieces of the under frame, and if desired in an additional bearing at or near the centre longitudinally of the said under frame, and having the axle of its hind wheels straight, in contradistinction to being cranked or bent; Secondly, the combination with such tip van or wagon of a removable and adjustable covering.

1078. Elastic Wire Bands, *F. Wirth, Frankfort-on-the-Main.—27th February, 1883.—(A communication from G. Pickhardt, Hagen, Germany.)* 6d.
This relates to elastic wire bands formed of closely wound wire springs.

1146. Ridge Ploughs, &c., *H. J. Haddan, Kensington.—3rd March, 1883.—(A communication from B. Lanoizelet, Bourbon-Lanay, France.)* 4d.
The ridge plough comprises chiefly a bent piece of iron forming the beam of the plough, and provided at one end with a socket adapted to receive a handle or a swingle-tree, while a share made of steel is attached at the other end.

1147. Automatic Signalling Apparatus for Railways, *H. J. Haddan, Kensington.—3rd March, 1883.—(A communication from L. Vérité, Beauvais, France.)—(Not proceeded with.)* 2d.
This consists of three principal parts, viz., the controlling apparatus, the commutator or contact breaker, and the indicator.

1162. Bicycles, &c., *J. H. Adams, Wandsworth.—5th March, 1883.* 6d.
This relates principally to the construction of the bearings.

1168. Machine for Cutting Corks, *J. Hix, London.—5th March, 1883.—(Not proceeded with.)* 2d.
This relates to the construction of the guide for the pieces of cork to be operated upon, and also to the cutting tool.

1169. Apparatus for Purifying and Heating Water, &c., *T. Lishman, West Hartlepool.—5th March, 1883.* 6d.
This relates to an improved method and apparatus for automatically purifying water used in steam boilers; also for superheating and extracting the solid matters of the water prior, when possible or convenient, to the same being supplied to the boiler.

1170. Machines for Stitching Books and Appliances for Making Fasteners, *G. W. von Nawrocki, Berlin.—5th March, 1883.—(A communication from G. Haunhorst, Osnabrück, Germany.)* 6d.
The invention essentially consists in the combination with the stitching machine of a device whereby the automatically supplied wire is cut off and bent into the shape of a fastener.

1171. Electric Lamps or Lighting Apparatus, *H. H. Lake, London.—6th March, 1883.—(A communication from E. Weston, Newark, N.J., U.S.)—(Not proceeded with.)* 2d.
Relates to the general arrangement of the magnets and armatures in an arc lamp, and to the method of connecting and suspending the lamp.

1178. Boxes or Cases for Containing Tea, &c., *C. Cheswright, Holloway.—5th March, 1883.* 6d.
The invention has chiefly for its object the prevention of fraudulent interference with the contents of boxes or cases and other like packages containing tea or other dry goods enclosed in thin sheet metal or foil, thereby ensuring the genuineness of their contents.

1185 Centre-boards for Sailing Vessels, &c., *W. Blakely, Bournemouth.—6th March, 1883.—(Not proceeded with.)* 2d.
This consists in making the centre-board or sliding keel work in and out of its well or casing with a perpendicular or vertical motion.

1186. Governors for Steam or other Machinery, *W. Mellor, Oldham.—6th March, 1883.* 6d.
This consists in apparatus for application to governors of motors wherein a sliding spindle wheel connects the governor with the cut-off or regulating apparatus, and is turned in one direction or the other when the speed of the engine varies by means of vibrating pawls acting upon reverse ratchet wheels or of continuously revolving frictional or toothed drivers, wheels, or parts, whereby a screw forming part of the connection is turned in a nut so as to lengthen or shorten the connection.

1190. Secondary or Storage Batteries, *T. Rowan, London.—6th March, 1883.* 6d.
Relates to constructing the containing vessel with suitable grooves, against which thin sheets of lead or other suitable material are laid so as to form a series of compound plates.

1194. Cop-retaining Spindles for Loom Shuttles, *A. J. Boult, London.—6th March, 1883.—(A communication from W. T. Coggleshall and J. E. Rice, Lowell, U.S.)* 6d.
This relates to the employment and construction of a grooved spindle.

1195. Steam Smoothing Iron for Laundry Purposes, *J. M'Lean, Belfast.—6th March, 1883.—(Not proceeded with.)* 2d.
This relates to the arrangement of pipes or tubes for supplying the steam.

1196. Driving and Clutch Mechanism, *J. Carpenter, Southampton.—6th March, 1883.—(Not proceeded with.)* 2d.
This relates to the construction of driving and clutch mechanism, principally applicable to velocipedes.

1197. Secondary Piles or Batteries or Accumulators of Electricity, *E. G. Brewer, London.—6th March, 1883.—(A communication from B. Pfeifer, Antwerp.)—(Not proceeded with.)* 2d.
This new pile is obtained by the employment of spongy lead obtained electrolytically or by chemical precipitation.

1198. Dynamo-electrical Machines, *C. Lever, Bowdon, Ches.—6th March, 1883.* 6d.
In a machine in which both the armature and field magnets are stationary a polarised revolving inductor magnetically connected to its paramagnetic spindle revolves in one or more pole pieces of the field magnet. The inductor revolves within the armature by this means, and by separately exciting the field magnets the usual commutator is dispensed with.

1200. Lamps for Velocipedes, &c., *H. Markham and T. Brettell, Birmingham.—6th March, 1883.—(Not proceeded with.)* 2d.
This relates to the means for suspending the lamp.

1201. Rope Traction Tramways or Railways, *C. F. Findlay, Kensington.—6th March, 1883.* 8d.
This relates essentially to the rope gripping apparatus.

1202. Electric Arc Lamps, *E. and A. B. Jones, London.—6th March, 1883.* 1s.
Relates to lamps in which the carbons are fed towards each other by a cord passing over pulleys, the feed being controlled by a lever, arranged to grip the cord, the lever being acted on by a differentially wound electro-magnet. In a modification the feed is controlled by a train of clockwork, the last wheel of which engages with the rack of the upper carbon holder. The lamp is adapted to bring three or more pairs of carbons into action successively and automatically.

1203. Manufacture of Files, Taps, Dies, &c., *H. H. Lake, London.—6th March, 1883.—(A communication from M. A. Howell, jun., Chicago.)* 6d.
The object of the invention is to effect an improvement in the manufacture by casting the blanks from white cast iron, softening or annealing the same in contact with oxides or other matter having an affinity for carbon, if an excess of carbon is present; surfacing and cutting the same while in this annealed condition, and finally by converting and cooling the same in an atmosphere of hydrocarbon where all traces of oxygen are kept excluded to the end of the operation.

1205. Brewing, &c., *W. Laurence, London.—6th March, 1883.* 8d.
This relates to improvements in the whole process of brewing.

1206. Manufacture of Pumps for Drawing Beer, &c., *T. Woollerton, Leicester.—6th March, 1883.* 6d.
The pump is constructed so that the plunger or bucket when at the lower end of its traverse shall close the suction pipe, and thus prevent the escape of beer through the barrel.

1209. Pumps Employed in the Manufacture of Artificial Ice, *T. D. Kyle, London.—6th March, 1883.—(Not proceeded with.)* 2d.
This relates to the general construction of the pump, and to a lubricated packing.

1210. Process of and Apparatus for Distilling Coal and other Carbonaceous Materials in Order to Obtain Coke, Tar, &c., *J. Woodhead, Wakefield.—6th March, 1883.—(Not proceeded with.)* 2d.
This relates principally to the construction of the oven.

1211. Targets for Rifle Practice, *F. Clarke, Canterbury.—6th March, 1883.* 8d.
This relates to the arrangement of running targets.

1212. Rings for Ring and Traveller Spinning Frames, *A. M. Clark, London.—6th March, 1883.—(A communication from G. Jaquith, Marysville, U.S.)* 6d.
The ring has in its upper peripheral edge or flange an annular oil reservoir, with inlet orifices for introducing the oil.

1213 Apparatus or Fittings to be Applied to Baths, *T. Bradford, Manchester.—7th March, 1883.—(Not proceeded with.)* 2d.
The object is the mixing of hot and cold water (or other liquid or liquids, such, for instance, as brine) together, so as to deliver them into the bath at any required temperature, and at the same time indicating the latter.

1214. Clipping Machines, *J. Range, Nottingham.—7th March, 1883.* 8d.
This relates to the general construction of the machine for clipping lace or the like.

1216. Construction of Walls, Partitions, and Ceilings of Buildings, *G. Napier, Manchester.—7th March, 1883.—(Not proceeded with.)* 2d.
This relates to the employment of slabs of concrete, cement, or other suitable material.

1217. Production of Gas for Illuminating and other Purposes from Hydrocarbons, &c., *J. F. Schnell, A. Heywood, jun., and W. Darbyshire, Manchester.—7th March, 1883.—(Not proceeded with.)* 2d.
This relates to the use of a sealed cistern partly filled with hydrocarbons, such as coal tar, or naphtha, or gasoline products in a fluid and solid state mixed, or in either separately. To this cistern is connected a pipe, one end of which is attached to the upper surface of a stationary outer shell or drum; this drum is water-tight and provided with an opening on its upper surface, through which it may be filled with water to about one and a-half its depth or more or less; this opening also serves to admit air. Inside the hollow drum is a cylinder with buckets round its periphery which revolves in the water. This cylinder runs in bearings made in the ends of the hollow drum, and its axis or shaft projects at one end, and may be driven in any convenient manner.

1219. Lawn Tennis Bats, *R. C. Powell and F. Thompson, London.—7th March, 1883.* 6d.
This relates to a method for tightening up the cat-gut web or mesh.

1220. Ingot Moulds or Utensils employed in the Manufacture of Iron, Steel, or other Metals, *J. Rideal, Manchester.—7th March, 1883.—(Not proceeded with.)* 2d.
The moulds or utensils are made with an outer casing of metal and an inner shell or mould of refractory material, with an annular space between the two, which space is filled with friable, porous, non-conducting materials.

1222. Appliances for Imparting Heat to Water, &c., *J. Jameson, Newcastle-on-Tyne.—7th March, 1883.* 4d.
This consists in the introduction of an easily fusible metal or metallic alloy within a receptacle or receptacles forming the walls, roof, and base of a furnace or any of them, and capable of circulating when in a melted state, so as to come in contact with the water or other fluid to be heated or evaporated, whereby a very intense heat may be conveyed to the intermediate fluid, metal, or alloy, and thence without any further interposing medium into actual contact with the water to be evaporated or other fluid to be dealt with.

1223. Dyeing Loose Cotton Black, *G. W. von Nawrocki, Berlin.—7th March, 1883.—(A communication from G. Jagenburg, Rydboholm, Sweden.)* 4d.
This relates to a mode of dyeing, whereby the steaming is dispensed with.

1224. Truss for Rupture or Hernia, *E. M. Bowajeaurd, London.—7th March, 1883.* 6d.
This relates to the general construction of the truss.

1225. Machines for Straightening, Bending, and Circling Angle, Tee, and other Bars, *W. F. Gilmer, Gosport.—7th March, 1883.* 6d.
This relates to the arrangement of the rolls so as to admit variable thicknesses of web between them.

1226. Manufacture of Anchors, *C. Mace, Sunderland.—7th March, 1883.* 4d.
The anchors are manufactured by casting them of steel or other metal of tubular or hollow form.

1227. Steam Generators, *R. G. Rodham, London.—7th March, 1883.—(Not proceeded with.)* 2d.
The steam generator is constructed in sections, each section being composed of any suitable number of water heating tubes screwed into connecting tubes at each end.

1228. Screw Gill Boxes or Hackle Frames for Preparing Wool, &c., *G. W. Douglas, Bradford.—7th March, 1883.—(Not proceeded with.)* 2d.
This consists in driving the gills or fallers in such a manner that the speed increases as they travel from the first pair of rollers towards the delivery rollers, and the gills or fallers are arranged to be close together at the end where the material enters the machine, and to separate as they move forward towards the delivery rollers.

1230. Apparatus for Setting the Teeth of Circular Saws, *W. R. G. Roebuck, Shoreditch.—7th March, 1883.—(Not proceeded with.)* 2d.
This relates to an apparatus for setting the teeth of saws to definite angles.

1231. Automatic Musical Instruments, *M. A. Wier, London.—7th March, 1883.* 6d.
This relates to an instrument in which reeds or other similar sound-producing devices are employed in connection with air bellows for the production of tunes, harmonies, and so forth automatically by the mere fact of working the bellows.

1232. Construction of Tramways, &c., *E. F. Roberts, London.—7th March, 1883.—(Not proceeded with.)* 2d.
This relates to apparatus for propelling tram-cars by a rope.

1233. Manufacture of Barbed Fencing Wire, *W. R. Lake, London.—7th March, 1883.—(A communication from O. P. Brigg, Chicago.)* 6d.
This relates to the two-strand twisted or cable form of fence wire provided with four-pointed wire barbs, in which the barbs are secured to the cable by the conformation of the parts joined.

1234. Process of Treating Plaster of Paris for Use in Building, &c., *J. M. Bockbinder, London.—7th March, 1883.—(Not proceeded with.)* 2d.
The object is to indurate the plaster by means of dextrine.

1235. Lathes suitable for Turning Shafts, *W. Allan, Sunderland.—7th March, 1883.* 8d.
This relates to providing two headstocks to carry between them the shaft to be turned and a hollow spindle or cylinder to receive the shaft through it to rotate the shaft, the said hollow spindle or cylinder being itself driven by gearing.

1236. Coupling for Metallic Fencing, *C. J. Holroyde, near Halifax.—7th March, 1883.—(Not proceeded with.)* 2d.
The object is the construction of a coupling for metallic fencing, by means whereof such fencing can be readily erected and removed, and a temporary opening formed therein where required, and subsequently closed.

1237. Locomotive Steam Engines, *J. H. Johnson, London.—7th March, 1883.—(A communication from T. Ricour, Paris.)* 8d.
The object is to provide a free admission of external air to the interior of the steam chest or slide valve casing and cylinders of locomotive engines when running with the steam shut off, and thereby to obtain, among other advantages, a diminution of the friction, and consequently of the wear of the slide valves, pistons, and cylinders resulting from the contact with the heated gases charged with ashes, which have heretofore been drawn into the steam passages when the engine is running with the steam shut off.

1238. Telephonic Apparatus, *S. Thompson, Bristol.—7th March, 1883.* 8d.
Relates to various details of construction and arrangement of the Reiss instruments.

1239. Fresh Air-injector or Down-cast Water-tight Ventilator, *S. Low, jun., London.—7th March, 1883.* 6d.
This relates to the employment of a suction head, to which is fixed a shaft provided with a water course and an air course.

1240. Electrical Induction Apparatus, *E. Edwards, London.—7th March, 1883.—(A communication from G. Babillot, Montoir-de-Bretagne, France.)—(Not proceeded with.)* 4d.
Relates to so arranging induction coils that "if the primary current was obtained from a small dynamo machine actuated by hand, the secondary regulated currents being made to pass through a series of self-exciting induction machines of increasing magnitude, the final current would be of an intensity so much greater that the work it could do would be many times greater than the muscular force consumed.

1241. Multitubular Steam Boiler, *E. Edwards, London.—7th March, 1883.—(A communication from J. J. Godot, Paris.)* 6d.
This relates to the method of composing the boiler of any desired number of separate elements, each consisting of a distributor, a corresponding evaporating couple, and a collector, so that each such element is capable of expanding freely, and the steam generated in it passes directly to a separator without passing through any other evaporating couple.

1242. Preventing the Deposit of Sand, Mud, or the like in Rivers, &c., *W. R. Lake, London.—7th March, 1883.—(A communication from H. E. Hargreaves, Brazil.)* 6d.
This relates to the employment of an apparatus whereby jets of water are discharged from one or more pipes or tubes laid along the bed or bottom of the river or channel.

1243. Hurdles, *A. E. Maudslay, Littlebourne.—7th March, 1883.* 8d.
One part relates to the construction of the portion of the hurdle which enters the ground, and another part relates to the means of connecting a row or series of hurdles.

1244. Apparatus for Consolidating or Condensing Carded Asbestos Fibres, *A. Hollings, Salford.—8th March, 1883.—(Not proceeded with.)* 2d.
Consolidating or condensing rings or rollers and aprons are used, so constructed, arranged, and operated, and in combination with carding machinery of any suitable kind, that the asbestos fibres shall not be subjected to any undue friction during its passage through the consolidator or condenser.

1246 Apparatus for Darning Fabrics, and for Producing a Running Stitch thereon, *F. C. Glaser, Berlin.—8th March, 1883.—(A communication from Mrs. E. Weiss, Breslau.)—(Not proceeded with.)* 2d.
This refers to the general construction of the apparatus.

1247. Attachment for Sharpening that Class of Pencils Known as Solid Ink Pencils, &c., *J. Darling, Glasgow.—8th March, 1883.—(Not proceeded with.)* 2d.
This relates to the employment of an elastic knife or cutter within a cap.

1248. Supplying and Working Vehicles with Compressed Air, &c., *C. R. Stevens, Lewisham.—8th March, 1883.—(Not proceeded with.)* 2d.
This relates to the means of distributing the compressed air.

1249. Apparatus for Operating the Valves of Reciprocating Steam Engines, *H. J. Haddan, Kensington.—8th March, 1883.—(A communication from J. P. Northey, Toronto.)—(Not proceeded with.)* 2d.
This relates to the construction of apparatus for operating the valves.

1250. Automatic Couplings for use on Rail or Tramways, *S. Gilbert, jun., Wansford.—8th March, 1883.—(Not proceeded with.)* 2d.
This relates to the general construction of the apparatus for automatic coupling.

1251. Driving Apparatus for Tricycles, &c., *J. Hall, Wigton.—8th March, 1883.—(Not proceeded with.)* 2d.
In place of cranks the inventor uses friction drums or ratchet apparatus.

1252. Bale Ties or Bands, Iron Hoop Fencing, &c., *R. Hale, Liverpool.—8th March, 1883.* 6d.
The bale ties or bands, &c., are made with punched or drilled ends or other parts strengthened by means of plates.

1253. Heated or Drying Rollers or Cylinders, *J. Horrocks, Worsley.—8th March, 1883.* 6d.
The principal object of the invention is to use high-pressure steam, and it consists in the general arranging of the apparatus for that purpose.

1254. Steam Generators, &c., *H. Gerner, New York City.—8th March, 1883.* 6d.
The boiler is provided with two internal conical flues placed horizontally one above the other in such a manner that the gaseous products of combustion travel from the wide part towards the narrow part of the flue.

1255. Electric Lamps and Fittings therefor, *J. G. Statter, Wakefield.—8th March, 1883.* 8d.
Relates to an arc lamp, to automatically cutting the lamp out of circuit when the carbons are consumed, and to allow of extinguishing the lamp without interfering with the other lamps of the circuit. Also to adapting the existing gas fittings to electric light fittings.

1257. Shuttle-box Operating Mechanism for Looms, *J. Brownlee, Glasgow.—8th March, 1883.* 6d.
The mechanism comprises, First, a novel construction of gearing for actuating the excentrics or cranks which raise and lower the shuttle-boxes; and Secondly, novel arrangements of lever apparatus or devices operated by the jacquard or pattern mechanism of the loom, and combined with such gearing to bring each shuttle-box of the series in line with the race of the lath as may be required.

1258. Electrical Signalling Apparatus, *W. F. Brewer, London.—8th March, 1883.* 6d.
The rails are used to convey the current by which an audible signal is given to the engine driver, and to permit of intercommunication between the signalman and driver.

1259. Manufacture of Velvet, Rep, &c., *J. Imray, London.—8th March, 1883.—(A communication from A. Duquesne, Paris.)* 6d.
This relates to a method of and apparatus for manufacturing fabrics of the kinds of velvets, &c., which, according to the character of the material employed, may be adapted for carpets or other uses, and may have their upper and under surfaces varied by varying the setting and operation of the loom.

1260. Extracting Soluble Matters by Washing and Diffusion, *C. D. Abel, London. 8th March, 1883.—(A communication from H. L. J. Parenty, Paris.)* 6d.
This relates to the combination of the ordinary levigating process, consisting of the passage of the levigating liquid successively through receptacles charged with the material to be treated, with the process of diffusion, consisting in the use of a small stream of liquid, which is caused to displace very slowly and in

horizontal layers a solution circulating through the substances to be operated upon.

1261. ALL-STEEL OPEN SOCKET SHOVELS, *T. Sidaway, Brierley Hill.—8th March*, 1883. 4*d*.

The inventor claims stopping the coffer short and continuing the solid rib down the centre of the blade of the shovel.

1262. ADJUSTING ROLLER AND OTHER AXLES IN THEIR BEARINGS, *J. A. A. Buchholz, Twickenham.—8th March*, 1883. 8*d*.

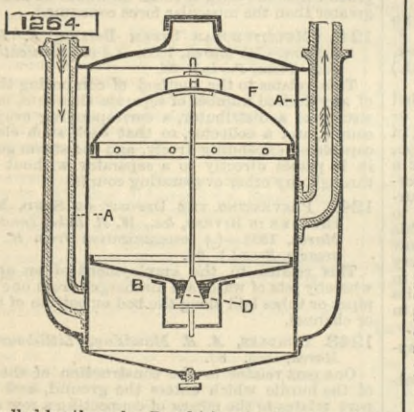
This relates to the use of bearings whereby the shaft or axle mounted therein is free to yield to an undue resistance presented to the rotation of such axle or to the instrument mounted thereon, while at the same time the axle is prevented from shifting in the opposite direction, such axle being free to expand by heat without the liability of becoming locked in its bearings.

1263. UMBRELLAS AND PARASOLS, *H. Hughes, Liverpool.—9th March*, 1883.—(*Not proceeded with.*) 2*d*.

This relates to self-closing umbrellas and parasols or sunshades.

1264. AUTOMATIC GAS REGULATOR, *J. and E. Tuckett, Exeter.—9th March*, 1883. 6*d*.

This consists in an apparatus for regulating the supply of the use and combination in the chamber A of the rigid diaphragm B, wherein is an aperture



controlled by the valve D, which valve is actuated by the flexible diaphragm F weighted as required, whereby the pressure of the gas that is allowed to reach the burner or burners is regulated and governed.

1265. CONSTRUCTION OF HOT-WATER BUILDINGS FOR HEATING PURPOSES, *T. C. Olney, Manchester.—9th March*, 1883.—(*Not proceeded with.*) 2*d*.

The object is to combine the advantages of the high-pressure system with the safety of the low-pressure system.

1266. APPARATUS FOR SUPPORTING THE BODY IN CASE OF INJURY TO OR OF DISEASE OR WEAKNESS OF THE SPINE, *J. W. Guilarette, Manchester.—9th March*, 1883. 6*d*.

This consists of a particular construction of axilla rests or crutches, which support the patient under the arm-pits, with their lower ends resting upon the chair, couch, or bed.

1268. ADJUSTABLE WINDOW FLOWER STANDS, *R. Körner, Dresden.—9th March*, 1883.—(*Not proceeded with.*) 2*d*.

This relates to rods pivotted together, so that the stand may be lengthened or shortened.

1269. CONSTRUCTION AND ARRANGEMENT OF APPARATUS FOR ROCKING CHAIRS, *J. T. Simpson, Halifax.—9th March*, 1883.—(*Not proceeded with.*) 2*d*.

The chair is rocked by means of levers and cranks.

1269. MECHANICAL TELEGRAPHS AND THEIR FITTINGS FOR SHIPS, *W. Chadburn, Liverpool.—9th March*, 1883. 6*d*.

This relates to the use, in connection with telegraph instruments, of two or more sounding devices having different notes or tones to give notice of change of orders by change of sound.

1270. LIFE-SAVING APPARATUS APPLICABLE FOR SEATS IN OCEAN-GOING AND RIVER VESSELS, *R. E. Pinkey, Oxton.—9th March*, 1883. 6*d*.

The object is to form the seats of boats so that they prove life rafts.

1271. RECEPTACLES USED IN WHAT ARE KNOWN AS "SANITARY CLOSETS," &c., *C. K. Lawton, Manchester.—9th March*, 1883. 6*d*.

This relates partly to the construction of the pails.

1272. CONSTRUCTION OF WHEELS SUITABLE FOR USE ON COMMON ROADS, *J. Burbridge and T. Oakley, Tottenham.—9th March*, 1883.—(*Not proceeded with.*) 2*d*.

This relates to improvements in wheels for velocipedes, perambulators, &c.

1273. FASTENINGS FOR SCARVES AND TIES, *E. Hewitt, London.—9th March*, 1883. 6*d*.

This relates to a metallic spring clip fastener.

1274. SLEEPERS AND RAIL CONNECTIONS, CHIEFLY FOR PORTABLE RAILWAYS, *A. J. Boult, London.—9th March*, 1883.—(*A communication from P. Dietrich, Berlin.*) 6*d*.

This relates to the construction of the connection at the points where the rails meet, by means of two fish-plates placed out of line with one another, so as to "break joint," and parallel with the rails, so as to prevent any single frame shifting sideways or upwards, and to produce a safe and yet loose longitudinal connection of the rails.

1275. ELECTRIC LAMPS, *J. S. Kelso, Stamford, Conn., U.S.—9th March*, 1883.—(*Not proceeded with.*) 2*d*.

Relates to arranging two filaments in an incandescent lamp.

1276. REFLECTING APPLIANCES FOR LIGHTING VEHICLES, *H. J. Haddan, Kensington.—10th March*, 1883.—(*A communication from E. T. Piper, Toronto.*) 6*d*.

This relates to the arrangement of the lens.

1278. MACHINERY FOR RAISING MUD AND OTHER STREET REFUSE INTO CARTS, &c., *E. Burton,—10th March*, 1883. 6*d*.

The apparatus is provided with a series of buckets upon an endless band.

1279. COOKING UTENSIL FOR COOKING EGGS, &c., *J. Darling, Glasgow.—10th March*, 1883.—(*Not proceeded with.*) 2*d*.

The apparatus is provided with a movable tray, upon which the eggs are placed, and which is raised up by springs at a certain period.

1280. APPARATUS EMPLOYED IN THE APPLICATION OF HOOPS TO WOOD CASKS, &c., *T. C. Hooman, London.—10th March*, 1883.—(*Not proceeded with.*) 2*d*.

This relates to the construction of a compressing case.

1281. LOOMS, *G. H. Hodgson, Bradford.—10th March*, 1883. 6*d*.

This relates partly to apparatus for raising and lowering the drop boxes, and for locking the same in position.

1282. VENTILATING HOUSE DRAINS, &c., *G. E. Mineard and T. Crapper, London.—10th March*, 1883. 8*d*.

This consists partly in the combination with an up-cast ventilating shaft, in connection with the house drains, of a hot-water circulating cistern.

1284. MANUFACTURE OF BLOCKS OR BRICKS TO BE USED AS FUEL, &c., *L. Blackburn and J. G. Elliott, London.—10th March*, 1883. 2*d*.

The object is to employ animal shale in combination with coal, preferably anthracite, in powder or small pieces, compounded with oil, chloride of sodium, lime chalk, common soda, acetic acid, tar, and an adhesive body to give cohesion.

1283. ADJUSTABLE SPANNERS, *C. Neil, Sheffield.—10th March*, 1883. 6*d*.

This relates to the use of a solid worm or roller for actuating the adjustable jaw.

1285. MITRE DOVETAILING MACHINES, *A. J. Boult, London.—10th March*, 1883.—(*A communication from The United States Box Machine Company, New York.*)—(*Not proceeded with.*) 4*d*.

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

1286. BOOKS FOR ADVERTISING AND OTHER PURPOSES, *R. Ripley, Liverpool.—10th March*, 1883. 6*d*.

This relates to the manufacture of books with backs for advertising or other purposes, in which a series of leaves at the beginning or end of the book, or both beginning and end, are arranged with a considerable strip of each leaf projecting beyond those in front of it, upon which strip the title or distinguishing or most important point of the advertisement, table, or other matter set forth on said page is placed.

1287. KALEIDOSCOPIC TOPS, *A. A. King, London.—10th March*, 1883. 6*d*.

This relates to the use in spinning tops or wheels of one or more freely revolving cylinders, prisms, or spheres, having various colours at their peripheries.

1288 GUN CARRIAGES, &c., *W. R. Lake, London.—10th March*, 1883.—(*A communication from H. Gruson, Buckau, Magdeburg.*) 6*d*.

This relates to the general constructions of the gun carriage and to apparatus connected therewith.

1289. STIRRUPS, *W. R. Lake, London.—10th March*, 1883.—(*A communication from J. Persson, Bosarp, Sweden.*)—(*Not proceeded with.*) 2*d*.

The object is to construct a stirrup so that in case a rider is thrown from his horse, his foot will be readily released therefrom.

1290. TELEPHONIC APPARATUS, *S. H. Bussano, A. E. Slater, and F. T. Hollins, Derby.—10th March*, 1883. 8*d*.

The transmitter is a modification of Hughes' microphone, the diaphragm being secured only at one end, and the carbon pencils being fixed at the loose end. The receiver has a disc or plate moving bodily and secured in a central position by a spring holder. The carbon pencils are arranged in a multiple circuit to admit of varying the battery power.

1295. ELECTRICAL APPARATUS FOR IGNITING INFLAMMABLE GASES, &c., *A. R. Molison, Swansea.—12th March*, 1883. 6*d*.

Relates to a self-inducing apparatus contained in a closed case for igniting inflammable gases.

1298. APPARATUS FOR CARRYING, PROTECTING, AND INSULATING WIRES EMPLOYED FOR CONVEYING ELECTRIC CURRENTS, *R. Longdon and F. B. Welch, Manchester.—12th March*, 1883. 6*d*.

The conductors are carried in longitudinal slabs of slate having a series of longitudinal grooves and provided with a slate cover. One wire is laid in each groove, and the whole is suitably secured together by bolts and nuts or dowels.

1314. DYNAMO AND MAGNETO-ELECTRIC MACHINES, *W. Vincent, London.—12th March*, 1883. 6*d*.

The armature and field magnet coils are wound with insulated iron or steel wire in place of the copper wire usually employed.

1322. GOVERNORS FOR REGULATING THE SPEED OF STEAM OR OTHER ENGINES, *F. M. Rogers, London.—13th March*, 1883.—(*A communication from J. M. Gorham, Bucharest.*) 4*d*.

This relates to the application of the pressure in the cylinder or in any other part between the cylinder and the governor to regulate the speed of a steam or other engine in such a manner that as the load on the engine is increased the speed of the engine shall automatically increase, and as the load on the engine is taken off the speed shall automatically diminish.

1329. RAILWAY FROGS, *H. J. Haddan, Kensington.—13th March*, 1883.—(*A communication from W. J. Morden, Chicago, U.S.*) 6*d*.

The invention consists in constructing the point with wings or flanges formed on each side thereof, and

shaped to conform to the lower part or shank of the outer or wing rails, to which they are secured by bolts or otherwise.

1334. SLIDE VALVES, &c., *A. J. Boult, London.—13th March*, 1883.—(*A communication from W. T. Reaser and C. R. Stein, Madison, U.S.*) 6*d*.

This relates to means for lessening or removing the friction between a slide valve and its seat resulting from the downward pressure upon such valves of steam or other fluids.

1363. MANUFACTURE OF COLOURING MATTERS AND THEIR SULPHO ACIDS OR SALTS FROM PHTALIC ANHYDRIDE, &c., *C. D. Abel, London.—14th March*, 1883.—(*A communication from the Actien Gesellschaft für Anilin-Fabrication, Berlin.*) 4*d*.

This relates to the process of manufacturing the colouring matters, &c.

1400. STUD OR BUTTON FOR FASTENING THE ENDS OF METAL BALE BANDS, *R. Benwell, Egypt.—16th March*, 1883. 4*d*.

This relates to a stud or button with enlarged head excentrically disposed so as to project beyond at least three sides of the shank for fastening the ends of metal bale bands.

1430. GALVANIC BATTERIES, *J. B. Hannay, Glasgow.—19th March*, 1883. 4*d*.

In the bottom of a wooden barrel a board, provided with vertical pegs, is placed. The pegs form a rack for supporting the alternate plates of copper and zinc. A solution of bisulphate of soda is used as the exciting liquid and the spaces are filled with roughly crushed pumice stone.

1431. BREECH-LOADING REPEATING FIRE-ARMS AND CARTRIDGES THEREFOR, &c., *B. Burton, London.—19th March*, 1883. 6*d*.

This relates partly to means for preventing the cartridges from turning over in the hopper.

1433. VENTILATED TAP TO BE PERMANENTLY FIXED TO CASKS, &c., *T. Peacock, London, and J. S. Sworder, Loughton.—19th March*, 1883. 6*d*.

This relates to the general arrangement of the tap.

1464. APPARATUS FOR UTILISING THE CURRENTS OF RIVERS, &c., FOR PROPULSION OR MOTIVE-POWER, *C. D. Abel, London.—20th March*, 1883.—(*A communication from N. Yagn, St. Petersburg.*) 6*d*.

This relates to the employment of an endless rope or band provided with collapsible buckets.

1477. WRENCHES OR SPANNERS FOR NUTS, BOLTS, OR PIPES, *F. J. Drewry, Burton-on-Trent, Executor of W. Morgan-Brown, London.—21st March*, 1883.—(*A communication from J. A. Dodge, Somerville, U.S., and G. R. Marble, Boston, U.S.*) 6*d*.

This consists in the combination in a wrench of a stationary jaw, a bar, loosely carried by the same, a jaw movable with and adjustable along the bar, and a handle pivotally connected with the stationary jaw for moving the bar.

1612. APPARATUS FOR CLEANING AND LUBRICATING THE JOURNALS OF CAR AXLES, *W. G. Mitchell, New York.—31st March*, 1883.—(*Complete.*) 4*d*.

This consists in an axle lubricator of a spool bearing bristles, combined with a frame to carry it, provided with journal bearings therein for the spool formed so that they can be opened to remove and replace the spool.

1819. STEAM BOILERS, *W. R. Lake, London.—10th April*, 1883.—(*A communication from G. Stollwerck, Cologne-on-the-Rhine.*) 6*d*.

This consists in constructing a number of tubular boilers or compartments containing two chambers firmly closed at their outer ends by means of detachable covers, communicating with each other by a number of tubes tightly fitted into the opposite walls of the said two chambers, and in arranging these tubular boilers or compartments in sets above or alongside each other, or both, and connecting the front walls by means of a system of pipes, in such a manner as to form one single large boiler.

1860. MANUFACTURE OF STEEL OR OF ALLOYS OF IRON AND STEEL SUITABLE FOR CASTING, *A. J. Boult, London.—12th April*, 1883.—(*A communication from G. W. Francis, Middlesex, Conn., U.S.*)—(*Complete.*) 4*d*.

The invention consists in melting steel which is rich enough in carbon to be hardened and tempered in conjunction with charcoal pig iron, pouring such fluid or molten mixture into any desired form of moulds and then annealing the metal so cast. It also includes the peculiar composition of metal or material which is the product of said process.

1936. CENTRIFUGAL MACHINES AND MANUFACTURE OF SUGAR THEREIN, *A. G. Brookes, London.—17th April*, 1883.—(*A communication from D. McC. Weston, Boston, U.S.*)—(*Complete.*) 6*d*.

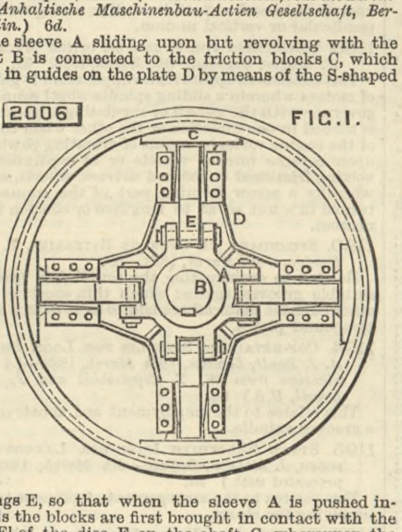
This consists partly in the combination with a revolving cylinder of a centrifugal machine, with an impervious pan-like charger located within it to receive the syrupy mass or charge, hold it, and when the machine is in motion, discharge the charge outwardly against the wall of the cylinder. Other improvements are described.

1937. CENTRIFUGAL MACHINES, *A. G. Brookes, London.—17th April*, 1883.—(*A communication from D. McC. Weston, Boston.*)—(*Complete.*) 6*d*.

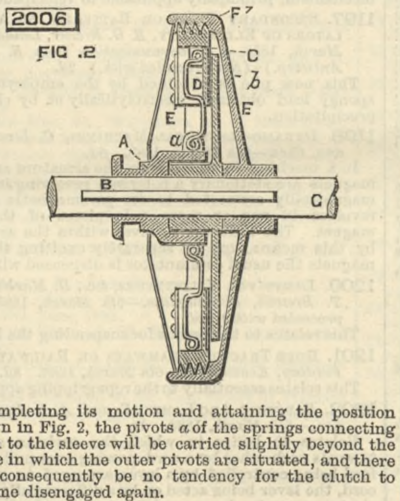
One part consists in combining with the usual basket a counterbalanced valve, which is adapted to descend or be lowered to close the openings at the bottom of the basket, either by the weight upon it of the sugar or material being introduced into the basket and resting on the said valve, or by slight downward pressure by the workman on the sleeve of the valve, the latter again rising to uncover the openings at the bottom of the basket as soon as the sugar, or the material resting on the valve, is thrown therefrom in the rotation of the basket.

2006. FRICTION CLUTCHES, *N. Simon, Manchester.—20th April*, 1883.—(*A communication from the Berlin-Anhaltische Maschinenbau-Actien Gesellschaft, Berlin.*) 6*d*.

The sleeve A sliding upon but revolving with the shaft B is connected to the friction blocks C, which slide in guides on the plate D by means of the S-shaped



springs E, so that when the sleeve A is pushed inwards the blocks are first brought in contact with the rim F' of the disc F on the shaft G, whereupon the spring E will be compressed somewhat on the continued motion of the sleeve, thereby increasing the frictional contact between the blocks and disc, and on



A completing its motion and attaining the position shown in Fig. 2, the pivots *a* of the springs connecting them to the sleeve will be carried slightly beyond the plane in which the outer pivots are situated, and there will consequently be no tendency for the clutch to become disengaged again.

2878. HYDRAULIC CRANK WITH VARIABLE EXCENTRIC MOTION, *J. C. Müller, Paris.—9th June*, 1883.—(*Complete.*) 6*d*.

This relates to the general construction of the apparatus.

2916. CAR AXLE-BOXES, *H. J. Haddan, London.—12th June*, 1883.—(*A communication from J. A. Hamilton, New York, U.S.*)—(*Complete.*) 6*d*.

This relates to the construction of dust shields for car axle-boxes; also to the arrangement of springs for resisting the longitudinal thrust of the axles, and to the construction and arrangement of oil receptacles for lubricating the journals.

2928. MACHINES FOR MOULDING OR SHAPING PLASTIC MATERIALS, *W. R. Lake, London.—12th June*, 1883.—(*A communication from O. R. Chase, Boston.*) 1*s*.

This relates to the general construction of the machine.

3000. ELECTRIC ARC LAMPS, *S. Pitt, Sutton, Surrey.—16th June*, 1883.—(*A communication from N. H. Edgerton, Philadelphia, Pen., U.S.*) 6*d*.

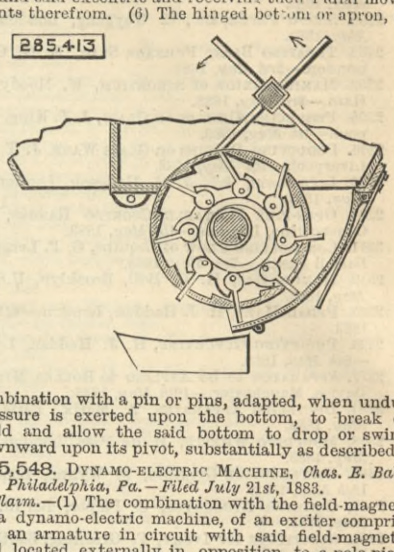
The power fixed electrode is of refractory material, the upper electrode feeds down by gravity, and consists of a carbon pencil contained in a metallic tube provided at its lower end with detaining pins, and attached to the armature of an electro-magnet placed in the lamp circuit. A supply of carbon pencils is contained in a magazine.

SELECTED AMERICAN PATENTS.

(*From the United States' Patent Office Official Gazette.*)

285,413. FORCE-FEED FERTILISER DISTRIBUTOR, *Charles F. Johnson, Owego, N.Y.—Filed April 7th*, 1883.

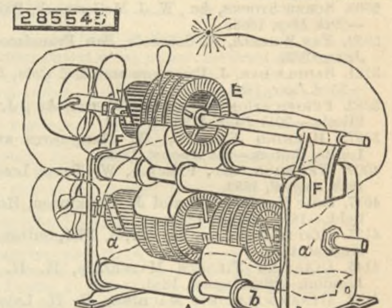
Claim.—(1) In a fertiliser distributor, the rotating axle, in combination with a stationary excentric secured to the distributor wheel casing and surrounding said axle, and radially-moving buckets rotating around said excentric and receiving their radial movements therefrom. (6) The hinged bottom or apron, in



combination with a pin or pins, adapted, when undue pressure is exerted upon the bottom, to break or yield and allow the said bottom to drop or swing downward upon its pivot, substantially as described.

285,548. DYNAMO-ELECTRIC MACHINE, *Chas. E. Ball, Philadelphia, Pa.—Filed July 21st*, 1883.

Claim.—(1) The combination with the field-magnets of a dynamo-electric machine, of an exciter comprising an armature in circuit with said field-magnets, and located externally in opposition to a pole-piece sustained upon the magnet bars of such field-magnets. (2) The combination, with a dynamo-electric machine having a double pole-piece, *i.e.*, one with inwardly and outwardly turned horns, of an armature



mounted upon an externally-located shaft, said armature being adapted and designed to act as an exciter for said machine, substantially as shown and described. (3) The combination, with machine A, comprising ends and heads a a^1, and magnet bars b b^1, of an externally-extended pole-piece, and an armature E, located in opposition to said pole-piece, and mounted on a shaft sustained in brackets or supports F F, formed on or attached to the said head, substantially as shown and described.

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