THE HORSE-POWER OF TURBINES.

By PROFESSOR R. H. SMITH.

No. II.

IN my first article on this subject I showed the relation between volumetric flow and section and velocity. In using it we generally need a knowledge of the velocity. The velocity may be found either by direct instrumental measurement as previously mentioned, or by means of calculation from other measured data. For this calculation we must know the law governing the variation of the velocity along the stream. The variation of velocity depends on the variation of pressure, because momentum is generated or destroyed only in consequence of the want of balance of applied forces. It is easy to deduce the well-known elementary equation—

$$\frac{v^2 - v_0^2}{2g} = h + \frac{p_0 - p}{w}$$

where w is the weight per unit of volume, and $\frac{1}{w}$, therefore, the volume per unit weight of water. This is an incomplete equation, and its real meaning is not commonly enough understood. $\frac{v^2 - v_0^2}{2g}$ is the gain of kinetic energy per unit weight of water flowing from one section to another in the stream. The equation states that this gain of kinetic energy is equal to the work done on the water between those sections per unit of weight flowing past them. h is the work done by gravity per unit of weight. $\frac{p_0}{w}$ is the work done on each unit weight of water by the water flowing behind it in passing the first section. $\frac{p}{w}$ is the work done by each unit weight of water on the water flowing in front of it in passing the second section.

The equation evidently leaves out of account any work the water may do on the walls of the stream between the two sections considered. This work is chiefly done in two ways: firstly in overcoming the frictional resistance to the flow over these walls; secondly, in pushing these walls from one position to another, as occurs in the passages of turbines. There is also an amount of work done on viscous resistances, but it may here be taken into account as part of the "frictional" resistance. The frictional and viscous work is partly spent in heating the walls and the water, and partly in creating eddies.

Let the work so done per unit weight while flowing from the first to the second section be called F, and that done in moving the walls be called W. Then the complete equation is—

$$\frac{v^2 - v_0^2}{2g} + W = h + \frac{p_0 - p}{w} - F. \quad . \quad . \quad (5)$$

In a "steady" stream, as, for instance, approximately in the head race and inlet guide blades and in the tail race of a turbine, the walls do not move, and therefore W becomes zero. In the turbine wheel, if W represent the work done on the wheel by each unit weight of water passed through it, then v_0 and v may be taken as the inlet and outlet velocities of the water over the earth, and p_0 and p the pressures at inlet and outlet.

The flow of water obtainable depends largely on the frictional resistances in the head race. Here our equation (5) is simplified by the omission of W, but even omitting also F, *i.e.*, putting aside all the effects of friction, we find certain limits of possible flow dependent on the sections of the passages. So far as I know, the limits here referred to have hitherto passed unnoticed, and it is, therefore, the more important to consider them. They are deduced from the fact that the pressure p cannot diminish below zero; it cannot become negative. Putting W, F, and p equal to zero in equation (5), we find that at any and every section after S_0 where the pressure and velocity are p_0 and v_0, the velocity cannot be greater than

$$v \leq \sqrt{v_0^2 + 2g\left(h + \frac{p_0}{w}\right)}$$

Since $V = v\,S$, and $v_0 = \frac{V}{S_0}$, this limit may be written as one within which the volumetric flow at any part of the stream must lie, namely—

$$V \leq S\sqrt{\frac{V^2}{S_0^2} + 2g\left(h + \frac{p_0}{w}\right)}$$

Squaring and bringing the terms involving V to one side, we have

$$V \leq S_0\,S\sqrt{\frac{2g\left(h + \frac{p_0}{w}\right)}{S_0^2 - S^2}} \text{ where } S_0 > S \Bigg\} \ldots (6)$$

In using these limits it must be remembered that h is measured positively downwards from S_0 to S. The limit to V, so far as it is affected by a length of uniform section S, is determined by the highest part of this length—*i.e.*, where h is least—if $S_0 > S$. So far as it is effected by a level (h constant) length of channel, it is determined by the furthest forward end of this level length, because at that end S will be least and the divisor in the square root greatest. This limiting equation is inapplicable wherever $S_0 < S$; that is, wherever the section increases down streamwards.

If the channel be so constructed that the pressure at no part of it can fall below atmospheric pressure, similar, but still narrower limits, of the flow may be investigated.

The limits of possible volumetric flow are still further restricted by frictional resistances to be immediately explained. If in equation (10) below, where friction is taken account of, the mechanical work done W be omitted and the pressure p be put = O, we obtain the limit—

$$V \leq \sqrt{\frac{h + {\cdot}016\,p_0}{{\cdot}0155\left(\frac{1}{S^2} - \frac{1}{S_0^2}\right) + {\cdot}0001\,\Sigma\left(\frac{L}{S^2\delta}\right)}} \quad \text{Eqn. } (6a)$$

the units being feet, square feet, cubic feet, pounds, and seconds; or—

$$Q \leq 1000\sqrt{\frac{h + {\cdot}016\,p_0}{\frac{1}{d^4} - \frac{1}{d_0^4} + \frac{1}{3}\Sigma\frac{L}{d^5}}} \quad . \quad . \quad . \quad . \quad \text{Eqn. } (6b)$$

where Q is in gallons per hour, h and L in feet, p_0 in pounds per square foot, and d and d_0 in inches.

If p_0 be atmospheric pressure, then ${\cdot}016\,p_0$ may be taken as 34ft. If the pipe or channel be so laid as to prevent p falling below atmospheric pressure, then $({\cdot}016\,p_0 - 34)$ must be used in these formulas instead of ${\cdot}016\,p_0$; and this becomes O when p_0 is atmospheric pressure.

The frictional and viscous—probably mostly viscous—resistances increase rapidly with the velocity of the water, but are practically independent of the pressure. The law has not been carefully investigated by thorough experiments, but the rough approximation to it commonly adopted by engineers is that the resistance, considered as distributed over the area of the walls, is proportional to the square of the average velocity, the average being taken over the whole section. As the rules based on this assumption do not lead to calculated expectations extravagantly at variance with the actual results of practice, we will follow this hypothesis. The results of practice give the following average value to the frictional coefficient as viewed above.

f pounds per square foot = ${\cdot}0065\,v^2$,

where v is taken in feet per second.

From this we can calculate F, the work done on viscosity or friction per unit weight in passing from section S_0 to S, the length of which passage we will call L, the fall being as before h. F is more usually termed the "head lost in friction." The most useful results are the following, where V is in cubic feet per second, and all the dimensions in feet. F is in feet:—

Rectangular channel open at top, breadth b, water depth d;

$$F = {\cdot}0001\,V^2\,L\,\frac{b + 2d}{b^3\,d^3}$$

Round pipe of diameter d running full bore—

$$F = {\cdot}00066\frac{V^2 L}{d^5} = \frac{2}{3000}\,\frac{V^2 L}{d^5}$$

or $F = \frac{1}{3 \times 10^5}\,Q^2\,\frac{L}{d^5}$; where Q is in gallons per hour, F and L in feet, and d in inches. (7)

Channel of any shape with water section S and mean hydraulic depth δ—

$$F = {\cdot}0001\,\frac{V^2 L}{S^2\,\delta}$$

If there are in the pipe, lengths of different diameters, the sum of the F's for the various lengths must be found according to the formula (7). This formula only applies to a round pipe if it run full bore. In a length of uniform diameter, in order to run full bore there must be no increase of velocity from end to end; that is, the expression for $(v^2 - v_0^2)$ in equation (5) must be zero. If it be not zero, the velocity will increase, less and less of the section being filled with water, until the rapid increase of friction, due to the increase of velocity, balances the further generation of forward momentum.

As an example of this increase of velocity until further increase is balanced by increased friction, we take an open rectangular channel throughout which the pressure remains constantly atmospheric. Here the depth of water decreases until a limit is reached, given by

$$\frac{d^3}{b + 2d} = {\cdot}0001\,V^2\,\frac{L}{h\,b^3}$$

If the depth of water be small as compared with the breadth, this will give nearly

$$d = \frac{1}{21{\cdot}5}\sqrt[3]{\frac{V^2 L}{b^2 h}}$$

when the velocity in feet per second would be

$$v = 21{\cdot}5\sqrt[3]{\frac{V h}{b L}}$$

Taking an average frictional coefficient, we find that the horse-power spent in overcoming friction in the length L of a round pipe running full bore is in terms of V, the volumetric flow in cubic feet per second, and L and d both in feet;—

$$\text{Frictional horse-power} = {\cdot}000076\,V^3\,\frac{L}{d^5}. \quad . \quad . \quad (8)$$

$$\text{or frictional horse-power} = \frac{1}{6 \times 10^{11}}\,Q^3\,\frac{L}{d^5}. \quad . \quad (8a)$$

where Q is the flow in gallons per hour, L is in feet, and d in inches.

We will now write over again equation (5), inserting for F the last and most general expression given in (7). We will also write $\frac{V}{S}$ and $\frac{V}{S_0}$ for v and v_0; also the value $\frac{1}{2g} = {\cdot}0155$, and $\frac{1}{w} = \frac{1}{62{\cdot}4} = {\cdot}016$ cubic foot per pound. We obtain

$$\cdot0155\,V^2\left(\frac{1}{S^2} - \frac{1}{S_0^2}\right) + W = h + {\cdot}016\,(p_0 - p) - {\cdot}0001\,\frac{V^2 L}{S^2\,\delta}$$

The last term indicates a frictional loss in the length L throughout which the section is supposed to remain S. As the section may vary, however, we must, in order to make the equation general, add all the frictional resistances for the different lengths L with different sections. This summation we indicate by the usual summation sign Σ, and since this term involves V^2 we bring it to the left-hand side, and so obtain—

$$V^2\left\{{\cdot}0155\left(\frac{1}{S^2} - \frac{1}{S_0^2}\right) + {\cdot}0001\,\Sigma\left(\frac{L}{S^2\delta}\right)\right\} + W = h + {\cdot}016\,(p_0 - p) \quad \text{Eqn. (9)}$$

where the units are linear, square, and cubic feet, and pounds, and seconds. The similar equation for a flow through a succession of round pipes all running full bore is the following, where Q is the flow in gallons per hour, L, h, and W are in feet, d_0 and d are in inches, and p_0 and p in pounds per square foot:—

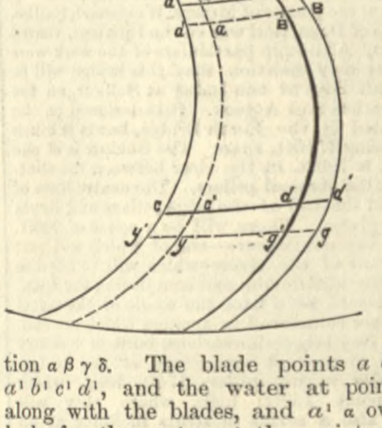
$$\frac{Q^2}{10^6}\left\{\frac{1}{d^4} - \frac{1}{d_0^4} + \frac{1}{3}\Sigma\frac{L}{d^5}\right\} + W = h + {\cdot}016\,(p_0 - p) \quad \text{Eqn. } (9_a)$$

The extra resistance to the flow occasioned at "bends" is most conveniently allowed for by adding a suitable amount to the actual length of the part in which the bend occurs in the formula $\frac{L}{S^2\delta}$.

We must now investigate more closely the quantity W, namely, the work done on the blades of the turbines per unit weight of water passing through the machine. To do this most simply we use a well-know theorem of mechanics regarding what is called the moment of momentum of a moving mass. This is precisely analogous to the moment of a force. Each part of any mass is moving at a given instant in a definite line, which gives the direction of its momentum. If the perpendicular distance of this line from any chosen axis be multiplied by the momentum, *i.e.*, if the momentum be multiplied by its leverage round the chosen axis, the product is called the moment of momentum round that axis. The momentum may be looked on as made up of two components, one radial or directed straight away from the axis, and therefore having zero leverage; the other tangential, whose leverage is the actual radial distance of the mass from the axis. Thus the moment of momentum is most conveniently looked on as due to the tangential component alone; and as being, therefore, the product of the mass, its distance from the axis and the tangential component of its velocity. If the different parts of a large mass move at the same time in different directions, and at different distances from the axis, the moment of momentum of the whole mass is obtained by adding up the moments of momentum of all its parts.*

If, now, any mass move in a certain fashion round an axis, and be controlled in its motion by a force or a number of forces, then the moment of this controlling force, or the combined moment of the different forces, round the same axis, equals the rate at which the moment of momentum of the mass round the same axis is changed by the action of the force; because the radial component of the force—which has no leverage, and therefore contributes nothing to the moment of the force round the axis—changes only the radial component of the momentum, and therefore does not affect the moment of momentum. The tangential component of the force measures the rate of change of the tangential component of the momentum. Therefore, multiplying each by the radial distance of the mass from the axis, we find that the moment of the force equals the rate of change of the moment of momentum. This, at any rate, proves the equality for a small mass, the different parts of which may be looked on as nearly all at the same distance from the axis. For a large mass we add up the moments of the forces applied to all its small parts, and also add up the moments of momentum of all these small parts, and obtain a total force-moment equal to the total rate of change of moment of momentum of the whole mass. The water in passing through the turbine presses on its blades, which return the pressure—re-act—so as to change the velocity and momentum of each portion of water as it flows through. The total moment of all the blade pressures round the axis of the turbine equals the rate at which the moment of momentum of the water round the same axis is being changed in consequence of its doing work on, *i.e.*, driving, the blades. The driving moment of the water pressure on the turbine is the exact negative of that of the turbine blades on the water. We have, therefore, to find an expression for—a means of calculating—the rate at which the moment of momentum of the water round the axis of rotation is being changed in its passage through the wheel.

In Fig. 2 let the full lines $a\,c$ and $b\,d$ represent portions of two successive blades in the positions they occupy at the beginning of a small time, such as $\frac{1}{100}$ second, through which we will follow the motion. The figure drawn as if for an outward flow turbine, but the argument applies equally well to any form of turbine. If the passages do not run full bore, $a\,c$ represents the free surface of the water partially filling the passage. Let the water occupying the space $a\,b\,c\,d$ move in the small time considered into the position $\alpha\,\beta\,\gamma\,\delta$.



The blade points $a\,b\,c\,d$ have moved to $a^1\,b^1\,c^1\,d^1$, and the water at point a has moved $a\,a^1$ along with the blades, and $a^1\,\alpha$ over the blades; similarly for the water at the points $b\ c\ d$. Of the mass of water considered, namely that originally in $a\,b\,c\,d$, the portion originally in $\alpha^1\,\beta^1\ c\,d$ had at the beginning of the small time exactly the same moment of momentum round the axis of rotation as the portion contained at the end of the small time in the space $\alpha\,\beta\,c^1\,d^1$, provided the relative stream motion through the blades be steady throughout this small time. The change of moment of momentum in the mass originally in position $a\,b\,c\,d$, and finally in $\alpha\,\beta\,\gamma\,\delta$, consists, therefore, in the difference between the moment of momentum of the portion $a\,b\,\alpha^1\,\beta^1$ at the beginning, and that of $c^1\,d^1\,\gamma\,\delta$ at the end of the small time. These two masses are evidently equal, because each is the whole mass considered, less the portion contained in the equal volumes $\alpha^1\,\beta^1\,c\,d$ and $\alpha\,\beta\,c^1\,d^1$. Let the average distance of the small mass $a\,b\,\alpha^1\,\beta^1$ from the axis be r_1 and that of $c^1\,d^1\,\gamma\,\delta$ be r_2, and let the tangential component of the velocity of the former be v_{t_1} and that of the latter be v_{t_2}, then the above difference of moments of momenta is either small mass multiplied by $(r_2\,v_{t_2} - r_1\,v_{t_1})$. The rate of change of moment of momenta, which equals the force-moment, is the above divided by the small time. But the small mass referred to is evidently the mass of water that has flowed in the said small time through any section of the passage, such

* The moment of momentum is also called the angular momentum.

as $a\,b$ or $c\,d$. In our previous notation this mass is $\frac{w}{g}$ V multiplied by the small time. Dividing then by this time, we obtain force-moment of the blade pressure on the water between the sections $a\,b$ and $c\,d = \frac{w}{g} V(r_2 v_{t_2} - r_1 v_{t_1})$; and the force-moment of the water pressure on the blades is the exact negative of this. To obtain the effect over the whole length of the blade we have now simply to consider the sections $a\,b$ and $c\,d$ as coincident with the inlet and exit sections. In inward and outward flow turbines the r and the v are both the same all over the inlet surface, and again the same all over the exit surface. In parallel flow turbines an average value of $r v_t$ must be taken for the inlet area, and another average for the exit area. Equation (2) gives the radial inlet velocity in terms of the volumetric flow and of the inlet area for an inward or outward flow turbine, and a similar equation will give the radial exit velocity if we substitute for r_i and d_i the exit radius and axial depth, which we will call r_e and d_e. If θ_i be the angle between the inlet edge of the blade and the forward tangent of the wheel inlet surface, and θ_e be the corresponding angle at the exit surface between the discharge relative velocity of the water and the velocity of the discharge edge of the blade; and if ϖ be the angular velocity of the wheel in circular measure—*i.e.*, in radians—then the tangential component of the water's relative velocity over the blades is the radial velocity divided by the tangent of θ, and the tangential component of the water's velocity along with the blades is $r\,\varpi$. The tangential component of the water's velocity over the earth being the sum of these two, we have for this component velocity,

For inlet surface $\frac{V}{m_i\, 2\,\pi\, r_i\, d_i \tan.\, \theta_i} + r_i\,\varpi$;

and for exit surface $\frac{V}{m_e\, 2\,\pi\, r_e\, d_e \tan.\, \theta_e} + r_e\,\varpi$

To calculate the force-moment of the water pressure round the axis of rotation, the first of these is to be multiplied by r_i and the second by r_e and the difference of these products multiplied by $\frac{w}{g}$ V. The rate at which the force-moment works—that is, the work done by the water per second on the wheel, is the moment multiplied by ϖ. To obtain the work done per unit weight of water passed through the wheel, we must then divide by w V, because this is the weight passed per second. This work done per unit weight of water passed is what we called W in equations (5) and (9). Performing the above operations we find

$$W = \frac{V\,\varpi}{2\,\pi\, g}\left(\frac{1}{m_i\, d_i \tan.\, \theta_i} - \frac{1}{m_e\, d_e \tan.\, \theta_e}\right) + \frac{\varpi^2}{g}(r_i^2 - r_e^2) \quad . \text{ Eqn. (10)}$$

as applicable to both inward and outward radial flow turbines.

The analogous calculation for axial flow turbines is somewhat simpler. In terms of the notation of equation (3) it is

$$W = \frac{V\,\omega}{2\,\pi\, g\,(r_2 - r_1)}\left(\frac{1}{m_i \tan.\, \theta_i} - \frac{1}{m_e \tan.\, \theta_e}\right) \text{ Eqn. (11)}$$

in which θ_i and θ_e are the angles made by the inlet and exit blade edges, with the inlet and outlet surfaces, which latter are in this case perpendicular to the axis of the shaft.*

THE SUKKUR BRIDGE.

THE Sukkur Bridge, which we described and illustrated some time ago, will be the largest span bridge yet erected in India. It is in course of manufacture at the works of Messrs. Westwood, Baillie, and Co., London-yard, Isle of Dogs, and was on the 16th inst. visited by the Society of Engineers. Although particulars of the work were given some time since, we may mention that this bridge will be constructed over the Rohri Pass of the Indus at Sukkur, on the line of railway from Kurrachee and Attock. It is designed on the cantilever principle initiated in the Forth Bridge, but it is much smaller, the Forth spans being 1710ft. span. The Sukkur is of one span only, but that span is 790ft. in the clear between the abutments, and 820ft. between the vertical pillars. The centre lines of the main horizontal tie and the top of the large pillars and struts are 169ft. above the bed plates. There will be a space of 200ft. between the ends of the two cantilevers—one of which will rest on foundations on each bank of the river—which will be filled in by a girder, thus uniting the cantilevers and completing the span. The main guys, which have to hold back the whole of the structure, are 302ft. long, and are connected to anchors which are constructed of steel plates of very large dimensions, built in masonry below the surface of the ground at either end of the bridge. The superstructure includes raking pillars 174ft. long, which incline inwards to a point 169ft. high, where they will meet the guys. There is also a series of struts inclining at an angle of 35 deg. towards the centre of the bridge, and also inwards, these struts being 210ft. long and 16ft. square at the centre. The platform for carrying the rails consists of two horizontal girders running from end to end, placed 18ft. apart, and having cross girders every 8ft., the platform covering being of Westwood and Baillie's trough flooring. The bridge will be constructed of steel, of which material the cantilevers will absorb 3200 tons; this is exclusive of the 200ft. centre girder. Each of the cantilevers has to be erected complete in the contractor's yard before being sent out to India, and in order to comply with this condition of the contract a staging or scaffold has to be provided. This staging, which is in course of construction, will consist of about 300 piles, 14in. by 14in., driven into the ground, and on these will be built up in some cases four lengths of 40ft. timber, one above the other, braced together with horizontal and diagonal bracing. This staging covers an area of 400ft. long by 120ft. wide, and will be 180ft. high when completed. It will absorb more than 2000 loads of timber and many tons of bolts and nuts.

Besides the Sukkur Bridge, Messrs. Westwood, Baillie, and Co. have in course of construction 32 spans of iron bridges, 100ft. each, and weighing upwards of 2000 tons, for Indian railways.

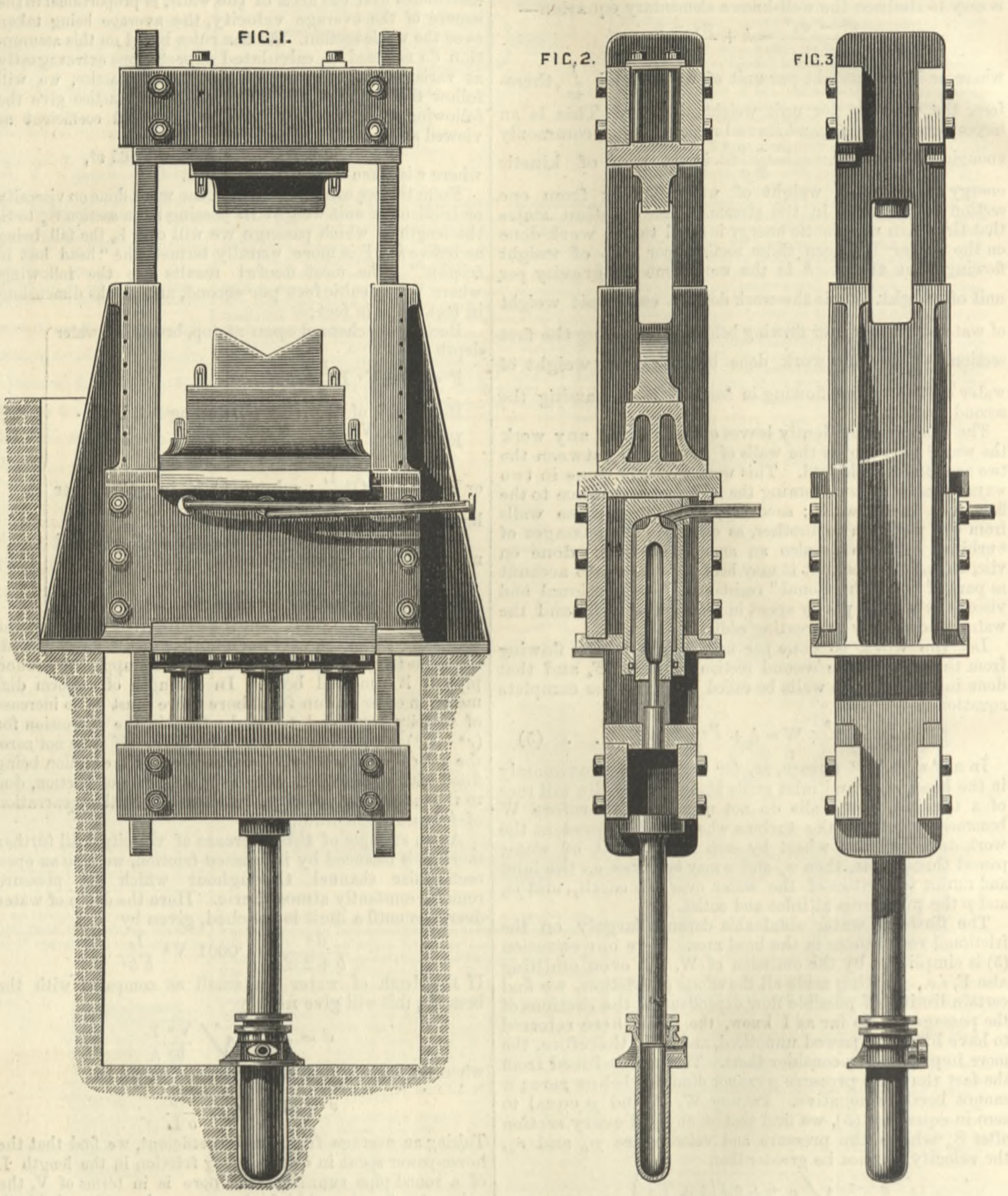
* Here it is assumed that the axial inlet velocity is uniform over the inlet area, and that θ_i is the same all along the inlet edge of blade. A similar assumption is made regarding the outlet area, and $\frac{1}{2(r_2 - r_1)}$ is taken as nearly equal to $\frac{2}{3}\,\frac{r_2^3 - r_1^3}{(r_2^2 - r_1^2)^2}$. In the practical application to turbines, the approximation is a close one, and introduces great simplicity in the above expression.

MISCELLANEOUS MACHINERY AT THE INTERNATIONAL INVENTIONS EXHIBITION.

A NEAT and efficient working model of Tweddell, Platt, and Fielding's patent hydraulic forging press is exhibited by Messrs. Fielding and Platt, who are the sole makers, and who claim for it, among others, the following advantages:—Economy in consumption of water by the employment of several cylinders which may either be used together or separately, according to the power required to be developed; great convenience in operating, as the cylinders are all placed below the ground, and therefore do not interfere with the manipulation of the work.

short and quickly following squeezes can be given. The advantages claimed for the use of hydraulic pressure for forging are numerous, and have been strongly urged by Mr. Tweddell for many years past. As a matter of fact, however, though hydraulic presses have frequently been applied, until quite recently no machines have been designed with any particular reference to economy of water in working. The arrangement illustrated permits of a very ready alteration of the "daylight," or space between the moving block and anvil, and also of the length of the stroke, by a simple manipulation of the tappet gear. We understood that Messrs. Fielding and Platt have made a number of forging machines on this principle, of sizes varying from 150 tons upwards. Our illustration represents a press

FIG. 1. FIG. 2. FIG. 3.



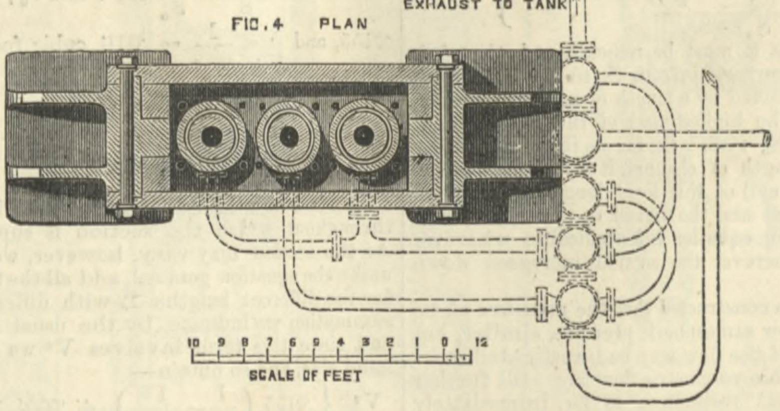
TWEDDELL, PLATT, AND FIELDING'S HYDRAULIC FORGING PRESS.

As will be seen from our illustrations herewith, the machine consists of a main standard or frame, on which is placed the anvil block, and which carries three vertical hydraulic cylinders having their rams working direct on to a bottom crosshead common to all. This crosshead is connected by suitable side rods to an upper head carrying the movable tool or die, which may be used either for drawing out, forging, or stamping, according to the form of the dies or moulds employed. In working, the movable head is raised by means of a return motion ram acting upon the lower crosshead, the work to be operated upon being placed on the anvil block. The pressure is then relieved from the returning cylinder, and this being opened to the exhaust, the lower crosshead, and with it the three rams and the upper head carrying the mould or die, descend by gravity, drawing low-pressure water into the cylinders from a tank. When the resistance of the material being pressed or forged prevents the further descent of the head, pressure water from an accumulator is admitted to the cylinders, the centre one alone, the two outer ones, or all three being used according as power required to be exerted is small or great. In certain kinds of work only one effort or stroke is necessary; but it is, of course, obvious that when desired, a succession of very

capable of exerting a total of 5000 tons, *i.e.*, 1666 on each ram.

In a recent article we illustrated and described the latest design of Tweddell's fixed rivetting and plate-closing machine, as made by Messrs. Fielding and Platt, Gloucester, and at that time explained some of the conditions necessary to ensure good rivetting in boiler work. It is evident, however, that even with the automatic plate-closing gear as described, the difficulty of properly closing the plates would be much lessened if the plates were properly fitted together previous to the boiler being brought to the rivetting machine. In order to ensure this, Mr. Tweddell some years ago introduced hydraulic flanging machines into this country, and the success which attended the use of these machines in their application to locomotive and portable engine boiler work has led marine boiler makers to wish for similar tools. The large dimensions, the great variety of shapes, and the depth of the flanges proved great obstacles to the treatment of plates for marine work in a similar manner to those for agricultural and locomotive boilers, the cost of the dies and moulds becoming so great as to be absolutely prohibitory, unless there was a great amount of repetition work. To overcome these objections the machine illustrated on page 236 was designed.

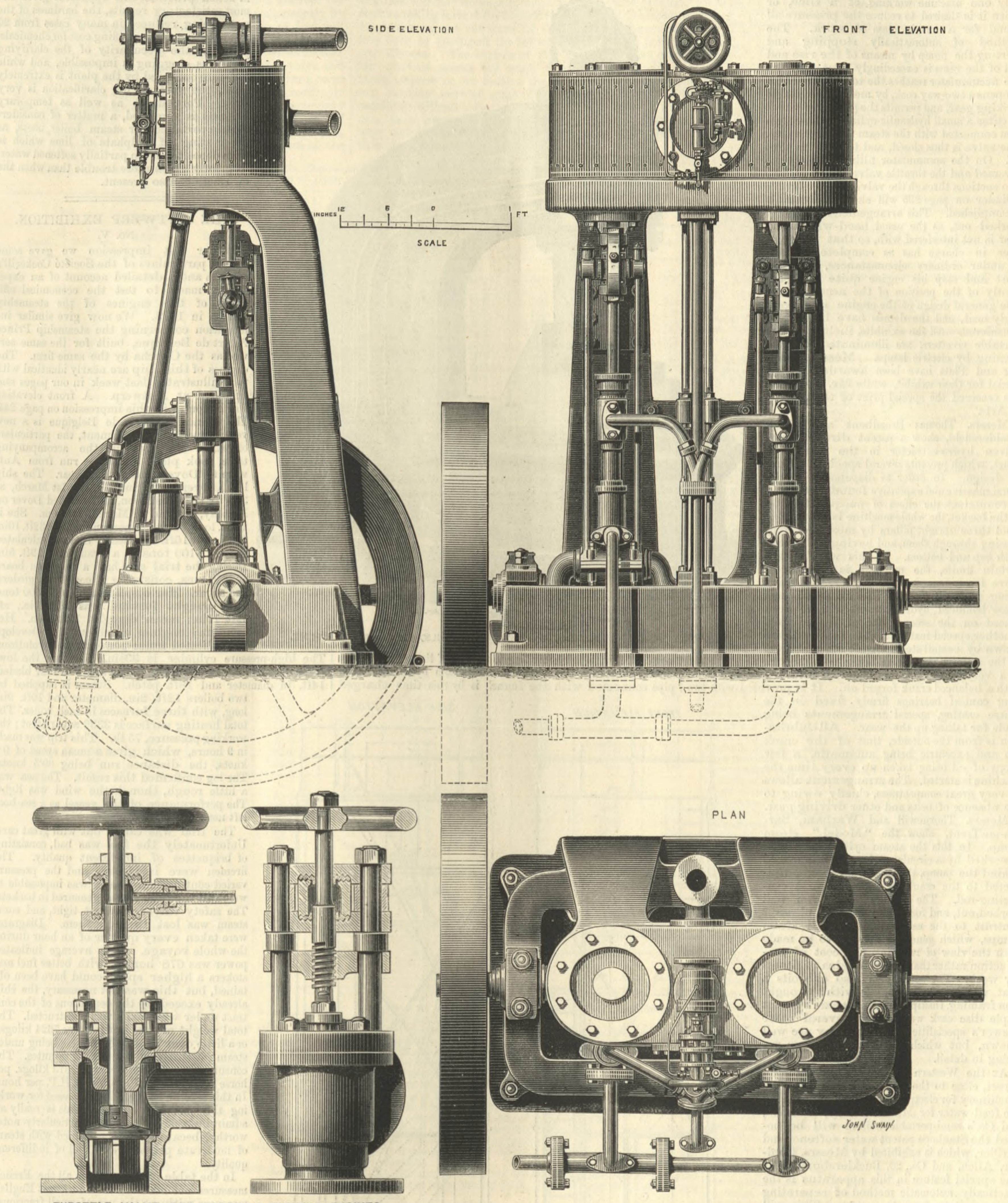
FIG. 4 PLAN



TWEDDELL, PLATT, AND FIELDING'S HYDRAULIC FORGING PRESS.

HIGH PRESSURE HYDRAULIC PUMPING ENGINES.

MESSRS. FIELDING AND PLATT, GLOUCESTER, ENGINEERS.



THROTTLE VALVE FOR HYDRAULIC PUMPING ENGINES.

In it, instead of the whole plate being flanged in one operation, a progressive action is adopted; in fact, by the combined action of three hydraulic cylinders the action of hand flanging is very closely imitated. The mode of working is extremely simple. When flanging the outer edges of circular boiler fronts, the plate is centred on a pin so as to bring the edge under the ram of the outer of the two vertical hydraulic cylinders. This ram carries a closing or nipping block, which when it descends holds the plate firmly against the small bottom block or die, which is formed to suit the desired radius or curve of flange. While the plate is thus held, the inner ram descends, the tool on it being shaped so as to turn over the edge of the plate without causing undue stress, these operations being repeated, until about 8ft. or 9ft. of flanging—this being a convenient length to heat at one time—is done. The inner ram is then withdrawn into its cylinder, and the horizontal ram brought forward. This, with a succession of short rapid strokes, squares up the flange, and the plate is then lifted by a hydraulic crane placed above the machine, and deposited in the furnace for another length to be heated. In this way flanges 8in. to 9in. deep are finished at the rate of 90ft. to 100ft. in nine hours. When it is desired to flange furnace mouths, the two vertical rams are coupled together by a block or die, and a suitable mould substituted in the bed-plate in place of the blocks used in flanging the edges.

The quality of the work turned out by these machines is most excellent, and they are now used by most of the leading marine boilermakers, as well as by some of the large steel companies, such as the Steel Company of Scotland, Messrs. Beardmore and Co., and the Llandore Steel Company. In general terms it has been stated by a large user that such work as steel boiler fronts with flanges 7in. to 8in. deep is flanged at four times the speed and at one-sixth the cost of hand work. When it comes to 9in. or 10in. flanges hand work is, of course, out of the question. In flanging dome ends and similar work the machine will do five times as much work in the same time at one-seventh the cost. All the flanges for from sixty to seventy large boilers per annum can be made with one machine, assisted with three ordinary fires for odd flanging. It should be added, however, that this is not the only saving, since the putting together of the boiler is much facilitated by the accuracy of the various parts when flanged in dies by hydraulic pressure. As will be seen, the machine forms a very important feature in Mr. Tweddell's system of workshop machinery, and the many neat devices and excellence of workmanship reflect equal credit on the designer and manufacturer.

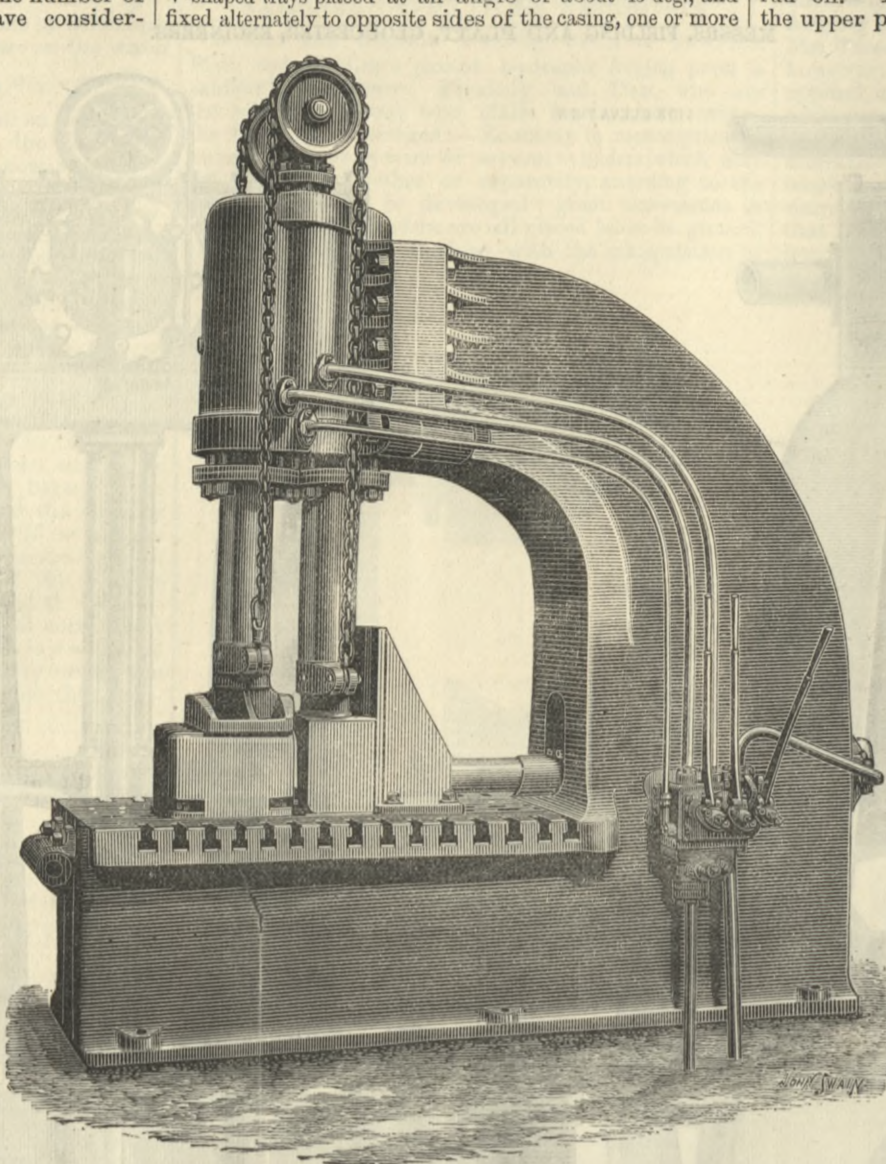
Besides the machines specially described, a number of portable and other rivetters are shown, the whole plant being supplied with water by a pair of neatly designed vertical pumping engines forcing into an accumulator of variable pressure. These are shown by three engravings on this page, and require but little explanation. The two steam cylinders are each placed above a double-acting force pump, which forces the water into the accumulator against a maximum pressure of 100 atmospheres per square inch. The pressure is, however, capable of alteration by varying the number of load rings—a plan which is found to have considerable advantage in an installation with only one machine working at a time, or when it is desired to reduce the pressure all round for a certain class of work. The method of automatically stopping and starting the pump by means of the rise and fall of the rams is exceedingly neat. When the accumulator reaches the top of its stroke it opens a two-way cock, by means of suitable striking gear, and permits the pressure water to enter a small hydraulic cylinder, having a ram connected with the steam throttle valve. The valve is thus closed, and the steam shut off. On the accumulator filling, the cock is reversed and the throttle valve opened. The two sections through the valve and hydraulic cylinder on page 235 will show how this is accomplished. This arrangement is nicely worked out, as the usual hand-wheel and gear is not interfered with, so that the engineer in charge has as complete control as under ordinary circumstances, and can start and stop his engine quite independently of the position of the accumulator. The general design of the engine is exceedingly neat, and the details have been well considered. All the exhibits, including the portable rivetters, are illuminated in the evening by electric lamps. Messrs. Fielding and Platt have been awarded a gold medal for their exhibit, while Mr. Tweddell has received the special prize of the Society of Arts.

Messrs. Thomas Broadbent and Sons, Huddersfield, show a patent direct steam-driven hydro-extractor in the American court, which presents several special features in design. In order to dispense with the usual massive and expensive foundations, and to counteract the effect of unequal loading of the basket, the whole machine is suspended from three upright pillars by means of rods passing through them, and having ball joints both top and bottom. In this way, within certain limits, the machine is allowed to move freely in any direction, the vibration being so much reduced that in some cases these balanced hydro-extractors have been placed on the second-floor of a building. Another special feature is that the basket is drawn by a small steam engine acting direct on the spindle, the engine being constructed so as to run at a very high velocity. The spindle is made of steel, with a balanced crank forged on. It is provided with two long conical bearings firmly fixed in the centre casting, special arrangements being made for taking up the wear. All lubrication is from the outside, that of the crank pin and excentric being automatic, a few drops of oil being taken up every time the machine is started. The arrangement allows of very great compactness, chiefly owing to the absence of belts and other driving gear.

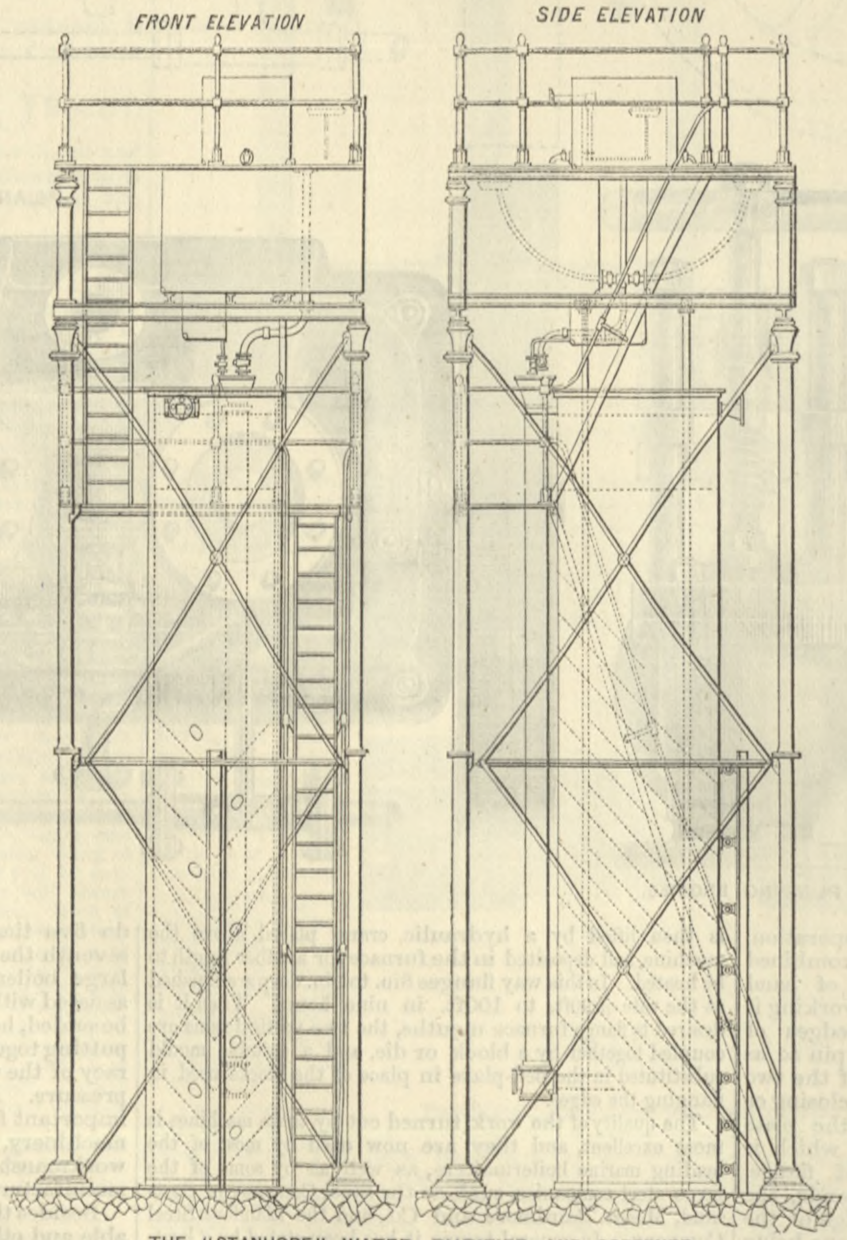
Messrs. Thornewill and Warham, Burton-on-Trent, show the "Model" steam pump. In this the steam cylinder, which is worked by a circular slide valve, is placed behind the pump, the crosshead being connected to the crank by a long forked connecting-rod. The design has been well worked out, and forms a great and pleasant contrast to the usual run of small steam pumps, which generally appear to be made with the view of reducing the cost of construction rather than with any idea of fitness for work. The same firm also exhibits a neat vertical steam engine with wrought iron framing, Inskipp and Mackenzie's patent triple disc cask washer, and several other brewer's specialities for which they are well known, but which space prevents our noticing in detail.

At the Western entrance to Old London Street, close to the building containing the machinery for electric lighting and supplying the feed water for Messrs. Davey, Paxman, and Co.'s semi-portable boilers will be noticed the Stanhope patent water softener and purifier, which is exhibited by Messrs. Cordner, Allen, and Co., 20, Bucklersbury, E.C. The special feature in this apparatus is the practically automatic method of separating the precipitates from the water. This will be readily understood by reference to the two engravings we give herewith. The reagents generally used are lime, caustic soda, sulphate of alumina, or aluminate of soda, according to the nature of the water to be treated. These are mixed in suitable proportions in small iron tanks placed above the clarifying vessels, the tanks being in duplicate, so that the mixture in one set may be prepared while the other is in use, in order to prevent the continuity of the process being interrupted. The water to be softened and purified is admitted to the clarifying vessel by the mixing pipe, shown herewith, a proper proportion of the liquid containing the reagents passing in at the same time and mixing with it, the amount of each being kept constant after final adjustment by causing the feed in each case to pass through tanks in which a uniform water level is preserved, and by graduated cocks.

The clarifying vessel consists, as will be seen, of a large rectangular iron casing, open at the top, and containing V-shaped trays placed at an angle of about 45 deg., and fixed alternately to opposite sides of the casing, one or more vessels being used according to the size of the plant. The water, entering the vessel at the bottom by means of a pipe connected with the funnel, is by this time charged with the solid particles of the precipitate. It is then, caused to flow past the trays, the motion as it passes each pair being first upwards and then downwards, during which the solid particles are deposited and settle at the angles at the bottom of each alternate tray, opposite the connections to a series of cocks by which it is run off. In this way by the time the water reaches the upper part of the vessel it is rendered quite clear, and is fit for immediate use. We understand that in actual practice this apparatus gives the most satisfactory results, the hardness of the water being reduced in many cases from 20 to 2 degrees at a very trifling cost for chemicals. Owing to the peculiarity of the clarifying apparatus clogging is impossible, and while the space occupied by the plant is extremely small, the surface for clarification is very large. Permanent as well as temporary hardness is removed, a matter of considerable importance for steam boiler users, as the coating of sulphate of lime which is often deposited from partially softened water, frequently gives more trouble than when the carbonate is also present.



TWEDDELL, PLATT, FIELDING, AND BOYD'S HYDRAULIC FLANGING MACHINE.



THE "STANHOPE" WATER PURIFIER AND SOFTENER.

THE ANTWERP EXHIBITION.

No. V.

In our last impression we gave some general particulars of the Société Cockerill's exhibits and a detailed account of an experiment made to test the economical efficiency of the engines of the steamship Concha in 1878. We now give similar information concerning the steamship Prince Albert de Belgique, built for the same service as the Concha by the same firm. The engines of this ship are nearly identical with those illustrated last week in our pages and exhibited at Antwerp. A front elevation will be found in this impression on page 242. The Prince Albert de Belgique is a new vessel, and the experiment, the particulars of which we give in the accompanying table, took place during a run from Antwerp to Dover, made this year. The ship left Antwerp on Sunday, the 1st March, at 3.10 in the afternoon, and reached Dover on Monday, the 2nd of March, at 8 a.m. She is 267ft. long between perpendiculars, 32ft. 10in. beam, and 16ft. 5in. deep. She was calculated to carry 2100 tons on a draught of 19ft. 5in. During the trial she had a cargo on board of 2240 tons, consisting of coal, rails, girders, and sugar. Her displacement was 3500 tons. Her draught forward was 18ft. 6in., aft 19ft. 11in.; mean draught, 19ft. 2½in. Her compound engines are intended to develope 750 indicated horse-power at 65 revolutions. The high-pressure cylinder is 33½in. diameter, the low-pressure 55in., stroke 3ft. 3½in. The screw is four bladed 14ft. in diameter and 18ft. pitch. Steam is supplied by two boilers 12ft. 2in. diameter and 10ft. 9in. long, with three furnaces in each boiler. The total heating surface is 3336 square feet; the working pressure, 75 lb. This trip was made in 9 hours, which gives a mean speed of 9·9 knots, the distance run being 89·5 knots. The log confirmed this result. The sea was a little rough, though the wind was light. The performance of the vessel as a sea-boat left nothing to be desired.

The trial was caried out with great care. Unfortunately the fuel was bad, consisting of briquettes of indifferent quality. The firemen were inefficient, and the pressure varied continually. As it was impossible to weigh all the fuel, it was measured in baskets. The safety valves were not tight, and some steam was lost through them. Diagrams were taken every quarter of an hour during the whole voyage. The average indicated power was 678 horses; with better fuel and stokers a higher speed could have been obtained, but this was not necessary, the ship already exceeding the conditions of the contract under which she was constructed. The total weight of fuel burned was 7624 kilogs., or a little over 7 tons, the boilers being under steam for thirteen hours fifty minutes. The consumption therefore was ·813 kilogs. per horse power, or 1·79 lb. per I.H.P. per hour. In this is to be included steam used for working the steering engine. This is really an admirable result, and it is particularly noteworthy, because it was obtained with steam of moderate pressure and fuel of indifferent quality.

In the table on next page all the French measures are reduced to the nearest English measures without the use of small fractions; thus the cylinder pressures are correct within less than half a pound in all cases. This table and that published in our last impression deserve careful study, containing as they do a great deal of information on the relations which exist between speeds and pressures. It is worthy of notice that the pressure in the boilers and in the valve chest of the Prince Albert de Belgique were always so nearly alike that it has not been thought necessary to give the fraction expressing the difference.

If our readers will turn to the engraving of the piston valves of the great Russian war ship Tchesma, which we published last week on page 211, they will see that these are neither more or less than cylindrical Trick valves, as we stated at the time. We have received a letter concerning them from Mons. Bellefroid, the president of the Société Cockerill, in which he says, "The engines of the

Tchesma have a special feature which might escape superficial observation. The screw engines we built for our cargo steamers—800 indicated horse-power, an example of which we exhibit—have slide valves with a supplementary passage at the back, so as to afford a double admission for the steam as soon as the slide valve begins to uncover the port. This valve was devised almost simultaneously by Herr Trick, a German engineer, and Mr. Allen, of America. When we got out the designs for the engines of the Tchesma, we wished to introduce the Trick system, and we succeeded. It is sufficient to take the section of the Trick valve and cause it to revolve on its longitudinal axis to form a *corps de rotation*. The engines of the Tchesma have accordingly been fitted with piston slide valves having a supplementary or Trick passage. It so happens that Mr. J. Thom, of Barrow-in-Furness, took out a patent on the 21st April, 1885, for exactly the same thing. The engines of the Tchesma were erected in the Antwerp Exhibition in March and April of the present year. We did not attach sufficient importance to the improvement to patent it. However, we made the valve a year before Mr. Thom patented it, and so we have here another instance of two engineers finding the same solution for the same problem." Before taking leave of the Société Cockerill for the moment, we must express our sense of the courtesy shown us by this firm in placing all the information in their power at our disposal. The engines of the Tchesma they cannot for obvious reasons say much about. We would once more impress on our readers the extreme desirability, to say nothing more, of examining the Société Cockerill's exhibits without delay. Young engineers in particular can learn lessons in the Antwerp Exhibition which they may not have the chance of acquiring at other times, and this should not be missed.

Table of Observations made on the Working of the Engine and Boilers of the Steamship Prince Albert de Belgique, on a Voyage from Antwerp to Dover, the 1st and 2nd of March, 1885.

Time.		Pressure in engine.	Vacuum in inches.	Number of revolutions per minute.	Degree of admission.	Average pressure.		Indicated horse-power.		
Hour.	Minutes.					Small cylinder.	Large cylinder.	Small cylinder.	Large cylinder.	Total.
3	10	—	—	—	—	—	—	—	—	—
3	15	66	26·7	58·0	5/10	34·0	13·0	348	361	709
3	30	68	26·7	60·0	,,	34·5	13·5	364	382	746
3	45	67	26·7	59·0	,,	34·0	13·5	349	371	720
4	0	68	26·7	59·0	,,	34·0	12·5	351	355	716
4	15	72	26·0	61·0	,,	35·5	13·5	386	384	770
4	30	68	26·0	60·0	,,	34·5	12·5	355	357	712
4	45	68	26·0	60·0	,,	34·5	12·5	367	365	732
5	0	68	26·7	59·0	,,	34·5	12·5	357	351	708
5	15	67	26·7	59·5	,,	34·5	12·5	363	354	717
5	30	65	26·0	58·0	,,	34·0	11·5	346	317	663
5	45	68	26·7	59·5	,,	35·0	12·0	369	346	715
5	50	—	—	—	—	—	—	—	—	—
6	0	68	26·3	59·5	5/10	34·5	12·0	360	350	710
6	15	65	26·5	58·0	,,	34·5	11·5	348	321	669
6	30	70	26·5	60·0	,,	36·0	12·5	381	361	742
6	45	68	26·3	54·0	,,	36·0	13·0	343	340	683
6	50	—	—	—	—	—	—	—	—	—
7	0	—	—	—	—	—	—	—	—	—
7	5	79	26·3	54·0	4/10	30·5	11·5	290	295	585
7	15	72	26·3	51·0	,,	27·0	11·5	279	303	582
7	30	70	26·5	53·5	,,	28·0	11·5	270	293	563
7	35	—	—	—	—	—	—	—	—	—
7	37	—	—	—	—	—	—	—	—	—
7	38	—	—	—	—	—	—	—	—	—
7	39		—	—	—	—	—	—	—	—
7	42		—	—	—	—	—	—	—	—
7	44		—	—	—	—	—	—	—	—
7	45	Taking pilot	—	—	—	—	—	—	—	—
7	47		—	—	—	—	—	—	—	—
7	53		—	—	—	—	—	—	—	—
7	55		—	—	—	—	—	—	—	—
7	55½		—	—	—	—	—	—	—	—
10	30	—	—	—	—	—	—	—	—	—
10	32	—	—	—	—	—	—	—	—	—
10	35	—	—	—	—	—	—	—	—	—
10	45	62	27·1	59·0	5/10	32·0	12·5	338	355	603
11	0	56	27·5	58·0	,,	29·0	10·5	300	297	597
11	15	57	27·5	59·0	,,	29·0	12·0	308	323	631
11	30	56	27·5	58·0	,,	29·0	12·0	303	317	620
11	45	56	24·8	57·0	,,	29·0	10·5	289	288	577
12	0	57	26·0	57·0	,,	30·0	12·0	302	312	614
12	15	57	26·0	58·0	,,	29·0	11·0	298	305	603
12	30	64	26·0	60·0	,,	32·0	12·0	343	340	683
12	45	64	26·0	60·0	,,	26·0	12·0	269	340	609
12	46	pilot	—	—	—	—	—	—	—	—
12	55	—	—	—	—	—	—	—	—	—
1	0	66	26·0	60·0	5/10	33·5	13·0	357	377	734
1	15	76	25·6	61·5	,,	37·0	15·0	406	446	852
1	30	66	25·6	60·0	,,	32·0	13·0	342	369	711
1	45	67	25·6	60·0	,,	32·0	12·5	345	357	702
2	15	66	25·6	60·5	,,	32·0	12·0	349	347	696
2	45	69	26·0	61·5	,,	35·0	12·5	380	370	750
3	15	63	26·3	59·0	,,	31·0	12·5	327	351	678
3	45	61	26·0	57·0	,,	30·0	11·0	302	304	606
4	15	61	26·3	58·0	,,	30·0	12·0	308	317	625
4	45	61	26·3	59·0	,,	30·0	11·0	315	315	630
5	15	62	26·3	59·0	,,	31·5	12·0	327	323	650
5	45	58	25·6	57·0	,,	30·0	11·0	294	296	590
6	15	58	25·6	57·0	,,	28·5	10·5	286	288	574
6	45	72	26·0	61·5	,,	34·0	13·0	370	378	748
7	15	70	26·0	61·0	,,	35·0	13·0	371	384	755
7	30	72	26·0	61·5	,,	35·0	13·5	377	399	776

THE INSTITUTION OF CIVIL ENGINEERS.

Subjects for Papers.—Session 1885-6.

The Council of the Institution of Civil Engineers invite original communications on any of the subjects included in the following list, as well as on other questions of professional interest:—

1. Recent Experiments on the Strength of Materials.
2. Machines and Apparatus for testing Metals, and the Equipment generally of Mechanical Laboratories.
3. The Thermic Properties of Metals commonly used in the Arts, especially with respect to Conductivity and Diathermancy at high temperatures.
4. The manufacture, properties, and use of castings of Malleable Cast Iron and Cast Steel.
5. The Effect of Cold-hammering and Cold-rolling upon Iron and Steel.
6. The Present Position of the Manufacture of Steel—its defects, and suggestions for its improvement.
7. The various Processes of Tempering Steel, and their effects.
8. Modern Machine Tools and Workshop Appliances for the treatment of Heavy Forgings and Castings.
9. The Testing of Work done by Motors and Machines.
10. Analyses of different types of Steam Engines as shown by Independent Testing.
11. The Production of Heating-gas from Coal.
12. The Production of Ammonia and other useful substances in the Manufacture of Coal-gas.
13. The heating of Steam Boilers with Producer-gas.
14. The Manufacture of Artificial Fuel from small Coal.
15. The Application of the Compound Principle to Locomotive and Portable Engines.
16. The Driving-axles of Locomotive Engines.
17. High-speed Engines for Dynamos and Launches.
18. The Machinery of Modern War Ships.
19. Machine Guns.
20. On Built-up Crank Shafts for Marine Engines, and on the liability of crank and screw shafts to fracture.
21. The Structural and other Defects to which Iron and Steel Ships are subject, and their Causes.
22. Recent Investigations on the Tides.
23. Descriptions of recent Graving Docks, Gridirons and Floats.
24. Promenade and other Piers; with reference to the effect of sea-water on wrought and cast iron structures, and the best means of preserving the same.
25. Dredging Machinery for Small Harbours, and for Drainage and Irrigation Canals.
26. The Economical Construction and Operation of Railways in countries where small returns are expected.
27. Descriptions of recent Metallic Arch Bridges.
28. The Machinery and Labour-saving Appliances used in the Execution of Public Works and Buildings.
29. The Ventilation of Sewers, with a Summary of Experiments as to the motion, pressure, &c., of gas in sewers.
30. Filter Presses for Separating Solids from Fluids, particularly for the treatment of Sewage Sludge.
31. Explosions in Coal Mines; their Causes, Warnings, and Prevention.
32. Winding Machinery and Balancing Apparatus for Mines, and the cost per ton of winding under different conditions and varying depths.
33. Underground Haulage, especially on the application of compressed air and of electrical power.
34. The Methods Employed in Securing Large and Irregular-shaped Mineral Workings.
35. The Manufacture of Common Salt, including the Mining of Rock Salt and Brine Pumping.
36. Gold Quartz-crushing and Amalgamating Appliances.
37. The Manufacture and Desilverisation of Lead.
38. Appliances for the Rapid Shipment of Coals, with a comparison of different methods.
39. Electro-motors; their theory, practical construction, efficiency, and power.
40. The Construction of Dynamo-electric Machines and their Prime Movers.
41. The Working and Cost of the Treble and Double Wire Systems of Distributing Currents for Electric Lighting.
42. Thermo-electric Batteries, and their Application to Electric Lighting, Electro-plating, and other purposes.

Premiums Awarded.—Session 1884-85.

The Council of the Institution of Civil Engineers have awarded the following premiums:—

For Papers Read and Discussed at the Ordinary Meetings.

1. A Watt Medal and a Telford Premium to Professor Henry Selby Hele Shaw, Assoc. M. Inst. C.E., for his paper on "Mechanical Integrators."
2. A George Stephenson Medal and a Telford Premium to William Stroudley, M. Inst. C.E., for his paper on "The Construction of Locomotive Engines."
3. A Telford Medal and a Telford Premium to Peter William Willans, for his paper on "Electrical Governors."
4. A Telford Premium to David Salmond Smart, for his paper on "The Modern Practice in the Construction of Steam Boilers."
5. A Telford Premium to Andrew Jamieson, F.R.S.E., Assoc. M. Inst. C.E., for his paper, "Electric Lighting for Steamships."
6. A Telford Premium to William Shelford,* M. Inst. C.E., for his paper "On Rivers Flowing into Tideless Seas, Illustrated by the River Tiber."

The special thanks of the Council were voted to their colleagues, Messrs. Benjamin Baker and John Wolfe Barry, for their papers on "The Metropolitan and the Metropolitan District Railways."

For Papers Printed in the Proceedings without being Discussed.

1. A Telford Medal and a Telford Premium, to William George Brounger, M. Inst. C.E., for his paper on "The Cape Government Railways."
2. A Telford Premium to Professor William Cawthorne Unwin,* B.Sc., M. Inst. C.E., for his paper, "Experiments on the Friction of Discs Rotated in Fluid."
3. A Telford Premium to Thomas Andrews,† F.R.S.E., Assoc. M. Inst. C.E., for his paper on "Corrosion of Metals during long Exposure in Sea-water."
4. A Telford Premium to John George Mair,‡ M. Inst. C.E., for his paper on "The Results of some Independent Engine Tests."
5. A Telford Premium to James Craig, M. Inst. C.E., for his papers on "Discharge from Catchment Areas."
6. A Telford Premium to Claude William Kinder, Assoc. M. Inst. C.E., for his paper "Notes on Electric Blasting in China."

For Papers Read at the Supplemental Meetings of Students.

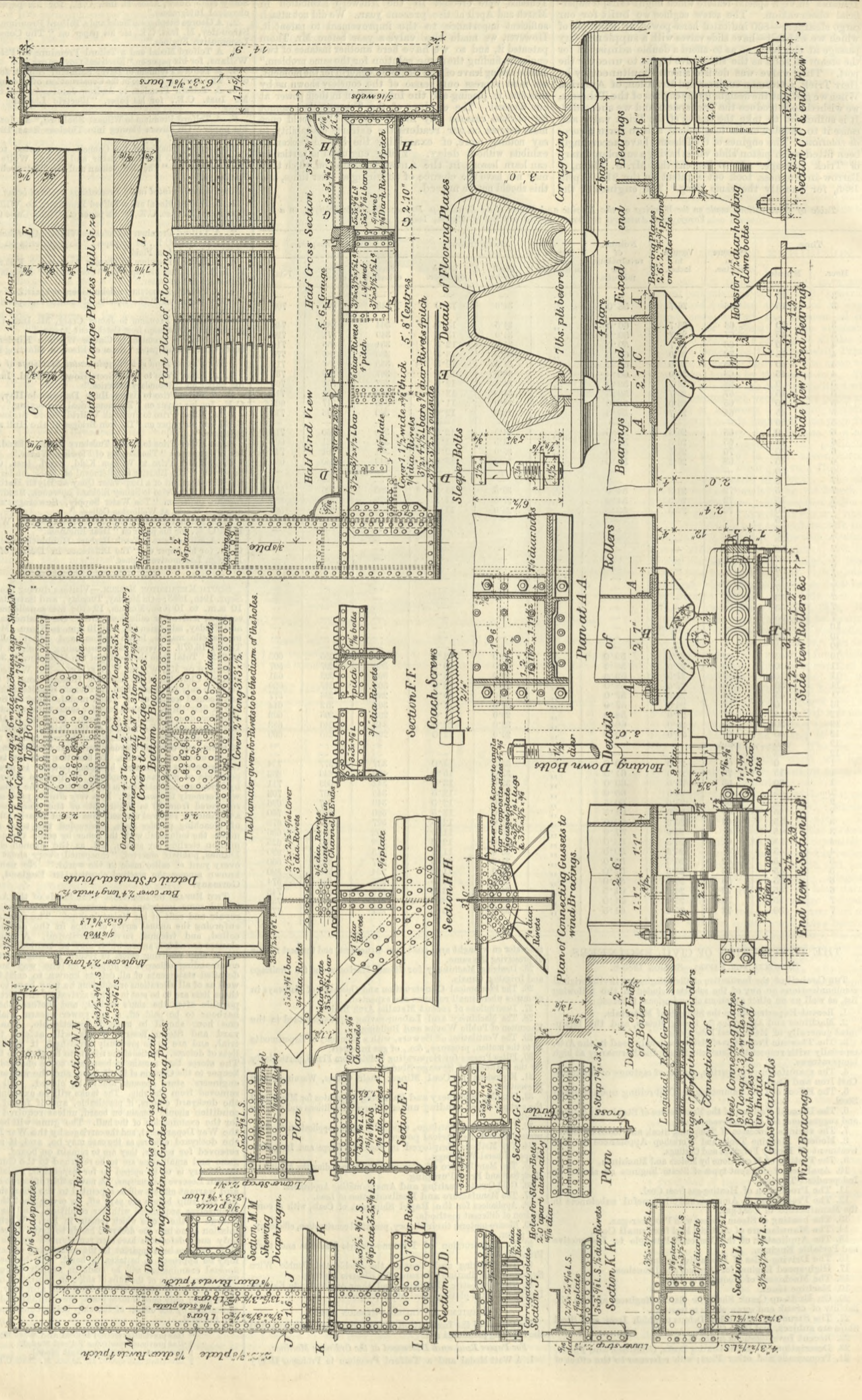
1. A Miller Prize to Frank Geere Howard, Stud. Inst. C.E., for his paper on "Secondary Batteries."
2. A Miller Prize to Harley Hugh Dalrymple-Hay, Stud. Inst. C.E., for his paper on "Trigonometrical Surveying."
3. A Miller Prize to Frederick Wilfrid Scott Stokes, Stud Inst. C.E., for his paper on "The Iron Bridges of the Hull and Barnsley Railway."
4. A Miller Prize to Henry Tudsbury Turner, Stud. Inst. C.E., for his paper on "The Gauging of Flowing Water."
5. A Miller Prize to William Kidd, Stud. Inst. C.E., for his paper on "The Blasting and Removal of Rock under Water, and the Construction of a Deep-water Quay at Blyth Harbour."
6. A Miller Prize to Sidney Richard Lowcock, Stud. Inst. C.E.,§ for his paper on "The Water Supply, Sewerage, and Sewage-disposal Works at Wellington College."
7. A Miller Prize to Edward John Mines Davies, Wh. Sc., Stud. Inst. C.E., for his paper on "Heat Engines."
8. A Miller Prize to Frank Herbert Hebblethwaite, Stud. Inst. C.E., for his paper on "The Difference in Design of British and Foreign Locomotive Engines."

South Kensington Museum.—Visitors during the week ending Sept. 19th, 1885:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 12,410; mercantile marine, Indian section, and other collections, 2784. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. to 6 p.m., Museum, 1279; mercantile marine, Indian section, and other collections, 206. Total, 16,679. Average of corresponding week in former years, 18,352. Total from the opening of the Museum, 24,309,468.

Death of Mr. Walter W. Weldon.—Mr. Walter W. Weldon, F.R.S., Chevalier of the Legion of Honour—one of the five men, and the only foreigner whom the French Société d'Encouragement has deemed worthy of its "grand medal," died on Sunday, at the age of fifty-three. He had been for some time afflicted by mental disorder, due, it is said, to over work. He went to Aberdeen a few days previous to the meeting of the British Association, with a view to attending the meetings, but he was unable to attend any of them, and only left Aberdeen early last week during a temporary improvement in his health. To him the country is indebted for the process by which alone bleaching powder is now made. The peroxide of manganese employed to liberate chlorine from the hydrochloric acid obtained in the first step of the soda manufacture was formerly thrown away. By a very simple process Mr. Weldon recovered from 90 to 95 per cent. of the manganese in a form available for renewed use, and thus saved nearly £6 on every ton of bleaching powder made, quadrupled the total manufacture, made the industrial world the richer by some three-quarters of a million sterling per annum, and, as the French chemist, J. R. Dumas, publicly observed, "cheapened every sheet of paper and every yard of calico made in the world." No name was better known among the practical chemists in England, France, and Germany.

The Repair of Ironclads.—The Lords of the Admiralty have issued some important new instructions with reference to the repair and refit of her Majesty's ships. The existing regulations enforcing the annual survey of ships in the dockyards are cancelled, and triennial surveys substituted. A number of new clauses are added, among which may be named the following:—On a ship receiving orders to return to England to pay off, the commanding officer is to prepare, on the way home, full and detailed statements of all defects known to exist in the ship, as well as of all alterations or additions he may have to suggest; and these lists are to be sent in on her arrival at the port. As soon as possible after the ship's arrival, and before she comes into harbour to be paid off, a full power steam trial of at least one hour should be made, if practicable. The usual dockyard and Steam Reserve officers will attend to watch the trial, and are to be previously furnished, if possible, with the lists of defects. Notice of the trial is to be given to the Admiralty. The stores that remain on board are to be charged by the storekeeper to the Captain of the Reserve, and the warrant officers' and engineers' store accounts are to be closed. All coal is to be removed from the ship. The tanks will be examined in place by the dockyard officers, if practicable, and if found to be in good condition should remain on board, unless required to be removed for the examination of the hull. The guns will be examined by the War Department, and the carriages by the War Department or the dockyard officers, as the case may be, and, if not required to removed for repairs, they are to remain on board. The machine guns and small-arms are to be returned to the Gun-wharf. The machinery is to be opened up for inspection, as laid down in the Steam Reserve instructions. A navigating officer, a chief engineer, and warrant officers will be appointed to the guardship of Reserve for the ship before she pays off, in order that they may make themselves acquainted with her condition, and be ready to take charge of the stores which remain in her. When ships in commission come into the dockyard hands to have defects made good, only such defects as have been represented by the officers of the ship, or have been apparent to the examining officers, and which may be approved to be taken in hand, will be made good. No special examination will be made in search of further defects. The examination of the hulls of ships in commission by the dockyard officers, which has hitherto been held annually, will in future take place only once in three years, the annual and quarterly examination by the officers of the ship being considered sufficient in the interval.

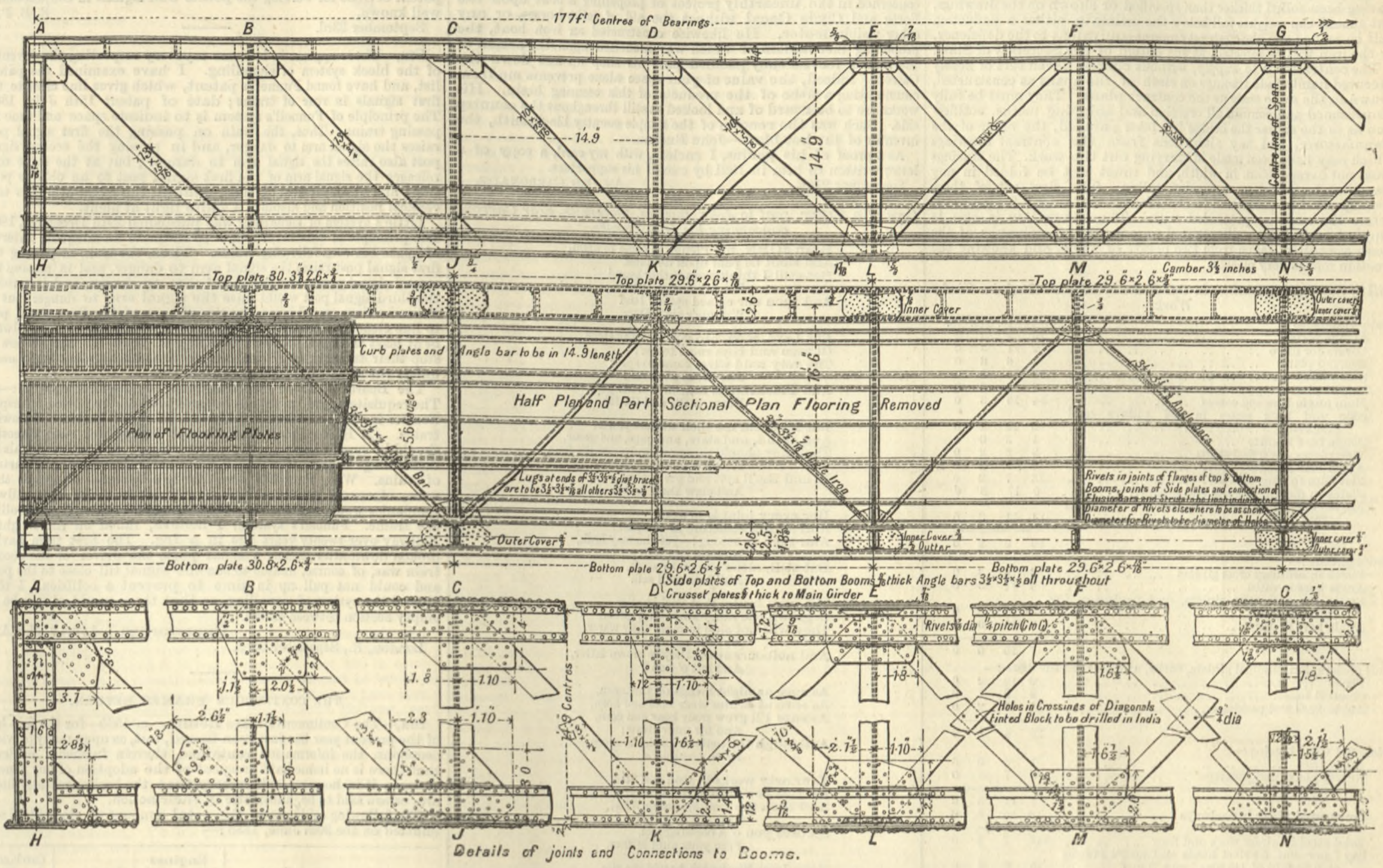
* Has previously received Telford and Watt Medals.
† Has previously received a Telford Medal.
‡ Has previously received a Watt Medal.
§ Has since been elected an Assoc. M. Inst. C.E.



CONTRACTS OPEN—BRIDGES FOR THE INDIAN STATE RAILWAYS.

(For specification see page 239.)

CONTRACTS OPEN—INDIAN STATE RAILWAY BRIDGES.



Details of joints and Connections to Booms.

CONTRACTS OPEN.

INDIAN STATE RAILWAYS (NAGPUR AND CHATISGARH RAILWAY), 5FT. 6IN. GAUGE.—CONTRACT FOR STEEL WORK, IRONWORK, &c., FOR BRIDGES, SPANS OF 170FT.

THE Indian State Railways require tenders for the supply, construction, and delivery in England, at one or more of the ports named in the tender, of the whole of the steel work and ironwork for six triangulated girder spans for openings of 170ft. in the clear, including all rivets, bolts, &c., required to complete the erection of the bridges in India, together with an allowance of 50 per cent. on the net quantity of rivets, and 10 per cent. on the net quantity of bolts required. With each span are to be supplied 200 sleeper bolts, 490 dozen coach screws, ⅝in. diameter, and one ton of service bolts and 10 cwt. of ordinary platers' washers, to be selected by the Inspector-General of Railway Stores for use in the erection of the work in India. With the whole six spans ten steel connecting plate are to be supplied for the bed plates. The timber work and permanent way are not included in the contract. The spans are illustrated on page 238 and above.

The whole of the girder work and floor plates are to be of steel. The whole of the rivets used throughout the work are to be of steel. The steel and wrought iron are to be well and cleanly rolled to the full sections shown on the drawings or in the specification, and free from scales, blisters, laminations, cracked edges, and defects of every sort, and the name of the maker, and the distinguishing number of the plate or bar, are to be rolled or stamped on every piece.

The steel and wrought iron must be of such strength and quality as to be equal to the following tensional strains, and to indicate the following percentages of elongation and of contraction of the tested area at the point of fracture:—

	Tensional strain per sq. inch.	Percentage of contraction.	Percentage of elongation in 8in.
	tons.		
Steel plates, either with or across the grain, angle, or flat bars, not less than	27	20	20
Or more than	31		
Wrought iron, round and square bars, and flat bars under 6in. wide	24	20	—
Wrought iron, angle and T bars and flat bars 6in. wide and upwards	22	15	—
Wrought iron plates	21	10	—
Wrought iron plates, across grain	18	5	—

Strips of steel, whether cut lengthwise or crosswise of the plate, bar, or angle bar, heated to a low cherry red and cooled in water at a temperature of 82 deg. Fah., must stand bending double round a curve of which the diameter is not more than three times the thickness of the piece tested. In addition to this, angle and flat bars must stand the tests known at Lloyd's as the ram's horn tests. Tests for tensile strength are to be made from side and end shearings from every plate, and from at least one angle or flat bar from every charge of steel. To guard against the occasional acceptance of brittle or dangerous steel, the manufacturer is to preserve a side and an end shearing from every plate, and an end shearing from every flat bar and angle bar, in order that it may be tested by bending cold in the presence of the Inspector-General or his deputy. Each such shearing is to bear a stamped number corresponding to the plate or bar from which it was taken. This number is to be stamped by the contractor to the satisfaction of the Inspector-General. It is to be understood that the Inspector-General will insist on this inspection with regard to every item, and no piece of steel will be permitted to be used in the work until its corresponding marked shearings are forthcoming, and pronounced to be satisfactory by the Inspector-General or his deputy. The steel used for rivets must be of a special quality, soft and ductile, and must stand bending double, both hot and cold, and also flattening down from the head without showing cracks or other defects. Any plates, flat bars, or angle bars which may require to be heated for bending must be carefully annealed after bending, to the satisfaction of the Inspector-General. All cast iron must be from a good mixture of such strength that a bar of the same, 3ft. 6in. long and 2in. by 1in. in section, placed edgeways on bearings 3ft. apart, shall not break with a less weight than 30 cwt. applied in the middle. The tests are to be conducted by some person to be approved by the Inspector-General. The cost of the tests is to be borne as provided for in the conditions of contract. The steel used for the rollers is to be made from ingots of Bessemer steel cast from pigs of the best description for the purpose by manufacturers approved of by the Inspector-General. It is to be well hammered, and free from defects of every kind. No material is to be used which, in the opinion of the Inspector-General, falls short of the tests and other requirements of the specification, and no iron of foreign manufacture is to be used throughout the contract.

It is to be expressly understood that the greatest accuracy is to be observed in every part of the work, a main object of the designs being to facilitate as much as possible the erection of the girders in India by perfection of workmanship in this country. All corresponding parts of all spans must be made exactly similar and interchangeable. All plates and bars must be rolled to the full sections, and the angle bars to the full widths and weights per foot shown on the drawings. All angle bars which do not hold their full widths and weights from end to end, or which have rough, jagged, or imperfect edges or ends, will be rejected. All plates, flat bars, and angle bars must be carefully levelled and straightened—the angle bars by pressure, and not by hammering—before and after they are drilled. All edges of all plates, and the ends of all bars of every kind must be planed true to dimensions, or, where planing is impossible, they must be dressed off fair with hammer, chisel, and file. No rough edges, fresh from the shears, will be permitted anywhere throughout the work. Throughout the work all holes are to be drilled, but the contractor may, if he think proper, first punch a smaller hole of such diameter in each case as to leave at least ⅛in. of material all round to be subsequently drilled out; thus, the punched hole intended to be enlarged to 1in. must not exceed, at the largest end, ¾in. diameter. The holes are to be slightly arriced on the side next the rivet head. All steel or ironwork intended to be rivetted or bolted together must be absolutely in contact over the whole surface. Although the word rivets may be used on the drawings, the rivet holes are to be made to the sizes figured. All rivetting is to be done by hydraulic or steam machines of approved construction, and in no case must the diameter of the rivet under the head be more than $\frac{1}{32}$in. less than the diameter of the hole it is intended to fill. The rivet steel must be of such size that the rivet, when inserted hot, shall be a tight fit in the hole. All loose rivets, and rivets with cracked, badly formed, or deficient heads, must be cut out and replaced by others. Rivets must also be cut out when required for the examination of the work. All rivets are to be cup-headed at each end, and the heads are to contain not less than 1¼ diameters of the rivet. The gussets and cover plates must be shaped to the full sizes shown on the drawings, and any plate or bar in which the rivet holes have been made nearer to the edge than shown on the drawings will be rejected. Wherever necessary for the division of the work for transport, the rivets are to be left out, but the holes, except those hereinafter mentioned, must in all cases be made ready for rivetting, and all the requisite rivets, including 50 per cent. extra, must be sent with the work. All rivet holes at the intersections of the diagonals with the struts and with each other, and with the angle bars on the curbs, are to be drilled in India after the girders are erected. In all cover plates the fibre of the material must run in the direction of the length of the span. The ends of all plates, &c., to be rivetted in India must be chipped and filed so as to butt with perfect accuracy over the whole of the meeting surfaces, to the true radius necessary for the specified camber, and any joint which fails to form a perfect butt all over will involve the rejection of the plates and bars which cannot be made to fit without being shortened. Where cover plates are used to connect flanged plates of different thicknesses, so much of the covers must be planed off as will make them fit fairly over the joint, no packing plates being allowed. In planing, a small fillet is to be left in the corner, as shown on the drawing. The main girders are to be built on the blocks, with a camber of 3½in. in the arc of a circle. The underside of all bearing plates must be perfectly flat, and the rivets countersunk. All bolts are to be screwed to Whitworth's standard thread, and all nuts must fit too tightly to be turned by hand. The heads and nuts of all timber bolts—except where otherwise shown on the drawings—and service bolts are to be square; for other bolts they are to be hexagonal. The head and body of all bolts are to be forged out of one piece of rod or bar iron. All bolts are to be screwed for a length of three diameters. The rollers are to be of Bessemer steel. The bed-plates, saddles, and knuckles are to be of cast iron, and the truck frames of forged wrought iron. The bed-plates, saddles, and knuckles are to be planed on both top and bottom. The rollers are to be turned accurately to the same diameter. The knuckles are to be planed and bored, and if the Inspector-General think necessary, ground to a true bearing surface. The saddles are to be planed to take the bearing plates of the girders. Generally, in connection with the roller and bearing gear, all meeting surfaces, including the sides of the roller frames, are to be machined, all bolt holes are to be drilled, and all bolts are to be turned and fitted, and the whole got up in a style of first-class machine work. The rollers are to be turned all over, and brought to a smooth surface, and accurately to the same diameter, and the roller trucks when complete must run straight and easily on a planed surface of sufficient length to test their truth.

Each span is to be temporarily erected complete in every respect, so that accuracy of fit and perfection of workmanship may be assured. When erected in the contractor's yard, all the holes which are left to be rivetted in India must be filled at one and the same time by temporary bolts, $\frac{1}{16}$in. less in diameter than the holes which they fill, firmly screwed or keyed up. It will not be sufficient that bolts shall be placed in a certain number of holes only at a time, nor will it be sufficient that only such a number of bolts shall be inserted as may temporarily hold the span together.

The whole of the steel and iron work, with the exception of the bolts, nuts, and rivets, is to be scraped perfectly free from rust, scale, and dirt, and then brushed all over with boiling hot linseed oil. It is afterwards to be painted with two coats of good oil paint, the first being of red lead and the second of colours to be specially approved by the Inspector-General. All machined surfaces, including turned bolts, are to be coated with white lead and tallow. All bolts, coach screws, and rivets are to be heated to the temperature of melted lead, and then dipped into boiled linseed oil. Every portion of every span is to be very distinctly stencilled with paint, and marked with the punch, for guidance in erection in India, and every piece or bundle of steel or iron is to be similarly marked, and all packing cases branded, with such shipping marks as the Inspector-General may require. All parts of the work are to be stamped with the letters "I. S. R." A neat casting bearing the name of the manufacturer, with place and date of manufacture, is to be bolted conspicuously on each main girder.

The top and bottom booms of the main girders are each to be sent out to India in six lengths rivetted up complete. The struts and end pillars of the main girders are to be sent out rivetted up complete. The cross girders and the end girders are to be sent out rivetted up complete. The rail and roadway girders and the curbs are to be divided as shown on the drawings, each length being rivetted up complete. The ends of the various sections of the girders and curbs are to be sufficiently protected by timber chocks or angle irons bolted or rivetted to them. The ends of the end pillars and booms, and generally all protecting plates or angle bars, are to be kept in shape by timber, plates, or angle irons, bolted to them, as may be directed by the Inspector-General. The planed surfaces of the bed plates and knuckles are to be protected by planks bolted to them. All straight bracing bars and angle bars, all gusset plates and cover plates, and generally all plates above 12in. square, are to be sent out in convenient bundles temporarily rivetted or bolted together, or bound with rod iron, as may be directed by the Inspector-General. The corrugated floor plates may be sent out loose. All bolts, nuts, and washers, and all rivets required for erection in India, including 50 per cent. extra, all coach screws, all plates under 12in. square, and generally such small articles as may be selected by the Inspector-General, are to be packed in strong cases, weighing, when full, not more than 7 cwt. The cases are to be made of 1¼in. deal boards, with elm ends, nailed with 3½in. wire nails, and strengthened by battens and 1½in. No. 16 b.w.g. hoop iron, the joints grooved and tongued, and the whole made secure for transit to India. The cost of all oiling, painting, temporary erection, marking, packing, and delivery is to be included in the price named in the tender.

For the convenience of the Inspector-General, a statement of the quantities of iron and steel required has been prepared and is appended hereto, but neither the Secretary of State nor the Inspector-General, nor any one on their behalf, will be responsible for the accuracy of these quantities, and if the contractor make use of them in preparing his tender, he must do so at his own risk, as he will not be entitled to make any claim or demand, or raise any question whatsoever, on account of any errors, miscalculations in, or misunderstanding of the said quantities. The contractor will not be paid for any excess of weight due to the steel or iron having been rolled thicker than specified or shown on the drawings, but should the weights fall below the estimate, either a deduction will be made from the contract amount equivalent to the deficiency, or the iron will be rejected, at the option of the Secretary of State.

The contractor is to supply, without charge, seven sets of neatly executed hand-made tracings on cloth of the spans as constructed, drawn to the same scale as the contract plans. They must be fully dimensioned and contain all erection and shipping marks, notification as to the colour the bridge has been painted, the name of the manufacturer, and any alterations from the contract drawings which may have been made in carrying out the work. The tracings must not exceed 25in. in width, and must not be folded in any way, but be rolled on a wooden roller. The first set of these tracings must be submitted to the Inspector-General for approval before the rest are proceeded with. The contractor is also to supply twenty large well-executed unmounted photographs of the spans as erected, taken from two points of view, and showing the erection marks very clearly.

Bill of Supposed Quantities in One Span of 170*ft.—Steel in Girder Work.*

	Tons	cwts.	qrs.	lb.
Main girders:—				
Flange plates	19	2	2	0
Covers for ditto	2	11	3	0
Bearing plates	0	6	2	0
Side plates	19	10	3	0
Gusset plates, top and bottom booms	7	13	3	0
Main angle bars and covers	14	16	3	0
Side and back plates in end pillars and brackets	2	12	1	0
Angle bars in ditto	1	3	0	0
Web plates of vertical struts	3	2	2	0
Angle bars in ditto	6	9	3	0
Flat bars in diagonal ties	13	7	2	0
Plates in diaphragms and end pillars	0	17	3	0
Angle bars, lugs for ditto, and for vertical struts	1	11	3	0
	93	6	2	0
Cross girders:—				
Plates in ordinary cross girders	2	4	3	0
Angle bars in ditto	3	11	3	0
Plates for end cross girders, and packings for ordinary ditto	0	18	2	0
Angle bars in ditto	0	15	0	0
	7	10	0	0
Rail girders, longitudinal girders, curbs, and covers for ditto:—				
Plates	9	19	2	0
Channel bars	3	0	1	0
Angle bars and packings	15	5	2	0
	28	4	1	0
Diagonal wind bracing:—				
Angle bars	1	4	0	0
Gusset plates and packings	0	7	3	0
	1	11	3	0
Corrugated plates in roadways	12	15	0	0
Total steel in girder work and floor	143	7	2	0
Say 7 per cent. for rivet heads and spare rivets on a weight of 143 tons 7 cwt. 2 qrs.	10	0	3	0
Wrought iron in roller frames	0	7	2	0
Steel in rollers	1	1	2	0
	154	17	1	0
Cast iron:—				
In saddles	1	13	1	0
In bed plates, roller end	1	8	1	0
In knuckles, roller end	0	19	3	0
In knuckles, fixed end	1	16	1	0
	5	17	2	0
Bolts, screws, &c.:—				
No. 18 holding down bolts and washers	0	6	1	19
No. 200 sleeper bolts	0	2	0	26
No. 490 dozen coach-screws	0	7	3	14
No. 35 bolts in roller gear	0	0	3	21
No. 18 ditto	0	0	2	4
Service bolts and washers	1	10	0	0
	2	8	0	0
Total, exclusive of connecting plates at bearings	163	2	3	0
No. 10 steel connecting plates—total number required for six spans	7	18	3	0

Tenders, addressed to the Secretary of State for India in Council, with the words "Tender for Steelwork, &c., for Bridges," on the envelope, must be delivered at the India-office, Westminster, S.W., before 2 p.m. on Tuesday, October 6th. If delivered by hand, they are to be placed in a box provided for that purpose in the Store Department.

LETTERS TO THE EDITOR.

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

INVENTION OF THE HOT BLAST.

SIR,—For the last thirty years I have read THE ENGINEER with increasing interest and pleasure, but never perhaps with greater pleasure than on reading of the characteristic and kindly welcome given to the members of the Iron and Steel Institute at "Auld Carron Side," the birthplace of so much that is good and great in connection with the iron history of Scotland, if not of the world. I should esteem as a favour the insertion of the following in your next issue:—In Dr. Percy's address I observe that the invention of the hot blast is imputed to Mr. James Beaumont Neilson. Now, that gentleman may have been the inventor of the application of the hot blast to the smelting of iron, but—and I speak from an intimate knowledge of the case—the idea of the hot blast itself did not originate with him. Many years before Mr. Neilson's application of the hot blast, there might have been seen by the side of the Carron a country blacksmith's shop. The smith himself was known far and wide by reason of his talent and mechanical ingenuity. His smithy was full of curious contrivances for reducing or aiding labour, while in the every day work of his forge he used a hot blast. The man of whom I am speaking was John Buchan, and his hot blast was obtained by placing coils of iron tubing immediately above the heat and flame of his forge and driving the blast from the ordinary bellows through these coils to the fire. He was thus enabled to get a heat in much less time on a larger piece of iron, and more uniformly soft and mellow for welding than by the common method. In those days this proved to be a desideratum which brought grist to his mill from all parts in repairs to the anchors, &c., of the smacks plying between the port of Carronshore and London, also in work from the numerous distilleries around, and it was not till after Mr. Neilson had paid a visit to "Johnnie's shop" that the invention of the hot blast was given to the world.

This was well known in the country round at the time, but poor Johnnie had neither the means nor the inclination to establish his claims, though the members of his family have ever been, and are still, jealous of securing to their ingenious relative the honour of this invention among his many others.

His bellows were driven by a condensing engine, the cylinders of which once formed part of an old ship's pump chamber, supported upon four uprights of wrought iron, fixed at the ends with lead into a block of native sandstone. An old Carron tea-kettle served for the hot well. Steam was applied to the underside of the piston only, and everything made of wrought iron save the tea-kettle. This engine did duty for many a day at Carron side, and its remains may still be viewed at Grangemouth, in the possession of its inventor's namesake, a worthy scion of the family.

John Buchan was also one of the "uncanny chields" who were concerned in the unearthly project of propelling a boat upon the Forth and Clyde Canal without the aid of sails, horses, or any other visible motor. He likewise constructed an iron boat, the propelling mechanism of which was modelled upon the action of the swan's feet as they paddled past his shop up and down the Carron. Indeed, the value of your space alone prevents me from enumerating a tithe of the products of this teeming brain. His works are to be heard of and looked at still throughout the country side. Such was the renown of the simple country blacksmith, the inventor of the hot blast—John Buchan.

As a proof of his genius, I enclose, with my card, a copy of a letter written to him in 1821 by one of his supporters.

September 21st. AN OLD CARRONADE.

Copy of a Letter, sent to John Buchan, Blacksmith, near Carron, concerning his Iron Ploughs.

DEAR JOHN, my Plough is come to hand,
And shall be paid upon demand.
But still I think she's rather grand
For my coarse Cotters;
And then our cursed staeny land
Will gie'r sic totters.

But Lord, man, had you seen the steer
Of men and boys come to see'r !
The very auld wives came to speer
The kicks about'er !
And Blacksmiths measur'd a' her gear,
Beam, stilt, and Cutter.

But let them use their utmost power,
And stand, and stare, and gape, and glour,
Tho' they should measure twelvemonths four,
It's all a farce;
In end the'll spit and gie it o'er,
And claw their a——e.

Her every joint is so exact,
And all her structure so compact!
And then so strong!—yet she may brak,
No man can tell:
But still, altho' she go to wrak,
Aul' Iron will sell.

The very brutes that yocket at'er
Is grown sae saucy since they gat'er,
They will not stop to mak' their water,
At head or en';
And neibours swear they're grown fatter,
And out o' ken!

As sure as night brings on the morn,
As sure as brutes wear hoof and horn,
As sure I'll grow mair bear and corn,
And far mair straw;
And laugh the neibour Carles to scorn,
Baith ane and a'

Your arty works in Iron and Steel
Declare you are a curious chiel;
And then the *Iron Spinning Wheel*
You put th'gither,
Secures you o' a blessing leel,
Frae your auld Mither.

Your Iron-Works are turn'd sae rife,
Down a' the Frith, and o'er to Fife,
That shou'd you still improve thro' life,
It will be seen
That ye will mak an *Iron Wife*,
Or a' be dane!

But sick hard lack shall not be thine,
You'll get a Wife mair to your min';
If you'll allow me to divine,
I'll gi'e my warran',
That ye shall get the bonniest quean
That steps by CARRON.

But dinna tig wi' ilk light hizzie,
That wi' daft duds their heads are dizzie,
For wi' sic sort the De'il's ay bizzie
To get you nicket;
Instead then of a decent Lizzie,
You've de'ilbelicket.

But you that studies stucko brains,
Ken a' the blots, and a' the blains,
And every other ill that stains
The human life,
It will not cost you muckle pains
To wyle a Wife.

Give my kind love to your Mamma,
And to your Sisters ane and a',
And to your Love, tho' far awa'
She may be frae you;
You'se get nae mair o' my foul jaw,
So GOD be wi' you.

I am yours, the *B. P.*

P.S.—Now, JOHNNY, if it be your will,
Step o'er the gate to *Mungal Mill*,
Gi'e my kind wishes to my WILL:
And, or ye leave that,
I hope he'll treat ye wi' a gill
Of his *Glenlivat*.

Scottsmill, the 19th Jan., 1821. Yours, WILLIAM LILLIE.

BLOCK SIGNALLING.

SIR,—Before proceeding to discuss the invention of block signalling on railways it is necessary to define what is meant by the expression. Your correspondent, Mr. Hugh Brown, who writes in your last issue, seems to regard the system of maintaining a constant distance between trains travelling in the same direction on the same line of rails as the "block system." This idea must have occurred to many persons at a very early period in railway history. In the *Mechanic's Magazine* for February 22nd, 1840, p. 372, Mr. W. J. Curtis proposes to place a series of signal posts at short intervals along the line, for the purpose of giving warning of an approaching train. He also shows a modification by which the signals may be worked by the train itself. Supposing *a*, *b*, and *c* to represent three successive signals, he says:—"The engine in passing *a* is made to open or show the signal at *b*; on arriving at *b*, to shut *a* and open *c*, and so on, so that it exhibits the signal a mile before it and a mile behind it. Thus, a second train must on no account pass *a* whilst the signal remains on, until the train passing *b* shuts it off. As the distance of a mile is performed in a given time—say, three minutes—if an engine on arriving at *a*, and after waiting or going very slowly, the signal does not shut off, the engineman must presume that either some permanent cause of detention has happened on the line or that the apparatus is deranged. In either case he must go on very cautiously until he arrives at the next signal post." Curtis took out a patent for his invention in 1838, No. 7792, but the specification is confined to a description of the mechanism for operating the signals, the importance of blocking not being insisted upon.

In 1841 Chas. Berwick Curtis, whose relationship with W. J. Curtis I am unable to determine, took out a patent for self-acting railway signals—No. 8803—the distinguishing character of which was "that at every time when a train travels along that part of the railway where any such self-acting apparatus is situated, so as to pass by that apparatus, the same will exhibit a signal immediately on the said train so passing by such apparatus, and will continue to exhibit this said signal without alteration in the appearance thereof so long as there will not have been sufficient time for the said train to have advanced far enough along the line beyond the said apparatus to permit of any succeeding train to follow after the said first-mentioned train; and the signal so exhibited will give information to the driver of any such succeeding train which may happen to come up in sight of the apparatus that he is to stop and not proceed." After naving been exhibited for a certain period the signal was taken off by an automatic arrangement. Mr. Saxby's patent of 1856 for working the points and signals in conjunction is well known. R. B. P.

September 23rd.

SIR,—There appears to be some mystery respecting the inventor of the block system of signalling. I have examined the patent list, and have found Funnell's patent, which gives line clear to the first signals in rear of trains; date of patent 15th July, 1863. The principle of Funnell's system is to indicate space and time for passing trains. Thus, the train on passing the first signal post raises the signal arm to danger, and in passing the second signal post also raises the signal arm to danger; but at the same time releases the signal arm of the first signal post to an oblique position; and at an interval of three minutes the signal arm falls to a vertical position and displays a white light at night.

Little's system of signalling was published 29th December, 1865. The principle of this invention is to indicate an adequate interval of space between following trains. Thus, the train in passing the first signal post raises the signal arm to danger, and in passing the second signal post raises the signal arm to danger, and in passing the third signal post would raise the signal arm to danger, but at the same time would lower the signal arm of the first signal post to line clear by electricity or equivalent, so that there would always be at least the space between two signal posts for the drivers to stop their trains in foggy weather, so that no accident could occur unless the signals were out of order.

The Board of Trade memorandum of requirements is:—(1) The requisite apparatus should be provided at the period of inspection for insuring an adequate interval of space between following trains. (2) Home signals and distant signals for each direction should be supplied at stations and junctions, with extra signals for such sidings as are used either for the arrival or for the departure of trains. With Funnell's and Little's systems of signals they were, of course, worked automatically, as in those days railway companies would not think of fitting up signal cabins for controlling the traffic. Funnell's system, I believe, failed on the Brighton Railway over twenty years ago in a fog. The first train having broken down after passing a signal post, the driver of the second train was, of course, unable to see the signal till close to the post, and could not pull up in time to prevent a collision. I then altered the system of signalling, so that there would always be an empty section between trains.

CHRISTOPHER J. LITTLE, M.S.A.

London, E., September 23rd.

THE CONTINUOUS BRAKES RETURN.

SIR,—The Continuous Brakes Return—c. 4565—for the first half of the present year has just been issued, but, as upon many previous occasions, the information contained therein furnishes evidence that there is no immediate prospect of the adoption of any general system; it is, however, satisfactory that the brakes recently fitted are, or are said to be, automatic in their action.

The following table shows the total amount of stock fitted and unfitted on the 30th June, 1885:—

	Engines fitted with brakes.	Engines fitted with apparatus for working the brakes.	Carriages, &c., fitted with brakes.	Carriages, &c., fitted with pipes or chains only.
Total amount of stock returned as fitted with brakes which appear to comply with conditions of Board of Trade	2726	670	20,086	4104
Total fitted with brakes which do not comply	1190	626	13,274	3388
Totals fitted	5212		40,852	
Not fitted with any continuous brake	1765		10,707	
Total passenger rolling stock therefor	6977		51,559	

The above amount of fitted rolling stock is provided with brakes as follows, exclusive of those vehicles which have through pipes, &c., only:—

Name of brake.	Engines fitted with brakes.	Engines fitted with apparatus for work'g brakes	Vehicles fitted with brakes.
Automatic vacuum	*630	579	6395
Heberlein	1	1	4
Smith's automatic vacuum	573	1	2290
Steel-McInnes	3	—	29
Westinghouse automatic	1434	89	10,795
Clark's chain; Clark and Webb's chain; Wilkin and Clark's chain	†85	—	3922
Fay's; Fay and Newall's; Newall's	—	—	2164
W. P. Smith's	—	—	3
Smith's vacuum	1142	89	5530
Vacuum (Webb's)	—	537	1878
Westinghouse pressure	48	—	350
Total	3916	1296	33,360

* These engines are placed under the wrong heading, they having only steam brakes and "apparatus for working" the vacuum brake.

† Eighty-five engines on the North London are recorded in the wrong column, being only provided with hydraulic brake and cord.

These totals do not include 129 goods engines on the North-Eastern Railway fitted with the Westinghouse brake. In consequence of the different systems used by companies working in connection, it has been necessary to fit no less than 784 vehicles with double apparatus, but they are, of course, only included once in the above totals.

The following table shows the amount of rolling stock fitted with two complete systems of brakes, so that both act on the same blocks:—

N.E.	Ten engines.	Westinghouse automatic—Smith's vacuum
	Vehicles.	
G. W.	73	Fay and Sanders' vacuum.
West Coast J. S.	275	Westinghouse automatic and Webb vacuum.
Caledonian	15	" "
L. and N. W.	68	" "
Midland S. J. S.	85	Westinghouse automatic—automatic vacuum.
Midland	114	" "
G. and S. W.	*	" "
East Coast Joint Stock	89	Westinghouse automatic—Smith's vacuum.
N. E.	44	" "
N. E.	13	Westinghouse automatic & Midland vacuum.
N. E.	8	Westinghouse automatic & L. N.W. vacuum.
Total	784	

* G. and S. W., number not given.

Fifty-one engines on the North-Eastern Railway are also fitted with appliances for working two brakes, and a very large number of vehicles have two, or even three, kinds of connecting pipes.

The following table shows the total number of engines and vehicles which were fitted with each system during the half-year ending 30th June, 1885:—

	Engines.	Vehicles.
Westinghouse automatic	90	586*
Automatic vacuum	64	353
Smith s automatic vacuum	109	491
Smith's vacuum	70	224
Vacuum, L. & N. W.	4	952
Heberlein	—	6
Fay	—	9
Chain brake	4	—
Total	341	2621

* Exclusive of L. and N. W. vehicles fitted with two brakes.

The progress made during the half-year cannot be considered satisfactory; the total stock fitted shows but a small increase; many of the brakes fitted are inefficient; for instance, the "leak-off" and the simple vacuum, and in the case of the London and North-Western vacuum, the large nominal increase is not progress, but simply the change of brakes from the chain to the vacuum. To remove one brake and fit another which does not fulfil the Board of Trade conditions is but a useless waste of money, as a still further alteration must ultimately be made.

A comparison of the two last Board of Trade returns shows that during the half-year the undermentioned brakes were removed or changed:—

Brake.	Railway.	Engines.	Vehicles with brakes.	Vehicles with chains, pipes, &c.
Clark-Webb chain ..	L. & N. W.	—	761	301
Clark's chain	Belfast C.	2	—	—
Fay's	L. and Y.	—	9	—
Fay and Newall.. ..	L. and Y.	—	5	—
Smith's vacuum ..	G. E.	5	33	12
ditto	Taff V.	2	19	1
			827	314
Total		9	1141	

The fact that in six months the companies should take off such a large number of inefficient brakes shows the absurdity of money having ever been thrown away upon fitting them. Out of a total of 6977 engines and 51,559 vehicles, only 2726 engines and 20,086 vehicles have brakes which even "appear" to fulfil the conditions, and, to quote the words of the return, "some of the brakes but very imperfectly fulfil that designation." The most unsatisfactory part of the return is again that portion relating to the "failures." The information furnished is in many cases incorrect, and in some absolutely false. It is a well-known fact—in support of which I should be happy to furnish ample evidence—that there have been numbers of failures, especially upon the Midland Railway, yet under the head of failures or partial failures the word *nil* is recorded. Such a return is clearly misleading, especially when it is remembered that during the six months in question the accident at Swadlincote occurred.

Taking the figures as they stand, the following details can be obtained. No case is recorded under Class 1 of actual failure when required in case of an accident to a train, or a collision between trains being imminent. Under Class 2, failure to act under ordinary circumstances, the following are given:—

	Railway.	Class 1.	Class 2.	
Smith's vacuum	C. L. C.	Nil	5	
" "	G. N.	"	22	
" "	L. C. D.	"	2	
" "	M. S. L.	"	2	
" "	Met.	"	4	
" "	Mid.	"	1	
" "	N. E.	"	1	
" "	S. E.	"	8	
" "	D. W. W. of I.	"	1	
" "	G. S. W. of I.	"	2	
			—	48
Newall	L. & Y.	"	1	
			—	1
Westinghouse automatic.. ..	G. E.	"	1	
" "	Mid.	"	1	
			—	2
Smith's automatic vacuum ..	L. & S. W.	"	1	
			—	1
Total				52

The Great Southern and Western Company of Ireland also report a case under the wrong heading, in which Smith's vacuum pipe became uncoupled, and a train ran 100 yards past Limerick Junction station. From these figures it will be seen that non-automatic brakes failed to act no less than fifty times in running 22,072,882 miles, whereas automatic brakes only have three cases in 31,573,582 miles. Now, with reference to these three instances, one is a neglect of the coupler when attaching the engine, another was a defective washer which affected the engine wheels alone, and the third case, on the London and South-Western, is not clearly explained; the main vacuum pipe broke, but it is not stated whether the train overran Reading station or not. A number of delays are recorded; those relating to automatic brakes, however, are the best possible proof that they are in proper working order, and the fact that good automatic brakes will not permit a train to be run with a brake out of order is not a defect, but the greatest proof of their efficiency and safety.

It would be of the greatest advantage if the returns contained a summary showing each incident under one of the three heads:—(1) Failure in case of emergency; (2) failure under ordinary circumstances; and (3) cases of delay; clearly showing if the failure was due to defective material or the faults of companies' servants. All instances in which continuous brakes avoided or mitigated accidents should also be recorded in the returns.

CLEMENT E. STRETTON,
Hon. Mem. Amalgamated Soc. Railway Servants.
40, Saxe Coburg-street, Leicester, September 18th.

BRITISH ASSOCIATION AT ABERDEEN.

THE following address was delivered in the Mechanical Science Section by Mr. B. Baker, M.I.C.E., president of the section:—

Two hundred and fifty-seven presidential addresses of one kind and another have been delivered at meetings of the British Association since the members last mustered at Aberdeen. I need hardly say that the candid friend who informed me of this interesting fact most effectually dispelled any illusion I may have entertained as to the possibility of preparing an address of sufficient novelty and suggestiveness to be worthy of your attention. I labour under a double disadvantage—firstly, that only two addresses intervene between the present one and that of my partner, Mr. John Fowler, and secondly, that within the same period I have read before this section two somewhat lengthy papers on the work which is at present chiefly engaging the attention of Mr. Fowler and myself—the great Forth Bridge.

Although for the reasons aforesaid I am conscious that my address may fail in novelty, I cannot honestly profess to feel a difficulty in preparing an address of some kind, for the subjects embraced under the head of "mechanical science" are so inexhaustible that even the youngest student might safely accept the responsibility of speaking for an hour on some of them. Professor Rankine, addressing you thirty years ago, said it was well understood that questions of pure or abstract mechanics form no part of the subjects dealt with in this section. With characteristic clearness of conception and precision of language, he told you what the term "mechanical science" meant, and, after thirty years interval, his words may be recalled with advantage to every one proposing to prepare an address or report for this section: "Mechanical science," said Professor Rankine, "enables its possessor to plan a structure or machine for a given purpose without the necessity of copying some existent example; to compute the theoretical limit of the strength and stability of a structure or the efficiency of a machine of a particular kind; to ascertain how far an actual structure or machine fails to attain that limit, and to discover the cause and the remedy of such shortcoming; to determine to what extent, in laying down principles for practical use, it is advantageous for the sake of simplicity to deviate from the exactness required by pure science; and to judge how far an existing practical rule is founded on reason, how far on custom, and how far on error." There is thus an ample text for many discourses, but, as I am not writing a treatise on engineering, but merely delivering a brief address, I will confine my attention at present to a particular case of the branch of mechanical science referred to in the last clause of Professor Rankine's definition, and will ask you to consider how far the existing practical rules respecting the strength of metallic bridges are "founded on reason, how far on custom, and how far on error."

The first question obviously is—what are the rules adopted by engineers and Government departments at the present time? and it is one not easily answered. I have for some time past been receiving communications from leading continental and American engineers asking me what is my practice as regards the admissible intensity of stress on iron and steel bridges, and in replying I have invited similar communications from themselves. As a result I am able to say that at the present time absolute chaos prevails. The old foundations are shaken, and engineers have not come to any agreement respecting the rebuilding of the structure. The variance in the strength of existing bridges is such as to be apparent to the educated eye without any calculation. If the wheels of a miniature brougham were fitted to a heavy cart, the incident would excite the derision even of our street boys, and yet equal want of reason and method are to be found in hundreds of bridges in all countries. It is an open secret that nearly all the large railway companies are strengthening their bridges, and necessarily so, for I could cite cases where the working stress on the iron has exceeded by 250 per cent. that considered admissible by leading American and German bridge builders in similar structures.

In the case of old bridges the variance in strength is often partly due to errors in hypothesis and miscalculation of stresses. In the present day engineers of all countries are in accord as to the principles of estimating the magnitude of the stresses on the different members of a structure, but not so in proportioning the members to resist those stresses. The practical result is that a bridge which would be passed by the English Board of Trade would require to be strengthened 5 per cent. in some parts and 60 per cent. in others before it would be accepted by the German Government or by any of the leading railway companies in America. This undesirable state of affairs arises from the fact that in our own and some other countries many engineers still persistently ignore the fact that a bar of iron may be broken in two ways, namely, by the single application of a heavy stress or by the repeated application of a comparatively light stress. An athlete's muscles have often been likened to a bar of iron, but if "fatigue" be in question, the simile is very wide of the truth. Intermittent action, the alternative pull and thrust of the rower, or of the labourer turning a winch, is what the muscle likes and the bar of iron abhors. Troopers dismount to rest their horses, but to relieve a bar of iron temporarily of load only serves to fatigue it. Half a century ago Braithwaite correctly attributed the failure of some girders, carrying a large brewery vat, to the vessel being sometimes full and sometimes empty, the repeated deflection, although imperceptibly slow and wholly free from vibration, deteriorating the metal, until, in the course of years, the girders broke. These girders were of cast iron, but it was equally well known that wrought iron was similarly affected, for in 1842 Nasmyth called the attention of this section to the fact that the "alternate strain" in axles rendered them weak and brittle, and suggested annealing as a remedy, he having found that an axle which would snap with one blow when worn would bear eighteen blows when new or after being annealed. So important a matter as the action of intermittent stresses could not escape the attention of the Royal Commissioners appointed in 1849 to consider the application of iron to railway structures, and some significant and sufficiently conclusive experiments were made by Captain Douglas Dalton and others. Cast iron bars 3in. square and 13ft. 6in. span between the supports were deflected, both by the slow action of a cam and the percussive action of a swinging pendulum weight. When the deflection was that due to one-third of the breaking weight, about 50,000 successive bendings by the cam broke one of the bars, and about 1000 blows from the pendulum another. When the deflection was increased from one-third to one-half, about 500 applications of the cam and 100 blows sufficed to rupture two of the specimens. Slow-moving weights on bars and on a small wrought iron box girder gave analogous results, and the deduction drawn by the experimenters at the time was that "iron bars scarcely bear the reiterated application of one-third the breaking weight without injury, hence the prudence of always making beams capable of bearing six times the greatest weight that could be laid upon them."

Although these experiments were entirely confirmatory of all previous experience, they would appear to have little influenced the practice of engineers, since Fairbairn, more than ten years later, in a communication to this section, said that opinions were still much divided upon the question whether the continuous change of load which many wrought iron structures undergo has any permanent effect upon their ultimate powers of resistance. To assist in settling the question he communicated to the Association the results of some experiments carried out by himself and Professor Unwin on a little rivetted girder, 20ft. span and 16in. deep. Once more the same important but disregarded facts were enforced on the attention of engineers. About 5000 applications of a load, equal to four-tenths of the calculated breaking load, fractured the beam with the small ultimate deflection of $\frac{3}{8}$in., and subsequently, when repaired, the beam broke with one-third of the load and a deflection of but $\frac{1}{4}$in., which sufficiently indicated how small a margin the factor of safety of four, then currently adopted, allowed for defective manufacture, inferior material, and errors in calculation. Still nothing was done, and the general practice of engineers and the Board of Trade regulations continued unaltered.

Soon after the introduction of wrought iron bridges on railways, the testimony of practical working was added to that of experiments. In 1848 several girder bridges of unduly light proportions were erected in America, and one of 66ft. span broke down under the action of the rolling load in the same manner as Fairbairn's little experimental girder. Again, in early American timber bridges the vertical tie rods were often subject to stresses oscillating between one ton and ten tons per square inch and upwards. Many of these broke, as did also the suspension bolts in platforms subjected to similar stresses. In my own experience, dozens of broken flange plates and angle bars, and hundreds of sheared rivets, have been the silent witnesses of the destructive action of a live load. Like evidence was afforded by early-constructed iron ships deficient in girder strength. Under the alternating stresses due to the action of the waves, weaknesses not at first apparent would, in the course of time, be developed, and additional strength, in the way of stringers and otherwise, become imperative.

If none of the preceding evidence had been forthcoming the results of the historical series of experiments carried out by Wöhler for the Prussian Ministry of Commerce would alone be conclusive. For the first time, a truly scientific method of investigation was followed, and an attempt was made to determine the laws governing the already proved destructive action of intermittent stresses. In previous experiments the bar or girder was alternately fully loaded and wholly relieved of load. Wöhler was not satisfied with this, but tested also the result of a partial relief of load. The striking fact was soon evidenced, on testing specimens under varying tensions, that the amount of the variation was as necessary to be considered as that of the maximum stress. Thus, an iron bar, having a tensile strength of 24 tons per square inch, broke with about 100,000 applications of a stress varying from *nil* to 21 tons, but resisted 4,000,000 applications of the 21 tons when the minimum stress was varied from *nil* to $11\frac{1}{2}$ tons. The alternations of stress in the case of some test pieces numbered no less than 132,000,000, and too much credit cannot be bestowed by engineers upon Wöhler for the ingenuity and patience which characterised his researches. As a result, it is proved beyond all further question, that any bar or beam of cast iron, wrought iron, or steel may be fractured by the continued repetition of comparatively small stresses, and that, as the differences of stress increase, the maximum stress capable of being sustained diminishes. Various formulæ based upon the preceding experiments have been proposed for the determination of the proper sectional area of the members of metallic structures. These formulæ differ in some essential respects, and doubtless many experiments are still required before any universally accepted rules can be laid down. Probably at the present time the engineers who have given the most attention to the subject are fairly in accord in holding that the admissible stress per square inch in a wrought iron girder subject to a steady dead load would be one and a-half times as great as that in a girder subject to a wholly live load, and three times that allowable in members subject to alternate tensile and compressive stresses of equal intensity, such as the piston-rod of a steam engine, or the central web bracing of a lattice girder. If the alternations of stress to be guarded against are not assumably infinite in number, but only occasional—as in wind bracing for hurricane pressures, or in a vessel amongst exceptionally high waves—then the aforesaid ratio of 3, 2, and 1 would not apply, but would more nearly approach the ratios 6, 5, and 4. Hundreds of existing railway bridges, which carry twenty trains a day with perfect safety, would break down quickly under twenty trains per hour. This fact was forced on my attention nearly twenty years ago by the fracture of a number of iron girders of ordinary strength under a five-minute train service. Similarly when in New York last year I noticed, in the case of some hundreds of girders on the "Elevated Railway," that the alternate thrust and pull on the central diagonals from trains passing every two or three minutes had developed weaknesses which necessitated the bars being replaced by stronger ones after a very short service. Somewhat the same thing had to be done recently in this country with a bridge over the Trent, but the train service being small, the life of the bars was measured by years instead of months. If ships were always amongst great waves the number going to the bottom would be largely increased, for, according to Mr. John, late of Lloyd's, "many large merchant steamers afloat are so deficient in longitudinal strength that they are liable under certain conditions of sea to be strained in the upper works to a tension of from 8 to 9 tons per square inch, and to a compression of from 6 to 7 tons"—stresses which the experiments already referred to prove would cause failure after a definite number of repetitions. Similarly on taking ground or being dry-docked with a heavy cargo on board, it has been shown that vessels are liable to stresses of over 11 tons per square inch on the reverse frames, but no permanent injury results from such high stresses, because the number of repetitions is necessarily very limited. It appears natural enough to every one that a piece even of the toughest wire should be quickly broken if bent backwards and forward to a sharp angle; but, perhaps, only to locomotive and marine engineers does it appear equally natural that the same result would follow in time if the bending were so small as to be quite imperceptible to the eye. A locomotive crank axle bends but $\frac{1}{32}$in., and a straight driving axle the still smaller amount of $\frac{1}{64}$in. under the heaviest bending stresses to which they are subject, and yet their life is limited. During the year 1883 one iron axle in fifty broke in running, and one in fifteen was renewed in consequence of defects. Taking iron and steel axles together, the number then in use on the railways of the United Kingdom was 14,848, and of these 911 required renewal during the year. Similarly, during the past three years no less than 228 ocean steamers were disabled by broken shafts, the average safe life of which is said to be about three or four years. In other words, experience has proved that a very moderate stress alternating from tension to compression, if repeated about one hundred million times, will cause fracture as surely as a sharp bending to an angle repeated perhaps only ten times. I have myself made many experiments with a view to elucidate the laws affecting the strength of iron and steel work subject to frequent alternations of stress. Perhaps the most suggestive series was one in which I subjected flat steel bars about 3ft. long, in pairs, to repeated bendings until one bar broke, and then testing the surviving bar under direct tensile and compression stresses to ascertain to what extent the metal had deteriorated. It had come under my notice, as a practical engineer, that if the compression members of a structure were unduly weak, the fact became quickly evident, perhaps under the test load; but if, on the other hand, the tension members were weak, no evidence might appear of the fact until frequent repetition of stresses during several years had caused them to fracture without any measurable elongation of the metal. In the case of crank-shafts, also, the fracture is invariably due to a tearing and not a crushing action. It appeared to me, therefore, eminently probable that repetition of stresses might be far more prejudicial to tension than to compression members, and if so the fact ought to be taken account of in proportioning a structure. This proved to be the case in my experiments. For example, the companion bars to those which had broken with 18,000 reversals of a stress less than half the original breaking weight, behaved when tested as columns thirty diameters in length, precisely the same as similar bars which had done no work at all, whereas, when tested in tension the elongation was reduced from the original 25 per cent. to 2·5 per cent., and the fracture appeared to indicate that the bars had been made of three different kinds of steel imperfectly welded together. With a stress reduced by one-fourth the number of bendings required to break the bars was increased to 1,200,000. In this instance the calculated maximum working stress on the extreme fibres was 43 per cent. of the direct ultimate tensile resistance of the steel, and about 30 per cent. of the stress the bar was capable of sustaining as a beam under the single application of a load. Of course, the bars failed by tension, and the extreme fibres had thus deteriorated as regards tensile stresses to the extent indicated by the above percentages. Tested as a column, however, the injury the bar had received from the 1,200,000 bendings was inappreciable. The ductility was of course very largely reduced, but ductility is a quality of comparatively little importance when a material is in compression. There is no ductility in the slender Gothic stone columns of our cathedrals, which though heavily stressed have carried their loads for centuries. As I found repeated bending raised the limit of elasticity, I rather anticipated finding an increased resistance from this cause in long columns. This did not prove to be the case, nor did I find any difference in short columns four diameters in length. In addition to the preceding experiments with rectangular bars, I have tested the endurance of many revolving shafts of cast iron, wrought iron, and steel with similar results. About 5000 reversals of a stress equal to one-half the static breaking weight sufficed generally to cause the snapping of a shaft of any of the above materials. When the stress was reduced and the number of applications increased, I found the relative endurance of solid beams to be more nearly proportional to the tensile strength of the metal than to the breaking weight of the beam, a distinction of great importance where axles, springs, and similar things are concerned. Many of my experiments were singularly suggestive. Thus, it was instructive to see a bar of cast iron loaded with a weight which, according to Fairbairn's experiments, it should have carried for a long series of years, broken in two minutes when set gently rotating. Also to find a bar of the finest mild steel so changed in constitution by some months of rotation as to offer no advantages either in strength or toughness over a new cast iron bar of the same section.

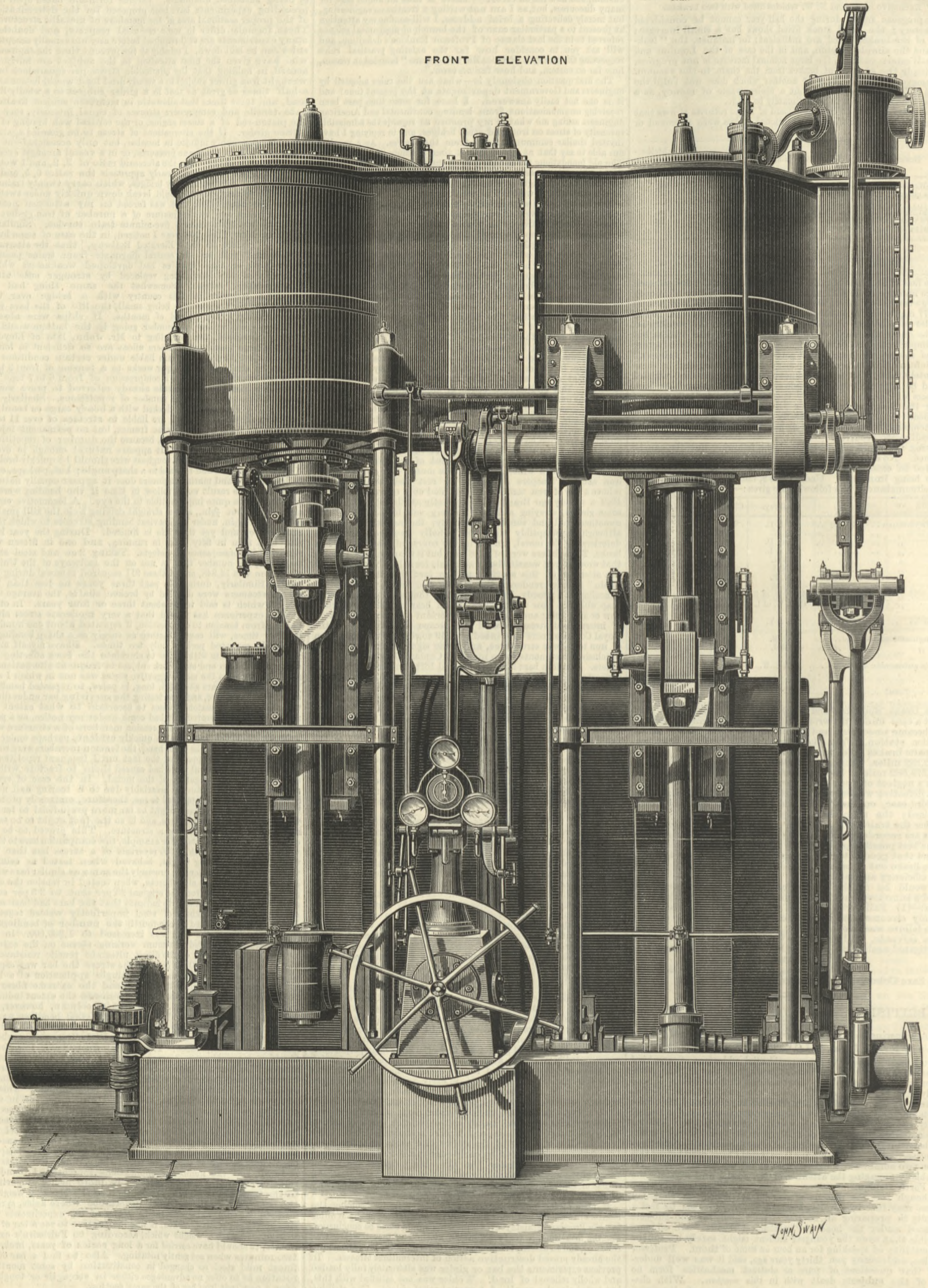
(*To be continued.*)

COMPOUND ENGINES AT THE ANTWERP EXHIBITION.

LA SOCIÉTÉ COCKERILL, SERAING, ENGINEERS.

(*For description see page* 236.)

FRONT ELEVATION



FOREIGN AGENTS FOR THE SALE OF THE ENGINEER.

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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.

*** *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.*

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

*** *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.*

J. V. N.—*If you think proper to send us a sketch, we will give you our opinion of its merits in confidence.*

C. F.—*We are requested to inform our correspondent "C. F." that Messrs. Nettlefolds, Birmingham, are makers of soft steel produced by the Clapp and Griffiths converter.*

WROUGHT IRON CHIMNEYS.—*On this subject Mr. A. Jackson writes us:—"Your correspondent will find all he requires in a work noticed in* THE ENGINEER *under head of 'Books Received,' page 167, August 28th last. I bought the volume from seeing that notice, and upon reference to it, I find mention made of several iron shafts, with thickness of plates, size of rivets, &c. The title of the book is 'Tall Chimney Construction.' I got mine through Messrs. E. and F. N. Spon, 125, Strand." Messrs. A. Marshall and Co., of Heneage-street, Whitechapel, also write to say that they have made many of these chimneys.*

SCHMIDT'S DECORTICATING MACHINE.

(*To the Editor of The Engineer.*)

SIR,—Can any reader tell me where I can get the Schmidt machine which decorticates the textile plant San Ciberia, grown in the island of Cuba? There is also a machine for the Ramie plant. C. A. C.

Clapton, September 17th.

COKE CRUSHING AND FLANGE JOINTS.

(*To the Editor of The Engineer.*)

SIR,—Will any reader kindly tell me who is the maker of Thomas and Somerville's patent coke crushing machine? Also, what is the best material for making the joints of flange pipes, which are to be laid underground and used for water? H. C.

Halifax, September 21st.

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THE ENGINEER.

SEPTEMBER 25, 1885.

THE MANAGEMENT OF HIGH-PRESSURE MARINE BOILERS.

ENGINEERS at sea have to contend with two special difficulties in the management of marine boilers. They have to prevent corrosion and to prevent incrustation. Now, incrustation is the great remedy for corrosion, while it is the more usual cause of furnace collapse. On the one hand, then, if the incrustation be obviated, corrosion will make short work of the boiler. On the other hand, if incrustation becomes excessive the furnaces will collapse. The engineer has, therefore, to steer a difficult course between Scylla and Charybdis. Constant practice, combined with intelligence and common sense, has rendered engineers so skilful that we seldom hear anything about corrosion now. As regards collapsed furnaces the case is different. Collapsing occurs so frequently and persistently that it cannot be regarded in any other light than as a dangerous nuisance; and we make no apology for returning to a subject with which we dealt very recently, but by no means exhaustively. We desire at present to call attention to the fact that there is good reason to believe that boilers working with the very high pressures now in vogue, are much more liable to dangerous accumulations of lime deposit than were boilers working at comparatively low pressures, such as 70 lb. or 80 lb. per square inch. Consequently a system of working which may answer well in the one case may not answer well in the other. It is of very great importance that the truth or error of this proposition should be established; and we shall be glad to receive information from superintending engineers, seagoing engineers, or, indeed, anyone who can supply it, which may be of use to set the matter at rest.

It is well that our meaning should be made quite clear; we may be excused, therefore, if we tell an oft-told tale once more. Sea-water contains numerous constituents. Those with which the engineer is concerned are common salt, sulphate of magnesia, and sulphate of lime. In 100,000 lb. of sea-water there are 2806 lb. of salt, 229 lb. of sulphate of magnesia, and 141 lb. of sulphate of lime. Now, 100,000 lb. is nearly 44·5 tons. Let us suppose that two new boilers are filled up for a voyage with 44·5 tons of water. Then we have put into each 1403 lb. of salt, $114\frac{1}{2}$ lb. of sulphate of magnesia, and 70 lb. of sulphate of lime. The water by the salinometer shows $\frac{1}{32}$—that is to say, for every 32 lb. of water we have 1 lb. of saline and mineral constituents. Sea-water is not nearly saturated with salt. Indeed, salt will not be deposited in a boiler save in very small quantities unless the salinometer shows $\frac{9}{32}$, at which time each of our supposed boilers would contain $1403 \times 9 = 12{,}627$ lb., or more than $5\frac{1}{2}$ tons of salt. The case is entirely different as regards the lime and the magnesia. These are soluble in cold water, but they are not soluble in hot water, and the hotter the water the less soluble do they become. To put this in another way, cold water will hold a certain proportion of lime in solution. Water at 212 deg. will not hold half as much, and at the temperatures reached with steam of 130 lb. to 150 lb., namely, 350 deg. and 358 deg. respectively, it will not hold any in solution. Besides the earthy constituents which we have named, sea-water contains a small quantity of carbonate of lime, about 3 lb. in 100,000 lb. This is held in solution by carbonic acid gas present in the water. This gas is driven off by boiling, and the carbonate of lime is deposited, and probably plays a mischievous part in more effectually consolidating the sulphates of lime and magnesia incrustation. M. Cousté has carefully investigated the phenomena, and his statement of what takes place is so clear that we reproduce it here.

"First," he writes, "a few moments after ebullition has commenced the water in the boiler grows muddy and holds in suspension first free magnesia, then carbonate of magnesia. These two substances are light, flakey, and have no tendency to agglomerate. They form with the other impurities in the water the mud which is found in boilers, especially on the bottoms of them. Secondly, as the boiling goes on the water soon arrives at the point of saturation with regard to the sulphate of lime, and from this moment, if the degree of saturation is allowed to pass the point where the motion of the water is sufficient to keep the sulphate in suspension mechanically, its particles will be deposited as a crystalline crust on all surfaces in contact with the water. Thirdly, the heating surfaces impart to the water in immediate contact with them a sufficiently high temperature to make a supersaturated solution as far as the sulphate of lime is concerned. This sulphate is then deposited in a thin scale on the plates, whatever may be the degree of concentration of the great mass of the water. Subsequently, when the concentration extends further through the volume of water by the rise in temperature as steam gets up, the swimming particles of lime cling to this layer and increase its thickness. It appears that in case these particles, which are precipitated without being in contact with the heating surface, did not have such a layer of scale to cling to, they would not adhere, but would form a loose deposit instead of a scale. Fourthly, when the fires are drawn and the water is allowed to cool down, the mud before held in suspension by the violent motion of the water, now falls down and forms a very thin layer, filling up the roughness of the lime crust. This does not seem to be disturbed when steam is again got up. As soon as the new water is heated up to saturation point, more lime is thrown down and the incrustation is thickened. The second deposit is separated from the first by the thin coating of mud, consisting principally of carbonate of magnesia and a little oxide of iron, which gives it a yellowish tinge."

The saturation here spoken of, it must be clearly understood, is not the saturation due to the removal of water by evaporation such as takes place in a salt pan. It is saturation due to temperature. One hundred pounds of water at 212 deg. can hold in solution 0·60 of a pound of sulphate of lime; at 251 deg., corresponding to 15 lb. pressure, it can hold only 0·23, or less than one-fourth of a pound; and at 285 deg., corresponding to 38 lb., the water cannot hold any sulphate of lime at all in suspension.

Returning now to our two boilers referred to above, we find that as soon as the pressure has reached about 15 lb. all the sulphate of lime, namely, 70 lb., is in a condition to be deposited forthwith, nothing is required for this but time, and a few hours will suffice to clear the water of this substance, and distribute it in a thin, more or less evenly disposed scale, all over the heating surface. The quantity does not seem large, but it will be freely admitted that 70 lb. of common lime made into limewash would suffice to give the heating surface of a marine boiler a couple of thick coats. It may be taken for granted that this first layer is sufficient for the purposes of protecting the boiler from corrosion, provided it is equally distributed. The common salt will do no harm, as it will not be deposited. If waste could be prevented the boiler might now be worked in safety for any period, provided no more sea-water was admitted. But waste takes place in various ways. Steam escapes from safety valves and stuffing-boxes. It is used for driving donkeys and steam winches, &c., and the result is that sea-water has to be added by the supplementary feed from time to time. Thus fresh quantities of sulphate of lime are introduced and the scale is thickened. As the voyage proceeds the engineer finds his water growing denser. It cannot be otherwise, because the waste is all pure steam; but the waste is made up by introducing sea-water, and thus more salt is thrown into the boiler every time the donkey is started. As soon as the density reaches $\frac{4}{32}$ this salt begins to be deposited, in small quantity it is true, but every little helps to add to the scale, and so at last the engineer opens his scum cocks and blows down his boilers two or three inches; then he shuts the cocks, and restores the level with water from the sea pumped in by the donkey. This reduces the density as shown by the salinometer, because a great deal of salt has been got rid of, strong brine being blown out, and weak brine pumped in. But this weak brine carries with it another dose of sulphate of lime, and the scale is thickened up once more. Thus it follows that the careful engineer, who holds by his salinometer, and will by no means permit the density of the water to rise beyond a certain point, is all the time doing as much harm as he possibly can by pumping into his boiler the sulphate of lime, which he cannot get rid of by blowing down. The result is, of course, that scaling and chipping must be resorted to.

All that we have said up to the present is quite simple and straightforward, and may, we believe, be understood by any man of ordinary intelligence. If the phenomena invariably presented themselves in the same way and under the same conditions, engineers would know exactly what course to pursue in managing the boilers under their care. At the end of every voyage the boiler would be opened and chipped and scaled. It would never be suffered to run for more than a couple of weeks without this. Beyond question this is the treatment which marine boilers get in very many instances. For example, Atlantic steamers have their boilers scaled and washed out in Liverpool. They are filled up with fresh water, and the supplementary feed is afterwards used every watch to a greater or less extent. In New York the boilers are emptied, but not scaled. They are filled up with fresh water, and the donkey and blowing down are used on the voyage back. Then the boilers are emptied, opened, scaled, and again filled up with fresh water. This is not an invariable practice; every superintending engineer almost has his own plan. That which we have described is based on the assumption that like causes will produce like effects. But to all appearance this is not the fact with marine boilers. For example, instead of a nice coating of scale being formed at once on the inside of a boiler, in some cases it can only be obtained with the utmost difficulty. We could name a ship which went to the Mediterranean with a new boiler, and nearly six weeks elapsed before the engineer could get a scale as thick as a sheet of writing paper, and to get this he worked persistently with the supplementary feed. He got plenty of mud, but no incrustation. Again, it is well known that a boiler may be beautifully coated with an even scale about as thick as a sixpence, and that the whole of this may be removed, to the engineer's intense chagrin, by the injudicious use of the donkey. It seems, in short, that while in one ship the introduction of plenty of sea water during a voyage will cause incrustation to take place with dangerous rapidity, in another ship the use of the supplementary feed will positively prevent a coating sufficiently thick to protect the boiler from corrosion from being formed.

This brings us directly to the proposition with which we started. Although it is quite true that the whole of the sulphate of lime ought to be thrown down in the shape of a hard scale when a temperature of 280 deg. is reached, it is a matter of fact that this effect does not invariably take place; if it did ships could not be kept as they are for long periods under steam. But there is reason to believe that when very high pressures are employed, that which is indicated by theory does take place in practice, and we believe that most engineers who have to deal with the new type of engines in which pressures of 120 lb. to 160 lb. are used will admit that they are more likely to get hard scale in quantity than is the case when pressures of half the amount are carried. Recent practice with some of the long voyage triple-expansion engines goes to prove this, and there is no doubt something yet to be learned as to the best method of dealing with marine boilers carrying heavy pressures on long voyages. On this point we shall have more to say at another time.

THE STANDARD OF LIGHT.

NEARLY half-a-year has elapsed since we drew attention to a valuable report which had just then been laid before the Metropolitan Board of Works with reference to the mode by which the lighting power of gas is tested. One fact brought out very clearly in that report was the untrustworthy character of the statutory sperm candle as a standard of illuminating power. If it was difficult to decide as to the best substitute for the legalised candle, there was no difficulty in coming to the conclusion that of several competing methods, any one of them was better than the system which existed. It is a singular fact that while a candle of some kind or other—wax, tallow, paraffine, stearine, or sperm—has long been accepted as the unit of light, the uncertainty attending the use of such a standard has been recognised from an early date. Something like twenty different devices by way of improvement may be distinctly specified, and the actual number is no doubt still larger. The sperm candle was condemned in 1881 by the committee appointed by the Board of Trade in 1879 to investigate the subject, Mr. Vernon Harcourt's pentane or air-gas flame being recommended in preference. A committee appointed by the Council of the Gas Institute subsequently recommended Mr. Methven's screened Argand flame. This committee considered that sperm candles had undergone a change since their introduction so as to give a brighter flame than formerly, to the detriment of the gas companies. Later on, Mr. Dibdin expressed his doubts on this point, being rather inclined to believe, from his own experiments, that the tendency was the other way. But whether sperm candles burned brighter than formerly or not, Mr. Dibdin was convinced that they gave a variable light, and he recommended that they should be ousted from their position as the legal photometric standard. As a substitute, he was disposed to prefer the Keates lamp—a standard which, by an oversight, had not been fairly dealt with by the Board of Trade Committee. Thus the authorities were considerably at variance as to the proper substitute; but were generally agreed that the sperm candle, as a photometric standard, was simply to be looked upon as "the light of other days," to be got rid of—as Mr. Dibdin expressed it—"as speedily as possible."

The circumstance that the Board of Trade Committee reported in favour of Mr. Harcourt's pentane standard may perhaps account for the latest phase of the photometric controversy. The subject was in a state of quiescence when, early in the present month, a letter with the unmistakeable signature of "A. V. H.," appeared in the *Times*, calling attention to the Board of Trade report, and stating that the committee, while condemning the sperm candle, recommended "another standard." What this standard was, "A. V. H." did not say, but spoke of it as "described in the report." Despite the recommendation which had been given to it, the pentane lamp remained unadopted, the Board of Trade not being disposed to take any action until some public demand arose for them to do so. Accordingly Mr. Harcourt proceeded to set the ball rolling himself, and did so with considerable effect. In order to interest the consumers of gas in the matter, he ventured to suggest, not merely that sperm candles were untrustworthy, but that they were subject to an artful intervention on the part of the gas companies, who managed in an indirect way to get candles of inferior lighting power brought into the market, whence they ultimately passed into the hands of the official gas examiners. As might be expected, this accusation, though put in a somewhat guarded form, was followed by an explosive outburst on the part of the gas companies. Mr. George Livesey, the chairman of the South Metropolitan, and Mr. H. E. Jones, the engineer and general manager of the Commercial, at once replied to the "unfounded innuendo," and gave it an absolute denial. Mr. Sugg came afterwards, with a long and interesting letter, giving a large amount of information, and discrediting the notion that sperm candles were otherwise than as good as they should be, though subject to a degree of unavoidable imperfection. Mr. F. W. Hartley also wrote, declaring the suggestion that candle-makers had lent themselves to the production of a debased article in the interest of the gas companies was, "not only untrue, but ridiculous." But it is observable that while the gas companies and their friends fight against the charge of having played tricks with the candle, they all admit that the present standard is unsatisfactory. The companies themselves have sought to do something better, and are making extensive use of Methven's lamp. With respect to Mr. Dibdin, it is satisfactory to find that he is about to carry out the further series of investigations which he was anxious to make, for the purpose of determining the relative value of the proposed standards, as mentioned in our former article. Mr. Dibdin has no standard of his own to recommend, and has no other object than that of discovering the best practicable mode of measuring light. By means of a four-way photometer he will be able to test four standards simultaneously upon one gas flame, and the results, in such able hands, cannot fail to be of signal service in determining the important question now at issue.

Mr. Harcourt followed up his first letter by a second, in which he made a rejoinder to the reply which he elicited from Mr. George Livesey and Mr. H. E. Jones. He repudiated the idea of any direct collusion between candle-makers and gas-makers; but he signified that gas managers were quite aware of the difference in lighting power which prevails among the photometric candles, and gave their preference to candles of minimum brilliancy. The facts of the case, it may be presumed, are well known to manufacturers, and it is reasonable to suppose that they will make such candles as find the readiest market. But on this point there is a strong denial from Mr. Leopold Field, who asserts that the consumption of standard candles is too small to lay a manufacturer open to any temptation for the sake of gaining the trade. Of course, if gas of diminished lighting power is enabled to pass the standard, the consumer has to burn more gas in order to get the same quantity of light, and has to pay for the excess. Mr. Harcourt states that on a recent occasion a gas engineer of eminence complained to him of certain candles with which he had been supplied, their fault being that they seriously reduced the apparent lighting power of his gas. By way of remedy, this gentleman had purchased some other candles for future use. Mr. Harcourt tested both kinds. The first sort were found to give 7 per cent. more light than an average candle, and the second lot 4 per cent. less. The former might be considered unfair to the gas company, the latter were clearly unfair to the consumer. Mr. Harcourt observed in his second letter that there appeared to be no difference of opinion as to the necessity of legalising some other standard of light than the sperm candle. This is the point of agreement, and we may assume that the gas companies would themselves prefer an unvarying standard of comparison. It has been contended that if such a standard were provided, they would be able to fine their gas down to a lighting power just above the statutory limit; whereas now they are compelled to give a wide margin, lest by chance they should suffer from comparison with a candle of high lighting power. Respecting the part which Mr. Harcourt has taken in this matter, it is objected that, as a gas referee, he is bound to be an impartial as well as a competent authority, and that his impartiality is prejudiced by the attitude which he has assumed towards the gas companies, as well as by the fact that he is seeking to obtain official preference for an invention of his own wherewith to establish a new photometric standard. Granting that Mr. Harcourt's position as a gas referee is somewhat affected by this circumstance, it must be acknowledged that he appears as a public benefactor, while at the same time seeking nothing that would injure the companies in their rightful interests. Had he not insinuated that the gas companies were introducing a debased standard, no storm need have been raised. But Mr. Harcourt apparently thought the storm was wanted in order to overcome the inertia of the Board of Trade. This inertia he excused, on the ground that Government Departments felt the hopelessness of carrying any measure through Parliament until it was demanded by the force of public opinion. Whatever view may be taken of the course pursued by Mr. Harcourt, it is to be hoped that the requisite reform in this case will not be long delayed. At the same time it seems inevitable that the result of Mr. Dibdin's further experiments must be awaited before a new standard is offered for the approval of Parliament. A few months will doubtless serve to finish these investigations, and the data will then be sufficient to warrant further action. Something also has to be said as to the practical nature of the standard to be employed. A high scientific standard might be devised which would not be the best for ordinary purposes. Mr. Harcourt's device, excellent in many respects, is open to some objection on this score. The pentane lamp seems, perhaps, better adapted as a check on other standards, than as the actual working standard for daily use. The officers of the Metropolitan Board have large experience in this matter, and whatever may be said as to the proclivities of the candle makers, there is happily no suspicion that the Board itself is unduly influenced in favour of the gas companies. Hence the conclusions proceeding from this quarter are entitled to the more respect, especially when founded upon a long and careful examination of the subject by an expert of acknowledged ability.

SUCCESSFUL MEN.

The causes that have led to success are not always discernible in men that have risen, and there is, indeed, room for much difference of opinion on the mere abstract question of what are the necessary qualities of success. In every trade and profession men are seen to prosper of whom friends and acquaintances would hardly have predicted so much, and it would be interesting, and perhaps instructive, to find by a process of retrospection what were really the main stages and moving springs of their career. It is certainly not the rule that men who rise to the top of their profession do so by superior technical knowledge, although, as a matter of propriety, or according to unwritten conventional rules, such a supposition on the part of outsiders may be tacitly approved. On the contrary, it is generally by the display of qualities which would have led to success in almost any pursuit that they might have entered that engineers of eminence have succeeded. To the fact that this is not always appreciated is due much of the surprise and disappointment which are felt when men of whom much was expected fail in the race. That a full technical training is needed for professional men is too obvious to need discussion, and what is, or ought to be, learnt in the school or college can be acquired only with trouble in after life. But that which is merely one of several means to an end is often unduly exaggerated, and the clever student, who is at the head of his class, or who takes all the prizes, generally, if other qualities are wanting, is heard of no more when the real struggle of life begins. First, the very ordinary and common-place virtues are necessary—steadiness, integrity, perseverance, and punctuality; but they are at the command of all. Then come fertility of resource, self-reliance, and a sanguine temperament that forgets temporary failure in the hope of ultimate success. Opportunities for the exercise of these qualities come to all men in time, even though the occasions may appear petty or uninteresting; but if these qualities be wanting, no ability however great, nor scientific knowledge however profound, will prevail.

Some of the qualities that command success can hardly be classed as virtues; indeed, when carried to excess they might be deemed the very opposite. The concentration of effort on a particular purpose often leads—at any rate, in strong-willed men—to what the world may deem selfishness. It cannot be denied that those who rise to the top in any trade or profession are the masterful men, who, being determined to get their own way, do so with apparent disregard of others. Very often it is not really wilful disregard, but an absolute unconsciousness of the effect which their conduct has on other people. This masterful quality in men has many aspects, and shows itself in various ways. Sometimes it is distinctly a saleable quality, and one which, when used on behalf of others, commands a special fee. Thus the counsel at the parliamentary bar or elsewhere who can say the hardest things, or who can, with the greatest indifference to the feelings of a witness, discredit and demolish him, will be eagerly sought after. It may be merely the indifference of a thick-skinned man who does not know the sufferings he causes, or it may be sheer cynical disregard. In a more justifiable way there are engineers of eminence who largely owe their position to their special aptitude for baffling the keenest counsel and upholding in the witness-box their own or their client's schemes. Intense belief in oneself and the courage to force one's views on others is a form of masterfulness that leads often to success. The implicit trust of a patient in the ability of his physician is necessary to a cure, and the physician knowing this, assumes, even if he has it not, an absolute confidence in his own diagnosis and methods. So an engineer can hardly expect a client to trust him if he does not show that he trusts himself. The faculty of putting forward at its best whatever knowledge one possesses or acquires allows one to use liberally the talent of others who may lack this faculty while possessing great technical skill. In a recent well-known case in the Law Courts a sculptor was accused of being merely the broker of other men's ideas, and as really subletting all that his clients entrusted to him. In the case of an artist whose individual handiwork is sought, such deputing of it may be deemed, if not dishonest, at any rate uncandid. But an engineer with an established reputation, and whose individual skill is really confined to one branch of the profession, must either refuse work of a different kind when offered to him, or have it done for him by others, using, of course, his best judgment in the selection of his assistants, and taking upon himself the entire responsibility, and if he judiciously follows the latter course a wide career is open to him. Nothing succeeds like success, and if the public find that work of whatever kind entrusted to certain men goes well they will continue to employ them, careless of the method and assistance by which they gain their ends. There are occasionally men who seem capable of doing everything themselves. Isambard Brunel, for instance, was certainly an all-round man, who could, and did, as far as the time at his disposal would allow, do the veriest details of his varied work.

But what avails an analysis of the causes of success if the prizes are few and far between, and the chances be few for ordinary men? The engineering profession is said to be too crowded just now; parents who seek some occupation for their sons look askance at one in which it seems so difficult to find remunerative employment. Nevertheless, and even in the face of the present almost universal depression, we think that the business of an engineer presents as favourable opportunities for earning a livelihood as any of the trades and professions now available. We know that there are many who think otherwise; there are those who associate success in engineering only with certain kinds of employments no longer at command, and of which there are no signs of revival. For instance, the men who have been engaged on the survey and construction of English railways, who can compare the activity of twenty or even ten years ago with the dulness of the present time, may appear to have some justification for the cry that the good times have departed to return no more. But events seldom repeat themselves; conditions alter, and a revival, if and when it comes, will not follow in the old grooves. But while those who can only wait for a repetition of the past are standing idle, new careers have opened out elsewhere. If railway extensions in England are almost at an end—at any rate for those outside the staff of the existing companies—are there not the English colonies and foreign countries where railways are yet to build and Englishmen are wanted?

It is one of the great advantages of the engineering profession that the whole world is open to those who practise it. No one can for a moment suppose that there will be any lack of engineer recruits, notwithstanding the prognostications of evil. Just as all English boys are supposed to be born to the sea, so are large classes of them determined to be engineers; and though many who entered the ranks a few years ago complain bitterly of their early choice, none the less do we maintain that the profession, as a career open to all but the very stupid, does more than hold its own.

MINERS' WAGES.

As the crisp touch of autumn begins to be felt in town and country, an increase in the value of house coal takes place, and with it an improved demand for steam fuel. The reasons for this regular revival in the great industry are simple enough. Householders, looking to winter, begin to stock their cellars, and those who have laid in supplies earlier in the season fill up for Christmas; then in steam coal there is a pressure to make deliveries before the Baltic ports are closed. Both circumstances, therefore, work together for good in the coal trade. The discouraging aspect of the situation is that with the usual fillip which can be anticipated and discounted to a large extent, the miners, or rather their leaders, reopen the wages question, and disturb an industry which more than any other needs rest for recuperation. In Yorkshire—South and West—there have been many extensive contracts lost in consequence of the strikes causing ships to go north for supplies. This has grievously affected capital as well as labour, with the result that the miners have been deprived of employment, and the coalowners have generally not only made no profit, but positively lost money in working their pits. Now, as the business begins to feel the animating effect of winter demand, the note of discord is again sounded, and the cry is for 15 per cent. advance, the laying of the whole mining community idle, and the limiting of the output by the reduction of the hours of labour. This is the old folly tried again and again, and followed every time by defeat and disaster. When will miners learn wisdom? A season of rest and quiet, and recovery of lost trade, would do more to restore good times for the coalowner and collier than all the mass meetings which could be held. It is impossible, by heroic measures, to turn adversity into prosperity. To benefit a whole community by throwing it idle while the business drifts away to other districts, is about as wise as it would be for a man, before setting out on a long journey, to have both legs amputated.

STEEL CONSUMPTION IN STAFFORDSHIRE.

There is interesting information this week from Staffordshire concerning the opinions which are finding expression upon the progress of steel. Inquiries have just been made of some of the leading constructive engineers there as regards the existence among consumers of bridge and girder work of the preference which it was thought they would manifest for structures of steel over iron. The reply which has been given is that the change of taste is making only slow progress, and that wrought iron continues to hold its own with remarkable tenacity. Singularly enough, however, some engineers thereabouts say that even when steel is ordered they find a difficulty in getting it. If this circumstance argues an inability on the part of steel masters to supply constructive engineers' demands with all the alacrity needed, it is somewhat remarkable. Simultaneously, finished ironmasters in Staffordshire decline to be frightened into the idea that the days of the puddling furnace are gone. They argue that steel masters have yet much to do before they can secure perfect regularity in the quality of the material supplied from day to day in the ordinary course of business, and this week some ironmasters are enforcing their opinions by illustrating their own experience of experimental steel. Nevertheless, it is undeniable that steel in the form of ingots, blooms, billets, and the like, is being rolled down in gradually increasing quantities in the iron mills of Staffordshire alike into sheets, tin-plates, bars, angles, tees, and hoops. The solution, doubtless, is that in that part of the kingdom the newer metal is not making such strides, either for engineering work or for ordinary purposes, as some people had believed was certain to occur.

The Production of Feldspar in the United States in 1884 was 10,900 long tons, or 3200 tons less than in the previous year. Its value at the quarries was 55,112 dols.

Cooper's Hill.—A Parliamentary return has just been issued by the India Office showing the working of the new scheme for the college at Cooper's Hill during the last two years, the annual expenditure and receipts, the number of students who have entered the college since its foundation, and of those who have received appointments as civil engineers in India, together with the cost per head of the education of the students. The scale of fees is now £180, instead of £150 a year as formerly. The number of students in the college on July 18th this year, the date of the report, was 105; and in the last two years, out of 116 candidates who have presented themselves, 99 entered the college after examination. Thirty appointments were made in the same time, of which 26 were to the Public Works and 4 to the Telegraph Department. It appears that the average cost to India of each student during his three years' residence is £69 per annum.

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

(*From our own Correspondent.*)

THE state of the iron trade has not shown much alteration this week. No further accession of strength has generally taken place, and opinion is divided as to what we may expect in the next two or three weeks. On October 7th and 8th the quarterly meetings will be held, and these autumn gatherings often prove the most important of the whole year. It is not now thought likely that prices at those meetings will show much increase upon the rates which ruled at the July meetings.

Sheets will undoubtedly be firmer than any other description of iron, but marked bars are likely to be re-declared at £7 10s., with £8 2s. 6d. as the Earl of Dudley's quotation. Ordinary bars will be £6, and common £5 10s. down to £5 7s. 6d., and occasionally a shade less.

The galvanised sheet makers keep busy. Merchants are making more forward inquiries than for a considerable time. Australia, New Zealand, South America, India, and the Cape are all buying. There is a fair amount of unanimity among makers in demanding the 5s. advance. The Wolverhampton Corrugated Iron Company are making an extension of premises, and their capacity of output is 1400 tons per month.

Plate makers are still subject to a good deal of competition from the North of England ironmasters. Plates for pipe making, constructive engineering, and other purposes, are being ordered from the North by consumers in this district.

The business of Messrs. John Knight and Co., Cookley Ironworks, makers of best sheets and tin-plates, is being converted into a limited liability company, with a capital of £50,000, in £10 shares.

Pig iron is without much alteration on the basis quotations of 39s. to 40s. for Derbyshire sorts, 41s. 6d. for Lincolnshires, 55s. to 57s. 6d. for best Staffordshires, and 32s. 6d. to 35s. for common.

Some fresh bridge work on colonial account has recently come into the district, and with one important firm a fair contract of this description has been placed on account of Japan.

The Horseley Engineering Company, Tipton, has secured the contract for the supply of 4300 tons of wrought iron pipes for the Government water supply at Sydney, New South Wales. The pipes are of 6ft. mean internal diameter, and of 12ft. lengths, and will be sent away in four segments. They will reach a distance of nearly five miles. The plates are to be capable of withstanding a tensile strain of not less than 20 tons, with an extension of not less than 8 per cent. of the tested length. The bars are to withstand a strain of 23 tons, with an extension of 15 per cent.; and the rivet iron a strain of 26 tons, with an extension of 18 per cent. The work will be delivered in about twelve months. Tenders for the contract were invited in New South Wales as well as in England, and nine colonial tenders were received, in addition to nineteen English tenders. The colonial tenders, however, were so much higher than the English, that the Minister of Works had no alternative but to accept one of the latter.

The bridge and girder work which the Horseley Company has recently booked includes a lattice girder bridge of 250ft. span, by 32ft. wide, weighing in all 750 tons, for the Buenos Ayres and Consenada Port Railway. The company is also building about 220 tons of heavy wrought iron box girders for warehouse erections at the Brunswick Dock, Liverpool, on the London and North-Western Railway. A two-lift gasholder which they have in hand for Wrexham is of 28ft. diameter and 120ft. in depth.

The Patent Shaft and Axletree Company is steadily occupied in its varied engineering departments, but it does not report any special activity. It anticipates to benefit by-and-bye from the increased railway extensions in the Indian Empire. The Director-General of Stores for India is enquiring for a supply of triangulated girders of 170ft. span for the State Railways, together with brass boiler tubes and other work.

A large business continues to be done by the Patent Shaft Company in railway wheels and axles for home and foreign railways.

The railway carriage and wagon builders are experiencing a good demand for heavy wrought iron carriage and wagon underframes and other frame ironwork on account of the Indian and South American lines, and for some other export markets. The demand for finished rolling stock is, however, slack. Messrs. Brown, Marshalls, and Co. have just booked some good orders for iron underframes for the Nizam's guaranteed State Railway. They have also contracted for a couple of magnificent saloon carriages, which will be fitted with dining and drawing-rooms and other complete apartments, for the Western Railway of Buenos Ayres. The company has just sent away twelve saloons to London and South-Western Railway.

The demand for electric light machinery keeps good. Messrs. Elwell-Parker, Wolverhampton, are full of work. Their recent contracts include a dynamo of 25-horse power, and fifty accumulators, each weighing about 2 cwt., for the San Paulo Railway. The accumulators are of power to run about 300 incandescent lamps; but it is the intention of the railway company to employ arc lights when repairs are going on. The same firm have lately sent off a consignment of lighting batteries for a locomotive manufacturing company in Switzerland which would supply about fifty or sixty lamps. They are also supplying two of their new type four-pole vertical dynamos, each capable of running about 400 lamps to Lloyd's Register for their new buildings in London.

Engineers who cater for the corrugated sheet makers are tolerably well employed. The re-start of the extensive Osier Bed ironworks in Wolverhampton, by Messrs. J. Lysaght, may possibly bring out a few engineering orders.

The limited amount of railway extension abroad continues to operate unfavourably on the business of railway fastening makers. The Patent Nut and Bolt Co., Smethwick, seems, however, to be a favourable exception, since this concern is still running briskly, and is understood to be making good profits.

Messrs. Clark and Bunnett, London and Birmingham, have just erected two hydraulic lifts of improved form at the new Birmingham Liberal Club. The main lift is said to be the finest specimen in existence. Its principle is very simple. The cage rests upon a piston 60ft. long, which rises from a cylinder sunk to a corresponding depth below ground. The pressure acts directly on the piston, and as there is no machinery from above, the speed of the lift in rising cannot become excessive, depending as it does upon the speed with which the water can be pumped into the cylinder. The descent is equally safe. The power is accumulated by one of Messrs. Crossley's patent "Otto" gas engines.

The revival has not yet reached the wrought iron tube firms, although the season is rapidly advancing when the books should be filled with winter orders. I have information, however, that the annual reports of one or two exceptional firms, shortly to be issued, will show that capital dividends are being earned.

The Birmingham and Wolverhampton Chambers of Commerce have taken action on the list of questions issued by the Royal Commission on Trade. Both Chambers have appointed a special committee to consider the document, and report back. The instructions of Wolverhampton are coupled with the distinct proviso that the committee is to report only upon questions of fact, and not upon questions of opinion. The same Chambers have also resolved to assist in a conference of the whole of the Chambers of Commerce of the Empire, promoted by the London Chamber, to be held in London probably in July, 1886, in conjunction with the Indian and Colonial Exhibition.

Mr. Joseph G. Wright, principal in the ironmaking firm of Messrs. E. T. Wright and Sons, Monmoor Works, Wolverhampton, has this week been selected for nomination to the office of mayor next November. Mr. Wright has accepted the nomination.

A conference of miners, to which most of the mining districts in Staffordshire and the Midlands have appointed representatives, commenced to-day—Thursday—at Nottingham, with the intention to press for an advance of 15 per cent.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—The market has pretty nearly returned to its previous normal condition of quietude, and although prices do not return to their previous low basis there is very little buying going on at the rates now being quoted. There are, however, buyers in the market who would be prepared to place large orders for pig iron even at some advance upon old rates, but they are not disposed to give the full prices that are being asked, and as makers are not at all inclined to give way, business is held in suspense. The general tendency seems to be rather in favour of waiting; makers are apparently content to work on with the orders they have on their books—which in some instances are full up to the end of the year—rather than meet buyers with any concessions to effect further sales, whilst buyers prefer to hold back from further purchases at present rates until they can see what turn the market is likely to take. The manufactured iron trade, which has not been appreciably affected by the recent spurt so far as any upward movement in prices is concerned, remains about stationary, with a steadier business doing, and makers firm at late rates.

There was a full average attendance on the Manchester iron market on Tuesday, but generally only a slow business was reported. Lancashire pig iron makers have been selling pretty freely in forge iron to the finished iron works in the immediate district on the basis of 39s., less $2\frac{1}{2}$, delivered equal to Manchester, and they are very firm at this figure, with 6d. per ton more quoted for foundry qualities. For district brands the minimum quotations are also on the basis of 39s. to 39s. 6d., less $2\frac{1}{2}$, for forge and foundry qualities delivered equal to Manchester, but no sales of any weight are reported at these figures. Outside brands are without change, and for Middlesbrough iron prices are very firm at 40s. 10d. to 41s. 10d. net cash, according to brand, for delivery equal to Manchester.

For hematites only a very poor demand is reported at 52s. to 52s. 6d., less $2\frac{1}{2}$; good foundry brands are to be readily got for delivery into this district.

In the manufactured iron trade a fairly good demand is reported, but there is no pressure of orders in the market, and makers are not able to hold out firmly for any general advance in prices. Here and there a slight advance upon late rates is being quoted, the strongest tone being shown in sheets, for which local makers are now quoting from £6 15s. to £7 per ton delivered, but for good specifications the minimum figure remains about the average basis on which business is done. Bars are only in moderate demand, and it is exceptional where more than £5 5s. is being got, and for hoops, although orders have recently been coming in more freely, prices do not average more than £5 15s. per ton delivered into the Manchester district.

The condition of the engineering trades remains without material change. Here and there works are busy, and I hear that further large orders for textile machinery are coming into this district from Scotland, but the general position is one of slackness, with no present indication of improvement.

Messrs. W. T. Glover and Co., of Salford, have in hand a new fuel economiser in which several improvements are being introduced. One of the principal features is the construction and arrangement of the pipes; these have been reduced in diameter from the 4in. pipes that are usually employed, to 3in., and this enables a zigzag arrangement of the pipes to be introduced without blocking up the draught in the flue, whilst a thinner pipe can also be employed, which is a further advantage in getting the best results from the waste heat. The distance between the centres of the pipes across the flues is 9in. and 6in. in the depth, so that while as large a surface as possible is exposed, against which the heat actually impinges in passing through the flue, a sufficiently clear space is left to prevent any serious obstruction of the draught. The pipes are fixed into bent ends at the top and bottom and held in position by a top plate, which prevents the draught escaping into the flue without passing round the pipes, whilst it can be readily removed for replacing pipes or scrapers without the necessity of going into the flue. The scrapers are also of improved design, and are made in three sections with an acute angle, so that they act as a knife against the scale of the pipes. The gearing for actuating the scrapers has also been very much simplified, and the whole apparatus is carried complete on an iron frame. This economiser is of the rapid continuous circulating type, but Messrs. Glover intend applying the same arrangement of pipes to Green's system of slow circulating economisers.

Improvements in high and low-pressure filters, for dealing with large quantities of water required for works' purposes, have also been introduced by Messrs. Glover. The chief feature in these filters is that they are fitted with horizontal and vertical filtering beds, by means of which an exceptionally large filtering surface is obtained in the smallest possible space. The horizontal bed is termed the first filter bed, and this is charged with an inexpensive material, which, when saturated with deposits from the water, is raked out and thrown away, and the bed recharged with fresh material, an operation which can be effected in about fifteen minutes. The vertical filter beds are arranged in double sets, and are called second filter beds. The vertical position of these beds prevents the deposit of dirt on their surface, and it falls to the bottom of the cistern, whence it is blown out through a slush trap. These vertical filter beds stand immersed in the water, which passes through perforated holes and the filtering material to the centre, from both sides at the same time; it then passes through valves into a longitudinal pipe, and forward to where it is required. To cleanse the vertical filter beds a back-pressure bed is applied to one end of the longitudinal pipe, which conveys a pressure of steam or water to the inside of the vertical filters, whence it drives the filth which falls to the bottom outwards, and thence through the slush trap. Several low-pressure filters of this type have recently been supplied to works in this district, for dealing with from 5000 to 6000 gallons per hour; in one case filtering the river Irwell water, and in another canal water, with, I understand, excellent results. Another filter for dealing with 10,000 gallons of canal water per hour is being erected at Huddersfield.

After the statements recently made that in face of the superiority of the Belgian engines shown at the Antwerp Exhibition, English makers need not expect much work from the above quarter, it may be interesting to mention that Messrs. Browett, Lindley, and Co., of Salford, have received an order for a pair of mill engines for Belgium, which are to be constructed of their most recent type, with automatic link expansion gear, and controlled by Porter governor. The engines are of 40-horse power, and have a pair of 14in. cylinders on Corliss frames; steel is used for the shafts and pins throughout, and all the working joints are case-hardened.

In the coal trade anticipations of an advance in prices next month is bringing forward an increasing demand for house-fire coal, but in no other class of fuel is there any improvement. Requirements for iron-making and steam purposes continue extremely limited, and common round coals are as bad to sell as ever. The continued strike in the cotton trade, and the depression in other branches of industry, are throwing a large quantity of engine fuel upon the market, and slack is quite a drug, with lower prices being taken to clear away stocks than have been known in the market for years past. At the pit mouth prices average about as under:—Best coal, 8s. 6d.; seconds, 6s. 6d. to 7s.; common, 5s. to 5s. 6d.; burgy, 4s. 6d. to 4s. 9d.; best slack, 3s. 6d. to 3s. 9d., with common sorts to be got at from 2s. 3d. to 2s. 6d. per ton.

Collieries here and there are still tolerably busy with orders for shipment, but generally the shipping trade is reported as being quiet, with extremely low prices being taken to secure orders, and steam coal delivered at the Garston Docks and the high level, Liverpool, can be got at from 6s. 9d. to 7s. 3d. per ton.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

THERE are additional indications that another agitation is about to be commenced for an advance of wages in the coalfield. This time the note of warning comes from Derbyshire. On Saturday a conference of Derbyshire miners' delegates was held at Chesterfield, when the report of what passed at the Manchester meeting in July last was submitted. At that conference it was resolved to bring before another gathering, to be held at Nottingham, the question of requiring an advance of 15 per cent. on the present rate of wages, and the best means of obtaining it. The committee expressed the opinion that the best way to secure the advance will be by laying the whole mining community idle, and afterwards limiting the output, either by working shorter hours or fewer days per week. The Derbyshire miners have approved of this programme, and appointed a deputation to represent their district at the Nottingham Conference.

The miners of the St. John's Colliery, Normanton, have been strongly advised by a circular issued by the local branch of the Yorkshire Miners' Association to join together for the purpose of securing an advance in wages. They are told that the advance obtained three years ago was lost because they became disorganised, and the masters took advantage of the opportunity to lower wages. If they became united again, the men are assured "there is no combination of dollars that can ever equal the power of the working man."

The Sheffield Chamber of Commerce have had under consideration a series of questions propounded by the Royal Commission on the Depression of Trade similar to those which have been sent to the other Chambers throughout the United Kingdom. There has been a singular display of feeling of a political character about the manner in which the various Chambers have treated these requests of the Government Commission. This diversity of opinion has, no doubt, arisen out of the controversy popularly known as "Fair-Trade *v.* Free-Trade." There was less of this at the Sheffield Chamber of Commerce than at others, but still there was some attempt made to have the questions shelved. The majority of the Chamber, however, did not feel at liberty to treat the request of the Commission in this fashion, and they therefore appointed an influential committee, consisting of the President, Mr. J. Willis Dixon; the vice-presidents, Mr. Charles Beck, Master Cutler, and Mr. John Marshall; with Mr. F. Brittain, Mr. J. E. Bingham (ex-Master Cutler), Mr. G. F. Lockwood, Mr. E. M. Bainbridge, and the secretary, to consider the questions, to answer such of them as relate to facts, and to report upon others that they consider cannot be correctly answered. The committee were also authorised to issue a circular to the members of the Chamber, who are more or less directly associated with all the trades carried on in the Sheffield district, asking for information to be supplied on any or all of the questions propounded by the Commission.

The Sheffield Chamber of Commerce have also had under consideration a communication from the Birmingham and District Railway and Canal Rates Association, inviting them to attend a public conference at Birmingham, under the presidency of the Right Hon. Lord Henniker, with reference to the recent decisions in favour of terminal charges by railway companies, the unfair preferential rates granted to foreign traders by English railways, and to ascertain the best means of protecting the interests of freighters in Parliament. Mr. E. M. Bainbridge and Mr. W. C. Leng were requested to attend on behalf of the Chamber and report the result of the conference to some future meeting of the Council.

Our commercial relations with Spain do not seem to improve. While the British Government has obtained the sanction of Parliament to the extension of the alcoholic scale to the requirements of Spain, the Government of that country has neglected to carry out their side of the engagement, to admit British commerce to most favoured nation treatment throughout the Spanish dominion. This is regarded as a matter of serious interest to the Sheffield district, where a much larger trade can be done with Spain if other matters were equal, and competition with German and French manufacturers could be maintained.

By what appears to have been the neglect of the engineer at the Oakwell Colliery, Ilkeston, Derbyshire, last Thursday, the cages were overwound and smashed, one against the headstocks, and the other to the bottom of the shaft. Three hundred miners were entombed for several hours, but were subsequently rescued by means of a bucket *viâ* the ventilating shaft. Considerable damage was done to the engine-house, but work was resumed on Monday morning.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

THE attendance at the iron market held at Middlesbrough on Tuesday last was small, and but little business was transacted. The tone was, however, steady, and as less iron was on offer than at the previous market, prices did not fall below the minimum then accepted. For prompt and early delivery merchants accepted 32s. 9d. per ton for No. 3 g.m.b. Makers quoted 6d. to 9d. per ton more than that figure, and could not be tempted to reduce. Seeing that they have orders which will last them some weeks, there is no present need for them to press their iron upon the market.

Warrants are firmly held, the price quoted by most holders being 34s. per ton. Buyers offer 33s. 9d., but only in exceptional cases is that figure accepted.

The stock in Connal's Middlesbrough store continues to increase at a rapid rate. On Monday last the quantity held was 94,360 tons, being an increase of 5541 tons for the week. At Glasgow their stock is 623,188 tons, the increase last week being 2537 tons.

Shipments of pig iron from the Tees are so far larger than in any previous month this year. Up to Monday last 59,597 tons had been sent away, being about 6000 tons more than in the corresponding portion of August.

There is no improvement in the finished iron or steel trades, and quotations remain as follows: Ship plates, £4 15s. per ton; angle iron for ships, £4 10s.; common bar iron, £4 17s. 6d.; steel plates, £7; steel angles, £6 10s.; and steel rails, £4 15s. All f.o.t. at makers' works, less $2\frac{1}{2}$ per cent. discount.

The directors of Messrs. Armstrong, Mitchell, and Co. have declared a dividend at the rate of 8 per cent. for the year ending June 30th last.

Messrs. Schlesinger, Davis, and Co., of Wallsend, have been placed on the Admiralty list as builders of vessels for the British Government.

Dr. Spence Watson, of Newcastle, has again consented to officiate as referee to the North of England Board of Arbitration. The employers claim a reduction of $7\frac{1}{2}$ per cent., the men objecting to any further reduction whatever. The date of the arbitration has not yet been fixed.

Two eminent and old-established Tyneside firms have just decided on amalgamation and re-construction as a private limited company. The firms in question are R. and W. Hawthorn and Co., locomotive and marine engineers, and Andrew Leslie and Co., iron and steel shipbuilders. The style of the new company will be R. and W. Hawthorn, Leslie, and Co. Mr. Leslie, who established the iron shipbuilding business some thirty years since, and with indomitable pluck and perseverance, through great difficulties, worked it up to a high state of prosperity, retires. His partner and son-in-law—Mr. Coote—will assume the chief control of that department. The engineering departments will be conducted precisely as before. There are many advantages in the application of the limited principle, even though the proprietary and management remain unaltered. Not the least of these are the facility afforded for transferring shares, for resigning leading positions, and appointing successors to them, and for associating together capitalists of varying means without unlimited liability. The above firms evidently appreciate these advantages just as those which composed the eminent and prosperous company at Elswick and many others have done. There is little doubt that they will be as successful in the future as they have been in the past.

The remarkable quiescence which has succeeded to the spurt in the iron trade, and in the value of public securities, which set in a month ago, has caused the latter to be christened the "newspaper boom." All are now agreed that it began at the wrong end; in other words, that it enhanced the value of materials before there was any increase in the consumption of them. No one can find any increased activity in those trades wherein pig iron is used. On the other hand, there has undoubtedly been a transference of the ownership of stocks, from makers, brokers, and merchants to outside capitalists. This is a solid advantage so far as it goes, but it has done nothing whatever to re-employ idle labour and set the lagging wheels of industry going. The managers of the daily newspapers in the North naturally lay themselves out to supply whatever information their readers are eager to obtain. Thousands of the latter seek with greediness every morning for some tidings, some signs of better times. It cannot be wondered at, when hopeful news does arrive, it is made too much of. That which recently came from America to the effect that railway property there had risen in value was talked about, written about, expanded, enlarged upon, speculated upon, and operated upon, until great expectations were excited as to returning prosperity here. These expectations have not been realised—at least, not yet—and considerable disappointment has naturally ensued. The "bears" especially sneer at the newspaper boom, and are hard at work at their old game of bearing prices. It is to be hoped, however, that the better feeling will not altogether pass away. It is something to have disturbed, even for a brief period, the dead level of depression which had seized upon the industrial world everywhere. But if, and when, another wave of hope arrives, it will be well for the prophesying journals not to be in such a hurry to magnify it. Such a policy cannot do any good, and may do great harm. In the boom of 1879 the workmen in the iron trade in the North were excited prematurely by what they read in the papers, so that they struck in all directions, until they obtained heavy advances of wages, and that before their employers had reaped any advantage whatever. Three montns afterwards another strike took place, when the above unwarranted advance had to be taken off, owing to the disappearance of the short-lived boom. It is therefore to be hoped that the newspapers will throw their influence on the side of moderation and caution, and will not encourage, much less initiate, booms of any kind.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

THERE has been again a rather better feeling manifested in iron circles this week. This has been due mainly to an increase in the shipments—several thousand tons greater than was anticipated. They amounted to 12,214 tons, as compared with 7557 in the preceding week, and 11,021 in the corresponding week of 1884. The principal shipments were to the United States, Canada, and Australia. An additional furnace having been put in blast at Gartsherrie, there are now ninety in operation, as compared with ninety-four at this date last year. In the course of the week about 2600 tons of pigs were added to the stock in Messrs. Connal and Co.'s Glasgow stores.

Business was done in the warrant market on Friday up to 43s. cash. On Monday forenoon transactions occurred from 42s. 10½d. to 42s. 11½d. cash, the afternoon's quotations being 42s. 9d. to 43s. cash. Tuesday's market was irregular at 42s. 8½d. to 42s. 10d. cash. Business was done on Wednesday at 42s. 10½d. to 42s. 11d. cash. To-day—Thursday—business was done at 42s. 11½d. cash, which was the closing quotation.

The values of makers' iron are generally firm, and certain brands show an advance. Free on board at Glasgow, Gartsherrie, No. 1 is quoted at 46s. 6d. per ton; No. 3, 44s. 3d.; Coltness, 50s. 6d. and 46s.; Langloan, 48s. 6d. and 45s. 6d.; Summerlee, 48s. and 44s.; Calder, 52s. and 44s.; Carnbroe, 45s. 6d. and 42s. 6d.; Clyde, 46s. 6d. and 42s. 6d.; Monkland, 43s. and 41s.; Quarter, 42s. 6d. and 40s. 6d.; Govan, at Broomielaw, 43s. and 41s.; Shotts, at Leith, 47s. 6d. and 46s. 6d.; Carron, at Grangemouth, 51s. and 47s.; Kinneil, at Bo'ness, 44s. 6d. and 43s. 6d.; Glengarnock, at Ardrossan, 46s. and 42s. 6d.; Eglinton, 42s. 6d. and 40s.; Dalmellington, 44s. and 41s.

Messrs. Merry and Cuninghame have applied to the Scottish Pig Iron Trade Association to have their Ayrshire brand M. and C. admitted to the class of G.M.B. It is to be presumed that there will be no difficulty about this, provided the analysis of the iron is sufficient to warrant its classification.

The annual meeting of the Monkland Iron and Coal Company was held in Glasgow on Tuesday. The report, already published, showing a loss on the year of £11,000 and on three years of £58,000, was held as read; but when the chairman, Mr. Reid, proposed its adoption, Mr. George Wilson, of Dalmarnock, moved that it be received but not adopted. The amendment was duly seconded, and Mr. Wilson produced proxies sufficient to carry it. The directors proposed by the chairman were rejected in a similar way, and others put in their place. It will be necessary to call another meeting to see what should next be done.

The past week's shipments of iron and steel goods from Glasgow have included £3414 worth of machinery, £6400 sewing machines, £2200 steel goods, and £41,000 general iron manufactures, the total being rather less than usual. The iron goods embraced £9400 worth of cast iron pipes for Monte Video, and £6400 pipes, &c., for New South Wales.

In consequence of the serious depression in trade, notices have been posted at the ironfounding works in Johnstone of a reduction of 1s. per week on the wages of moulders, dressers, and labourers. On Saturday a number of the moulders were discharged, and the prospect is the reverse of cheering.

Some trouble has occurred at the Dalzell Steel Works of Messrs. David Colville and Sons, Motherwell, as the result of an intimation of a reduction of the wages of levermen and hammermen. The soaking pits recently constructed at the works save a considerable amount of labour formerly required in the reheating of the ingots, and it was on this account that the employers determined to reduce wages. In this they appear to have been fully justified. The intimation resulted in a strike, but the men have since gone back to work.

Speaking at the annual meeting of the Steel Company of Scotland, held in Glasgow a few days ago, Sir Charles Tennant, Bart., M.P., reminded the shareholders of the opinion he expressed twelve months ago, that the gloom which had so long overhung the iron and steel industries was nearing its end. He was sorry to say that his hopes had not been realised, for from that date up to the close of their financial year the depression had been of an almost unparalleled character. The dividend of 4 per cent. now to be paid he considered a reason for congratulation in the circumstances. The application of steel for all works of a constructive nature continued to increase, and while the productive power of the steel works was also extending, Sir Charles said he did not doubt that this company would continue to receive a fair share of the orders in the market. He paid a high compliment to Mr. Riley, the manager, for the excellent way in which the works were conducted.

The Scotch coal trade is in a satisfactory condition as regards the amount of business passing. Orders for domestic purposes are materially increasing, the shipping demand is well maintained, and ironmasters have been in the market this week trying to fix quarterly contracts for splint coals. Coalmasters report, however, that they have as yet failed to obtain any advance on prices. The past week's shipments of coals included 22,948 tons at Glasgow, 15,434 at Grangemouth, 10,401 at Ayr, 4488 at Troon, 2483 at Irvine, and 2012 at Greenock.

At the last weekly meeting of the miners' delegates at Hamilton, it was again resolved to approach the masters for an advance of 6d. a day in wages. It is not expected that the men will be at once successful, but the coalmasters state that the miners' weekly holiday is now being more generally observed, and should it become universal, it will create a scarcity of coals that will force up prices and enable them to concede the increase of pay. The best feeling exists among the masters on the subject, and they will no doubt give the men the 6d. at the earliest possible opportunity.

The Executive Board of the Fife and Clackmannan Miners' Association have passed the following resolution:—"That this Board learns with satisfaction that strenuous efforts are being made to establish the eight-hours' day in Lanarkshire, and expresses the hope that success will attend the effort, believing that if the time were restricted generally throughout the West of Scotland an advance of wages would assuredly be easily obtained."

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

I HAVE passed over a great breadth of country during the last few days, and from one end to the other the prevailing tone is one of depression. Every industry is flagging, and yet coalowners and ironmasters remain hopeful, and think that with the autumn a desirable change will be forthcoming. In the matter of coal it is the small coalowner who suffers most. As for the larger men, they come in for Government contracts, which if taken at low figures, yet leave a small margin, and keep the colliers employed. During the last few days the much welcomed Peninsular and Oriental contracts have been given out, and as usual some of our leading coalowners have secured a share. Amongst these I am glad to note the Glamorgan, Powell Duffryn, and Tylors; Dinas, too, and Ferndale are included, and the senior institution amongst collieries, Locketts Marthyr, which, if I am not mistaken, had a steam coal trade prior to the Taff Vale.

I may be allowed to claim some small prescience in the forecast of coal sinkings. A month ago, and gloom to a great extent extended itself over Pontypridd. Men of ability told me that the great Ynysbwl sinking, in which Ocean Davies was engaged, had proved a failure; they had gone a long way below the depth where it was thought that coal would be found, and still no coal. Having confidence in the Messrs. Beith, and judging from the character of the locality, my prediction was that coal would be struck, and this week the highest hopes were realised. The seam struck is the well-known 6ft., such as has proved so remarkably well at the Ocean Colliery, and it has been found at a depth of 545 yards. It is in capital condition for working, having a holing of soft shale beneath, which renders the collier's task an easy one. Great credit is due to the sinkers, Messrs. Beith, and to Mr. William Jenkins in the undertaking, and Mr. Morgan Joseph, too, must not be forgotten. The sinking was begun in June, 1884, and now a fine new coal-field will be opened out. The Taff Vale Railway has long prepared for the event, and will now reap the reward of the forethought exercised.

Generally speaking the steam coal trade is in its old inanimate condition, and steam small shares in the depression, and is by no means so firm in price as it has been.

House coal is in little request, but a few weeks may be expected to tell upon this trade, and October totals will certainly be better locally and for shipment.

Patent fuel, singularly enough, is an industry that shows more activity in degree than coal, and at Cardiff and Swansea good cargoes have been despatched. The trade is yet too young at Newport to call for much comment.

In respect of the proposed amalgamation of the Rhymney and Taff Vale Railways, a correspondence has taken place between Mr. Boyle, the chairman of the Rhymney line, and Mr. Sayce, who issued a circular letter in advocacy of the amalgamation. Mr. Boyle, while admitting the advantages of a fusion to some extent, yet insists upon the directors being left to their own judgment. At present the views of the two boards are very dissimilar, and any outward influence which would force them to agree might be prejudicial to the interests of the Rhymney. Mr. Boyle evidently believes in a waiting game. The public think the time a good one for all parties, and influential shareholders on both railways take the same view.

There is not much to notice in the iron and steel trades, only that the hopeful view is still prominent. The consignments of the week from Newport were 1699 tons to Montreal, 836 tons of rails and 730 tons of steel sleepers to Madras, 126 tons of machinery, 82 tons of tie bars, and 166 tons of wire to the same destination I must not omit to note that the pair of horizontal engines used at the sinking of Ynysybwl were made and erected by Lee and Co., of Patricroft. Six steel boilers already placed are by D. Adamson and Co. The winding engines to be supplied early in October are by Daglish and Co., St. Helens.

Cefn Glas Colliery has been restarted, and under hopeful prospects. 2000 tons of tin-plate were shipped this week from Swansea for America. Tin-plates are decidedly looking up. Stocks are getting very low, and buyers soon will have no alternative but to put in orders. Prospects of the trade are better at Swansea, and I am glad to note this, as the coal trade there is flat. The failure of the Lower Resolven Colliery Company at Neath and stoppages of their collieries and Neath Merthyr, make things look black for the port of Swansea, which has been the outlet.

AMERICAN NOTES.

(*From our own Correspondent.*)

NEW YORK, September 12th.

THE Government is taking steps for the transfer of an immense amount of gold and silver coin from San Francisco, New Orleans, Carson City, St. Louis, and other distant towns, to New York city and one or two other commercial centres, where it is probable it will soon be wanted. Twenty millions of dollars are to come from New Orleans, five millions of which are coming by water and the balance by rail. The possibility of financial stringency is recognised in high financial circles. A vigorous effort will be made to repeal the Act permitting the coinage of silver at 2,000,000 dols. per month. The Financial question and the Tariff question promise to create unusual interest in Congressional circles this winter. The Silver question is to be the subject of special consideration at the annual convention of the American Bankers' Association in Chicago, on September 23rd. Among other questions that will come up there are reforms in extradition treaties; the avoidance or the diminution of the evils periodically occurring from financial panics; the unprecedented growth of wealth, material, and motive power, especially in the West and South; the developments of the iron and cotton manufactures in this section. There are 8000 banks throughout the United States, and representation has been requested from all.

The volume of idle money is at a standstill, and it is probable that the improving industrial activity will find employment for a portion of it. One hundred thousand pounds in sovereigns arrived from Australia at San Francisco. Large shipments are expected from across the Atlantic. The United States Treasury has at present 517,000,000 dols., of which 250,000,000 dols. are in gold and 170,000,000 dols. in silver dollars and bullion. The industrial interests are apprehensive of agitation upon the silver question, and the consequent unsettling of values. Various organisations have been formed for defensive purposes, and any attempt to inaugurate radical measures by the banking interests will be vigorously met. The manufacturing interests will request that tariff duties be permitted to remain where they are; but it is evident that there is a powerful body at work, which will be able to secure attention to the very last.

A bitter war of rates is in progress in the south-west, in consequence of the cut of 55 per cent. in eastern rates out of Chatanooga, Tenn. It was met by a competing cut of 60 per cent. The Louisville and Nashville, and other roads, are being thrown into the fight. Thus far it is confined to the passenger rates. The Union Pacific has borrowed 6,000,000 dols. on favourable terms. Several other roads are in the market for money, and this demand will serve to absorb some of the surplus which has been begging for employment for months.

The manufacturing interests throughout the country are inclined to believe that the present improvement will continue throughout the autumn and winter. Rolling mills, rail mills, sheet mills, bridge works, car works, the hardware industries, and agricultural implement establishments have, within a few days, received large orders for material to be delivered during the rest of the year. Prices have not improved, but manufactures everywhere are more anxious for business than for wider margins. There is a heavier demand for machinery for textile mills. The rail mills are crowded with orders for the rest of the year. Heavy exports of copper continue. Lake is selling at 11 cents. The demand for wire rods continues heavy, and sales are from six to seven thousand tons per week. English Bessemer and spiegeleisen are quiet, at 19 dols. for Bessemer and 25 dols. for spiegeleisen. Receipts of tin-plates since January 1st are 1,286,237 boxes at this port; at Philadelphia, 631,379 boxes; at Baltimore, 317,588 boxes; at Boston, 113,054 boxes. The consumption of iron and steel is steadily improving, but no increase in price is probable until manufacturing capacity is pretty well absorbed for the next ninety days. Labour strikes continue with increased frequency because of the industrial improvement. Labourers are taking advantage of the activity to demand higher compensation, and in the majority of cases slight concessions have been granted even where no corresponding advance has been made in products.

LAUNCHES AND TRIAL TRIPS.

ON the 14th inst. Messrs. Oswald, Mordaunt, and Co., Southampton, launched a fine iron screw steamer of about 1800 tons net register, and of the following dimensions:—Length, 323ft. 6in.; breadth, 38ft. 6in.; depth of hold, 26ft. 9in. The vessel has been built for Messrs. Lamport and Holt, of Liverpool. She is brigantine rigged, having pole masts of iron. Accommodation is provided for captain and officers in full poop; engineers and petty officers under bridge deck; crew and firemen under togallant forecastle. She is fitted with Harfield's windlass, with capstan combined for working ship. Quartermaster steam steering gear amidships; screw gear aft; anchor crane on forecastle; four steam winches for working cargo. The engines and boilers are by the same firm; the engines being compound surface condensing, with cylinders 34in. and 70in. diameter, with a stroke of 4ft.; built crank-shaft; steam and hydraulic reversing gear. Steam is generated by two large multitubular double-ended steel boilers, each having four furnaces, at a pressure of 100 lb. per square inch. The vessel has been built under the superintendence of Mr. John Russell. As the vessel left the ways she was named the "Spenser" by Miss Ella Oswald.

The steamship Shieldrake, built at Dundee, by Mr. W. Thompson, of Glasgow and Dundee, made a steam trial outside the river Tay on Monday, the 14th inst., when very satisfactory results were obtained. The Shieldrake, which has been built of steel for the Cork Steamship Company, is of the following dimensions: 250ft., by 32ft., by 15ft. 8in., with compound surface-condensing engines of 160 nominal horse-power; cylinders, 29in. and 37in.; stroke, 48in.; steam being supplied from a double-ended steel boiler, at a pressure of 90 lb., engines and boilers being made at Mr. Thompson's Tay foundry. Leaving Dundee in the forenoon, the steamer made direct for the Bell Rock, where the Ferdinand Brum, a Swedish barque, timber laden, had stranded the previous day. On arriving close to the rock, Mr. Thompson and Mr. Anderson, his manager in the Caledon Shipyard, who were both on the steamer, boarded the stranded barque—the weather being favourable—and from the examination they made came to the conclusion that the vessel might be towed off at high water. The Shieldrake was then put about for the Buoy-of-Tay, and from that point ran to the Beacon at the Carr, doing the distance at a speed of 12·7 knots per hour. On the return run from the Carr to the Buoy-of-Tay, against the tide, the speed observed was 12·27 knots, giving a mean speed of about 12½ knots, during which the engines indicated 1326-horse power, at seventy-eight revolutions per minute. On reaching the Buoy-of-Tay on the northward run, the Shieldrake made again for the Bell Rock, which was reached shortly before flood tide. By this time the stranded vessel appeared to be afloat, and a boat containing Mr. Anderson and some of the hands put off from the steamer, and were soon aboard the wreck, from which a hawser was passed on to the steamer, and a little before sundown the barque was successfully towed off the rock. It was now found that the chains having fallen through the broken bottom were dragging, and until these were cut little progress could be made in towing; accordingly the Shieldrake stood by the barque all night, and at daylight a number of men under Mr. Anderson boarded the derelict and cut both cables. Towing was then resumed, but as the wreck had a heavy list to port, and floated only on her cargo, which consisted of pitch pine logs, and a strong breeze prevailing, very little progress was made. About nine o'clock the tug, Iron King, came up, and an agreement being entered into for her assistance, good progress was made in the direction of the river mouth. When about half way to the Buoy-of-Tay the wind came away with increasing force from the south, and the services of a second tug, which by this time had appeared, were likewise secured, and later on a third tug appearing was also engaged, and with the Shieldrake, and the three tugs towing, a good speed was obtained, and during the course of the afternoon the barque was successfully beached in the West Ferry bay, about three miles below Dundee. The vessel had suffered damage to such an extent that repairs will probably be considered impossible, but the salvage of her cargo, valued at about £2500, will form a good prize to those who took part in the work.

DECLINE IN SHIPBUILDING.—The official report of the Registrar-General of Shipping and Seamen states that in the past month there were added to the registers of the United Kingdom and the Colonies 114 vessels, the net register tonnage of which was 38,974. In the same time the number of vessels removed from the registry was 166, the net tonnage being 37,915. Out of the vessels added only thirty-six were steamers, and many of these were of small dimensions, for river or special service—five iron steamers being added to the register for the United Kingdom of less than 100 tons each, while all the wooden steamers added to the United Kingdom register were less than 20 tons each. The chief addition to the tonnage last month was in the iron sailing vessels—fifteen being added to the register for the United Kingdom, of the net registered tonnage of 19,787. All the wooden sailing vessels added to the United Kingdom register last month were of small dimensions, with one exception, twenty-four ships being below 100 tons net register, and only one above that tonnage. Similar remarks apply to the colonial registers, so that it would seem that there are now very few large vessels being built, and that the building carried on is of vessels for special trades and uses. On the other hand, the loss of vessels is more varied, the iron steamers removed from the registry being fourteen, of a net tonnage of 9485. Taking both home and colonial registers, the horse-power of the vessels added last month was 2708, and that of the vessels removed was 3158, so that the effective carrying power is being reduced.

NEW COMPANIES.

THE following companies have just been registered:—

Venezuela Western Railway Company, Limited.

On the 16th inst. this company was registered with a capital of £300,000 in £10 shares, to acquire concessions granted by the Venezuelan Government for the construction and working of a railway from La Fria to El Brazo or Encontrados. The subscribers are:—

	Shares.
Emil Josaphat, 11, Duke-street, London Bridge, wine merchant	1
Samuel Samuels, 18, Old Broad-street, stock-broker	1
W. A. Ross, Empire Club, Grafton-street	1
A. H. Thorne, 38, Old Jewry	1
F. Fowler, C.E., Aylesbury	1
J. A. Eaton, C.E., 49, Starch-green-road	1
E. F. Grainge, 36, Bromer-road, Denmark-hill, bank secretary	1

The directorate is to consist of not less than four nor more than seven members; the subscribers are to appoint the first. Qualification for subsequent directors, 20 shares or equivalent stock; remuneration, £1500 per annum.

Ulpha Copper Mining Company, Limited.

This company proposes to acquire and work the Long Garth Copper Mines, in the parish of Ulpha, Cumberland. It was registered on the 14th inst. with a capital of £12,000, in £1 shares, with the following as first subscribers:—

	Shares.
S. Birkett, M.E., Millom, Cumberland	1
T. Cock, Dalton-in-Furness, mining agent	1
M. L. Boundy, Millom, turner	1
R. Dinnis, Millom, turner	1
R. McGowan, Millom, auctioneer	1
W. Voisey, Millom, miner	1
W. Sharpe, Millom, miner	1

Registered without special articles.

Garw Water and Light Company, Limited.

On the 14th inst. this company was registered with a capital of £30,000, in £10 shares, to carry on the business of a water, gas, and electric light company, in all branches, for the purpose of supplying several parishes in the county of Glamorgan. The subscribers are:—

	Shares.
C. L. Waugh, M.E., Pontycymmer	20
J. Walters, Treherbert, grocer	30
E. T. Kynns, Rhondda Valley, grocer	30
E. S. Pike, Rhondda Valley, gas and water manager	12
D. Roberts, Ynore Vale, overman	20
J. Williams, Tynewydd, grocer, &c.	20
J. Barrow, M.E., Malstey, Glamorgan	20
W. R. Randall, Bridgend, Glamorgan, solicitor	30

The number of directors is not to be less than three nor more than seven; qualification, shares or stock of the nominal value of £100. The subscribers are to appoint the first directors, and act *ad interim.* The company in general meeting will determine remuneration.

Talk o' th' Hill Colliery Company, Limited.

This company was registered on the 11th inst. with a capital of £50,000, in £10 shares, to carry on business as colliery owners and working ironmasters, brick and tile manufacturers. The subscribers are:—

	Shares.
A. F. Wallan, 8, Austin Friars, merchant	1
F. H. Birley, East Grinstead, barrister	1
*T. H. Birley, 66, Peter-street, Manchester, commission agent	1
A. E. Harty, 16, Charlotte-street, Manchester, calico printer	1
*John Dunn, 53, Brown-street, Manchester	1
G. H. Gaddum, 7, South-street, Manchester	1
*J. Hardman, Wetley Abbey, Leek	1
*S. Murray, Levenshulme	1
Peter Dunn, 53, Brown-street, Manchester	1

The number of directors is not to be less than three nor more than five; the first are the subscribers denoted by an asterisk. The company in general meeting will determine remuneration.

Atlas Soap and Candle Works Company, Limited.

This is the conversion to a company of the business of soap and candle manufacturer carried on by Mr. Richard Thomas Gray at the Atlas Soap and Candle Works, Lemon Quay, Truro. It was registered on the 14th inst. with a capital of £5000, in £20 shares. The subscribers are:—

	Shares.
R. T. Gray, Lemon Quay, Truro, chandler	20
C. W. Weirbank, Truro, jeweller	10
J. C. Furnip, Lemon-street, Truro, manufacturer	20
J. John, Boscawen-street, Truro, grocer	5
W. Rowe, Falmouth, steamship owner	10
G. Dixon, Truro, merchant	5
J. Colmer, Truro	10
J. H. Faull, Truro, accountant	5
T Chirgwin, Truro, chartered accountant	10

The number of directors is not to be less than five nor more than seven; qualification, shares or stock of the nominal value of £100; the company in general meeting will determine remuneration.

Iguana Gold Syndicate, Limited.

This company was registered on the 10th inst. with a capital of £2750, in 55 shares of £50 each, to advance moneys to Messrs. J. F. Guignes and P. Quartier, upon the mortgage of six concessions of lands situate in the Commune of Mana, French Guyana, known as the Iguana concessions, granted by the French Government; and also of certain lands, sugar plantations, &c., in the Island of Guadaloupe, the property of Mr. Guignes. Power is taken to take possession of, and to explore, work, mine, and cultivate such lands. An agreement made between J. F. Guignes and P. Quartier of the one part, and T. S. Godman Kirkpatrick and D. Forbes of the other part, will be adopted. The subscribers are:—

	Shares.
J. D. Gord, 1, Guildhall-chambers, chartered accountant	1
T. S. G. Kirkpatrick, 38, Charlwood-street, Belgrave-road	1
D. Green, 1, Finsbury-circus, quarry owner	1
D. Forbes, 18, Endymion-road, Finsbury Park, engineer	1
E. V. Viard, 8, Brompton-crescent	1
Major R. A. Barlow, 5, Williams-place, Enfield	1
R. Melbourne Jackson, 2 Fen-court, E.C., merchant	1

The numbers of directors is not to be less than five nor more than seven; qualification, one share; the subscribers are the first. In the event of the mining engineer or expert of the company reporting that the said concessions may be successfully worked for the production of gold, it is intended to form a company to be called the Iguana Gold Company, with a capital of £120,000, in £1 shares, to purchase the six concessions for £104,250, of which £100,000 will be payable in fully-paid shares.

ENGLISH IRONWORKS IN RUSSIA.

RUSSIA has made many great efforts to develope the resources of the mineral basin of the Donetz. Ironworks were established at Lugan, but the manufacture of pig iron proved unsuccessful, and iron had to be procured from Siberia. In 1865 a large sum was expended in erecting coke ovens, brickyards, &c., at Petroffsky. After several years of experimental working with the assistance of French and German artisans, as well as with the best workmen from Siberia, the authorities were not able to succeed in producing ordinary pig iron. The machinery was then removed to Lissetchansk, where coal and iron ore were said to be abundant, but the old story was repeated, the works were razed to the ground and the machinery sold by public auction. Then, in 1868, the experiment of concessions was tried, and several failures followed. Notwithstanding these repeated and costly failures, the Government was still very anxious to establish ironworks in the Donetz mineral basin, and about this time a concession was granted to Mr. John Hughes, of the Millwall Ironworks, London, to establish ironworks, and to construct a railway fifty-seven miles in a southerly direction towards Mariupol or Berdiansk from Constantinoffka station, on the Koursk-Kharkoff-Azoff Railway. It should be mentioned that Mr. Hughes has been connected with the Russian Government for many years in supplying armour-plates, &c., and in erecting—1864—the first iron fortifications at Cronstadt, on the Constantine Island, now called the "Constantine Fort." Mr. Hughes formed a company with wealthy English capitalists in London, under the English Limited Liability Act, called the New Russia Company, Limited, he and his sons personally undertaking the superintendence of the erection of the ironworks, which were commenced in 1869 on the banks of the river Kalmius, in the Province of Ekaterinoslay. The railway was constructed under a separate company formed by Mr. Hughes according to the Russian law. The ironworks were commenced with great energy, the first blast furnace having been erected and started within nine months, in accordance with the conditions of the concession, and pig iron was produced of a very superior quality at the rate of 200 to 300 tons per week.

The works now possess three blast furnaces capable of producing together from 900 to 1000 tons of pig iron per week. All the plant for the blast furnace department was supplied by the Lilleshall Iron Company, Shropshire. Mr. Hughes' concession required the erection of rolling mills capable of producing not less than 5000 tons of iron rails per annum, with the requisite quantity of fastenings. Mr. Hughes was also to erect a merchant bar mill and mechanical shops to meet the requirements of the locality, as also to sink coal pits capable of producing up to 2000 tons per day, should it be demanded by the Government. The puddling and rolling mills, &c., were all completed in accordance with the terms of the concession, the plant and various machinery for the mills being supplied by Messrs. Thos. Perry and Sons, of Bilston, Staffordshire. The Fronstein concessions were eventually transferred by the Government to the company formed by Mr. Hughes, as was also Mr. S. Poliakoff's concession, and these obligations have been completely fulfilled by the New Russian Company several years since. The operations of the works were very successfully carried on under the personal management of Mr. Hughes and his sons for several years, exclusively in the production of iron rails, &c. But in 1878, the Government having decided that all rails for Russian railways should in future be made of steel, the New Russia Company had to reconstruct their works and adapt them to the new requirements. Mr. Hughes adopted by preference the open-hearth or Siemens-Martin principle, the plant and machinery being obtained from England. The works have, since their conversion to steel rolling, been in uninterrupted operation, producing steel rails of a very superior quality. The Government has lately given the New Russia Company a second contract for 32,000 tons of steel rails, which is extended over a term of several years. The production of steel rails at the present time is about 700 tons per week; merchant iron and rail fastenings are also produced in very large quantities to meet the requirements of the Government and private railroad companies.—*American Manufacturer.*

THE ROYAL COMMISSION ON TRADE.—On Monday, at a meeting of the Sunderland Shipowners' Society, the secretary read the answers proposed to be sent in reply to the questions submitted to the society by the Royal Commission on trade. It was stated that the value of shipping belonging to the port and its resident owners was between £3,000,000 and £4,000,000; that from 1866 to 1872 the shipping interest had suffered generally from the extravagant action of Mr. Plimsoll and the Board of Trade, the older classes of wooden vessels being indiscriminately condemned; that the present depression was of more than ordinary severity, and was felt the more because steamers when idle cause much heavier loss than did sailing ships; that it was doubtful if the depression had yet reached the bottom; that the only special circumstances to which the existing condition of trade could be attributed were that the Legislature and Government offices, influenced by men who really knew little about shipping, were perpetually devising crotchets which disturbed the trade and added cost and loss; that the prospects for the immediate future were very discouraging; and that measures proposed by the Board of Trade tend seriously to increase the shipowners' difficulties. With regard to foreign competition, it was pointed out that English shipping suffered from foreign competition, and the countries that derived advantages from our trade gave our shipping no equivalent in return. It was unanimously resolved to send the answers as framed.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Applications for Letters Patent.

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

15th September, 1885.

10,896 PHOTOGRAPHIC SHUTTERS, C. D. Durnford, Edinburgh
10,897. CHANGING PLATES, &c., for PHOTOGRAPHIC PURPOSES, F. Greene, Bath.
10,898. WHEELS, F. G. Myers, Northampton.
10,899. WHEELS, AXLES, and BEARINGS, F. G. Myers, Northampton.
10,900. ADJUSTABLE DIE for WIRE DRAWING, F. M. Blake, London.
10,901. STOVES, G. A. J. Schott, Bradford.
10,902. SPOON BUSKS, G. W. Mohrstadt and M. Lürgen, Harborne.
10,903. DECKING for BRIDGES, W. E. Wood, Darlaston.
10,904. WIND GAUGES, A. Allen, Guildford.
10,905. SUSTAINING WINDOW SASHES, &c., WITHOUT SASH WEIGHTS, C. Fellows, Wolverhampton.
10,906. STEERING and PROPELLING BICYCLES, T. Bayliss, J. Thomas, and J. Slaughter, Coventry.
10,907. SEPARATING VAPOURS from LIQUIDS, J. Murrie, Glasgow.
10,908. UMBRELLA STAND, J. Rowland, Sunderland.
10,909. GALVANOMETERS, J. Blyth, Glasgow.
10,910. SCHOOL FURNITURE, J. S. and W. Hughes, Portmadoc.
10,911. BOXES, L. Myers, Birmingham.
10,912. MEASURING, &c., LIQUIDS, A. St. J. W. Wriford, London.
10,913. SECURING FASTENINGS on STAY BUSKS, &c., J. Jackson, Sheffield.
10,914. GAS STOVES, H. Darwin and T. Greenwood, Halifax.
10,915. DOOR CHECKS, H. Hartung, London.
10,916. CLOCKS, C. A. Richard, London.
10,917. GAS MOTOR ENGINES, J. Robson, London.
10,918. CLEANING and SHARPENING KNIVES, &c., A. J. Sedley, Hammersmith.
10,919. PAPER PULP, E. Davies, C. F. B. Birchall, and A. Wood, London.
10,920. LENSES for OPTICAL INSTRUMENTS, E. G. Colton.—(*A. Wagner, United States.*)
10,921. PREVENTING SEA-SICKNESS, &c., A. C. Calmour, London.
10,922. BUCKLES for BRACES, &c., J. and J. A. Wise, London.
10,923. ANCHORS, G. B. Hingley and J. R. Curry, London.
10,924. POWER DISTRIBUTION, W. Lowrie, London.
10,925. HIGH SPEED ENGINES, W. Lowrie, London.
10,926. JUSTIFYING TYPOGRAPHICAL COMPOSITION, P. M. Justice.—(*W. H. Knowles, France.*)
10,927. CLEANING the RAILS and GROOVES of TRAMWAYS, J. C. Part.—(*M. J. Dozo, Belgium.*)
10,928. WATER-CLOSET, A. A. Common, London.
10,929. HOISTING and LOWERING APPARATUS, J. J. Pike, London.
10,930. INDUCING the FLOW of AIR or GASES at HIGH VELOCITY, G. Seagrave, London.
10,931. APPLYING GUM BALATA to INSULATING WIRES, P. A. Newton.—(*P. C. Matherson and C. W. Torrey, United States.*)
10,932. FIRE-ESCAPE, J. E. Sandberg and M. Akeson, London.
10,933. NUT-LOCK, W. Clark.—(*J. W. Morton, U.S.*)
10,934. CEMENT, R. Stone, London.
10,935. ELECTRICAL INSULATORS and CONDUCTORS, H. J. Haddan.—(*A. Arndt, Germany.*)
10,936. REMOVING GUM from GRASS and PLANTS, H. J. Haddan.—(*L. E. Vial, France.*)
10,937. PARANITRO-BENZALDEHYDES, H. J. Haddan.—(*F. Bayer and Co., Germany.*)
10,938. CHEMICAL FIRE EXTINGUISHERS, H. J. Haddan.—(*J. P. Scott, U.S.*)
10,939. SPRING CLASPS, J. J. Unbehend, London.
10,940. REDUCTION of ORES, &c., A. J. Boult.—(*H. M. Pierce, U.S.*)
10,941. FILTERS, B. Dukes, London.
10,942. FILTER PRESSES, &c., J. B. Alliott, London.
10,943. FASTENINGS for UMBRELLA CASES, T. R. Croger, London.
10,944. MUSICAL SPINNING TOPS and BOXES, E. Parr, London.
10,945. CASE for holding NEWSPAPERS, &c., E. Edwards.—(*C. F. Glass and Co., Germany.*)
10,946. FOLDING DRESS-STAND, H. Goldstein, London.
10,947. VESSELS for TRANSPORTING LIQUID CARGOES in BULK, L. V. Sone, London.
10,948. CONDUITS for the CABLES of CABLE RAILWAYS, H. H. Lake.—(*A. Bonzano, U.S.*)
10,949. AUTOMATICALLY REGULATING the FLOW of WORT, &c., from COOLERS, &c., E. Fielding, London.
10,950. TELEPHONIC APPARATUS, O. Imray.—(*W. Burnley, U.S.*)
10,951. ELECTRICAL RECEIVING APPARATUS for RELAY, &c., W. P. Johnston, London.
10,952. ELECTRICAL LOCKING APPARATUS for RAILWAYS, C. E. Spagnoletti, London.
10,953. FILLING SCREW-MOUTHED BOTTLES, H. Barrett, London.
10,954. DRIVING BANDS, H. Barrett and J. J. Varley, London.
10,955 SCREW STOPPERS for BOTTLES, H. Barrett, London.
10,956. HARROWS, F. Mote, London.
10,957. APPLYING LABELS to the STOPPERS of BOTTLES, G. Wright, London
10,958. APPARATUS for PRESS-COPYING LETTERS, A. W. Watson, London.
10,959. GALVANIC BATTERIES, T. J. Jones, London.
10,960. FASTENINGS for PIPE HEADS, D. Law, J. Law, jun., J. Law, and J. Jackson, Glasgow.

16th September, 1885.

10,961. METALLIC BEDSTEADS, F. Hoskins, Birmingham.
10,962. SCREW HOOKS, &c., G. J. Williams and F. R. Silk, Birmingham.
10,963. PORTABLE PUMP, T. Wolstenholme and C. Gaul, Bradford.
10,964. WHEELS of VELOCIPEDES, J. Appleby, Dunham Massey, near Altrincham.
10,965. INCREASING the SPEED of KNITTING MACHINES, R. Whittle, Pendlebury.
10,966. AUTOMATIC FIRE-EXTINGUISHERS, W. Woodhouse, Manchester.
10,967. MECHANICALLY FEEDING FUEL into FURNACES, E. C. Mills, Altrincham.
10,968. WITHERING the LEAVES of the TEA PLANT, A. Bryans, London.
10,969. FISHING HOOKS, W. H. Brookes, London.
10,970. RACKS for FORWARD and BACKWARD MOVEMENT, W. H. Pike, Lanark.
10,971. PREVENTION of SEA SICKNESS, W. Dodshon, London.
10,972. QUILTED and WADDED MATERIAL, &c., A. C. Henderson.—(*J. F. Grambois, France.*)
10,973. ADVERTISING, A. S., H. J., and G. A. Spratt, London.
10,974. STEAM INJECTORS, J. Miller, London.
10,975. ORNAMENTING BOOTS, &c, J. B. F. Clow, London.
10,976. SHEATH for MATCH-BOXES, &c., T. R. Ablett, Blackheath.
10,977. CASES for PROTECTING MAPS, A. Saloway and J. E. Groves, Brixton.
10,978. REGULATING DYNAMO MACHINES, A. Bernstein, London.
10,979. SEWING MACHINE NEEDLE, A. T. Boon, London.
10,980. ATTACHING TORPEDO NETS to SHIPS, W. M. Bullivant, London.
10,981. LEVER FASTENING for GLOVES, &c., J. R. Speck, London.
10,982. LINES or CORDS for SUSPENDING PICTURES, &c., G. Hookham and W. H. Tonks, London.
10,983. LUBRICATING JOURNALS, H. J. Haddan.—(*M. Lindner, Germany.*)
10,984. NOTATION STRIPS for KEY BOARD INSTRUMENTS H. J. Haddan.—(*C. Ress, Germany.*)
10,985. CONSTRUCTION of SHIPS and BOATS, A. M. Wood, London.
10,986. LUBRICATORS, J. L. McMurtrie, Glasgow.
10,987. RETIFORM WOODEN SHEETS for FLOOR MATTING, &c., T. Robb, Glasgow.
10 988. MOUNTING, &c., WINDOW SASHES, W. Wright, London.
10,989. SKATES, G. Powell, London.
10,990. BOXES for HOLDING TIN-PLATES, W. Williams London.
10,991. BOOTS and SHOES for CRICKETERS, A. Keats London.
10,992. CHANNELLING the SOLES of BOOTS and SHOES, W. Jackson, London.
10,993. LOCKS, J. G. Still, London.
10,994. COLLECTING PURE RAIN WATER, C. G. Roberts, London.
10,995. AXLE BOXES for RAILWAY, &c., ROLLING STOCK, W. Walker, London.
10,996. TRANSPORT and MIGRATION of EXHIBITIONS, W. Pritchard-Morgan, London.
10,997. BOTTLES for CONTAINING AERATED LIQUIDS, H. Codd, London.
10,998. HYDRAULIC APPARATUS for OPENING and CLOSING the BREACH of HEAVY GUNS, C. H. Murray, London.
10,999. FINISHING PILE FABRICS, S. C. Lister and J. Reixach, Bradford.
11,000. WASHING GUNS, A. Noble, London.
11,001. CEMENT for JOINTING STONEWARE, &c., W. Hassall, London.
11,002. APPLYING CORK RINGS to BOTTLES, &c., S. A. Bull, London,
11,003. BRUSHES, W. Clark.—(*P. P. Audoye, France.*)

17th September, 1885.

11,004. CASES for CLOCKS, E. Light, London.
11,005. CHIN-HOLDER for VIOLINS, &c., W. J. Cattell, London.
11,006. LAMPS, S. Watts, Bath.
11,007. CONNECTING SPRINGS to ARTIFICIAL TEETH, J. Brown, Scarborough.
11,008. COMBINED FLOAT REGULATING CHECK or STOP VALVE, A. Hitchon, Accrington.
11,009. AIR-SPRING PRESSURE GAUGES, A. Allan, London.
11,010. BLOCKING and DISPLAYING FRILLINGS, J. Helsby, Manchester.
11,011. MAKING FISH HOOKS, A. Stratton, Birmingham.
11,012. MILITARY COMPASS, F. Bosshardt.—(*C. Rossignol, France.*)
11,013. ENAMELLED IRON WALL-PLATES, B. Baugh, Birmingham.
11,014. CURE of PULMONARY DISEASES, A. Lynch, Manchester.
11,015. GRATES for ECONOMISING FUEL, E. Taylor, Blackburn.
11,016. HYDRO-PNEUMATIC ENGINE, A. S. Jones, Ipswich.
11,017. BUCKLES, T. Evans, Birmingham.
11,018. FURNITURE CASTORS, J. Parry, Birmingham.
11,019. HOLDING WOOL, &c., for KNITTING, A. G. Klugh, London.
11,020. TRAYS for DEVELOPING PHOTOGRAPHIC PLATES, A. Anderson, Elgin.
11,021. BUTTONS, C. E. Challis, London.
11,022. OPENING ENVELOPES, &c., R. W. Scaife.—(*A. H. Scaife, W. R. and J. F. Binns, Turkey.*)
11,023. RAILWAY COUPLING, A. P. Kendell, London.
11,024. BICYCLES, W. G. Wainwright, London.
11,025. PREVENTING the RATTLING of SASHES, H. Smith, Coventry.
11,026. AUXILIARY COMPENSATION for the CONTINUOUS COMPENSATION of MIDDLE TEMPERATURE ERROR of MARINE CHRONOMETERS, &c., G. P. Grace, London.
11,027. PRODUCING DESIGNS by DISCOLORATION, C. Villers, London.
11,028. PIPE for SMOKING TOBACCO, W. Britain, jun., London.
11,029. OPEN, &c., COOKING RANGE, G. W. Grove, Leamington.
11,030. LINING CONVERTERS, B. Versen, London.
11,031. CUTTING the TEETH of WHEELS, E. Shippey and T. O'Maher, Manchester.
11,032. SPRINGS for CARRIAGES and VELOCIPEDES, J. Harringon, London.
11,033. LOCK-UP SPIRIT and LIQUOR STANDS, G. Betjemann, London.
11,034. PREPARING MOULDS for CASTING HOLLOW-WARE, R. Clayton, J. Mason, and A. J. S. Cresswell, London.
11,035. SUBSTITUTE for HORSEHAIR, W. Clark.—(*O. F. I. Dhavernas, France.*)
11,036. COMPOSITION for PREVENTING, &c., INCRUSTATION in STEAM BOILERS, A. Pople and R. M. Bryant, London.
11,037. SCHOOL BENCH, L. Gustav-Fogel, London.
11,038. DEODORISING, &c., GASES, E. D. Latham, London.
11,039. BLOWING APPARATUS for SPRAY PRODUCERS, J. F. Churchill, London.
11,040. HAND AMBULANCE WAGON, E. Lee and W. Taylor, London.
11,041. PUNCHING and EYELETTING MACHINES, M. H. Pearson, London.
11,042. SLIDE VALVES FOR STEAM ENGINES, A. Macmillan, Liverpool.
11,043. FILTERS, J. Howie, Glasgow.
11,044. READING DESKS, R. H. Padbury, London.
11,045. GRILLERS, H. C. Turner, London.
11,046. OVEN, &c., FASTENINGS, H. C. Turner, London.
11,047. BLAST PIPES for LOCOMOTIVE ENGINES, H. and W. Adams, London.
11,048. TYPE WRITERS, J. P. Smith, London.
11,049. PRODUCING, &c., PRESSURE to CLIPS for LETTERS, T. Messenger, London.
11,050. WATCHES, L. Béguelin, London.
11,051. ELECTRIC CURRENT METERS, F. Borel and E. Paccaud, London.
11,052. AUTOMATICALLY PLAYING TUNES, E. Parr, London.
11,053 TREATING RHEA or RAMEH, O. W. G. Briegleb.—(*H. Plaisier, Holland.*)
11,054. BOOTS and SHOES, G. Chambers, London.
11,055. PHOTOGRAPHIC CAMERAS, A. M. Clark, London.
11,056. TELEPHONIC TRANSMITTERS, G. L. Anders, London.
11,057. TELEPHONIC TRANSMITTING INSTRUMENTS, G. L. Anders, London.
11,058. CLOSET-BASIN and other JOINTS, W. H. Tylor, London.
11,059. FEEDING BOTTLES for INFANTS, J. Hix, London.
11,060. REGULATORS for WATER SUPPLY, J. Hix, London.
11,061. METALLIC CASKS, A. Montupet, London.
11,062. CUTTING BEVELS on MIRRORS, L. de Coster, London.
11,063. ROPE-HAULING APPARATUS for TOWING, &c., J. Lang, London.
11,064. GRAPNELS for CUTTING and HOLDING SUBMARINE CABLES, W. C. Johnson and S. E. Phillips, London.

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11,065. CONICAL DETONATING SHELLS, G. H. Johnston, Lahardane, Mayo.
11,066. METAL-FRAMED LAWN TENNIS RACKET A. D Chapman, London.
11,067. RECOVERING TIN from WASTE TINNED IRON, W. Beatson, Rotherham.
11,068. CUTTING THIN BOARDS, T. N. Robinson, Manchester.
11,069. BRACES, J. W. Seddon, Manchester.
11,070. PNEUMATIC ELEVATORS for GRAIN, R. G. Morton, Glasgow.
11,071. ELIMINATING SNOW from COLD AIR, W. P. English, London.
11,072. WATERPROOF GARMENT, I. Frankenburg and J Grounowsky, Manchester.

11,073. Wagon Coupler, G. Turner, Ashton-under-Lyne.
11,074. Hand Brushes, J. Morton, Halifax.
11,075. Spinning and Doubling Fibres, W. Leach, Halifax.
11,076. Roller Blinds, E. R. Wethered, London.
11,077. Shelf Brackets, A. B. Milne, Birmingham.
11,078. Two-wheeled Carriages, O. F. Windover, Huntingdon.
11,079. Folding Paper in Printing Machines, G. A. Wilson, Liverpool.
11,080. Propelling and Steering Ships, J. Beveridge, Barrow.
11,081. Drilling Machines, T. H. Ward, Tipton.
11,082. Reeds, G. and E. Ashworth, Manchester.
11,083. Ventilating Hats, &c., J. Rowley and R. S. Brock, London.
11,084. Glazing China, &c., H. Venables, London.
11,085. Hat Boxes, E. Besant, Liverpool.
11,086. Combined Mattress and Bedstead, W. Howarth, London.
11,087. Compound High-speed Rotary Engine, J. H. McGuire, Leeds.
11,088. Lubricators, G. Bridge, London.
11,089. Match Balls, W. Howard, London.
11,090. Railway Wheels, W. H. Kitson, London.
11,091. Cigarettes, J. Bray, London.
11,092. Shears, G. E. Smart, Liverpool.
11,093. Fastener for Holding Curtains, F. Walker, Liverpool.
11,094. Electrically Illuminating Dials, G. H. James, London.
11,095. Combination Piece of Furniture, A. Crux, London.
11,096. Pessaries, J. C. Mewburn.—(*V. C. Lingrand, France.*)
11,097. Securing Clothes to Ropes, J. R. M. Mallett, London.
11,098. Cement, R. Stone, London.
11,099. Appliance for Teaching Children to Walk, F. Plaister, London.
11,100. Weaving Textile Fabrics, P. Speak and J. Pickles, London.
11,101. Cowls, W H. Dupré, London.
11,102. Establishing Electrical Communication between Ships and the Shore, F. Lake, London.
11,103. Hand Grenade Fire Extinguisher, S. P. Wilding.—(*N. Mitchell, U.S.*)
11,104. Boats, H. Gillespie, London.
11,105. Checking the Receipt of Money, S. Fynn and C. H. Worsey, London.
11,106. Fittings for Roller Blinds, W. H. B. Winchester, London.
11,107. Coupling Together Pipes or Tubes, W. Lea, London.
11,108. Cricket Bats, A. and H. A. Odd, London.
11,109. Cleaning Sinks, T. McLean, London.
11,110. Pavements, H. H. Lake.—(*I. Fabbri and C. Praga, Egypt.*)
11,111. Stays or Corsets, M. A. Landry, London.
11,112. Walls for Buildings, W. C. Johnson and S. E. Phillips, London.
11,113. Casting Apparatus, G. Hertzog, London.
11,114. Diffusing Air, G. Greig, London.
11,115. Purifying Refuse Waters, E. M. Dixon, Glasgow.
11,116. Washing Machines, T. Frater, Glasgow.
11,117. Porous Pots, G. A. Schoth, London.
11,118. Using Superheated Steam in Steam Engines, J. Holcroft, London.
11,119. Baling Hay, &c., H. C. Capel, London.
11,120. Telephonic Apparatus, S. P. Thompson, London.
11,121. Connecting the Wires of Acoustic Telephone Circuits, G. L. Anders, London.
11,122. Screw Propellers, B. Dickinson, London.
11,123. Train Signalling, C. W. Pridham, London.

19th September, 1885.

11,124. Fancy Weaving, J. Eccles and R. Westwell, Manchester.
11,125. Heating Apparatus, R. Cartwright, Wolverhampton.
11,126. Reaping Machines, P. C. Evans and H. J. H. King, Stroud.
11,127. Joining the Edges of Metal Plates, J. F. L. Crosland, Manchester.
11,128. Water-closets, C. Heywood, Manchester.
11,129. Treatment of Residuals from Copper Works, &c., G. L. and W. J. Wigg and M. Steele, Liverpool.
11,130. Blind Cord Racks, C. Homer, Birmingham.
11,131. Fishing Reels, C. F. Robinson, Redditch.
11,132. Propelling Paddle Steamers, D. McDermid, Darlington.
11,133. Ventilating Street and other Drains, H. P. Dawson, London.
11,134. Liquid for Removing Grease from Textile Fabrics, F. Hansen, London.
11,135. Opening Envelopes, &c., H. and G. Horridge and J. Fearnhough, London.
11,136. Securing Corve, &c., Wheels to their Axles, T. Fox and E. Leadbeater, London.
11,137. Mails for Dupe Healds, &c., W., J., J., B., and T. Milner, Bradford.
11,138. Fish-plates and Fasteners, G. H. Wells, Sheffield.
11,139. Filling and Corking Machines, J. P. Jackson, Liverpool.
11,140. Filling Machines, J. P. Jackson, Liverpool.
11,141. Chimney-tops for Preventing Down-draughts, J. Dickson, Liscard.
11,142. Dynamo-electric Machines, W. A. Carlyle, Birmingham.
11,143. Applying Forced Draught to Furnaces, J. Patterson and M. Sandison, Newcastle-on-Tyne.
11,144. Valve-gear for Marine Engines, &c., W. F. Perman, Glasgow.
11,145. Glazing Windows, Doors, &c., H. M. Girdwood, Manchester.
11,146. Automatic Thief-proof Window Sash Fasteners, C. H. M. Wharton, Manchester.
11,147. Governors for Steam, &c., Engines, J. Aimers, Galashiels.
11,148. Motor, J. Belliss, London.
11,149. Sash Fasteners, W. Lea and J. Beech, Wolverhampton.
11,150. Stringing Pianofortes, H. Hardy, London.
11,151. Drawing Compasses or Dividers, C. Rhodes, London.
11,152. Finishing Lace and other Fabrics, L. Lindley, London.
11,153. Treating Wines and Liquors with Electricity, E. J. Fraser, San Francisco.
11,154. Calcined Magnesia, G. Milligan, London.
11,155. Preparing Materials for Wearing Apparel, A. Parry, London.
11,156. Lace Fasteners, J. D. C. Houston, Belfast.
11,157. Mountings of Calendars, &c., E. A. Jahncke and H. W. Herbst, London.
11,158. Steering Apparatus, A. Winkler, London.
11,159. Paper-hangings, W. Scott, London.
11,160. Water-waste Preventing Cisterns, W. Carr, London.
11,161. Cyclometers, E. G. Colton.—(*G. H. Gould and the Tape Manufacturing Company, United States.*)
11,162. Tobacco Pipes, E. J. Van Walwyk, London.
11,163. Balls for Games, F. B. W. Malet, London.
11,164. Shaping Dough, R. Morton, Glasgow.
11,165. Forming Loops for Fishing Lines, W. Ireland, Glasgow.
11,166. Rails, T. G. Hardie, London.
11,167. Perambulators, &c., J. Simpson and S. T. Fawcett, London.
11,168. Bakers' Ovens, W. L. Wise.—(*A. Van der Schuyt, Holland.*)
11,169. Loom Attachments, F. Alsina-Parellada, London.
11,170. Bolting Machines, R. Ufer, London.
11,171. Facilitating the Cleaning of Windows, S. Richardson, London.
11,172. Machine Gun, T. Nordenfelt, London.
11,173. Gun Carriages, T. Nordenfelt, London.
11,174. Cement, J. Watson, London.
11,175. Arc Striking Mechanism of Electric Arc Lamps, C. F. Cooke and T. Robinson, London.
11,176. Foundations, D. Nicoll, London.
11,177. Refining Resins, O. Imray.—(*Dr. E. A. Behrens, Germany.*)
11,178. Sulphur, P. A. Mawdsley and T. Macfarlane, London.
11,179. Application of Cam Surfaces to Wheels, H. B. Payne, London.
11,180. Posts of Railway Signals, J. Knight, London.
11,181. Safety Tills, A. Humpage, London.
11,182. Safety Stirrup, H. Wincer, London.
11,183. Combing Machines, J. J. Richardson, Bradford.

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11,184. Hats, R. Wallwork, Manchester.
11,185. Closing, &c., the Mouths of Jars, &c., F. J. Beaumont and D. Rylands, Barnsley.
11,186. Nail Making Machinery, W. H. Ratcliff, Birmingham.
11,187. Ovens, H. Kerby, London.
11,188. Purifying Waste Gas Lime, &c., T. Lowe, Old Radford.
11,189. Loom Dobbies, W. Williamson, Manchester.
11,190. Hydraulic Main Ascension Pipes, &c., G. Pettigrew, Darlington.
11,191. Bevelled Bearings for Looking-glasses, H. and C. W. Bessell, Bristol.
11,192. Self-acting Direct-action Motor, S. A. Watkins, London.
11,193. Expansion Engines, T. C. Hide and W. Wardrop, London.
11,194. Shields for Protecting Vessels in Collision, W. Rawson, Halifax.
11,195. Barrel Bungs with Bayonet Joints, L. Mayer, London.
11,196. Ships, Rudder Fittings, &c., L. E. Liardet, London.
11,197. Gaiter, J. Morrison, Glasgow.
11,198. Piano and Organ Attachments, W. R. Eddington, London.
11,199. Weaving Plush or Looped Fabrics, T. Craven, London.
11,200. Vertical Bar Fencing, S. Bayliss and R. Howarth, London.
11,201. Spindle Bolsters for Spinning, C. A. Allison.—(*C. H. Chapman, United States.*)
11,202. Folding Chair, E. Smith, West Dulwich.
11,203. Fittings for Landing Handles and Rings for Fishing, A. Williams, Redditch.
11,204. Suspenders, H. H. Leigh.—(*C. H. W. Iden, Germany.*)
11,205. Printing Music and Colours, N. Pratt, Bromley.
11,206. Fireplaces, F. G. Dutoit and A. Burkart, London.
11,207. Folding Eye-glasses, P. and E. Franck-Valery, London.
11,208. Decorating Objects of Glass, &c., A. Landier and C. Houdaille, London.
11,209. Naming Poultry, Plants, &c., G. E. Smart, London.
11,210. Making Metallic Paint from Lead, A. M. Clark.—(*W. E. Harris, United States.*)
11,211. Utilising Heat and Pressure of Steam, &c., A. Walz, London.
11,212. Railway Track Support, &c., H. J. Gould, London.
11,213. Ships' Compasses, A. Mitchell, Glasgow.
11,214. Dress Improvers, H. Dicke, London.
11,215. Explosive Agent, J. Graddon and P. Harding, London.
11,216. Applying Paint to Textile Fabrics, Wood, &c., A. M. F. Caspar, London.
11,217. Machine Gun, T. Nordenfelt, London.
11,218. Controlling the Recoil of Ordnance, J. Vavasseur, London.
11,219. Generating Carbonic Acid Gas, F. G. Riley, London.
11,220. Locking Nuts, O. Imray.—(*F. S. D. Broughton, United States.*)
11,221. Desiccating Air for Drying Purposes, G. Greig, London.
11,222. Palliasses, H August, London.
11,223. Compound Steam Engines, H. B. Merton, London.

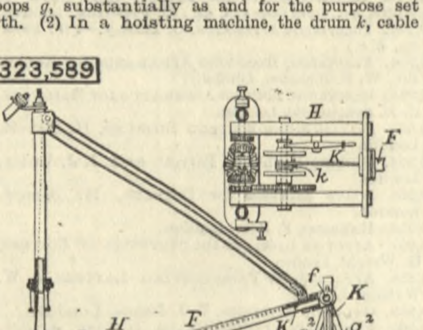
SELECTED AMERICAN PATENTS.

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

323,589. Coal-hoisting Machine or Dredge, *Bernard M. Munn, Elizabeth, N.J.—Filed February 18th*, 1885.

Claim.—(1) The side plates g^1, slotted, placed on shaft f, and having the scoops g pivotted to them, in combination with arms g^2 and the cable K for raising and lowering the plates g^1 for opening and closing the scoops g, substantially as and for the purpose set forth. (2) In a hoisting machine, the drum k, cable

323,589

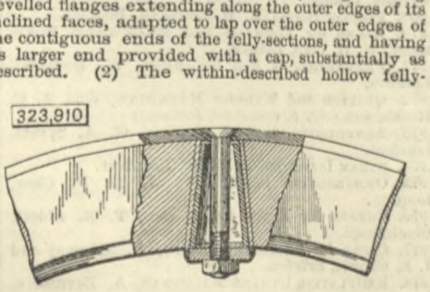


K, boom F, and means for revolving the drum k, in combination with the vertically-movable plates g^1, arms g^2, and scoops g, all arranged to operate substantially as and for the purposes set forth. (3) In a hoisting machine, the hinged frame H, drum k, and boom F, in combination with cable K and side plates g^1, to which the cable is attached for operating the scoops of the bucket, substantially as described.

323,910. Wedge for Vehicle Wheels, *Henry G. Cady, Pine Bluff, Ark.—Filed May 29th*, 1885.

Claim.—(1) A hollow metallic felly-wedge having bevelled flanges extending along the outer edges of its inclined faces, adapted to lap over the outer edges of the contiguous ends of the felly-sections, and having its larger end provided with a cap, substantially as described. (2) The within-described hollow felly-

323,910

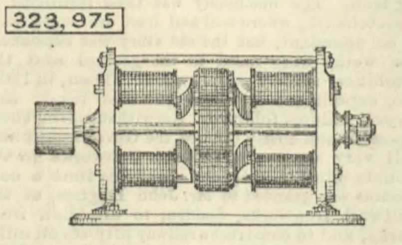


wedge having bevelled flanges extending along the outer edges of its inclined faces, adapted to lap over the outer edges of the contiguous ends of the felly-sections, and having its larger end provided with a cap having a shoulder upon its under side adapted to fit within the hollow interior of the wedge, substantially as and for the purpose specified.

323,975. Dynamo-electric or Electro-dynamic Machine, *Elihu Thomson, Lynn, Mass.—Filed September 10th*, 1884.

Claim.—(1) In a dynamo-electric machine or motor, a field magnet core having an extension, as a, and sheet iron plates secured to such extension and forming the pole pieces acting on the armature. (2) In a dynamo-electric machine or motor, a field magnet pole piece constructed from a number of superimposed sheet iron plates, which are each bent in a plane parallel to the plane of the rotation and having a curved edge presented to the armature. (3) The combination with the field magnet core of the perforated extension a, and a series of thin sheet iron plates bolted to said extension and forming the field-of-force pole piece. (4) In a dynamo-electric machine or motor, an armature having a series of magnets supported in a suitable frame and revolved bodily around the axis of said frame, each of said magnets having a core composed of a number of H-shaped pieces of iron mounted so that the edges of their legs shall form the poles of the magnets. (5) In a dynamo-electric machine or motor, an armature consisting of a frame carrying a series of electro-magnets, each consisting of a bundle or pile of H-shaped iron plates wound with insulated wire. (6) An armature core mounted on a

323,975

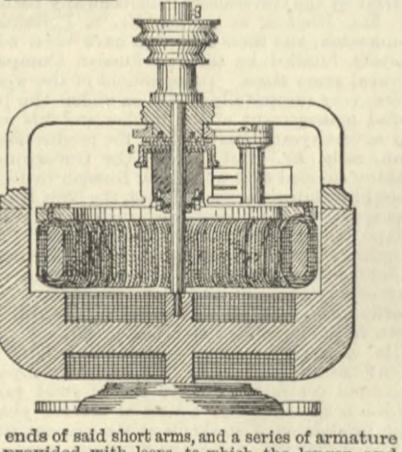


revolving carrier with its magnetic axis transverse to the plane of rotation, and provided with spaces, as $s\,s$, extending radially through its poles for the passage of bolts, whereby it may be fastened to its carrier. (7) The combination with the armature magnets mounted on a suitable frame with the magnetic axes parallel to the shaft, by which said frame is revolved, of fastening bolts passing radially through openings in polar extensions of said magnets into the frame, as and for the purpose described. (8) The combination with a non-magnetic carrier mounted on a suitable shaft of a series of magnets having their axes parallel to the shaft, the insulated plates or washers L L, and the fastening bolts passing transversely through the magnet poles and the plates L, as and for the purpose described. (9) The combination with the magnet core, made up of a series of thin H-shaped pieces of iron, of the side plates D, having rounded body, and retaining flanges to keep the armature coils in place. (10) The combination with a series of armature magnets mounted on a suitable frame of connecting links, as V, for the purpose described. (11) The combination with the series of armature magnets having laterally projecting pins of retaining links strung on said pins, as and for the purpose described. (12) The combination with a series of armature magnets mounted on the periphery of a suitable frame and parallel to the armature shaft of bolts passing transversely through the poles of the magnets for securing them to the frame, and a retaining band G, less in width than the length of the magnet cores, so as to permit the easy removal of an armature magnet or magnets, as and for the purpose described.

323,982. Electric Motor, *Charles J. Van Depoele, Chicago, Ill.—Filed October 27th*, 1884.

Claim.—(1) An armature consisting of a core, suitable coils upon said core, and insulated ring, to which each of said coils is attached by a loop extending therefrom, and a commutator formed of metallic segments sufficiently elongated to be adapted, when permanently secured by their outer ends to the loops of the armature coils, to form spokes radiating from the commutator and supporting said coils, substantially as described. (2) The combination of an insulating hub secured to the driving shaft, L-shaped metallic strips, the shorter arms of which are embedded in the surface of the hub, an insulated cap e for retaining the

323,982



outer ends of said short arms, and a series of armature coils provided with loops, to which the longer and radiating arms are permanently secured, substantially as described. (3) In an electric motor, a field magnet having a substantially diamond-shaped core, and pole pieces extending from the extremities thereof at right angles thereto. (4) In an electric motor, the combination of a U-shaped field magnet having a centrally enlarged or diamond-shaped core, and pole pieces extending at right angles therefrom, a commutator mounted upon a shaft journalled vertically between said pole pieces and having conducting arms integral with the commutating segments, and extending radially at right angles therefrom, and an armature the coils of which are secured to and supported by their respective conducting arms.

323,983. Incandescent Lamp, *Charles J. Van Depoele, Chicago, Ill.—Filed November 3rd*, 1884.

Claim.—(1) An incandescing filament consisting of a non-homogeneous aggregation of carbonised fibres, substantially as described. (2) An incandescing filament composed of an indefinite number of small individual fibres not necessarily continuous through-

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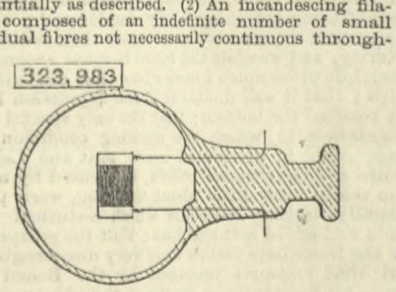

out the entire length of the filament, but intermingling with each other and affording numerous conducting passages through the conducting medium, substantially as set forth. (3) An increasing filament composed of an aggregation of short fibres interlaced so as to form numerous continuous passages throughout the entire filament, said fibres being united at their extremities, whereby the filament is adapted to be connected by suitable clamps with the line wires entering the lamp, substantially as set forth.

323,984. Suspended Electrical Conveyer, *Charles J. van Depoele, Chicago, Ill.—Filed March 10th*, 1885.

Claim.—(1) In a system of suspended electrical conveyors, the combination, with two supporting conductors and an electro-motor travelling thereon, of two supporting wheels running on said conductors, one of said wheels being in electrical connection with one pole of the motor and the other wheel with the other pole of the same, and each supporting wheel having an axle running in a bearing arranged above the conductors and connected to and supporting a car below the same, substantially as described. (2) In a system of suspended electrical conveyors, the combination, with two supporting conductors and an electro-motor travelling thereon, of two wheels running on said conductors and supporting a car, one of said wheels being in electrical connection with one of the poles of the motor and the other with the other pole thereof, and carrying a car below the conductors by a connection passing between the same, substantially as described. (3) In a system of suspended electrical conveyors, the combination, with two-supporting

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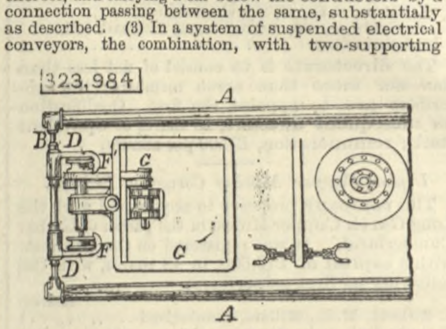
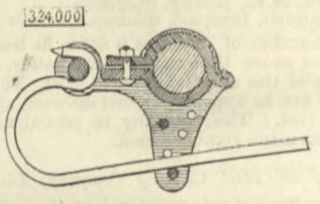


conductors, of a car and motor both suspended below and by said supporting conductors, and axle carrying supporting and driving wheels, one of which acts as an electrical connection between the supporting conductor and the motor, and intermediate connections, substantially as described, between the motor and the axle passing between the conductors for transferring motion from the motor to the axle, substantially as described. (4) In a system of suspended electrical conveyors, the combination of the uprights A, cross bar B, the hangers D, the conductors supported on said hangers and insulated from the cross bar, and the car G, hung below said conductors by standards passing between them, and carrying bearings for the supporting and driving axles. (5) In a system of electric cable conveyance, and in combination with the car and electric motor thereof, the posts A, the cross bar B, the hangers D, insulating sleeves E, and the cables F F^1, substantially as described.

324,000. Horse Hay-rake, *Frederick Bentel, Hamilton, Ohio.—Filed August 18th*, 1884.

Claim.—In a hay-rake, a tooth-supporting bar, a tooth-holder clamped to the bar, a flexible tooth pivotted to a wrist supported by said tooth-holder, a

324,000



pair of lugs straddling the tooth to the rear of said wrist, and adjustable supports above and below the tooth at said lugs, combined substantially as specified.

324,005. Furnace for Burning Liquid and Gaseous Fuel, *David H. Burrell, Little Falls, N.Y.—Filed November 6th*, 1880.

Claim.—In an apparatus for burning liquid or gaseous fuel, the combination of the conical nozzle B,

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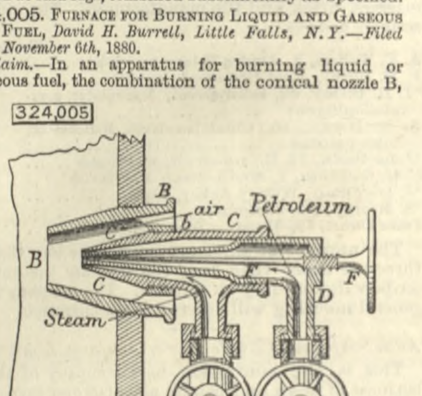

having internal screw-threaded ring b, the steam pipe C, and oil pipe D, arranged concentrically within said nozzle, and the stem F, passed longitudinally through the oil pipe, all substantially as and for the purpose specified.

324,339. Lubricator, *Robert Ruddy, Mount Vernon, and Leopold Kaczander, New York.—Filed July 9th*, 1885.

Claim.—(1) The combination, with the oil cup, the sight feed glass, and its connections, of the main steam conduit A and the channel B, located within and cast in one with the body of the oil cup and extending vertically and centrally from the bottom to the top of the oil cup, having no direct communication with the oil space of the lubricator, substantially as hereinbefore set forth. (2) The combination of the following instrumentalities, viz.:—The oil cup, the sight feed glass and its connections, the main steam conduit A, the channel B, located within and formed in one with the body of the oil cup and extending

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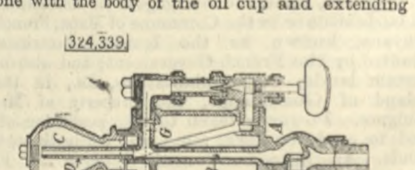

vertically and centrally from the bottom to the top of the oil cup, having no direct communication with the oil space of the lubricator, the condenser C, and the steam pipe D, screwed into the top of the channel B and forming its straight continuation to the upper part of the condenser, substantially as hereinbefore set forth. (3) The channels B and D, forming one single vertical steam passage through the oil cup into the upper part of the condensing chamber, the lower portion of which passage, located within the oil cup, communicates with the upper connection of the sight feed glass by a horizontal branch channel G, substantially as and for the purposes hereinbefore set forth.