THE CALCULATION OF CONTINUOUS GIRDERS, WITH AN EXAMPLE OF A GIRDER ON SIX SUPPORTS, WITH VARYING CROSS SECTIONS AND AN IRREGULAR LOAD.

By Max am Ende.

No. I.

As the economic advantages of continuous girders in bridges and other structures are more and more recognised, it is desirable that the knowledge of their theory and calculation should be more general than it is at present. The difficulty of the subject is in many cases the only reason why continuous girders are not designed in place of single girders, and therefore every fresh attempt to lessen those difficulties will be of some use. The method here given, having grown out of the exigencies of office work, has already proved useful. It consists of an arrangement of the quantities of calculation and of the statements in a tabular form, so as to make them easily controllable, and its principal feature is that any given case of a continuous girder, whatever may be the number of its spans, is reduced to or divided into problems of single cantilevers.*

Deflection of a cantilever: Let A A^1 and B B^1—Fig. 1—be two parallel planes at a small distance from each other, intersecting at right angles a straight beam which is rigidly fixed at one end and free at the other, and let Δx be the small distance; let M be a moment acting upon the small piece or solid lamina A B A^1 B^1. In consequence of this action, let the plane B B^1 assume the position C C^1 by turning round an axis N N—Fig. 2—and let B H C = N O H = $\Delta\phi$ be the angle of turning. Further, let Δa be a narrow surface lamina at the distance δ either above or below N N, and s the strain per unit of area produced in it by the moment M. Then the stress in Δa is $s\,\Delta a = \frac{s\,\delta\,\Delta a}{\delta}$, and if d and d^1 are the distances of the two extreme surface lamina from N N, and if equilibrium takes place, we have the sum of all parallel stresses—

$$\Sigma_{-d^1}^{+d} \frac{s\,\delta\,\Delta a}{\delta} = 0 \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

Fig. 1.

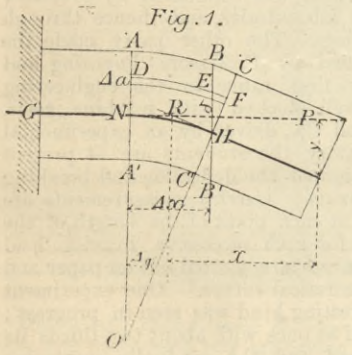
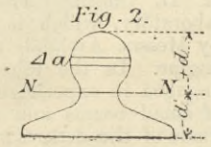


Fig. 2.



This is on the assumption that the moment M is produced either by a force of some magnitude at right angles with the stresses acting at a finite distance from the laminæ A B A^1 B^1, or by an infinitesimal force on an infinite distance. $\frac{s}{\delta}$ is constant according to the principle of elastic tension and compression, and therefore we can write—

$$\Sigma_{-d^1}^{+d} \delta\,\Delta a = 0 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

This is the condition which takes place if δ is measured from the centre line of gravity of the section B B^1, and therefore the axis of turning N N, *i.e.*, the neutral axis, is the centre line of gravity of the section.

The moment of the stress $s\,\Delta a$ is $s\delta\,\Delta a = \frac{s\,\delta^2\,\Delta a}{\delta}$, and the condition of equilibrium is that the sum of all moments acting upon A B A^1 B^1 should be = 0.

$$M - \Sigma_{-d^1}^{+d} \frac{s\,\delta^2\,\Delta a}{\delta} = 0$$

$\frac{s}{\delta}$ being constant, and $\Sigma_{-d^1}^{+d} \delta^2\,\Delta a$ being what is called the moment of inertia (J) of the section, we have—

$$M = \frac{s}{\delta} J \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

Reverting now to Fig. 1, we can read off—

$$\frac{E\,H}{N\,O} = \frac{E\,F}{N\,H} \text{ or } \frac{\delta}{N\,O} = \frac{E\,F}{D\,E} \quad . \quad . \quad . \quad (4)$$

$\frac{E\,F}{D\,E}$ is the extension of the material, and therefore $= \frac{s}{E}$ where E is the modulus of elasticity, and introducing the value of s from (3) we have—

$$\frac{1}{N\,O} = \frac{M}{E\,J} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (5)$$

From Fig. 1 we find—

$$\tan.\ \Delta\phi = \frac{\Delta x}{N\,O}$$

Putting the value of N O out of this into (5), considering also that for very small angles tan. $\Delta\phi = \Delta\phi$, we have—

$$\Delta\phi = \frac{M\,\Delta x}{E\,J} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (6)$$

This is the equation of the curve of flexure or "elastic line." $\Delta\phi$ is also the angle which the two ends of the neutral fibre N H form with each other, and if very small it is equal to the depression of the neutral fibre R P below its original position at a distance = 1 from R. The depression Δy at the distance x is therefore—

$$\Delta y = x\,\Delta\phi = \frac{M x\,\Delta x}{E\,J} \quad . \quad . \quad . \quad (7)$$

This is the deflection of the beam due to the lamina A B A^1 B^1 only.

If the beam G P throughout its length l is divided into a number of very small laminæ of the measurable lengths Δx, and if the moments of inertia in the central section at point R of each as well as the moments M acting upon that section, and the value of E are known, it is only necessary to state the value of Δy for each laminæ according to (7) and to add these values together in order to obtain the total deflection y of the beam at P. This merely arithmetical process must be resorted to if the quantities M, J, &c., change irregularly from lamina to laminæ, but if these quantities are either constant, or if the law of their change can be expressed by a simple function of x, then the shorter and more accurate mathematical process is preferable. In the former case we write—

$$y = \Sigma_0^l \frac{M x\,\Delta x}{E\,J} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (8)$$

and the accuracy of the result will depend on the smallness of the length Δx. In the latter case we write—

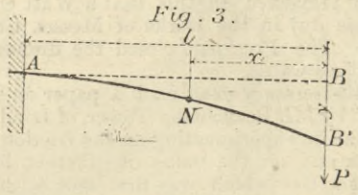
$$y = \int_0^l \frac{M x\,dx}{E\,J} \quad . \quad . \quad . \quad . \quad . \quad . \quad (9)$$

and the accuracy is perfect because dx is infinitely small. This equation is the only one required, if only the deflection at right angles with the neutral fibre comes into consideration, *i.e.*, if the neutral fibre is a straight line. If it is a curve before the deflection takes place, or if the deflection is so great that the elastic line materially differs from a straight line, a second equation must be introduced, but we shall not deal with such cases here.

Example 1.—Let A B, Fig. 3, be the neutral axis of a beam of uniform section and homogeneous material; P a force acting at right angles with it at point B; and let B B^1 = y be the small deflection in consequence of this action. Then the moment at point N at the distance = x from B is Px; and according to (9),

$$y = \int_0^l \frac{P x^2\,dx}{E\,J} = \frac{P l^3}{3\,E\,J}.$$

Fig. 3.



Example 2.—We now add in Fig. 3 a force Q parallel with P at distance = 0·3 l from B. The moment of this force at any point between Q and A is Q $(x - 0{\cdot}3\,l)$, and the deflection of B resulting from it is $\frac{Q(x - 0{\cdot}3\,l)\,x\,dx}{E\,J}$.

Between Q and B no moment is added, and therefore the summation has to be carried out only between $x = l$ and $x = 0{\cdot}3\,l$, *i.e.*,

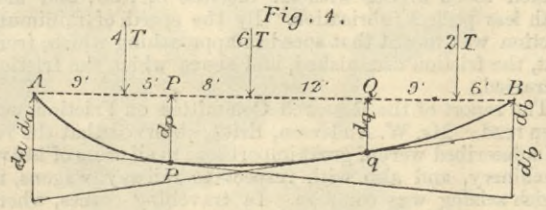
$$y_1 = \int_{0{\cdot}3\,l}^{l} \frac{Q(x - 0{\cdot}3\,l)\,x\,dx}{E\,J} = \frac{Q}{E\,T}\left(\frac{0{\cdot}973}{3} l^3 + \frac{0{\cdot}273}{2} l^2\right).$$

The total deflection of B is accordingly

$$y + y_1 = \frac{1}{E\,J}\left[P\frac{l^3}{3} + Q\left(\frac{0{\cdot}973}{3} l^3 + \frac{0{\cdot}273}{2} l^2\right)\right].$$

Example 3.—Let A B, Fig. 4, be a beam 49ft. long, of uniform section, supported at A and B, and let the forces 4, P, 6, Q, and 2 tons act upon it at intervals, as shown in the diagram. We draw the curve A p q B, representing in an exaggerated manner the elastic line of the beam under the action of the forces. Its form depends on the results of the calculation which follows, and possibly it ought to have been drawn above A B instead of below, or partly above and partly below; but this would not affect the calculation.

Fig. 4.



Our object now is to calculate the deflections d_p and d_q. We draw a tangent at p, and one at q, and name the distances cut off by them on the end verticals $d^1{}_a$, $d^1{}_b$, d_a, d_b. Then we have geometrically the following simple relations:—

$$\left.\begin{aligned} d_p &= \frac{14}{49} d^1{}_b + \frac{35}{49} d^1{}_a \\ d_q &= \frac{34}{49} d_b + \frac{15}{49} d_a \end{aligned}\right\} \quad . \quad . \quad (10)$$

As we assume that in reality the elastic line differs very little from the horizontal A B, and that, therefore, the two tangents are nearly horizontal, we can treat the vertical forces as being at right angles with these tangents. We can go even further and imagine that either of the tangents is the beam itself, that it is rigidly fixed at points p or q respectively, and that its ends are then bent upwards so as to reach points A and B. We have, therefore, a cantilever on each side of p or q respectively, and we can treat each cantilever according to example 2. This treatment, applied twice for each tangent, would give the quantities $d^1{}_b$, $d^1{}_a$, d_b, and d_a, and the problem would then be solved with equations (10). First we give to the pressure of each support A and B a direction, we assume an upward one, and trust that, if this should be wrong, the calculation will find out the error, namely, if one of them should be found negative, the direction should have been the opposite one. As the sum of the moments of all forces acting on the beam must be = 0, we have—

$$\left.\begin{aligned} A &= \frac{-35\,P - 15\,Q + 334}{49} \\ B &= \frac{-14\,P - 34\,Q + 254}{49} \end{aligned}\right\} \quad . \quad . \quad (11)$$

Taking first the tangent, which goes through p, we have for the cantilever to the left—

$$d^1{}_a = \int_0^{14} \frac{A x^2\,dx}{E\,J} - \int_g^{14} \frac{4\,(x-9)\,x\,dx}{E\,J}.$$

For the purpose of using the + or — signs correctly it is only necessary to consider that as A acts upwards it increases $d^1{}_a$, and as 4 acts downwards it diminishes $d^1{}_a$; the member with A must therefore have the same sign as $d^1{}_a$, and the member with 4 the opposite sign. Considering this constantly, it is obviously immaterial whether we begin by writing + $d^1{}_a$ or — $d^1{}_a$. For the cantilever to the right we have—

$$d^1{}_b = \int_0^{35} \frac{B x^2\,dx}{E\,J} - \int_6^{35} \frac{2\,(x-6)\,x\,dx}{E\,J} - \int_{27}^{35} \frac{6\,(x-27)\,x\,dx}{E\,J} + \int_{15}^{35} \frac{Q\,(x-15)\,x\,dx}{E\,J}.$$

Reducing and substituting for A and B their values from (11) we have—

$$d^1{}_a\,E\,J = \frac{-35\,P - 15\,Q + 334}{49} \times \frac{14^3}{3} - \frac{4}{3}(14^3 - 9^3) + \frac{36}{2}(14^2 - 9^2)$$

$$d^1{}_a\,E\,J = -280\,Q - 653\,P + 5619.$$

In a similar manner—

$$d^1{}_b\,E\,J = -4088\,P - 4262\,Q + 46655.$$

Equation (10) was—

$$d_p = \frac{14}{49} d^1{}_b + \frac{35}{49} d^1{}_a.$$

Substituting here the values obtained for $d^1{}_a$ and $d^1{}_b$, we have—

$$d_p\,E\,J = -1634\,P - 1418\,Q + 17344 \quad . \quad . \quad . \quad (12)$$

Taking now the tangent which goes through q we have in a similar manner—

$$d_a = \int_0^{34} \frac{A x^2\,dx}{E\,J} - \int_9^{34} \frac{4\,(x-9)\,x\,dx}{E\,J} - \int_{22}^{34} \frac{6\,(x-22)\,x\,dx}{E\,J} + \int_{14}^{34} \frac{P\,(x-14)\,x\,dx}{E\,J}.$$

$$d_b = \int_0^{15} \frac{B x^2\,dx}{E\,J} - \int_6^{15} \frac{2\,(x-6)\,x\,dx}{E\,J}$$

Reducing and substituting as before, we get—

$$d_q\,E\,J = -1414\,P - 1769\,Q + 16921 \quad . \quad . \quad . \quad (13)$$

If P and Q are given in figures, for example, P = — 1 ton and Q = + 11 tons, also J = 160 in^3 and E = 10000 tons, we find—

$$d_p = \frac{+1634 - 15598 + 17344}{1600000} = +0{\cdot}0021\text{ft.}$$

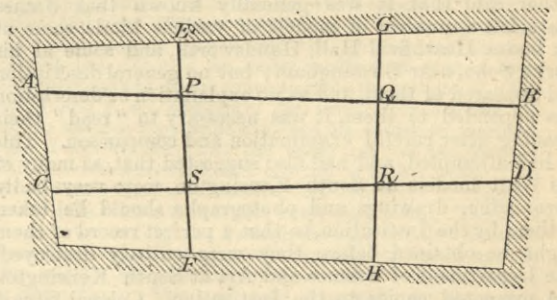
$$d_q = \frac{+1414 - 19459 + 16921}{1600000} = -0{\cdot}0007\text{ft.}$$

$$A = +\frac{204}{49};\quad B = -\frac{106}{49}$$

Four points of the elastic line and the tangents on two of them being now known, the line can be drawn approximately.

Example 4.—The same beam A B may be considered as crossed at P and Q by two other beams, as frequently happens in the construction of bridge platforms or floors. An example of this kind was given in this journal—December 2nd, 1881—and the method of calculation here adopted was there already indicated broadly. In Fig. 5

Fig. 5.



are four girders connected with each other at points P, Q, R, S, and supported at points A, B . . . . H. Girder A B should be treated according to the previous example; and applying the same treatment also to the other three girders we get eight equations instead of two, of the form—

$$d_p = c_1\,P + c_2\,Q + c_3 \quad . \quad . \quad (12 \text{ and } 13)$$

where c_1 c_2 c_3 are constants, derived from given quantities, and these eight equations contain only eight unknown quantities, because each of the deflections d_p d_q d_r d_s is common to two of the girders, and each of the forces P, Q, R, S is also common to two girders, although opposite in direction. If, for example, the force R is a downward or positive force on girder C D, it is an upward or negative force on girder G H, and *vice versâ*. An assumption must be made, and if the result of the calculation is a positive R, the assumption was right, if it is a negative R, it was wrong. The eight equations are then sufficient for the solution of the problem. The process of calculation would be only a fourfold repetition of that stated in Example 3.

Example 5.—The same beam A B may be considered as a continuous girder, resting on four fixed supports A, P, Q, B, Fig. 6. This condition is fulfilled, simply, if—

$$d_p = 0 \text{ and } d_q = 0,$$

i.e., according to equations 12 and 13.

$$\left.\begin{aligned} -1634\,P - 1418\,Q + 17344 &= 0 \\ -1414\,P - 1769\,Q + 16921 &= 0 \end{aligned}\right\} \quad . \quad . \quad (14)$$

* This method was alluded to in the latter portion of a letter addressed to the Editor by the writer, on the subject of platforms—The Engineer, Dec. 2nd, 1881.

This gives—

$P = +7{\cdot}56$ ton and $Q = +3{\cdot}52$ ton,

and with equations (11):

$A = +0{\cdot}34$ ton and $B = +0{\cdot}58$ ton.

The moment at P is then $= 0{\cdot}34 \times 14 - 4 \times 5 = -15{\cdot}24$, and the moment at $Q = 0{\cdot}58 \times 15 - 2 \times 9 = -9{\cdot}3$. Sometimes it is expedient to raise one or two of the supports of a continuous girder in order to modify the moments at the supports. If, for example, it were desirable to raise the support P in the present case so much that the moments at P and Q be equal, *i.e.*, so that

$$14\,A - 4 \times 5 = 15\,B - 2 \times 9 \quad . \quad . \quad . \quad . \quad . \quad (15),$$

then $d_p = -e$, is the elevation, and $d_q = 0$; then equations (12) and (13), with J = 160 and E = 10000 are as follows:—

$$-e\,E\,J = -1600000\,e = -1634\,P - 1418\,Q + 17344$$
$$0 = -1414\,P - 1769\,Q + 16921$$

This gives—

$P = 7{\cdot}56 - 3194\,e$ and $Q = 3{\cdot}52 + 2553\,e$.

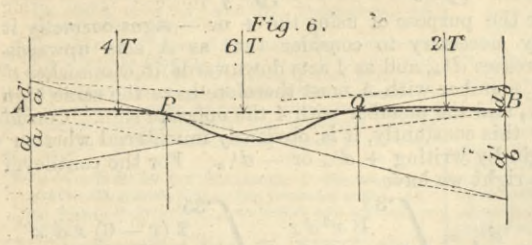
Putting these values into equations (11) and the resulting values for A and B into (15), we get

$e = -0{\cdot}0023$ft.,

that is to say, point P should be lowered 0·0023ft., not raised, as we assumed.

The examples 3, 4, and 5 comprise most of the conditions of elastic bending in a beam. Example 3 illustrates the manner how to define and draw the elastic line of a single beam. In example 4 the same beam assumes the functions of a continuous girder with two flexible supports, and in example 5 the same beam is modified into an ordinary continuous girder, resting on four fixed supports. The calculation is in each case essentially the same, and it is therefore shown that any continuous girder may be treated like a single girder. But this is in most cases not the best treatment, because the expressions would be very long, and the numbers very large. It is better to treat each span of a continuous girder separately until the statement of the equations is made. This will be shown hereafter.

Fig. 6.



INSTITUTION OF MECHANICAL ENGINEERS.

The quarterly meeting of the Institution of Mechanical Engineers took place on Thursday, the 1st inst., the president, Mr. Westmacott, in the chair. In his address the President said that the Council had lately had occasion to consider the mode of carrying on the business of the Institution, and had come to the conclusion that the present arrangement, which had grown up gradually, was not the best that could be adopted with a view to efficiency and economy. They proposed, therefore, that the secretary should be solely and entirely responsible to the Council for carrying on the business. One result of the change would be a considerable reduction in their annual expenditure in respect to salaries, leaving a corresponding amount of money free to be devoted to the purposes of the Institution. He regretted that the alteration necessarily involved the retirement of the assistant-secretary. The Council proposed to mark their sense of his services during the past twenty-eight years by presenting him with an honorarium of £1000, a course which they felt sure would meet with the approbation of the members. He then gave notice that at the annual meeting in January he should propose an alteration in the bye-laws to that effect. A paper, by Mr. E. A. Cowper, "On the Inventions of James Watt and his Models at Handsworth and South Kensington," was read by the assistant-secretary. The author said that it was generally known that James Watt left a number of models of various kinds, some at his house, Heathfield Hall, Handsworth, and some at his works, Soho, near Birmingham; but no general description had appeared of them, and as no explanation or description was appended to them, it was necessary to "read" their meaning after careful examination and comparison. This he had attempted, and had also suggested that, as many of the Watt models at South Kensington were very badly worm-eaten, drawings and photographs should be taken of them by the Institution, so that a perfect record of them might be obtained before they were entirely destroyed. The Department of Science and Art at South Kensington had presented copies to the Institution. Colonel Stuart Wortley, the curator of the Patent-office Museum, also allowed particulars to be taken of the parts of Watt's engine and other machines which were in that museum. Mr. George Tangye, one of their members, had kindly responded to the author's request to have photographs taken of the two important machines in the "Watt Room" in Heathfield Hall—now inhabited by Mr. Tangye—and he had had photographs taken of a number of other interesting articles and tools, including Mr. Watt's own lathe, work bench, tools, and old apron. Mr. Tangye had presented those photographs to the Institution; and the Council, in the interest of the members, had had drawings and diagrams made under his—Mr. Cowper's—direction to illustrate the several models and inventions. A list of thirty-four of the most interesting models of inventions by James Watt, diagrams of which had been taken, was next given. At considerable length Mr. Cowper entered into the technical details of the thirty-four models, describing their action, and pointing out many improvements which had followed the inventions of Watt.

Before the discussion commenced, Mr. Cowper spoke of a particular model at South Kensington, which he had not illustrated, because, being soldered up, it was impossible to see inside and make sure of the arrangement. He believed, however, that it represented a very early form of the separate condenser, the steam being admitted under the piston, passing through it—either by leakage or through a valve—and then being condensed by means of a stroke of the air pump. He drew attention to the old print of a Newcomen engine, reprinted by us about two years ago, and observed that this dated back to 1712, and showed a plug frame with tappets worked by self-acting gear. He remarked on the low pressures to which James Watt adhered so firmly, observing that he himself had seen the flat ends of old boilers bellying in and out with each stroke of the engine, and had also seen a boiler at work with the manhole cover off! In the sharpest possible contrast to this was Trevithick's use of 150 lb. steam—though not without risk, it must be confessed, when it was generated in cast iron boilers 4ft. to 5ft. long, and nearly the same diameter.

Mr. S. Timmins, of Birmingham, spoke eloquently in favour of doing all that was possible for preserving the relics of James Watt, contained in the "Watt Room" at Heathfield Hall—which had been visited by the Council that morning—and elsewhere.

Mr. W. P. Marshall followed in the same strain. Mr. Jeremiah Head read an eloquent tribute to James Watt's memory, and observed that he had had difficulties to struggle against, mistakes to discover and rectify, much as we had; and was so far in advance of his age as to remain a solitary worker at the end of his life. He observed that some of Watt's wagon boilers were working on Tyneside at a recent date. He might have added that a Boulton and Watt engine with the converted sun-and-planet motion was in actual work at Walker certainly as late as 1866. Mr. Henry Davey, of Leeds, mentioned a letter from James Watt to Murdock, now in his possession, which showed that the latter had probably suggested the mode of stiffening the square frames of the sculpturing machine which had been highly commended by Mr. Cowper. Mr. W. S. Hall spoke of a Watt engine working till recently at Neasham, near Ashby-de-la-Zouche, which had been ruthlessly broken up as scrap within the last few months, but of which he hoped to get some particulars. Mr. Timmins remarked on this that a Watt engine was working to this day in the works of Messrs. Clifford, in Birmingham. The President closed the discussion with a few appropriate words.

The assistant-secretary next read a paper on "Friction Experiments," by Mr. Beauchamp Tower, of London. The writer said that in experimenting on the friction of lubricated bearings, and on the value of different lubricants, one of the difficulties which was first met with was the want of a method of applying the lubricant which could be relied upon as sufficiently uniform in its action. All the common methods of lubrication were so irregular in their action that the friction of a bearing often varied considerably. That variation, though small enough to be of no practical importance, and to pass unnoticed in the working of an ordinary machine, would be large enough utterly to destroy the value of a set of experiments, say, on the relative values of various lubricants, for it would be impossible to know whether an observed variation was due to a difference in the quality of the oil or in its rate of application. The first problem, therefore, which presented itself, was to devise a method of lubrication such as would be perfectly uniform in its action, and would form an easily reproducible standard with which to compare other methods. Those conditions were best fulfilled by making the bearing run immersed in a bath of oil. By that method the bearing was always supplied with as much oil as it could possibly take, so that it represented the most perfect lubrication possible. After a description of the engine had been given, the method of experimenting was explained in detail, and the results of the experiments were related. There was reason to believe that, with perfect lubrication, the speed of minimum friction was from 100ft. to 150ft. per minute, and that the speed of minimum friction tended to be higher with an increase of load, and also with less perfect lubrication. By the speed of minimum friction was meant that speed in approaching which, from rest, the friction diminished, and above which the friction increased.

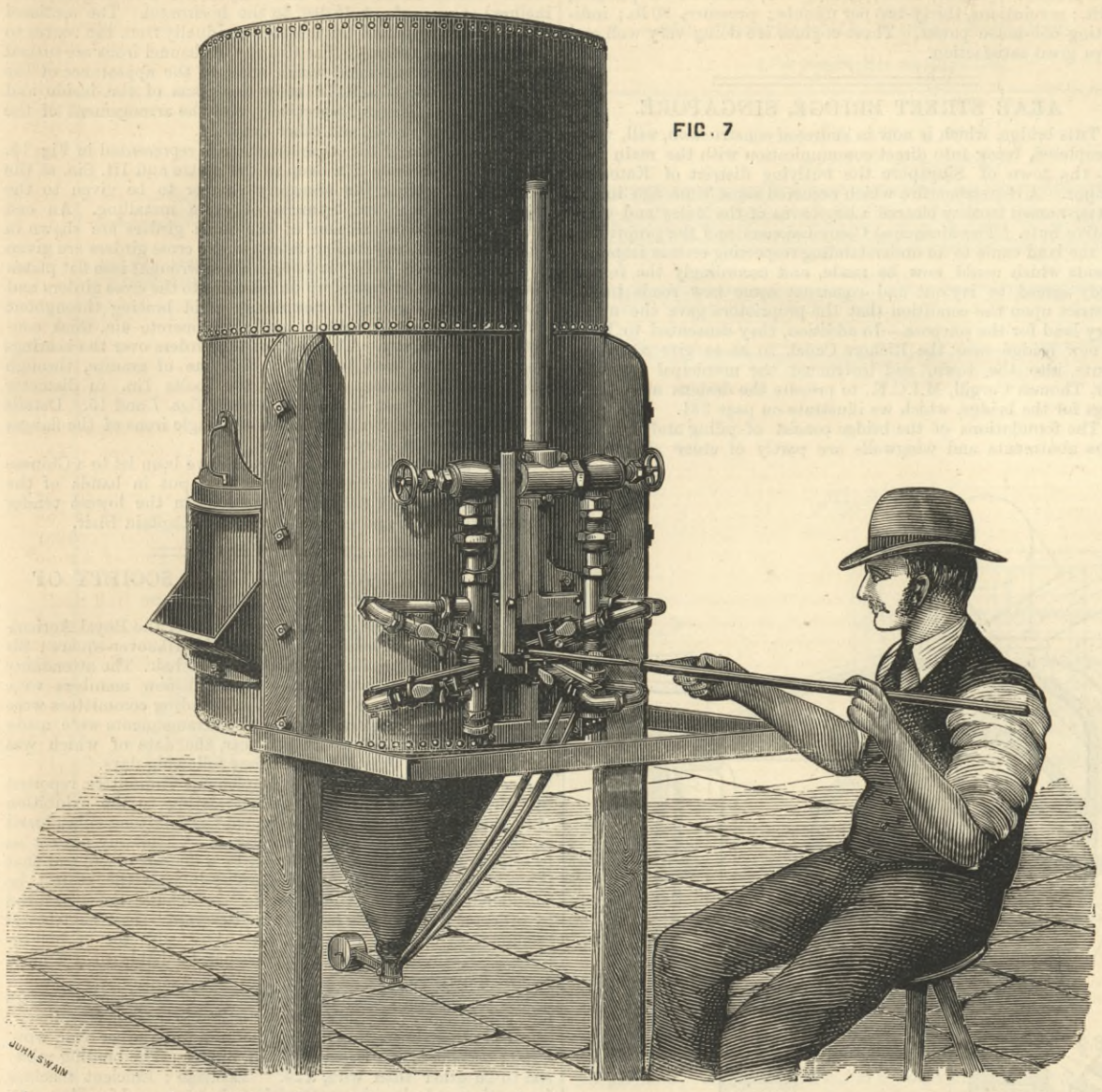
The report of the Research Committee on Friction was then read. Mr. W. Anderson, Erith, observed that the results described were of great importance to all users of heavy machinery, and also with respect to railway wagons, in which seizing was common. In travelling cranes, where the pressure was heavy and the speed slow, and where oil holes were very likely to get choked up, he had found lubrication from below, by a wick dipping into an oil-bath, much the best method. Mr. Wicksteed, Leeds, observed that the pressure of 620 lb. per square inch, as the limit at which seizing commenced, had surprised him. Certainly in some cases—as in the pins of punching and shearing machines—pressures obtained which might be reckoned in tons; but here the pressure was relieved at intervals and the motion was in alternate directions. He hoped some experiments would be made as to the limit of pressure at very low speeds, 20ft. per mm. Mr. John Robinson, Manchester, observed that a regular bath of oil was a very wasteful arrangement, but if it was sufficient that the journal should just skim the surface of the bath, then he thought the method might be used with success. Mr. H. Davey, Leeds, observed that in slow-going pumping engines, as made by his firm, 600 lb. per square inch was taken as the minimum pressure, and 1000 lb. and more was very common. Mr. Arthur Paget, Loughborough, observed that the fact of high pressures being possible with intermittent friction was a confirmation of the view taken in the report that the friction of journals was not solid but rather liquid friction, the oil having time to get back when the pressure was withdrawn. He thought some cases of very low friction had been well explained by Mr. Hawksley as due to a "dither" in the piece, which caused it to jump, as it were, lightly over the inequalities of the surface. Mr. H. Lea, Birmingham, however, mentioned the case of a lathe which could not be prevented from seizing when the cap above the bearing was off, though it worked perfectly well when the cap was screwed down. Professor R. H. Smith, Mason's College, referred to Professor Thurston's experiments in the United States as being substantially the same in their results, but observed that the apparatus did not fairly represent the ordinary conditions of a shaft journal. He asked if the journal was overhanging, and mentioned an apparatus designed by himself, in which all bending of the journal was made impossible. Mr. Druitt Halpin, London, referred to the difference in the pressures upon the crank pin and main bearings of a locomotive as an excellent illustration of the advantage of intermittent pressure. In the first case the working pressure was about 2500 lb. per square inch, but it was intermittent, and in the second it was about 350 lb, but it was continuous. Mr. E. A. Cowper described a good arrangement for the lubrication of marine cranks, used by Messrs. Rennie, and Mr. Price Williams urged the prosecution of the experiments with regard especially to the resistance of trains, on which, however, a great deal of excellent work has lately been done in Germany. Finally, the President, observing that the interest of the subject was not yet exhausted, announced that the discussion is to be resumed at the annual general meeting next January.

The meeting then broke up, after passing some formal votes of thanks, and the members adjourned to the Town Hall, close by, to see the lighting up by Swan incandescent lights as carried out by Messrs. Crompton. The starting into brilliance of the 600 lamps—in successive batches—was very striking, and when all was complete the effect was certainly one of the best yet recorded in the annals of electric lighting. It is rendered more peculiar from the fact that the dynamos are a quarter of a mile away, where they are worked by a rolling mill engine, and are connected by a system of signals with the hall itself. The installation was made as an experiment at the time of the musical festival, and may be dismantled at any time by a week's notice; but the notice has not yet been given, and it seems likely that the arrangement may be made permanent. From thence an adjournment was made to the Mason Science College, where they were met by Professors Poynting, Tilden, Sonnenschein, Watts, and Smith, and by the secretary, Mr. Morley, they divided in two parties, one of which was conducted by Professor Tilden to the chemical laboratories, and thence through the rest of the buildings. The other party made the reverse tour accompanied by Professors Poynting and R. H. Smith. They first came to the engineering laboratory, which is well stocked with machine tools, by Messrs. Archdale and Co., driven by an experimental engine. In the laboratory the students are at present engaged in experiments upon the deflection and breaking of small beams and struts. Careful measurements are made of the deflection at each point of the length of the beam or of the strut for each successive heavier load applied, and all these curves are plotted out on paper and compared with the "theoretical curves." One experiment of an unusual and interesting kind was seen in progress; a beam had been loaded at once with about two-thirds its estimating breaking load, and the gradually increasing deflection from hour to hour under this load was being recorded. The deflection had been increasing for five days, and the beam was expected to break finally without increase of load. Professor Smith's apparatus for testing the friction of lubricated journals under a variety of conditions was also inspected, but it is not yet in operation. The engineering museum contains collections of numerous varieties of all kinds of iron and steel, of English and foreign timbers, of building stones, bricks, &c. &c., and of brass manufactures; as well as a most instructive and numerous series of specimens of boiler plate and joint failures and of boiler incrustations, presented to the College by Mr. E. B. Marten. Professor Smith explained the very complete arrangements for experimenting upon boiler and engine efficiency. The engine made by Messrs. Platt Bros. is a compound surface-condensing, cylinders 6in. and 12in. by 10in. stroke. It drives a Siemens dynamo machine with separate exciter, besides all the machines in the workshop. The party then visited the drawing-office, which is a spacious and lofty hall about 80ft. long, and admirably fitted up. The students make all their drawings from their own free-hand sketches, taken from models of machine details, and from the engine and machines of the College workshop. They thus learn to measure dimensions and to sketch neatly and clearly, as well as to draw. In beginning their study of projection they are assisted by a black board with horizontal and vertical planes, upon which they carry out the actual projection from the model itself with the help of plumb-line and chalk. We also find here an ingenious arrangement, by means of which a chalk-pencil clamped in any position on a link of a mechanism draws on the black-board the path of motion of that point in the link. A large collection of such mechanism made of bars of wood jointed together in various ways was exhibited, and the curiously complicated curves through which points in even the simplest of these move, proves how useful this device of drawing them on the black board must be to the students of mechanisms.

The visitors then passed on to the physical laboratory, where Professor Poynting had placed for their inspection many interesting pieces of electrical and optical apparatus, and where Mr. E. B. Marten's very neat and useful paste-board models of boiler explosions were laid out and attracted much notice. Professor Smith then led the way to the library, which already contains 14,500 volumes, and is peculiarly rich in scientific serials and works of reference, and thence through the various lecture halls, examination hall, geological museum, and the chemical, physiological, and biological laboratories and museums. A new series of classes for mining engineers has just been started. This new departure has received very cordial support from the mineowners and managers of the Midland iron district, and numerous offers of models and materials wherewith to stock a mining museum in the College have been received. Altogether the evidence afforded by this tour of inspection of the vigour with which scientific, technicho-scientific, and literary studies are being prosecuted in what may now almost be called the new Midland University, are very striking and extremely gratifying.

TILGHMAN'S SAND BLAST FILE SHARPENER.

FIG. 7



A REMARKABLE characteristic of some inventions is the frequency with which some new application presents itself. This is necessarily an attribute of inventions rather of the nature of a process, than of a specific article for carrying out any one part of a process or operation. The very pretty process for ornamenting glass by means of the attrition effected by fine sand projected at a high velocity against its surface, invented by Mr. B. C. Tilghman, of Philadelphia, in 1870, is an illustration of one of these. During the millions of years through which the winds and the waters have driven detrital matter in various directions over the world, sand has acted as a powerful abrading medium, and masonry of the greatest antiquity has better withstood the defeaturing activity of all other agents than it has that of wind carried sand. It was left, however, to Mr. Tilghman to apply to the wants of man this capability of fast moving sand to cut the hardest materials. The process was matured by him, and first used to cut stone for building and other purposes, the sand being impelled by steam at a pressure varying from 60 lb. to 325 lb. per square inch. The process consists in projecting sand at a great velocity by a jet or jets of air or steam against any hard surface, by which means the hard substance is slowly or rapidly worn away according to the velocity of the current or blast of sand. With quartz sand driven with high pressure steam, granite crumbles away like a pile of sand under a falling stream of water, and even corundum can be drilled or grooved with ease. Diamond, the hardest of all substances, cannot withstand its action. With the steam blast cast iron stencils, $\frac{1}{4}$in. to $\frac{1}{2}$in. in thickness, are used to protect the surface which is not required to be cut away. The blast is then directed at right angles to the surface, and moved by suitable mechanism regularly over the whole surface. With a jet using 6-horse power of steam, at 60 lb. to 70 lb. per square inch pressure, and $1\frac{1}{2}$ cubic feet of sand per hour, $1\frac{1}{2}$ to 10 cubic inches, according to the hardness of stone, may be cut away per minute.

The steam and high-pressure air blast is used for several other purposes, such as cleaning brass and iron castings, sheet iron and steel for tinning or otherwise, frosting and ornamenting silver and electro-plated articles. For this purpose we mentioned its use at Swindon Works. For ornamenting and frosting sheet glass, gas and lamp globes and chimneys, table glass, &c., a blast of air produced by a blower of 1 lb. per square inch and below is found most suitable. The stencil or protection for producing ornaments on glass articles vary according to the intricacy of the design, the depth of cutting, and the number to be produced. In some cases lace or other open material is cemented to the surface and used as the stencil, by which a *fac simile* of the lace is indelibly engraved on the glass. Photographs by the gelatine method transferred upon glass may be used as stencils, and then subjected to the blast, by which the most beautiful and intricate designs may be reproduced on glass. Among the odd things to which the process is applied is the ornamenting buttons and marking glue. It has been suggested and tried among others for cleaning the outside of public buildings in London, and cutting tunnels through rock.

FIG 1

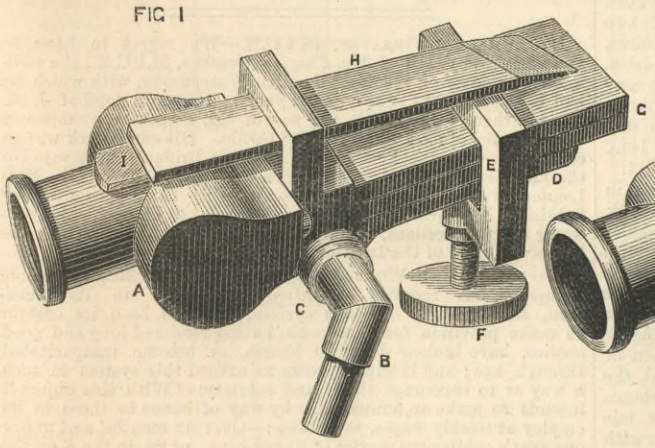


FIG 2

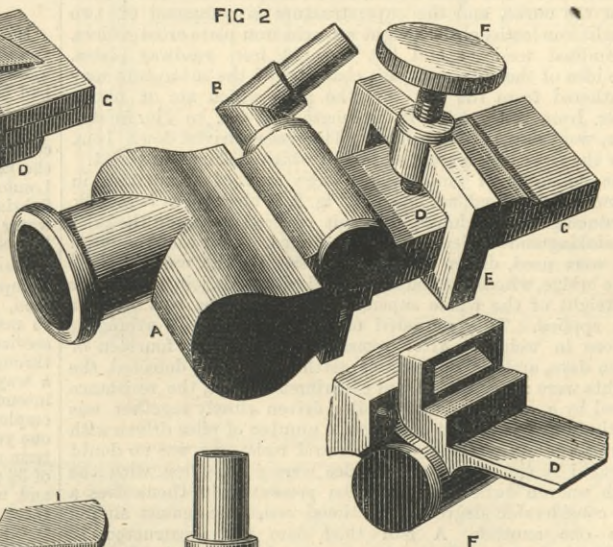
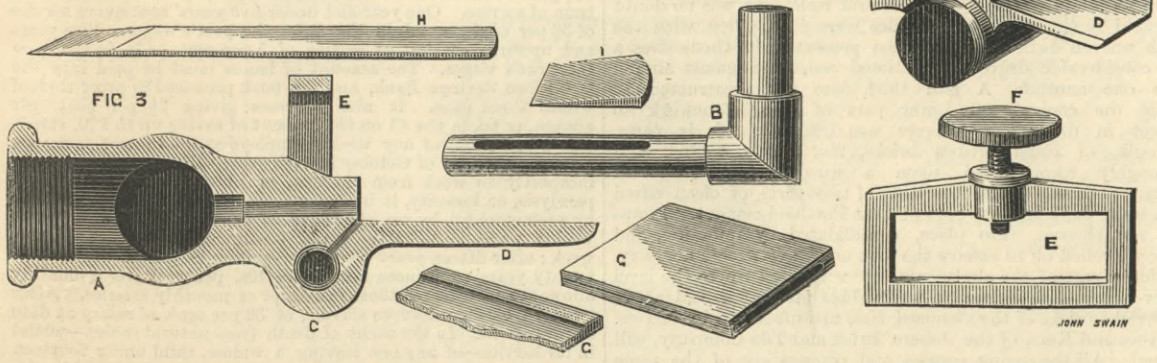


FIG 3



The application of the system to sharpening files is an illustration of what we have said above, for it could not have been at all clear that its use for such a purpose would be successful. To propose to sharpen a file by some abrading agent acting indifferently on all parts alike, would seem as reasonable as to propose to sharpen a saw with a grindstone. To this work, however, the process has been most successfully applied. In the annexed engraving we give a general view of the whole apparatus, and in Figs. 1 to 3 the details of the jet nozzles. From the perspective, Fig. 7, it will be seen that the apparatus consists of a vertical sheet iron cylindrical vessel, the lower part of which is an inverted cone fitted with a valve opening outwards. At the mouth of an opening in one part of the vessel are arranged two pairs of jet nozzles, those of each pair being placed with such relation to each other that the jets from them converge at an angle as shown at Fig. 6. The jet nozzles are shown clearly

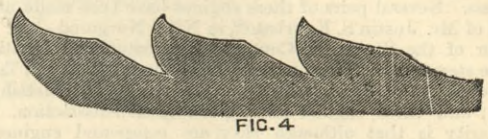


FIG. 4

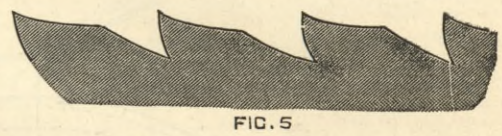
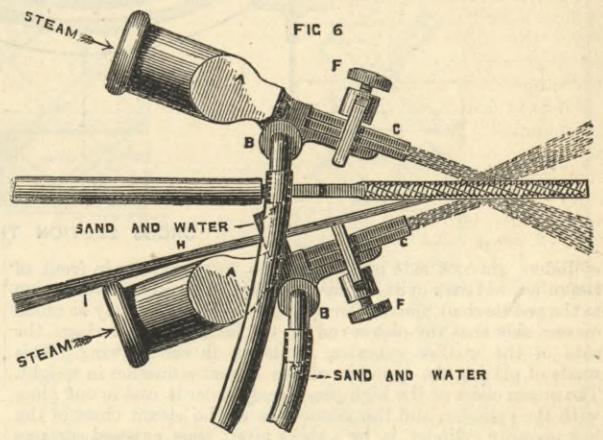


FIG. 5

at Figs. 1, 2, and 3. The case casting A shown in section at Fig. 3 is provided with a lip D, on which a pair of thin chilled iron lip castings G are clamped by the screw F. As shown, these lip castings are made so that when placed together they form a narrow flat nozzle slit. Into this slit is blown by steam at about 50 lb. per square inch, through the small round holes shown in section at Fig. 3, and in end view below Fig. 2. The number and size of these holes depends on the work to be done. In using this apparatus, steam is turned into the nozzles, and the short pipe B connected to the bottom of the conical part of the vessel, as shown by india-rubber tubes. Into the bottom part of the vessel is placed a quantity of very fine sand, with water, and when the steam is turned on into the nozzles, an induced current brings up this sand, and it is projected with the steam at whatever may be placed under it, the steam and sand being blown into the cylindrical vessel, and, as the steam condenses, falling to the bottom thereof. The operator has the files, which have to be sharpened, held in long gas pipe handles, into the ends of which have been driven a plug of wood, supplied to him by a boy, and he then holds one file at a time in the position shown in the perspective view Fig. 7, and at Fig. 6. The file is not held still, but is moved to and fro, resting upon a slip H of gun-metal, the file being also occasionally

FIG 6



turned over. The slip H not only forms a rest, but as the operator moves the file backward and forward upon it he learns when the file has reached a good cutting state. As far as the sharpening is concerned this is the whole operation. If files of another and very different width are to be sharpened, the other pair of nozzles is turned into the opening, and the first pair turned out. It will be easily understood that a little practice is necessary to enable a man to make the best job of a file. In Figs. 4 and 5 are sections of file teeth. Fig. 4 shows the form of the teeth as they come from the file cutter or machine. From this it will be seen that the upper part of the tooth is turned backwards somewhat, and the top is rather weak. The effect of the sand blast is to remove this bent-over or rounded top, and to take off the tops of the extra high teeth. The form is then as shown at Fig. 5. It might be expected that the sand would cut the point or fine edge off the teeth, but this is not the case, for smooth files are improved as much as those of the coarser descriptions. The sand used is exceedingly fine, and is the waste material resulting from the grinding of plate glass. It is so fine as to be like smooth, clean mud, and it seems almost remarkable that this will do the work.

At the Bellefield Works, Sheffield, of the Tilghman Sand Blast Company, there is a 40-horse power boiler, and another of similar size being fixed. The one supplies steam to two sets of sharpeners and to the cleaning tanks, to be hereafter mentioned. With this boiler, costing, say, £10 per month for coal, the company can do file-sharpening work to the value, we are informed, of about £500, those files which are sharpened for other manufacturers being charged for at about 5 per cent. of the value of the files. It should be here stated that the company does not, as a rule, sharpen worn files at these works. The business is confined to sharpening new files, and we may at once say that the difference between the cutting power and smooth working of a new file before and after blasting is so great that no one who has tried files so sharpened would ever afterwards use files that had not been so treated any more than they would buy unfinished articles of other kinds. We have ourselves used them.

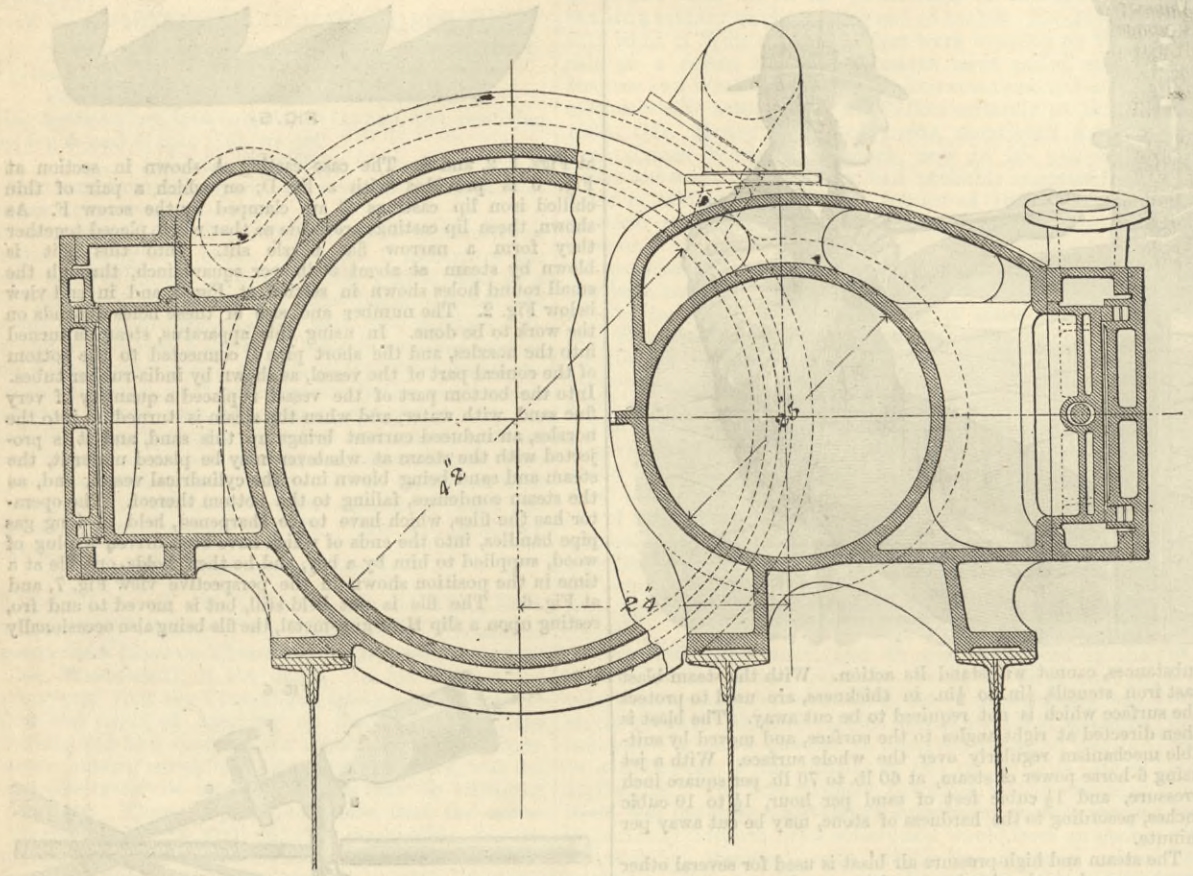
In the ordinary way cleaning files after the hardening and tempering processes is a dirty, laborious operation. They have to be scoured with brushes and sand by hand, and then put into lime-water and dried. By one workman, only about three dozen per hour can be cleaned. Now it is an accident of the sand blast process, that it cleans the files as well as sharpens them. As they pass from the sand blast hand, they go to a boy, who passes them under a jet of hot water, which cleans out sand

sludge, and the file being then hot, it dries of itself. The company is making a sand blast apparatus specially for cleaning files at the rate of about thirty dozen per hour, by means of low-pressure jets set at a suitable angle. Before the company used the hot-water jet one man used to be employed in brushing the dried sand mud out of the files at the cost of one man for each machine and 6s. per week for brushes. Now a lad does all. With one machine like that illustrated 14in. files may be sharpened at the rate of—flat bastard, 5 to 8 dozen per hour; second cut, 10 to 12 dozen; smooth, 12 to 15 dozen; half-round bastard, 4 to 6 dozen; ditto second cut, 8 to 9 dozen, and so on.

The apparatus is now being used a good deal at home and abroad by private engineering and other firms and railway companies, to sharpen worn files, which it does at a very low cost.

ENGINES FOR LIGHT-DRAUGHT STEAMERS ON THE SIBERIAN RIVERS.

The great object had in designing the engines illustrated in our supplement was to combine extreme lightness with compactness. Several pairs of these engines have been made at the works of Mr. Justin S. Kourbatoff, in Nijni Novgorod—the head partner of the Steamship Company Kourbatoff and Ignatieff—for the steamers carrying on the trade of the firm between Tumen and Tobolsk and Semiplatinsk on the rivers Tour, Irtish, and Tobol; and these engines have given great satisfaction. The peculiarity is that although they are compound engines the



CROSS SECTION THROUGH CYLINDER.

cylinders are not side by side, nor, so to speak, one in front of the other, but each cylinder has its own piston-rod and connection to the paddle shaft, the smaller cylinder being placed only so much on one side that the piston-rod of the larger cylinder clears the side of the smaller cylinder, as shown in the drawing. This mode of placing the cylinders allows a great reduction in weight. The steam chest of the high-pressure cylinder is cast in one piece with the cylinder, and the connection to the steam chest of the low-pressure cylinder is by a short pipe; thus exposed surfaces are as much as possible avoided, a matter of importance in a cold climate. Seeing that the centres of the two cylinders are not wide apart, there is no need of an intermediate shaft, and both drive direct on to the paddle-wheel shaft.

The crank shaft and pin of the high-pressure cylinder are of the usual type and work in bearings of the usual class. The low-pressure has a slipper guide, the high-pressure cylinder a four bar guide of the locomotive type. The air pump is worked off the crosshead as shown. The diameter of the air pump is 20in.; stroke, 21in. This double-acting air pump is placed below the water-line, and is connected with the condenser, which carries the slide bar for the low-pressure piston-rod; this piston-rod also passes through a stuffing-box through the lower cover of the cylinder so as to ensure a steady motion. So as to lessen the space occupied, the high-pressure cylinder has two balanced slide valves of the usual type. There is a single double ported valve to the low-pressure cylinder. There is another cock, not shown in the drawing, which may be used in case of need to turn on steam direct to the steam chest of the large cylinder; the diameter of this is 1in. Two pumps, a feed and a bilge pump, 4in. diameter, are worked by the same beam that works the air pump.

This type of engine has been patented by Mr. W. J. Kalashnikoff, the chief constructor—foreman and draughtsman—of the works of Kourbatoff. These works made a good display at the late Moscow Exhibition; and a pair of engines the same as those now under consideration obtained for the makers a gold medal. The dimensions are as follows:—High-pressure cylinder, 25in.; low-pressure, 42in.; stroke, 42in.; paddle wheels, Morgan's patent, diameter 13ft. 6in.; steam is admitted to the high-pressure cylinder during three-fourths stroke, and the same to the low-pressure cylinder The engines make thirty revolutions per minute, the boilers carry 90 lb. steam, and the engine indicates 360 to 380-horse power.

Engines of this type have been put into six steamers—iron built vessels, 180ft. in length and 25ft. in breadth. These boats when loaded with passengers and with all necessary fuel—wood—and water on board draw 2ft. 4in. The consumption of fuel is 3¼ piatericks—17½ fathoms—of wood per diem. In Russia wood is cut into logs 1ft. 6in. long, and is built up so as to form a wall one fathom long and one fathom high, and 1ft. 6in. thick, and this measure is called a fathom, five of which make a piaterick. The average speed against the current and towing a barge of the same dimensions as the steamer—with convicts or goods on board—is ten versts, or nearly eight English miles per hour.

This year a steamer of larger dimensions, called the Kazansky, has been put on the river by the same firm, the engines being of 200-horse power nominal; the high-pressure cylinder, 29in.; low-pressure cylinder, 48in.; stroke, 4ft.; diameter of paddles, 14ft.; revolutions, thirty-two per minute; pressure, 90 lb.; indicating 650-horse power. These engines are doing very well and give great satisfaction.

ARAB STREET BRIDGE, SINGAPORE.

This bridge, which is now in course of construction, will, when completed, bring into direct communication with the main part of the town of Singapore the outlying district of Kampong Rapur. A disastrous fire which occurred some time ago in the latter-named locality cleared a large area of the Malay and other native huts. The Municipal Commissioners and the proprietors of the land came to an understanding respecting certain improvements which could now be made, and accordingly the former body agreed to lay out and construct some new roads in the district upon the condition that the proprietors gave the necessary land for the purpose. In addition, they consented to build a new bridge over the Richore Canal, so as to give a shorter route into the town, and instructed the municipal engineer, Mr. Thomas Cargill, M.I.C.E., to prepare the designs and drawings for the bridge, which we illustrate on page 361.

The foundations of the bridge consist of piling and concrete. The abutments and wingwalls are partly of stone and partly of brickwork. The span is 50ft. in the clear and the width 30ft. inside the curbs, and the superstructure is composed of two wrought iron lattice girders, eight wrought iron plate cross girders, longitudinal tee-irons and flat wrought iron roadway plates. Some idea of the extremely soft character of the subtratum may be gathered from the fact that the piles, which are of native timber from 25ft. to 30ft. in length and 6in. to 7in. in diameter, went down 4ft. at a blow. They were driven down 18in. below the river bed, a cross section of which is shown in Fig. 1.

The necessity of employing a large area of foundation in instances of this kind, as shown in Fig. 2, is obvious, as it is only by reducing to a minimum the unit of pressure upon the piles that sinking and settlement can be avoided. Over four thousand piles were used, driven closely together. On the weakest parts of the bridge, where the abutments and wingwalls join, and where the weight of the whole superstructure rests, the test weights were applied. They consisted of pig iron piled up averaging 25 tons in weight. After remaining *in situ* for fourteen or fifteen days, and no appreciable settlement being detected, the weights were removed. From experiments made, the resistance offered by a cluster of these piles driven closely together was greatly in excess of that of the same number of piles driven with intervals between them. This lateral resistance was no doubt increased by the fact that the piles were in the log, with the rough uneven bark on them, thus presenting in themselves a very considerable degree of frictional resistance against sliding upon one another. A half tidal dam was constructed to enable the concrete or lower part of the stonework to be got in dry. The concrete was composed of six parts, by bulk, of clean broken bricks, 2in. gauge, mixed, and thoroughly incorporated upon a wooden platform with mortar previously made, consisting of two parts of clean sifted fresh water sand and one part of neat Portland cement. It was laid, not thrown, into place, consolidated by ramming, and the top levelled off to receive the first course of rubble masonry. The lower part of the abutments and wingwalls up to the level of low-water mark will be built of rubble stonework, and above this height bricks of the standard size, manufactured by Messrs. Boultbee and Kerr, of the Johore Brick and Tile Company, will be used. All the string courses and copings are of the same bricks, but of a superior quality, being pressed, and of a white colour, to contrast with the remainder of the work, which is of the usual brick red.

In Figs. 2 to 6 are shown the plan and sections of the abutments and wingwalls. In Fig. 16 is represented an elevation of one-half the main girders. These girders are of the well-known lattice type, with plate flanges and open web. The flanges and bars of the web are rivetted together through angle irons 4½in. by 4½in. by ½in., which form a part of the sectional area of the flanges themselves. The web is composed of plain bars for the ties or tensile members, and of channel irons for the struts or compressive members. It will be seen that there are no upright bars except those forming the end of the girders over the bearings on the abutment. Although it is a very common occurrence for lattice girders to be designed with vertical bars in the web as well as double diagonals, the principle nevertheless is faulty. Whenever there are double diagonal and vertical bars combined, one or other of the three sets is superfluous, and signifies simply so much useless metal and useless expense. The diagonals are inclined at an angle of 45 deg. to the horizontal. The sectional area of both struts and ties increases gradually from the centre to the ends of the girders. The ribs of the channel irons are turned outwards, an arrangement which adds to the appearance of the structure. Figs. 17 and 18 show the plans of the inside and outside of the flanges respectively, and the arrangement of the joints, pitch of rivets, and other details.

A cross section of the superstructure is represented in Fig. 19. The cross girders are 2ft. deep in the centre and 1ft. 8in. at the ends, thus enabling the necessary camber to be given to the roadway with the employment of extra metalling. An end elevation and cross section of the main girders are shown in Figs. 21 and 21A, and similar details of the cross girders are given in Figs. 22 and 23. The platform is all of wrought iron flat plates $\frac{5}{16}$in. in thickness, rivetted up on all sides to the cross girders and tee irons, thus forming a completely solid bracing throughout the whole bridge. A layer of asphalte concrete 4in. thick constitutes the roadway. The ends of the girders over the bearings rest upon sheet lead laid on a bedstone of granite, through which they are bolted down by two bolts 1in. in diameter passing through cast iron washers—see Figs. 7 and 15. Details of the intersection of the bars and the angle irons of the flanges are shown in Figs 9 to 14.

The piling, concrete, and brickwork have been let to a Chinese contractor, and the ironwork has been put in hands of the Tangang Pagar Dock Company, who sent in the lowest tender through their able and energetic manager, Captain Blair.

THE ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

On Wednesday a meeting of the Council of the Royal Agricultural Society was held at its house in Hanover-square; Sir Brandreth Gibbs, president, occupying the chair. The attendance was large. One governor and sixty-eight new members were elected. Reports from most of the standing committees were received and adopted, and preliminary arrangements were made for the Shrewsbury Show of next year, the date of which was fixed for Monday, July 14th, and four following days.

Mr. Hemsley, chairman of the Implement Committee, reported that they had revised the regulations relating to the exhibition of implements, and they recommended the following rules, based on the recommendation of the stewards:—"That any protest as to articles exhibited be accompanied by a deposit of £5, and that the said sum be forfeited to the Society in case the protest be considered frivolous by the stewards." "That articles removed by order of the stewards to the 'empties yard' shall be labelled 'removed by order of the stewards.' Any exhibitor or his representatives removing such articles shall be liable to a fine of £5 and expulsion."

The Committee recommended the offer of the following prizes for competition at Shrewsbury:—Sheaf-binding Machinery: Sheaf-binding reaper, the binding material to be other than wire, £100; second, £50. Separate sheaf binder: The binding material to be other than wire, £25. Ensilage: Efficient machine for cutting and elevating materials to be preserved in silos, £25. This report was adopted.

Mr. Randall, chairman of the Showyard Contracts Committee, reported that all the Society's permanent buildings had been removed from York, and were stored outside the racecourse at Shrewsbury. Mr. Bennison, the Society's superintendent of works, had presented a comparative statement showing the cost of the showyard works for the last four years, from which it appeared that there had been a saving at York of upwards of £1000, although the showyard there was much larger than either Reading, Derby, or Carlisle. This saving had been effected partly by a successful sale of the materials used, and partly by improved construction of some of the buildings.

Mr. Charles Greaves, M.I.C.E.—We regret to have to announce the death of Mr. Charles Greaves, M.I.C.E., the well-known engineer of the East London Waterworks, with which he had been connected twenty-seven years. He was a pupil of J. M. Rendel, then of Plymouth, and was in this respect contemporary with Mr. Beardmore and Sir John Coode. His early work was in connection with the Portsmouth Floating Bridge and surveys for the East India Railway; after which he was engaged on the East London Waterworks, the first work being hard parliamentary fighting. Mr. Greaves subsequently confined himself chiefly to water supply questions, rainfall, evaporation, &c., as shown by the "Proceedings" of the Institution of Civil Engineers.

Employers and Workmen.—The Morgan Plumbago Crucible Company has recently published a circular to its workmen, setting forth a bonus system. It has been its custom to make provision for those who, having rendered long and good service, have broken down in health, or become incapacitated through age; and it now proposes to extend this system in such a way as to encourage thrift and sobriety. With this object it intends to make an annual gift by way of bonus to those in its employ at weekly wages, as follows:—Over six months' and under one year's continuous service of 2½ per cent., or 6d. in the £ on the term of service. One year and under five years' continuous service of 3¾ per cent., or 9d. in the £ on the year's wages. Five years and upwards continuous service of 5 per cent. or 1s. in the £ on the year's wages. The amount of bonus must be paid into the Post-office Savings Bank, and the book produced in proof thereof within three days. It also proposes giving 2½ per cent. per annum, or 6d. in the £1 on the amount of saving up to £20, standing to the credit of any weekly employé at the Post-office Saving Bank on the 31st of October in each year. In cases of permanent incapacity to work from old age, or illness, such as blindness, paralysis, or insanity, it intends to supplement the savings made by each employé by an allowance in cases of those in receipt of weekly wages:—After ten years' continuous service, of 6s. per week; after fifteen years' continuous service, of 8s. per week; after twenty years' continuous service, of 10s. per week; or a monthly allowance in cases of those in receipt of monthly salaries. After twenty years' continuous service, of 30 per cent. of salary at date of retirement. In the event of death from natural causes—whilst in its service—of any one leaving a widow, child under fourteen years of age, or aged parent who has been dependent on him for support, the following amounts will be paid:—Three months' wages or salary, after not less than ten years' continuous service; six months' wages or salary, after twenty years' and upwards continuous service; less all sums that may have been paid as pension under Clause II. For the purpose of this clause, an employé will not be deemed to have left its service when retired on a pension. It proposes to pay to anyone in its employment who meets with a non-fatal bodily injury which disables him from performing his duties—whether the nature of the accident is such as to entail responsibility under the Employers' Liability Act or not—a weekly sum during disablement, equal to two-thirds of his wages or salary at the time of the accident for a period not exceeding twenty-six weeks. Other provisions are made which show that Messrs. Morgan and Company recognise the value of good and faithful service, and that it has claims which can only be met by a liberality which is wholly voluntary.

ARAB STREET BRIDGE, SINGAPORE.

MR. THOS. CARGILL, M.I.C.E., ENGINEER.

(For description see page 358)

Scale ⅛ Inch to a Foot
Fig. 1. Elevation

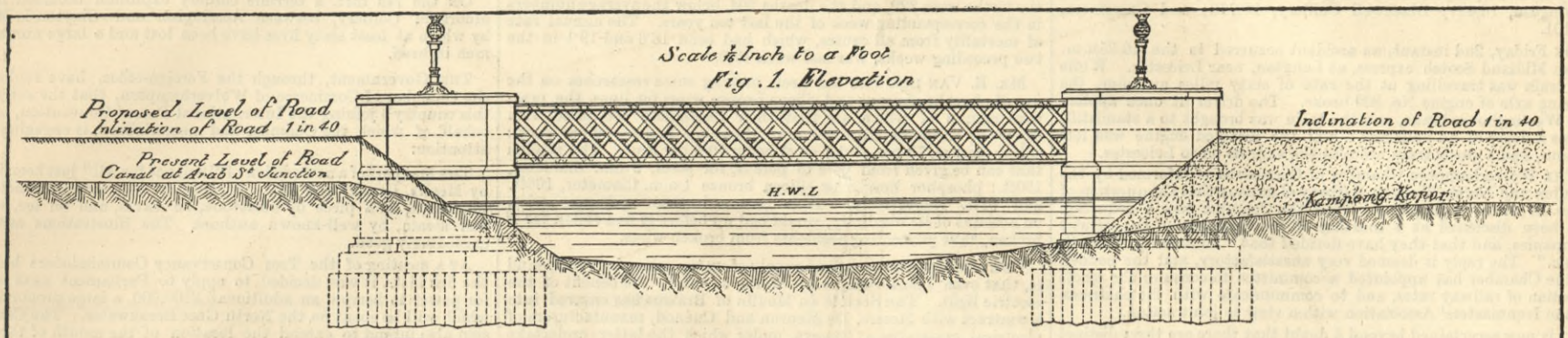


Fig. 4. Section CD

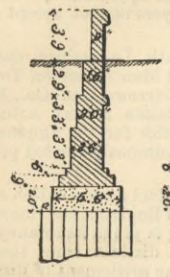


Fig. 5. Section AB

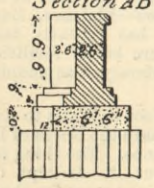


Fig. 6. Section EF

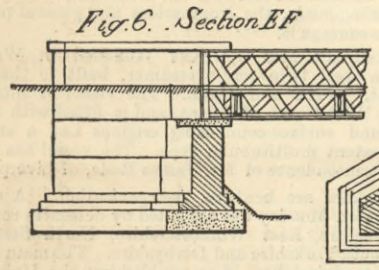


Fig. 2. Plan.

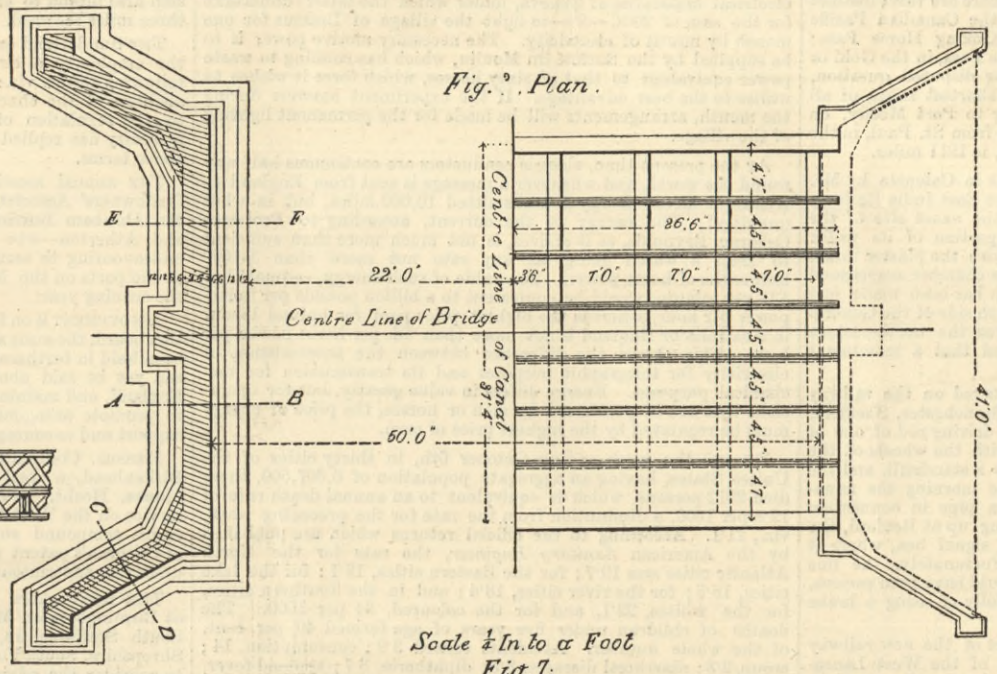
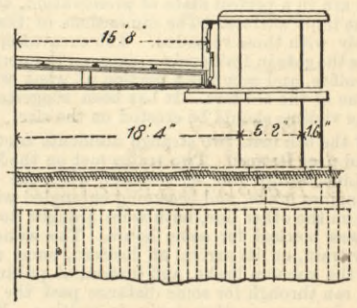
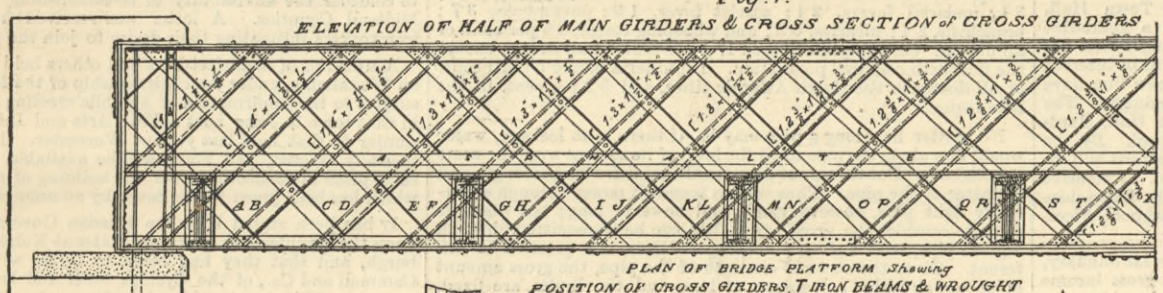


Fig. 3. Cross Section



Scale ¼ In. to a Foot
Fig. 7.
ELEVATION OF HALF OF MAIN GIRDERS & CROSS SECTION of CROSS GIRDERS



PLAN OF BRIDGE PLATFORM Shewing
POSITION OF CROSS GIRDERS, T IRON BEAMS & WROUGHT

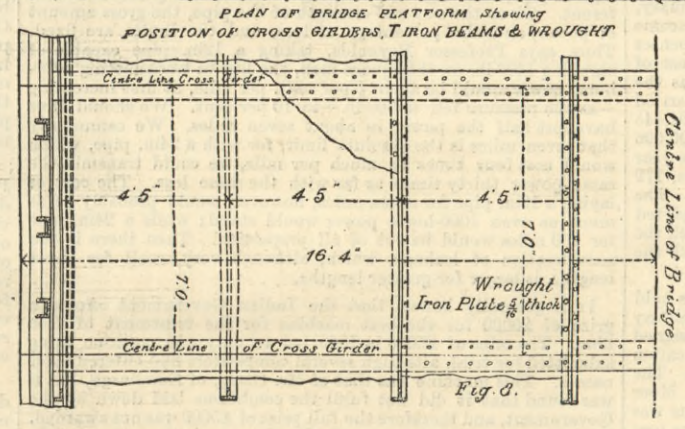


Fig. 8.

Cast Iron Washer Plates

Fig. 15.

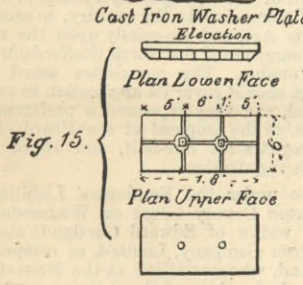


Fig. 12.

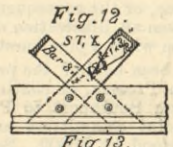


Fig. 13.

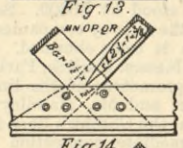
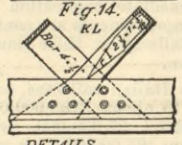


Fig. 14. KL



DETAILS
Scale ¾ In. to a Foot
Fig. 9. AB

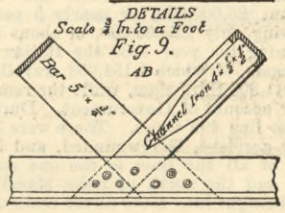


Fig. 10. CD EF

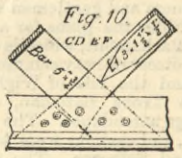
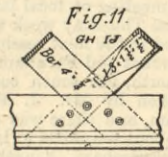


Fig. 11. GH IJ



Scale ¼ In to a Foot
Fig. 16.
ELEVATION OF HALF MAIN GIRDER

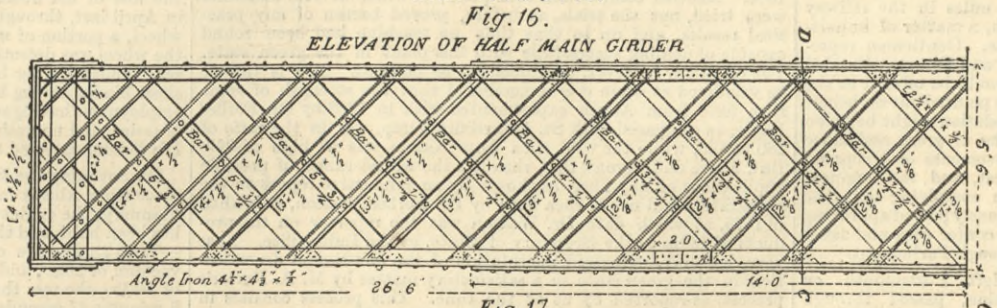


Fig. 17.
SECTIONAL PLAN OF HALF MAIN GIRDER

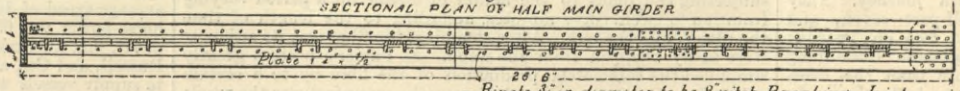


Fig. 18.
OUTSIDE FACE OF TOP & BOTTOM FLANGE OF HALF MAIN GIRDERS

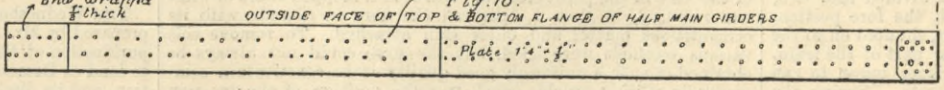


Fig. 19.
CROSS SECTION OF MAIN GIRDERS AT CENTRE & ELEVATION OF CROSS GIRDER

Fig. 20.
SECTIONAL PLAN OF CROSS GIRDER

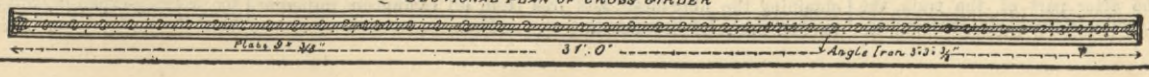


Fig. 21. END ELEVATION

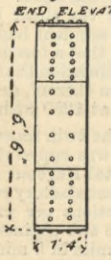


Fig. 21. SECTION CD

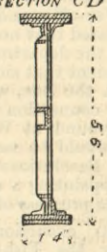
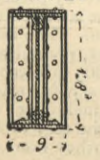


Fig. 22. SECTION AT CENTRE OF CROSS GIRDER

Fig. 23. SECTION EF



RAILWAY MATTERS.

ACCORDING to a French contemporary, the Suisse-Occidentale Railway Company is using the luminous paint in its carriages.

THE coal carried to London by rail during October, 1883, from leading collieries in the Sheffield and adjoining districts was as follows:—Messrs. Newton, Chambers, and Co., Thorncliffe, 29,187 tons; Clay-cross Co., 21,580 tons; Langley Mill, 16,725; J. and G. Wells, Eckington, 16,421; Blackwell Colliery, 15,768; and Grassmoor, 15,101.

ON Friday, 2nd instant, an accident occurred to the 10.35 a.m. down Midland Scotch express, at Langton, near Leicester. While the train was travelling at the rate of sixty miles an hour, the driving axle of engine No. 829 broke. The driver at once applied the Westinghouse brake, and the train was brought to a standstill. After a delay of an hour and a-half the disabled engine was left behind, and a goods train brought the express on to Leicester.

THE Wolverhampton Chamber of Commerce is informed by the London and North-Western Railway Company that the question of rates on return packages on which the Chamber seek a reduction has been discussed at a meeting of the managers of the railway companies, and that they have decided that "no alteration can be made." The reply is deemed very unsatisfactory, and the council of the Chamber has appointed a committee to consider the whole question of railway rates, and to communicate with the chairman of the Ironmasters' Association with a view to joint action.

IT is now ascertained beyond a doubt that there are three distinct passes which may be used as the route of the Canadian Pacific Railway through the Rocky Mountains:—Kicking Horse Pass; Rogers' Pass, in the Selkirk Range; and Eagle Pass, in the Gold or Columbia Range. This virtually settles a long disputed question, and gives the Canadian Pacific Railway the shortest route of all trans-continental railways. From Winnipeg to Port Moody, on the Pacific Ocean, is only 1480 miles, whereas from St. Paul, in the United States, to Portland, on the east coast, is 1911 miles.

AN interesting discovery has just been made in Calcutta by Mr. Bayne, an engineer in the employment of the East India Railway Company. He has succeeded in identifying the exact site of the historical Black Hole, and has laid bare a portion of its walls. They are in a perfect state of preservation, with the plaster intact on the inner surface. The dimensions of the chamber correspond exactly with those recorded. The excavation has been made just inside the gate in Dalhousie-square, on the north side of the General Post-office, and occupies a portion of what was the north-eastern bastion of the old fort. It has been suggested that a monument to the victims should be erected on the site.

ON the 6th inst. two strange accidents occurred on the railway at and near Retford. Two trains met on the Manchester, Sheffield, and Lincolnshire line at Sturton, when the driving rod of one of the engines broke, and becoming entangled with the wheels of the train on the other line, both were brought to a standstill, and the line was blocked for some hours. The same morning the newspaper train, on its arrival at Retford, burst a pipe in connection with the vacuum brake, and instead of pulling up at Retford, the train ran through for some distance past the signal box, where it often happens another train is waiting. Fortunately, the line happened to be clear, or the consequences would have been serious, and might have given an illustration of the folly of using a brake which looses a train when a pipe bursts.

A MEETING has been held of the promoters of the new railway from Blackpool to Preston, in continuation of the West Lancashire Railway from Southport to Preston, in the Town Hall, Blackpool, to appoint committees and to increase a guarantee fund, which last stood at £5600. Satisfactory arrangements are being made with the railway companies, and clauses will be inserted in the Bill which is to be obtained. Plans for the new line have been prepared by Messrs. Garlick, Park, and Sykes, engineers. The four responsible promoters of the line are Alderman Hall, Hardman, and Cocker, and Mr. Handley, all of Blackpool. By the arrangement with the Cheshire lines the midland districts will be brought into immediate connection with Blackpool. Extensive alterations and improvements are contemplated by the Lancashire and Yorkshire Railway on their lines between Blackpool, Fleetwood, and Preston.

THE cost of the Italian railways, completed on the 1st January, 1881, amounted to about £105,000,000. The total gross income for 1880 was about £7,000,000, while the working expenses amounted to about £5,000,000, or nearly 5 per cent. on cost of construction, leaving only £2,000,000, or about 2 per cent. as the net income. During the year 1880 the Italian railways carried 32,491,827 passengers, of which 1,154,958 travelled first, 5,594,445 second, and 14,941,808 third-class, while the remaining 10,800,606 were soldiers for account of Government. During the same year trains ran off the line 490 times. There were 347 collisions, 179 persons killed by accident, 688 wounded, and 54 suicides. The most important of all the lines is the one recently completed between Novara and the north of Lake Maggiore, by which the port of Genoa is brought into more direct communication with the St. Gothard road and Switzerland and Germany.

A PRIVATE meeting of local landowners and gentlemen was held at Farnham on Thursday week to consider the plans for a railway to be promoted in the next session of Parliament, which is designed to bring Aldershot and Farnham into direct railway communication with Portsmouth, the south coast, and the Isle of Wight. The chair was taken by Mr. J. F. La Trobe Bateman, of Moor Park, Farnham, and there was a large attendance. The line was stated to be about ten miles in length, and stations were to be provided for Wrecclesham, Kingsley, and Selborne. The proposed line will effect a saving of about fourteen miles in the railway distance between Aldershot and Portsmouth, a matter of importance, especially from a military point of view. Gentlemen representing both the War-office and the Woods and Forests attended the meeting, and stated that no opposition would be offered to the scheme by either of the departments. It was pointed out on behalf of the War Department that siding accommodation might be given at certain points on the line, which would be of great assistance and convenience in connection with the movements of troops on the Government ground at Woolmer Forest, and the engineer stated that there would be no difficulty in complying with the suggestions made. Resolutions were unanimously passed approving the scheme, and appointing a committee to confer with and assist the promoters in the progress of the Bill through Parliament.

SEVEN HUNDRED excursionists, who left Portsmouth on the 29th ult. for the Fisheries Exhibition, passed through some remarkable experiences on the return journey. They left Waterloo in fifteen carriages at half-past seven, and did not arrive at Portsmouth until half-past two on Tuesday morning. On the train reaching a spot between Godalming and Haslemere the gradient was found more than the overloaded engine could surmount, and a stoppage took place. In order to get over the difficulty the train was divided into two, and the engine proceeded to Haslemere with the fore portion, where the carriages were, by a singular oversight, shunted on to the up line. The engine then returned for the after part of the train. In the meantime, however, the shunted carriages began to run down the incline in the direction of Portsmouth. Seeing the approaching carriages, and appreciating the gravity of the situation, the Haslemere signalman promptly shunted them on to the down line, and they proceeded with great volocity until near Petersfield, when they were brought to a standstill by the level character of the ground. Having walked to Petersfield, the excursionists found that news of their accident had preceded them, and that steps had been taken to arrest the progress of the carriages. There was no panic, the passengers not being informed of the position in which they were placed until all danger had been removed. Eventually, on the engine returning with the after part of the train, the carriages were recoupled, and the excursionists arrived at Portsmouth.

NOTES AND MEMORANDA.

THE deaths for the week ended Saturday, Novomber 3rd, in twenty-eight great towns of England and Wales corresponded to an annual rate of 20·1 per 1000 of their aggregate population, which is estimated at 8,620,975 persons in the middle of this year. In London, during the week ending the 3rd inst., 2623 births and 1440 deaths were registered. Allowing for increase of population, the births were 229, and the deaths 204, below the average numbers in the corresponding week of the last ten years. The annual rate of mortality from all causes, which had been 18·6 and 19·1 in the two preceding weeks, was last week 19·0.

MR. E. VAN DER VEN has been making some researches on the use of phosphor bronze and silicon bronze wires for lines, the practical results of which are that their resistances compared with copper of the same diameter are: Phosphor bronze, 30 per cent.; silicon bronze, 70 per cent.; steel being 10·5 per cent. The stretch that can be given from pole to pole is, for steel, 2 mm. diameter, 130ft.; phosphor bronze or silicon bronze 1 mm. diameter, 106ft. and 91ft. respectively. It is assumed that a bronze wire, on account of its elasticity, would coil up before it had fallen far if broken, thus preventing accidents from broken wires.

ONE effect of the abundant supply of water power in Switzerland is, that even small villages are trying to obtain the benefit of the electric light. The Société du Moulin of Brassus has entered into a contract with Messrs. De Meuron and Cuénod, manufacturers of electrical apparatus at Geneva, under which the latter undertake for the sum of 200f.—£8—to light the village of Brassus for one month by means of electricity. The necessary motive power is to be supplied by the Société du Moulin, which has running to waste power equivalent to that of sixty horses, which force it wishes to utilise to the best advantage. If the experiment answers during the month, arrangements will be made for the permanent lighting of the village.

AT the present time, electric conductors are continuous half way round the world, and whenever a message is sent from England to Australia direct energy is transmitted 10,000 miles, but in what quantity? The energy of the current, according to Professor Osborne Reynolds, as it arrives, is not much more than sufficient to keep a watch going, at any rate not more than 1-1000 millionths of horse-power. The value of such energy, estimated at £17 per minute, would be equivalent to a billion pounds per horse-power per hour, whereas the highest price paid for animal labour in Australia or England is not more than 6d. per horse-power per hour. This shows the difference between the transmission of electricity for telegraphic purposes and its transmission for mechanical purposes. Energy differs in value greatly, but for operations that can be performed by men or horses, the price of energy must be regulated by the highest price of corn.

DURING the week ending October 6th, in thirty cities of the United States, having an aggregate population of 6,607,500, there died 2512 persons, which is equivalent to an annual death rate of 19·8 per 1000, a diminution from the rate for the preceding week, viz., 21·1. According to the official returns which are published by the American *Sanitary Engineer*, the rate for the North Atlantic cities was 19·7; for the Eastern cities, 18·1; for the lake cities, 18·5; for the river cities, 18·4; and in the Southern cities, for the whites, 22·1, and for the coloured, 34 per 1000. The deaths of children under five years of age formed 40 per cent. of the whole number. Accidents caused 3·9; consumption, 14; croup, 2·3; diarrhœal diseases, 8·5; diphtheria, 3·7; typhoid fever, 3·1; malarial fevers, 2·4; scarlet fever, 1·9; pneumonia, 3·7; bronchitis, 2·4; measles, 0·3; and whooping cough, 0·5 per cent. of all deaths. Consumption caused 17·1 per cent. of all deaths among the Southern coloured population. Diphtheria caused 5·6 per cent. of all deaths in the North Atlantic cities, and 5·2 per cent. in the lake region.

NO matter how long a pipe may be, if there is no leakage, water would flow along the pipe until the level of its surface were the same at both ends. But the rate of flow would diminish with the length and diameter of the pipe. Thus we can transmit power through a perfectly tight pipe, however small, and however long; but when we come to consider the gross power that can be transmitted through a given pipe, with a given percentage of loss, the question is different. Given the size and strength of the pipe, the gross amount of power, and the percentage of loss, and the limits are fixed. Thus, says Professor Reynolds, taking a 12in. pipe capable of standing 1400 lb. on the square inch, the loss in transmitting 1000-horse power would be about 5 per cent. per mile, at first increasing—as the pressure fell to 700 lb.—to 10 per cent. We should thus have lost half the power in about seven miles. We cannot say that seven miles is the absolute limit, for with a 24in. pipe, which would cost four times as much per mile, we could transmit the same power thirty times as far with the same loss. The cost of laying a 12in. pipe for seven miles, however, would probably be as much as even 1000-horse power would stand; while a 24in. pipe for 200 miles would be out of all proportion. Then there is the consideration of leakage, which, although very small for short lengths, is larger for greater lengths.

IT is generally known that the Indian Government offered a prize of £5000 for the best machine for the treatment of rhea fibre. The offer of £5000 in 1869 led to only one machine being submitted for trial, although several competitors had entered their names. This machine was that of Mr. Greig, of Edinburgh, but it was found that it did not fulfil the conditions laid down by the Government, and therefore the full prize of £5000 was not awarded. The prize was withdrawn, and the Government re-offered it in 1881. Another competition took place, at which several machines were tried, but the trials, as before, proved barren of any practical results, and up to that time no machine had been found capable of dealing successfully with this plant in the green state. The question, however, continued to be pursued. Nor is this to be wondered at when it is remembered that the strength of some rhea fibre from Assam experimented with in 1852 by Dr. Forbes Royle, as compared with St. Petersburg hemp, was in the ratio of 280 to 160, while the wild rhea from Assam was as high as 343. But, above and beyond this, rhea has the widest range of possible applications of any fibre, as shown by an exhaustive report on the preparation and use of rhea fibre by Dr. Forbes Watson, published in 1875, at which date Dr. Watson was the reporter on the products of India to the Secretary of State, at the India-office. Last year, however, witnessed the solution of the question of decortication in the green state in a satisfactory matter by M. A. Favier's process, as reported by us at the time. This process consists in subjecting the plant to the action of steam for a period varying from ten to twenty-five minutes, according to the length of time the plant had been cut. After steaming, the fibre and its adjuncts were easily stripped from the wood. M. Favier's process greatly simplified the commercial production of the fibre up to a certain point, for, at a very small cost, it gave the manufacturer the whole of the fibre in the plant treated. But it still stopped short of what was required, in that it delivered the fibre in ribands, with its cementitious matter and outer skin attached. To remove this various methods were tried, but the fibre could not always be obtained of such a uniformly good quality as to constitute a commercially reliable article. Such was the position of the question when, about a year ago, the whole case was submitted to the distinguished French chemist, Professor Frémy, member of the Institute of France, who is well known for his researches into the nature of fibrous plants, and the question of their preparation for the market. The professor carefully investigated the nature of the various substances, and in the result he found that the vasculose and pectose were soluble in an alkali under certain conditions, and that the cellulose was insoluble. He therefore dissolves out the cutose, vasculose, and pectose by a very simple process, obtaining the fibre clean, and free from all extraneous adherent matter, ready for the spinner.

MISCELLANEA.

THE meetings of the Institute of Civil Engineers for session 1883-84 commence on Tuesday evening, the 13th inst.

DR. OLIVER LODGE'S Cantor lectures on "Secondary Batteries and the Electrical Storage of Energy," are now being published in the "Journal" of the Society of Arts.

ON the 7th inst. a terrible colliery explosion occurred in the Moorfield Colliery, between Accrington and Clayton-le-Moors, by which at least sixty lives have been lost and a large number of men injured.

THE Government, through the Foreign-office, have replied to the Chamber of Commerce of Wolverhampton, that the subject of this country's joining the International Patent Convention, on the behalf of which the Chamber had memorialised, is engaging their attention.

THE first part of a new edition of "Science for All" just been issued by Messrs. Cassell and Co. It contains well-written articles on the moon, on a piece of limestone, on leaves, and on ice, water, and steam, by well-known authors. The illustrations are also exceedingly good.

AT a meeting of the Tees Conservancy Commissioners held on the 5th inst., it was decided to apply to Parliament next session for power to borrow an additional £100,000, a large proportion of which will be spent on the North Gare Breakwater. The Commission also intend to extend the location of the mouth of the river three miles seaward.

THE Sunderland engineers' strike still continues. The men sent the employers a circular offering to settle the dispute on the following terms, viz.: An advance of 2s. per week all round, the abolition of the character note system, and mutual concessions as to the regulation of the number of apprentices. The masters' secretary has replied that the employers cannot accept any of the above terms.

THE annual meeting of the South Lancashire and Cheshire Coalowners' Association was held at Manchester on Tuesday, and Mr. Abraham Burrows—Fletcher, Burrows, and Co., Manchester and Atherton—who has recently taken a very active part in endeavouring to secure better facilities for the shipment of coal at the ports on the Mersey, was unanimously elected president for the ensuing year.

A MOVEMENT is on foot in Wales to start a conciliation and arbitration board, the same as in the North of England, and one meeting has been held in furtherance. The thing is yet in its infancy, and little can yet be said about it. If kept distinct from the North of England, and maintained more for the settlement of disputes than to promote antagonism, the ironmasters and general public may support and encourage it.

MESSRS. COCHRAN AND COMPANY launched in West Float, Birkenhead, a steel twin screw steamer, built to the order of Messrs. Hecht, Lewis, and Halm. The vessel is intended for service on the West Coast of Africa, and is fitted with two single crank compound surface-condensing engines and a steel boiler of Cochran's patent multitubular type. The vessel has been built under the superintendence of Mr. James Rode, of Liverpool.

THE ironworkers are bent on re-organisation. A conference at Birmingham on Monday was attended by delegates representing South Staffordshire, East Worcestershire, North Staffordshire, Shropshire, South Yorkshire and Derbyshire. The main object was to consider the advisability of re-establishing the Union for the Midland Counties. A letter was received from the Lancashire ironworkers intimating their desire to join the proposed Union.

A MEETING of manufacturers and others held in Wolverhampton on Wednesday, under the chairmanship of the Mayor, determined, subject to the confirmation of a public meeting next week, to hold in that town in June next a Fine Arts and Industrial Exhibition similar to that held last year at Worcester. The building will be specially erected, and £3000 will be available. The opening will take place in connection with the building of a Fine Art Gallery, which has been given to the town by an anonymous donor.

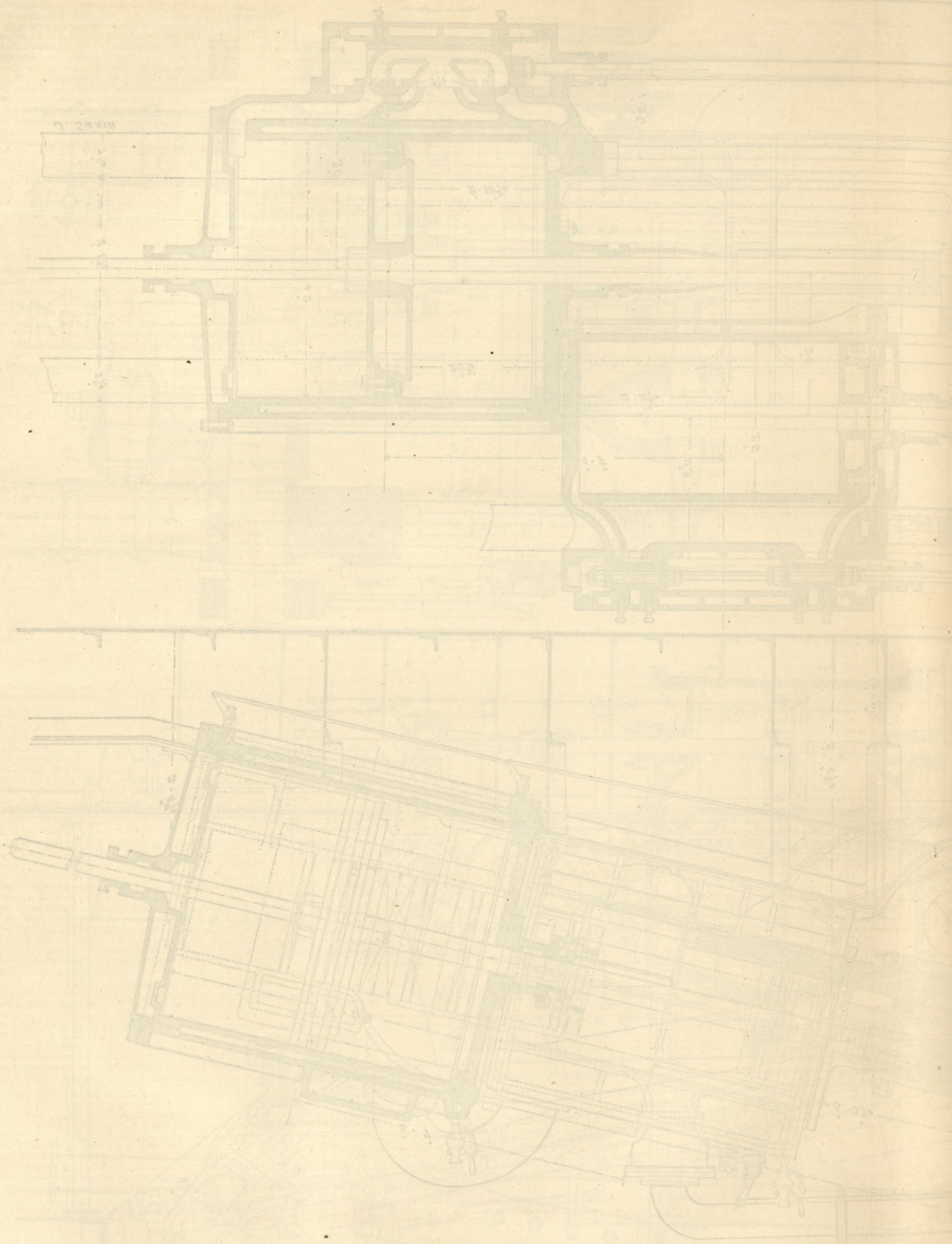
IT has been stated that the Russian Government had decided upon the manufacture of armour plates at Kolpino, near St. Petersburgh, and that they had come to terms with Messrs. Charles Cammell and Co., of the Cyclops Steel and Iron Works, for that purpose. This statement is misleading. An arrangement has been made for a term of five years, under which the Russian Ministry of Marine will manufacture iron and steel-plates at Kolpino, but these are ship plates—under 2in. in thickness—and not armour plates. The works are under English management; indeed, the managers are Sheffield men.

MR. WHITTLE, from the Patent-office, who, at the request of the President of the Board of Trade, is paying a round of visits to the different Chambers of Commerce in the country, to ascertain their views upon the Patents Act, and especially upon the registration of designs, met the Committee of the North Staffordshire Chamber of Commerce on Tuesday. The committee asked that one registration of a design should cover its application to every article to which it was applied, and they expressed a preference for this, even with a higher fee, to the proposal of the Board of Trade to reduce the cost of registration one-half, and afford other concessions, with separate registration.

AN important case under the Employers' Liability Act was decided at the Stockton County Court on Wednesday, the 31st ult. Mrs. Gartland, widow of Edward Gartland, claimed £312 from the Bowesfield Iron Company, Limited, as compensation for the loss of her husband, who was killed at the Bowesfield Works in April last, through the breaking of the shearing machine driving wheel, a portion of which fell on Gartland. It was alleged that the wheel was defective and that the shear blades were wrongly set. Judge Turner held that the accident had arisen owing to the shear blades having become loose, that a foreman in the defendants employment having received an intimation that the machine was out of order, and no notice being taken thereof, defendants were liable. His honour assessed the damages at £250 with costs.

ON Saturday the trial trip of the twin screw tug Churchill took place from Aberdeen. The run was superintended by Mr. J. F. Flannery, the engineer to the Natal Harbour Board, for whom she has been built, and the following satisfactory results were obtained:—With an average of 114 revolutions per minute, and having a vacuum of 25in., and 23in. for the two engines, and steam pressure of 90 lb., she ran the measured mile in 5 minutes 57 seconds and 5 minutes 47 seconds respectively for the two trials, which gives an average speed of 10·4 knots per hour. Her maximum indicated horse-power was 698·4. The vessel is 115ft. long, 22ft. beam, and of 7ft. 6in. maximum draught; she has been built by Messrs. Hall, Russell, and Co., and has specially powerful pumping machinery to supply vessels with fresh water or to put out fires; this as well as the main engines was found to work most satisfactorily.

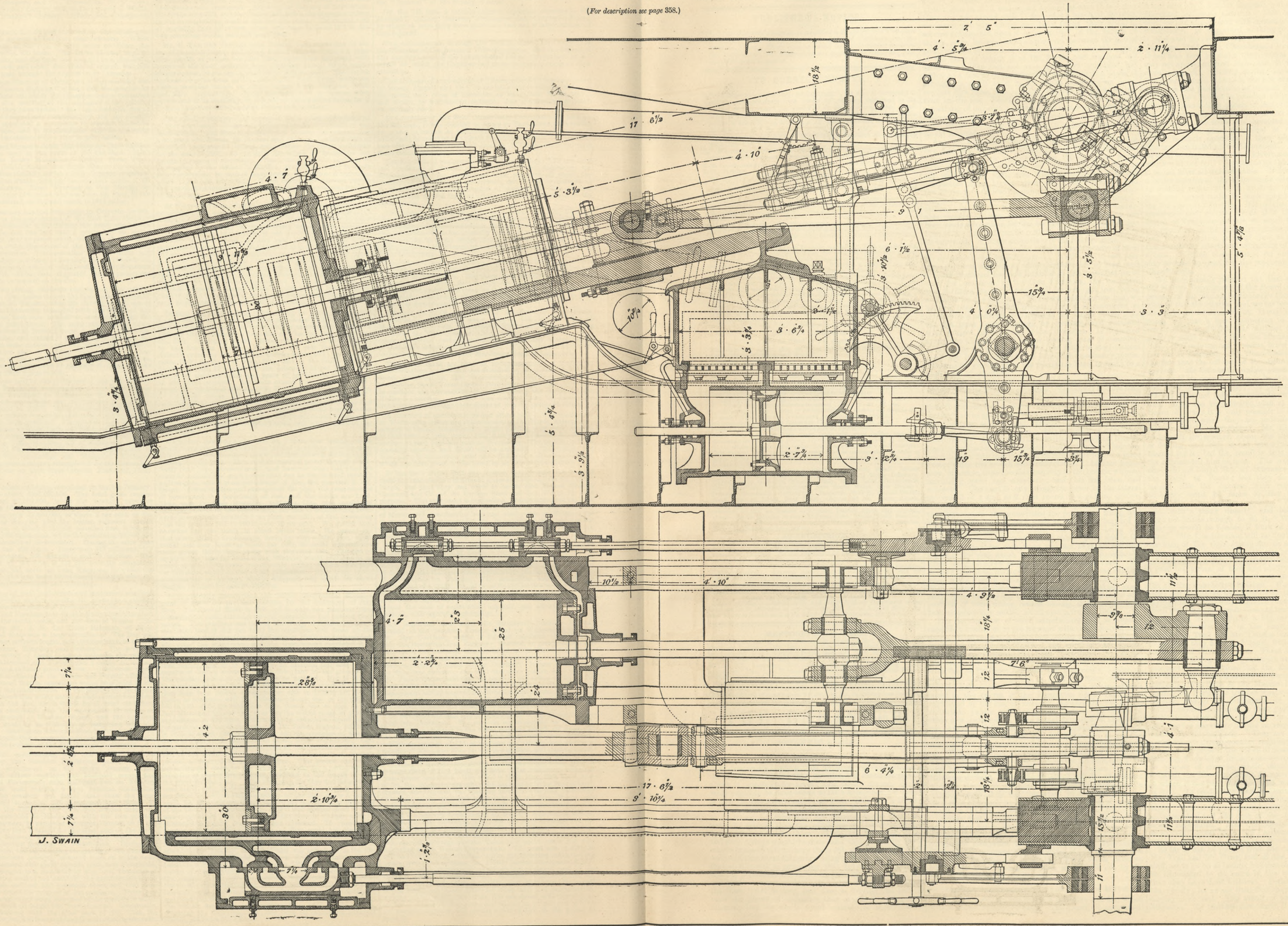
THE Wednesbury Local Board on Monday approved a scheme prepared by Mr. Pritchard, C.E., for the deep sewerage and the purification of the town, involving the conveyance of the sewage to land at Bescot, its treatment there by precipitation and filtration, and its discharge into the Tame at a point below the weir belonging to the Walsall Corporation. The total cost of £30,120 will be thus divided:—Outfall works, precipitating tanks, mixing house, workmen's cottages, &c., £8900; intercepting sewers, £7657; air compressing station and machinery for raising a part of the sewage, £2900; internal sewers, including engineer's charges, £10,663. In addition there will be the cost of the land for outfall works, £2000; and about £3000 for other land and compensation, making a total of £35,000. This, it is calculated, will represent an outlay of £1400 for fifty years, and adding an outside sum of £500 for working expenses, will require a rate of 7½d. in the pound to meet it.

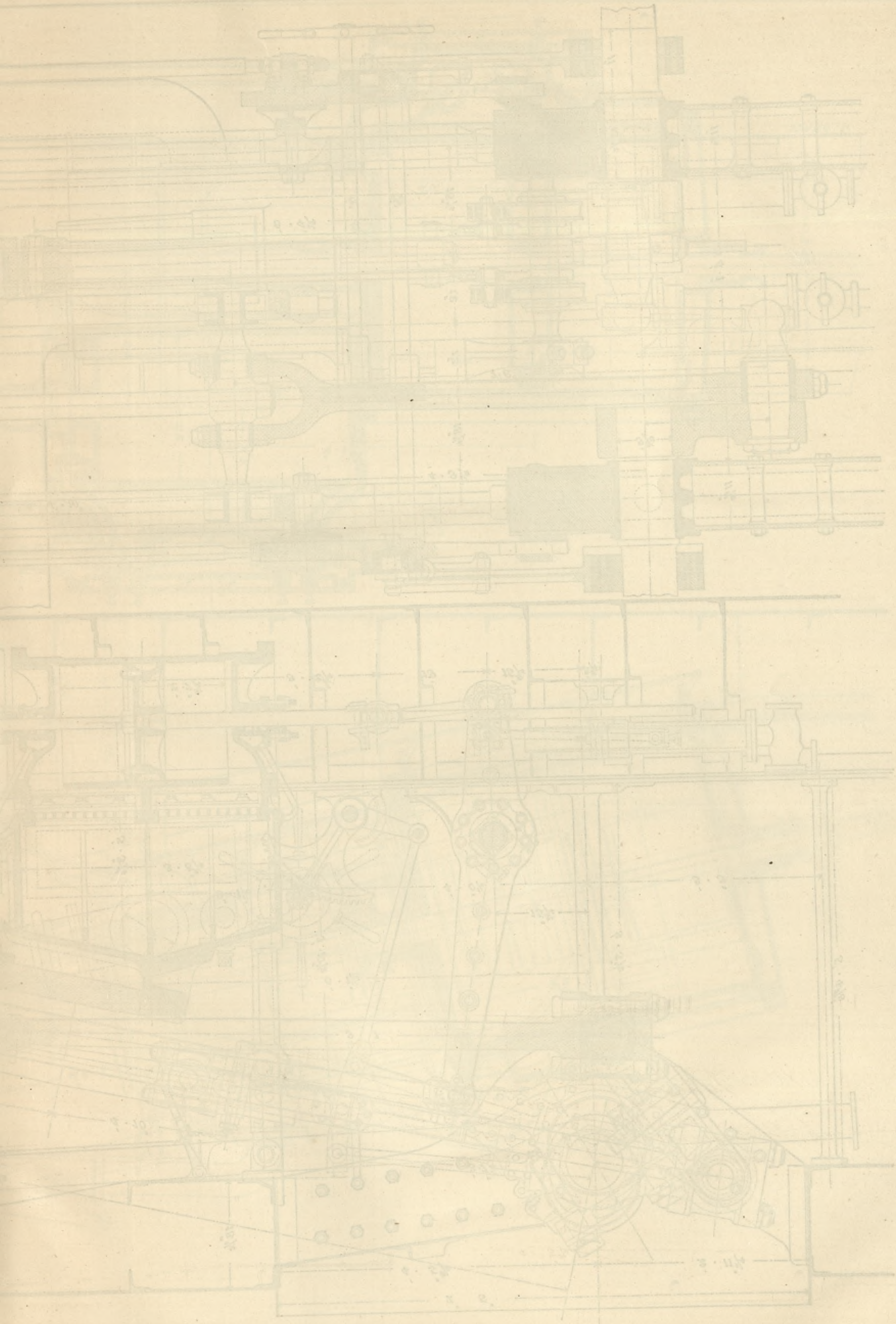


ENGINES FOR LIGHT-DRAUGHT STEAMERS ON THE SIBERIAN RIVERS.

MR. JUSTIN S. KOURBATOFF, NIJNI NOVGOROD, ENGINEER.

(*For description see page 358.*)





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LEIPSIC.—A. Twietmeyer, *Bookseller.*
NEW YORK.—The Willmer and Rogers News Company, 31, *Beekman-street.*

PUBLISHER'S NOTICE.

*** *With this week's number is issued as a Supplement a Two-page Engraving of Engines for Light-Draught Steamers on the Siberian Rivers. Every copy as issued by the Publisher contains this Supplement, and subscribers are requested to notify the fact should they not receive it.*

TO CORRESPONDENTS.

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

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

J. M. L.—*By receipt of your letter and enclosure we are obliged.*

F. W. (Farnley).—*The gauge illustrated is not the Board of Trade gauge, as you will see if you refer again to the engraving.*

W. M.—*Coal gas compressed to the pressure you mention will deposit its carbon and become almost useless in a very short time for illuminating purposes.*

Hydraulic.—*You will find a full description, with illustrations, of the three-cylinder hydraulic engine in the "Proceedings" of the Institution of Civil Engineers, vol.* 50, *page* 76. *We have not published the drawings you want.*

M. H. B.—*Write to Mr. Thos. Cole, Secretary, Association of Municipal and Sanitary Engineers and Surveyors,* 6, *Westminster-chambers, Westminster, S. W., and to Mr. E. Wallis, Secretary, Sanitary Institute of Great Britain,* 9, *Conduit-street, London, W.*

Enquirer.—*There is nothing new in your suggestion. Flat tramway rails have been tried and simple plates have been used, but none of them answer their purpose, the principal difficulty being connected with the substructure on which the flat rail has to be secured. If there is a flange of any kind to the wheels, there must be grooves for the flanges to run in.*

M. C.—(1) *Coke ovens never were invented; they originated in covering heaps of burning wood with clay or earth when charcoal was wanted.* (2) *The first coke ovens were made of bricks or anything that came handy.* (3) *You will find in the back volumes of* The Engineer *particulars of nearly, if not quite, all the modern systems of coking.* (4) *Each one of all the modern systems is the best, cheapest, and produces most coke in the shortest time—at least, so the inventors say. We must be excused if we refuse to decide between them.*

ALTENDI'S MAGNETS.

(To the Editor of The Engineer.)

Sir,—Can any reader give me some information about the Altendi magnet, its construction, and theory?

X.

London, November 7th.

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

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

MEETINGS NEXT WEEK.

The Institution of Civil Engineers.—Tuesday, Nov. 13th, at 8 p.m.: Ordinary meeting. Mr. Geo. B. Bruce, Vice-President, will give a brief account of the Northern Pacific Railroad. "On Standard Forms of Test-Pieces for Bars and Plates," by Mr. W. Hackney, B.Sc., Assoc. M. Inst. C.E. Thursday, Nov. 15th, at 8 p.m.: Special meeting. First lecture on "Heat in its Mechanical Applications;" "The General Theory of Thermodynamics," by Professor Osborne Reynolds, F.R.S.

Chemical Society.—Thursday, Nov. 15th, at 8 p.m.: "On the Estimation of Starch," by Mr. C. O'Sullivan. "On the Products of Decomposition of Solutions of Ammonium Nitrite," by Mr. G. Stillingfleet Johnson.

THE ENGINEER.

NOVEMBER 9, 1883.

STEEL GUNS.

It frequently happens that promise not only attains a much higher standard than practice, but continues to soar above it peacefully for a very long time. Stating clearly what ought to be done seems so far a substitute for doing it that it sets men's minds at rest. This is in a certain measure reasonable. If, for example, things are admitted to be wrong by those who are responsible for them, we naturally assume that the admission will be accompanied by an effort to rectify them. If we are told that such-and-such things should be done, and this is said by those whose business it is to carry them out, we assume that all is well, and that these things are being taken in hand. Nevertheless, it is well to remember that between the promise and the performance a very long interval may occur. We can hardly assume, perhaps, that when Longfellow penned the lines, "Art is long and time is fleeting," he had in view the pieces of ordnance that are now coming into fashion; but his words could scarcely be applied with more truth to any subject. We do not mean to refer to the length of their bores, which have attained such extraordinary dimensions, but rather to the time necessary for the production of the guns in large numbers. Take the most notable cases. In 1876 the Elswick 100-ton gun was fired at Spezzia. Now at the end of 1883 we greatly question if a dozen such pieces are mounted. Krupp fired a 71-ton gun in 1879, and we all seemed at once to feel that Germany was armed with 71-ton guns; but now, in 1883, we could not say where any have found their place in service armaments, even if a few exist. In the nature of things, some interval must elapse even between the actual performances of the first experimental gun and the supply of the class of which it is the herald, and we now call attention to the fact, not as a matter of complaint, but rather as a fact to be considered in estimating the power of armaments which exist in the tables of works on naval matters like those of King and Brassey long before they float on the sea. Bearing this in mind, it is well to know something of our own progress—not that we pretend to be giving information from official sources, but the simple facts which are patent to any one who pays a visit to the Royal Arsenal.

Any one who went round the Gun Factories a year or two ago, and who again visits it, must be struck by the absence of the four muzzle-loading 100-ton guns, which have gone off to Gibraltar and Malta, which, as well as the 80-ton guns that were with them previous to the completion of the Dover turret and of the Inflexible, and the 38-ton muzzle-loading guns of the Ajax and Agamemnon, have been succeeded by the new long type 43 breech-loading guns for the Edinburgh and Colossus. A considerable number of new long type breech-loading guns has been made altogether, but by far the greater number has been of the 8in. and smaller calibres. This might naturally be expected. A larger proportion of the heavier guns, however, would have been made had the manufacture of steel for ordnance been pushed further. At the end of last year wrought iron was almost wholly superseded by steel, and Colonel Maitland has now established the manufacture of steel for ordnance in the Gun Factories, the hammers and furnaces formerly employed for wrought iron being available for the purpose. The steel manufacture has, we believe, been a complete success; but it is conducted at present on a moderate scale, ingots for larger pieces than the 8in. guns being obtained by contract, and obtained with greater difficulty as the size increases. It is desired at present to make steel breech-loading guns of considerably greater weight than 43 tons, but hitherto steel-makers have not been found able to supply the necessary pieces. The smaller guns have in the meantime been brought to a high state of efficiency.

We may particularly notice two important matters in which difficulty has been overcome. As many of us have long been aware, the prolonged period of discharge very severely tests the breech-closing parts. The steel cups which were inserted to act as gas checks were costly and troublesome. In the Dubange asbestos pad pressed out between its metal washers, has been found a completely satisfactory solution of this difficulty. Again, while alive to the advantages of breech-loading ordnance, naval officers laid it down as abolutely essential to safety that it should be impossible to fire a piece except when the breech was firmly closed. It became necessary, of course, to secure this property in the breech without sacrificing speed and simplicity, and this has been well achieved. The vent is only brought to cover by the lateral movement of a stud as it runs round in a guiding groove, and then a sort of crutch prevents the possible descent of the hammer in the guns fitted for percussion firing, and keeps the piece on half-cock until an auxiliary lanyard is pulled, which leaves the main one free to bring the hammer down on the vent sealing tube. How simple the parts are may be seen from the fact that all are held together by pins which can be drawn out immediately, there being no screw except the breech screw itself. We believe that these fittings are better than anything existing even in the French guns, where mischief appears to have been caused by departmental jealousy. Speaking generally, then, we may say that the main questions as to proportions of bore, rifling, breech closing, and the like have been satisfactorily settled, at all events for the time.

The development of steel manufacture then is what is needed to enable us to get forward with our supply of ordnance. With respect to this, a new testing machine, designed in France by Colonel Maillard, and employed by Messrs. Schneider at Creusot, has been introduced by Colonel Maitland. It would be interesting to compare its work with that of Professor Kennedy's, at University College, or any other new one claiming to be of the same class. In this the behaviour of the metal under the strains experienced in the course of the elongation up to rupture is registered by the rise of mercury, showing the same characteristic pauses, rises, and falls that are exhibited in other new instruments. The actual extension of the metal can be read off by two microscopes fixed on a scale and vernier. This reminds us of the fact that we ought soon to get the elongation of metals within the limits of elasticity furnished us. This has always hitherto been omitted on the tables which furnish us with elongation before rupture, and pressure both within the elastic limit and before rupture. However difficult it may be to give a definite elongation which is altogether corrected by the metal returning to its original length, it is very important in ordnance to get a very close approach to it, for the building up of guns is based on the idea of elongation within elastic limits; for it is clear that inner rings which do not temporarily elongate do not bring into play the support calculated to be afforded them by the outer rings, while, on the other hand, permanent elongation means the process of destruction. However, the moment of introduction of new machines and improved manufacture is not the time to speak perhaps, but rather to wait and see what is brought out by the new means placed at our disposal.

THE MARINE DEPARTMENT OF THE BOARD OF TRADE.

Mr. Chamberlain has issued a tentative circular, which will be found on another page. The constitution, proceedings, and theories of action of the Marine Department of the Board of Trade have recently been sharply criticised, and it is evidently beginning to be felt at Whitehall that some steps must be taken to render the department more efficient and less vexatious; but it is quite clear that the President and the members of the Board do not know what these steps ought to be. In January, 1882, the Board sent out a circular suggesting the establishment of a Merchant Shipping Council. This circular was passed over, we had almost said with contempt, by the shipowning community. It suggested nothing to please anyone, and it produced no result. The present circular is a move of the same kind. Mr. Chamberlain wants the shipowners to tell him how to make them moral and honest. This may not appear at first sight, but it is really what the circular means. "Briefly stated," says Mr. Chamberlain, "the reasons for a change in the law are, that the powers of detention and punishment at present vested in the Board of Trade have proved in practice altogether insufficient to eliminate preventible causes of loss of life and property at sea. To be really effective, prevention must be ubiquitous, and proceed upon fixed and accepted principles. At the same time the penal provisions of any law should be certain in their operation, if they are to be deterrent." The law has failed up to the present. Will the shipowners be good enough to help the Government to draw up laws which will not fail? Grotesque as this appeal seems to be, it is not after all unreasonable. If Mr. Chamberlain had a better opinion of the shipowners as a body there would be nothing remarkable in his desire to get advice from a good and honest majority concerning the means of punishing the peccant minority. But judging from a recent correspondence and certain words that the President of the Board of Trade has let fall, we much fear that he regards the good men as the exception—those who are not good, at least from a nautical point of view, as the majority. This fact somewhat affects the congruity of Mr. Chamberlain's appeal. Putting these things on one side, however, we may proceed to consider the proposals now made by Mr. Chamberlain.

We have already pointed out that the grand defect in the Marine Department of the Board of Trade is the incompetence of the officials to discharge their duties, and we explained that the salaries paid are far too small to induce good men to serve the department. It ought to be unnecessary to point out that a man competent to discharge functions worth £700 or £800 a year will not consent to work for £150 or £200 a year. But the Marine Department of the Board of Trade cannot, it seems, bring itself to believe that fair pay is essential. Mr. Chamberlain practically admits the fact that the officials of the Board are incompetent as a whole. He defines the duties which the Board ought to perform if its operations are to be at once just and efficient, and then goes on to say, "A perfect army of scientific officials could not fulfil completely duties so extensive as this. With the very limited staff at the disposal of the Board of Trade it is only possible to interfere in the most flagrant cases when they are prominently forced on the attention of the surveyors." Mr. Chamberlain does not of himself know much about the subject with which he is dealing, and this is not remarkable, nor is he to be blamed for it; but the result is that he has to take what the officials tell him as true. The words we have quoted above do not sound like an utterance of the President of the Board of Trade; but they do sound very much indeed like the excuses with which every man in authority must be more or less familiar. We can fancy Mr. Chamberlain saying, "Why was not such and such a thing done?" and being told that there were not hands enough to do it, "Why, an army of inspectors would be needed if work of that kind has to be done." Mr. Chamberlain will no doubt in time learn that one man of the right stamp can do as much work in an hour as half-a-dozen men with less brains and energy can get through in a day. An army would not be wanted, but a good many men of tact and ability would be required. It is difficult to write concerning a question like this without hurting somebody's feelings. We have no wish to do this; but we cannot avoid incurring the risk of doing it by saying that retired ship captains—men who have handled small wooden sailing craft—are not best adapted to say what is and what is not right in a big cargo steamer. Again, if we go further up in the scale, and come to such men as Mr. Trail and Mr. Thomas Gray, it is not too much to say that they have lost touch with the shipowners and engineers of Great Britain. There is an entire want of sympathy between these gentlemen and the public. It is a noteworthy circumstance that the Railway Department of the Board of Trade manages to discharge duties not very dissimilar from those of the Marine Department, without causing any friction or trouble whatever; and this is beyond question due to the competence of the inspecting staff, which inspires confidence in their judgments, and the tact with which they discharge their functions. The subordinate marine inspectors inspire no respect whatever in shipowners or shipbuilders. "They are puir creatures," said a well-known North-country engineer to us once; and no doubt he expressed the views of many. They lack social standing, knowledge, importance—everything, in short, but an honesty of purpose, which, misdirected, has too often involved the Board of Trade in unseemly legal squabbles, in which it has been defeated, and, we may add, disgraced as well. To render the Marine Department of the Board of Trade efficient, a thorough change would have to be made. This would render the payment of some pensions indispensable, and the cost of the department would be much augmented. Mr. Chamberlain would fain make shipowners moral by Act of Parliament; but he does not want to spend much money in effecting his purpose.

So far as can be judged from the circular, it seems that Mr. Trail and Mr. Gray, and all the rest of the existing staff, are to go on as before, but that the subordinates are to be stimulated to do more in the way of stopping ships than they have done hitherto. Perhaps this puts the case too crudely; let us say then that they will be expected to display more zeal. The result of too much zeal will be litigation. As matters now stand, if an inspector insists

on certain things being done, the shipowner either defies him or compromises; he does one-half of what is wanted, and the inspector, feeling that he has asked for too much to begin with, rests content. If the shipowner defies the inspector, the latter will either give way, or detain the ship; if he detains her then there will be a lawsuit. The experiences of the Marine Department of the Board of Trade in the Law Courts have not been cheering, and recourse is had to them as seldom as possible. But this kind of thing cannot go on for ever; so Mr. Chamberlain would, as we have said, have more zeal, and proposes to provide special courts to do the legal work which will certainly have to be done. The new Local Marine Courts shall consist of two officers, one a Board of Trade official, the other a shipowner's nominee. We need scarcely point out that in all disputed cases the halves of the Court will take opposite sides, and as none but disputed cases will come before the Court, an appeal in every instance will be made to the Merchant Shipping Commissioners, consisting of one lawyer, one retired shipowner, and one expert. The utility of the Local Marine Courts under these circumstances appears doubtful; they may serve a good purpose, however, in this far—that in flagrant cases the criminal shipowner will not dare to go before them. They will be useful as deterrents, and in this way they may do sufficiently good service to make them worth having. But, on the other hand, they may inflict serious injury by detaining ships which ought not to have been stopped, and the shipowners will have no redress as against the Board of Trade. This injustice is no doubt an oversight, and must be amended.

Mr. Chamberlain, we are glad to see, fully recognises the cause of all the evils of which he complains—this is insurance. We have often pointed out that a ship belongs to many individuals, who know nothing about her save that they have either to pay or receive money on her account. The ship is fully insured; so is her cargo. The underwriting is done not by one, but by many. The whole pecuniary risk is so cut up and divided that even though £150,000 worth of ship and cargo goes to the bottom, no one is much the worse. Perhaps one hundred and fifty more or less rich men write off £1000 each as a trade loss, and think no more of the matter. A cargo steamer well managed ought to pay 18 per cent. clear profit per annum. They have been known to pay 28 per cent. If they pay but 7 per cent. clear of all expenses they do very badly. Under these circumstances men can afford "to use up and buy more." If they could not, our shipping yards would have been idle long ago. We do not see how Mr. Chamberlain can get over this difficulty, but he seems determined to try.

BRIGHTON BEACH.

At all points along the south coast the late gales have worked considerable mischief; but at Hove, adjoining Brighton, the results have been disastrous to the works which have so long been in progress, and on which we have from time to time commented. About two months back considerable damage was done; but the gales of latest occurrence have completed what was then but commenced, and we fear there is no alternative but to confess that all Mr. Ellice-Clarke's skilful arrangements, and the large outlay they involved, have been without result in affording protection to the beach at the threatened point. Further, and beyond that most vulnerable spot, what we have from the first feared and predicted has come to pass, viz., the removal of a large quantity of the beach just by what is known as the Round House, which is the Corporation toll station. Over and over again we have urged on the Brighton authorities the unwisdom of the course they have long pursued of selling the shingle at this particular spot; but the practice was persisted in up to a very recent date. We had hoped that the concrete groynes erected by Mr. Ellice-Clarke adjacent to this locality would have completely answered their purpose, and so we believe they would have done had not the removal of the lee side beach in the Brighton district caused the sea to wash in there with a violence totally unexpected. The result has been that even there a large proportion of the Hove beach which had been collected by Mr. Ellice-Clarke's groynes has disappeared during the recent storms. What stronger argument could we advance in support of our primary contention when first introducing these works to the notice of our readers, that independent action by local authorities was to be deprecated, as sure to end in disappointment and failure? In the instance quoted we have the authorities of one borough deliberately following a course certain to be prejudicial to the works erected at large cost by the corporation of another, and without any power existing to step in and say, "This shall not be." In our most recent article on this subject, when noting the amount of beach accumulated by the new Hove groynes during the calm season, we wrote, "What we must still doubt will be the result of a resumption of attack from the south-west. Will that beach which we have named as now accumulated have acquired so defined a lodgment that it will not again be displaced?" The query we then raised has been answered in no indeterminate manner. Scarcely any of the shingle now remains, and the groynes stretch naked and bare seawards, and, exposed to the full force of the rollers from the south-west, will, if left long in this condition, succumb to their attacks. The temporary defences erected to protect the embanked walk of the lower esplanade have wholly disappeared, and the entire site presents a wrecked and wretched appearance, very different to the trim order in which the adjacent lawns and gardens of the sea frontage are maintained. We fear there can be but one issue to follow all the skill and care with which a large expenditure has been directed during several years past, and that must be the erection of a solid sea wall with short protecting groynes. We have hoped almost against hope, though occasionally permitting ourselves to feel somewhat sanguine, when we have made visits to these works; but now we can only fall back on the opinion at first expressed by us to the effect that a substantial sea wall would in the end, although of greater first cost, prove to be the most economical method of meeting the difficulty.

At this point we must leave the past, which has, however, furnished us with much most instructive information, and turn to the future. We are informed that as soon as the weather will admit of the commencement of operations a sea wall will be begun under the direction in chief of Sir John Coode. Of the details of the designs proposed by that gentleman we are not in possession, but we believe he does not contemplate the retention of any of the angular timber groynes erected by Mr. Ellice-Clarke. Sir John's experience, contrary to the views we have expressed, induces him rather to trend the groynes he proposes very slightly in a windward direction, it being his opinion, we believe, that the travel of shingle is due solely to wave action as the result of prevalent winds, and that it is not in any way attributable to the effect of tidal current. It seems to us, however, that, while acknowledging much of the force of such an argument, there may be also something in the old story of the mouse and the lion which is applicable to the case in point. Our readers have doubtless often closely examined a sea beach. A large proportion of it certainly consists of stones of a size which a tidal current of three to four miles an hour could scarcely put in motion, but filling the interstices between such stones is a mass of finely broken pebble, which we have seen a current of two miles an hour wash away in quantities. Now such mass we believe to be the cementing agent which prevents the travel of rounded shingle, and if that be denuded, the body of well-rounded stones becomes disintegrated and liable to travel on very slight provocation. It therefore seems to us that it does not do to omit from consideration the effect of tidal current in designing beach protecting groynes, and if that current be increased in force by being driven in sharply to leeward of such groynes, its action will be very destructively increased. The mouse will gnaw away the confining pebbles, and set the lion stones free to travel by slight agencies. Hence, we are still disposed, in spite of the deference we must owe to Sir John Coode's great experience, to adhere to what we have before written as to the good effect of a slight leeward inclination to groynes. To trend them in the reverse direction must be to render more acute the attack of incoming waves of translation, and to intensify the violence of their change into waves of percussion. At least it appears to us, from what we have observed in our own experience, that such must be the result. Time will, however, show us. We have learned much from Mr. Ellice-Clarke's experiments, and we shall look forward to the acquirement of still further information from watching the works proposed by Sir John Coode as they progress.

Leaving the immediate subject of this article, we desire as a *sequitur* to it to turn to the results of the late storm at various other points on our coast. The coincidence of these gales with exceptionally high tides has rendered their effect doubly noticeable. At Worthing, where large expenditure has of late years been incurred for the retention of shingle, the newly-erected groynes were left completely bare of beach on their lee sides, and were in imminent danger of giving way. Instant measures were adopted to shore them, or they would have been laid prostrate. At Shoreham, the successful robberies perpetrated there of the shingle due to towns lying to the eastward, have, we believe, prevented any ill effects; at all events we have never been able to hear of any. At Black Rock, just beyond Brighton, however, a result we predicted in almost our first article on the subject of Brighton beach has come to pass, a large mass of the unprotected chalk cliff having fallen, endangering the safety of the Rottingdean road, and placing in jeopardy also the coastguard station close by. In the article last referred to we expressed the fear that sooner or later the defence works erecting along the line of the Brighton and Hove beaches would show some effect at this point. It is to be presumed that, following all previous precedent, the Brighton authorities will now say: "Oh, go on groyning until we turn the enemy off our responsible line, and shift the burden on to the Rottingdean folk," who are, we should say, but little able to bear it; but if they must perforce do so, they, in their turn, will throw it on to Newhaven, and so on *ad infinitum*, until some Government, having a decent regard for the interest of our shore population, shall step in and exercise the needed control over such matters.

To go further eastward along the coast. Hastings has of late been prominently under notice, both in these columns and those of our contemporary the *Times*, as regards the condition of its sea frontage. This town has always been particularly liable to inroads by the sea, but of late years these have become intensified, owing to the construction by the railway company of groyning works at the western extremity of the town, which for years arrested and absorbed all the shingle coming up from the westward. The travel due to waves and currents combined continued along the eastern line of beach, while no shingle came past the new obstruction at the west to compensate for it, the result being that for a long time the shore opposite the old town was almost entirely bare of beach. As, however, these works to the west became thoroughly filled with shingle, the overplus began again once more to pass on, and since then the threatened spot has witnessed some slight accumulation; but this has not been in sufficient quantity to resist the late attack of seas from the south-west at a time of abnormally high tides, as the inhabitants of old Hastings have found out to their cost during the last few weeks.

Instances such as those quoted we might cite *ad nauseam*, but their recapitulation is not needed to strengthen the force of the text upon which we initiated our articles on this subject. The stories we from time to time have related of the results attending the unchecked licence claimed by corporate bodies and individuals to erect works of various kinds on the sea shore prove that the multiplication of instances only needs time. The case must indeed daily become more and more difficult to deal with. We contend that no obstruction of any kind along our coasts should be permitted until Government has been enabled to fully determine that it will not give rise to injury, present or prospective, at any other point. When such injury is likely to arise from undue accumulation of beach, protective measures of a different kind should be insisted upon. For it is not as if we were so completely restricted to one system that other means of shore defence cannot be adopted. It has become only a question of economy of local rates; but if the aggregate of the cost of all the blunders committed were noted, it would be found to be enormously in excess of any first outlay that would have secured perfect immunity for all.

THE PROPOSED MANCHESTER SHIP CANAL.

The enthusiasm which characterised the crowded public meeting held at Manchester on Wednesday week in support of the proposed ship canal, clearly indicates that the promoters have not been daunted by their failure before the Lords' Committee last year, but that there is a strong determination to push forward the project in the next session of Parliament. The unavoidable postponement of the scheme, caused by the action of the Lords' Committee, although it has involved a considerable additional outlay in preliminary expenses, may not, however, be without good results. The interval has been wisely utilised by the engineers in a careful revision and improvement of their plans, with the view of meeting some of the more serious objections against which they had to contend last year. The result has been that Mr. E. Leader Williams, the engineer to the promoters, has, with the approval of the Ship Canal Committee, made several important alterations upon the plans which he prepared for presentation to Parliament last session. The main results of these alterations are to secure improved gradients for the railway crossings, and to dispense altogether with any necessity for tunnelling; a straighter course for the canal will be got by adhering less to the course of the river than was originally proposed; and a water level in a better working position in relation to the surrounding district. The canal will commence as originally proposed at a point above Runcorn bridge, with a low water basin in which vessels can lie afloat in all states of the tide. Above this low-water basin, however, a new set of locks is introduced, the gates of which will be open at high water of spring tides, and continuing the course upwards, the line of the canal has been carried generally some considerable distance southwards of that proposed last year, giving practically a straight length for a distance of about eight miles. The main object of this divergence is to enable a high level bridge to be introduced at the crossing of the London and North-Western Warrington and Stockport Railway in the place of the tunnel, to which so much exception was taken by the railway company last year. The London and North-Western Grand Junction Railway, which is the main line to Scotland, will be carried over a high level bridge as formerly proposed, but alterations have been made in the arrangements with the object of improving the gradients and otherwise facilitating the working of the traffic over these lines. At Warrington it is proposed to construct large docks on the Aspley Meadows, and to divert the present course of the river to the north of the docks, the water in which is to be maintained at the same level as the water in the canal. To provide access to the docks from the Mersey at all states of the tide, a lock will be provided above the proposed diversion of the river course, but the sluices and lock at Bank Quay, to which exception was taken by the Liverpool Dock Board last year, are to be entirely dispensed with. Immediately above the high level bridge crossing the Warrington and Stockport line a second set of locks has been introduced—in Latchford—taking the place of those formerly proposed at Walton. Beyond this point, except a few minor divergences from the original course, there is nothing to call for remark until the canal reaches the railway crossings at Partington and Irlam, where the Cheshire Lines Railways are to be carried over the canal by high level bridges as formerly proposed, but which, as in the cases of those lower down the river, have been designed with improved gradients. Continuing the course upwards, the whole line of the canal has been straightened and the curves flattened, with the object of generally improving the navigation. The site of the locks at Irlam is unchanged, but those proposed to be built at Barton have been moved about one and a-half miles further down the river, and placed at Salt Eye Meadows. The lines of approach to these locks, it may also be added, have been greatly improved. Barton aqueduct will be dealt with, as previously proposed, by means of a swing aqueduct, and from this point upwards the canal remains unchanged, the plans for the docks and quays at Manchester having undergone no alteration from the original design. The more frequent deviations from the present winding course of the river which is proposed in the improved plans will of necessity involve an increased amount of excavation, and the present course of the river will to a great extent be left open for the passage of flood water during the progress of the work. To a large extent, however, the increased amount of excavating from the cause above mentioned will be compensated by the saving in the depth of cutting which will be effected by the improved water level which it is proposed to secure, whilst the length of the canal will to a slight extent be shortened, and one decided advantage will be gained in a straighter and more navigable channel.

SHIPBUILDING WORK.

A very interesting table has been drawn up of the work of one of the shipbuilding yards in South Durham—the actual work of the yard in the three years that are now almost completed. The yard in question has four berths, and beginning with March, 1881, down to the 15th of October this year, it has launched thirty vessels. Between the date of the contract of the vessel and day of promised delivery there elapsed on the average 328 days for each vessel, and including a strike, each vessel was delivered on the average one-half day late, or if the vessels that were not affected by the strike are concerned, it would be found that on the average every vessel was delivered six days before the promised time. One vessel was delivered twenty-six days before the appointed time, and in the case of the five vessels on the ways at the time of the strike, there was delay that varied from fifteen to fifty-two days, with the general average that we have stated. One vessel was guaranteed to be delivered in about six months from the date of contract, and was delivered within three days of the 189 days that formed the actual period between the day of contract and the appointed day of delivery. In the most tardy case on the list, 431 days elapsed between the contract and the appointed period and the day of promised delivery; and the general average was 328 days, as we have stated. It is interesting to notice that the firm—which launches about twelve vessels yearly—booked twelve orders that have been executed in the year 1881; in the year 1882 ten orders were booked that have been executed, and the latest of these, contracted for in November last year, was launched last month. All the vessels named were built of iron, and most were cargo boats of good tonnage. Such work is one of the best testimonials to the excellence of the management of a yard, and to the order that now reigns in it, whilst the fact that for more than a year no delay has been caused by strikes, and that the delays have been fractional only, is creditable both to employers and employed.

RADIAL DRILLING MACHINES.

MESSRS. W. COLLIER AND CO., SALFORD, ENGINEERS.

Fig. 1

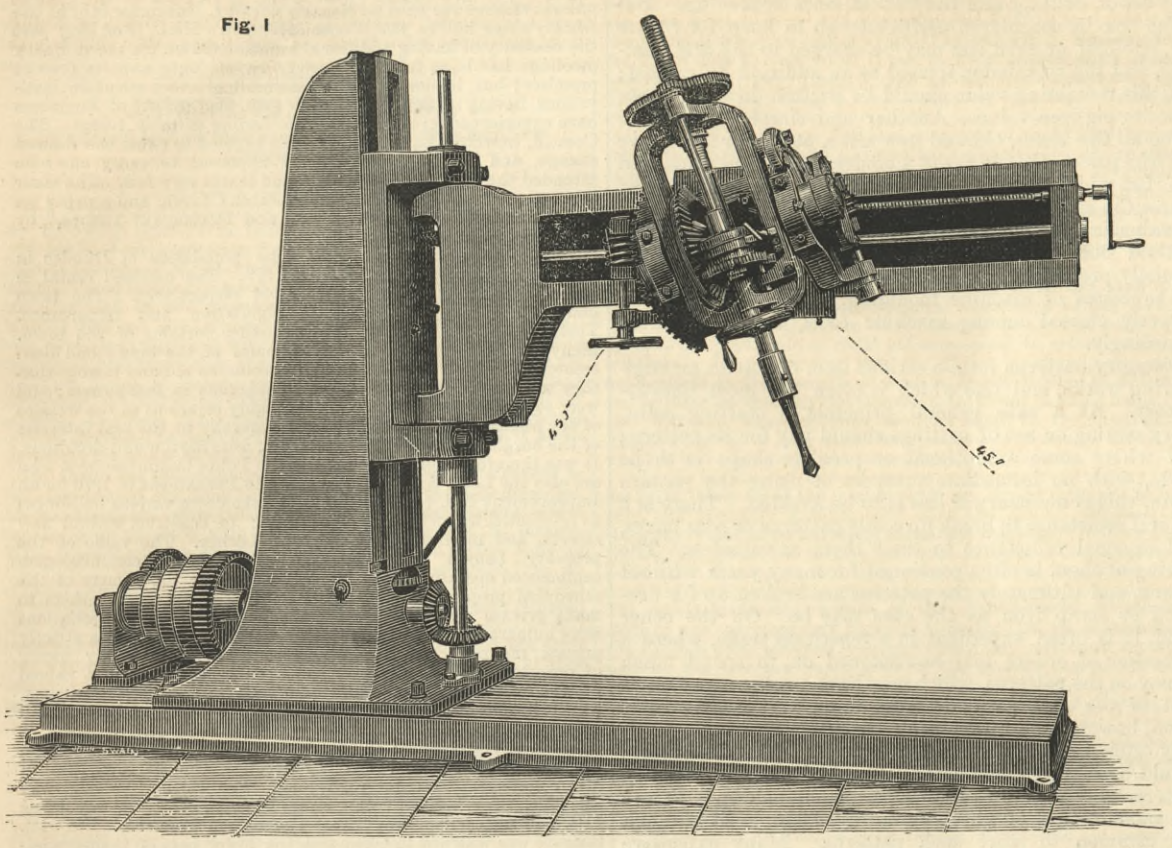
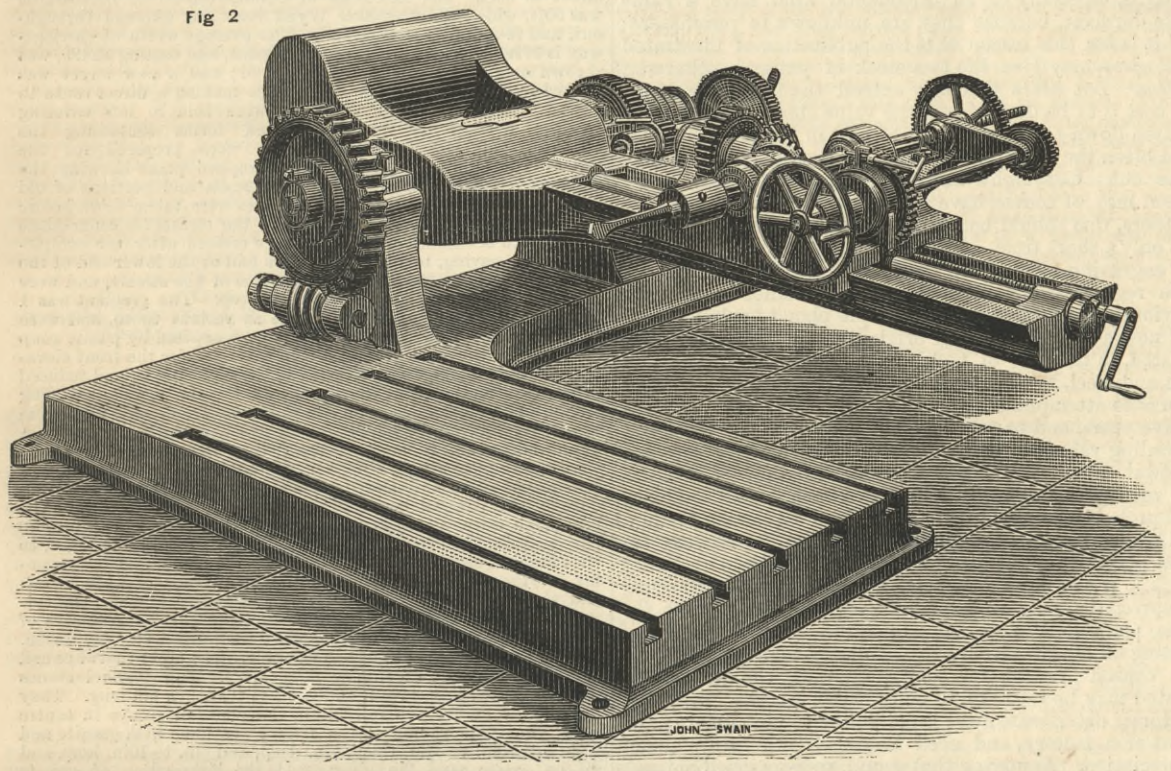


Fig 2

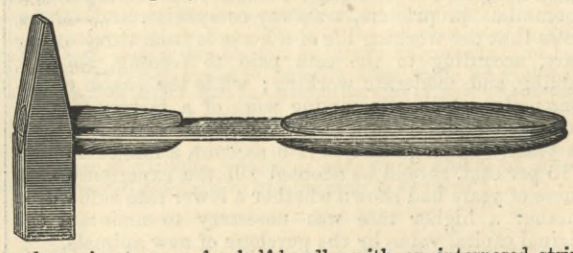


THE accompanying illustrations represent a couple of radial drilling machines recently constructed by Messrs. W. Collier and Co., of Salford, who have introduced several new arrangements to meet the requirements of special work. Fig. 1 is a radial drilling machine just completed for the Russian Government, and was briefly described in our "Lancashire Notes" a few weeks back. This machine has an arm 7ft. long to swing through an arc of 190 deg. fitted on trunnions to a vertical slide attached to the upright, and arranged to rise and fall from 2ft. 6in. to 5ft. from face of foundation plate to the underside of the spindle nose. The drill headstock can be traversed along the arm by a screw, and one important feature of the drill is the introduction of a special movement by which the attendant is enabled to swivel the drill spindle in any direction to an angle of 45 deg., and by means of index points to set the drill to any angle required within the radius of the 45 deg. This movement enables the machine to drill holes at different angles without the necessity of resetting the work, which, of course, is a great convenience when work of any great weight has to be dealt with. Another advantage secured is that holes can be perfectly drilled at right angles with the surface of a bent plate, such as used for shipbuilding, boiler-making, or armour plate work, and when the spindle is once set, any number of holes can be drilled exactly at the same angle.

Fig. 2 represents a horizontal radial drill in which a variable movement has also been introduced, but under different conditions. This machine has an arm 5ft. long, to radiate through an arc of 100 deg., and the drill headstock is movable along the arm by a screw. The arm is provided with a weight to counterbalance it in any position, and is raised or lowered to the radius required by a powerful worm and wheel motion, which also acts as a locking motion to keep the drill arm firm in any position of adjustment. The drill is provided with powerful double-purchase gearing and self-acting variable feed motion to feed inwards. The special purpose for which the machine has been designed is the drilling of pipes of any length or diameter, ends of cylinders, and such objects as cannot be got on the table of an ordinary drilling machine, whilst it could also be used for driving a boring bar, the bar being held in two stays, and the object to be bored bolted on the foundation plate. This is, so far as we are aware, quite a novel type of radial drill. Its utility might be extended if the horizontal arm were fitted so that it could swing horizontally as well as vertically through 90 deg.

SPRING HAMMER HANDLE.

THE hammer shown in the engraving is provided with a spring handle of peculiar construction, which, the *Scientific American* says, not only enables better and truer work to be done, but saves muscle and nerve, while admitting of more rapid work. The spring handle, as will be seen by reference to the cut, consists of a flat steel spring rivetted in the hammer head and supported by two wooden keys, which extend a short distance down the spring. The handle proper is formed by rivetting



to the spring two wooden half handles with an interposed strip of leather. The chief advantages of this handle are that it enables the user to deliver more powerful blows, while rendering the labour lighter and pleasanter. It is very strong and not liable to break, and there is no danger of the head coming off. The hammer provided with this handle is adapted to the use of all mechanics, for heavy as well as for light and medium work. The handle is applicable to all forms of hammers, and can be used on all tools with which blows are struck.

NAVAL ENGINEER APPOINTMENTS.—The following appointments have been made at the Admiralty:—John Anderson, engineer, additional, to the Indus, vice Moon; and William H. Moon, engineer, to the Shannon, vice Serle; and John H. Heffernan, inspector of machinery, additional, to the Terror, for service in Bermuda yard, vice Alton, promoted.

THE IMPROVEMENT OF THE RIBBLE.—The preliminaries for the construction of the dock and for the deepening of the Ribble for commercial purposes are being rapidly pushed on. At a recent meeting of the Town Council, it was resolved that borings should be taken along the course of the intended channel in the estuary of the Ribble. The estimated cost of the works is about half a million sterling.

THE DEPRECIATION OF FACTORIES.

By EWING MATHESON, M. Inst. C.E.

No. IV.

FIXED plant and machinery are sometimes included in one category with buildings, and an average rate written off the whole. It is, however, my purpose here to consider them separately, and this is necessary in the first instance even if an average rate be desired. With machinery, as with buildings, the first years of working show little effect, no reduction in value being apparent; and yet from the strictest point of view the depreciation in value may really then be the greatest. That is to say, if value be measured by the price which could be obtained by selling, it is obvious that only a second-hand price would be obtainable, even after one year of working, if the machines were removed for sale. In a going concern it would, of course, be unfair to estimate the value in this way; but it must always be borne in mind that the adoption of any new machine not only involves the purchase price, some of which could be recovered by a re-sale, but also the additional expense for installation, the latter outlay being irrecoverable, and only remunerative to the purchaser by the continuance of working.

The deterioration of machinery depends on many circumstances, and it is obvious that no fixed rules can be established. Machines which are heavy and work slowly generally deteriorate less than light, quickly-running machines. The excellence of the machine in the first instance, and the skill with which it has been set up in place, affect its durability. If made too light or not well balanced, it may soon become shaky and untrue. If wearing parts have not been properly hardened, or are not kept clean, they become loose and need renovation. The hours of actual work and severity of working have also to be considered in comparing the deterioration of one factory with another. In some factories overtime is the constant practice, and the wear and tear correspond. This would be duly met if the reserve fund or depreciation rate were proportioned to the output; but under the usual plan of writing off annually a certain part of the capital value, the deterioration due to arduous working would not be provided for. In very busy times, when there is a pressing demand for the products, and profits are large, it may be expedient and remunerative to work long hours and to force plant and machinery to their utmost power, even at the risk of breakdown, so as to take full advantage of the transient high prices; but in such a case a corresponding rate would have to be written off for depreciation. So also, where production is stimulated by a system of piecework, unless great supervision is exercised, the deterioration will probably be more rapid than in a factory where the workmen are paid according to time only.

There is often in a factory some large or special machine which, though necessary to the execution of certain work—of which, indeed, it may give the command—is seldom used. The deterioration of such a machine is therefore slow, but as a machine seldom needed is not so saleable as one of an accustomed kind, it is best to include it in the general deterioration rate. In small factories where the purchase of new machines occurs but seldom, it is particularly important to provide for such outlay by an annual depreciation rate. In large factories the purchase of new machines and the renovation of old ones are so frequent that the loss by deterioration is made manifest, the risk in these larger undertakings being that too much of such expenditure may be added to the capital value. If in an ironworks there be six steam hammers, it is probable that each year one of them may require extensive repairs, such as a new piston-rod, or cylinder, or anvil, while every second year a new hammer may be bought. Such outlay, if all defrayed out of revenue, might balance the average depreciation of the whole; but in a small factory, where only one steam hammer was employed, an annual depreciation rate would be required to balance the outlay when it came. Discrimination is needed in allotting these charges, for, while it is prudent and necessary to provide for renewals by an accumulated fund, the expenditure when it comes may be fairly considered as tending to restore the capital value if a liberal rate of depreciation in preceding years has brought down the book value of the plant to a point corresponding with its worn condition. In deciding upon a proper rate of depreciation it must be remembered that plant may become obsolete before it is worn out. Thus, in an iron rolling mill, new rolls may be cut to produce a certain pattern of bar iron, and if this pattern be of a standard shape and size constantly in demand, the rate of deterioration may be based on its probable durability and the number of tons of iron which the rolls will produce before they are worn out. If, however, the pattern be peculiar in shape or size, a higher rate of depreciation is necessary; indeed, it may be proper to charge the whole cost of the rolls to the first lot of bars produced, or at any rate to write off the outlay at a high annual rate, the cost of bars so produced being estimated accordingly. In this respect the rolls must be regarded like foundry patterns, which are in some cases charged to one set of castings for which they have been specially made, and in other cases as stock or standard patterns properly chargeable to capital.

In regard to the proper rate of depreciation for machinery there is, even in well-managed factories of similar class, a wide divergence of practice. Thus, in a new factory doing a profitable business, private partners will, in their desire to be on the safe side, sometimes commence by writing off annually 10 per cent. from machinery of all kinds. Unless there be some apprehension of the plant becoming obsolete, this is generally too liberal a rate for fixed machines unless it is neutralised in some other way. In other cases the records of many years' working may show that 2½ per cent. is sufficient, because the machinery was good in kind and quality to begin with, partly also because the expenses of installation and of liberal repairs have been defrayed out of revenue, and partly because the machines have been moderately worked. In engineering factories the rate which will properly meet the deterioration will generally be found between 5 and 10 per cent. Where the work is of a moderate kind which does not strain the machines

heavily, and where the hours of working do not average more than sixty per week, 5 per cent. would generally suffice for machinery, cranes, and fixed plant of all kinds if steam engines and boilers be excluded. Where there is a diversity of machinery and plant, and a past history of twenty years to look back upon, it is not difficult to arrive at an appropriate rate and to make periodical revisions.

Sometimes repairs serve so effectually as renewals that a very slight depreciation rate will suffice. For instance, in the case of blast furnaces no deterioration may appear to take place for the first two or three years, and the expenses afterwards will be mainly those due to re-lining. As such expenses must obviously be defrayed out of revenue, a depreciation rate of 5 per cent. will generally prove sufficient, but it should take effect from the commencement, leaving any reduction in the rate to be considered after a period of ten years. Such a rate as 5 per cent. would, however, be quite insufficient for the machinery of a rolling mill, for which, while a rate of 7½ per cent. may be appropriate for the first four years, a valuation at the end of that period will probably show that some rate between 10 and 20 per cent. will be necessary to meet effectually the depreciation in value due to wear and tear, and to the fact that the machinery is likely to become old-fashioned.

Steam engines and boilers if classed separately from the other machinery of a factory would generally require a higher rate of depreciation, and if again separated, boilers a higher rate than engines. Indeed, so wide is the possible variation, that special examinations of engines and boilers should be made at each annual balancing of accounts. If a well-made non-condensing stationary engine with Lancashire boiler cost, including foundations, £500, it would be prudent to write off 10 per cent. the first year, and 10 per cent. annually from the diminishing value, this being sufficient if the minor repairs and renewals, such as new brasses and fire-bars, be paid for out of revenue. At the end of ten years the book value will stand at £174. If then the cylinder be rebored, possibly a new piston supplied and the boiler renewed by the insertion of a new furnace at a total cost of £80, this sum might be added to the capital value, the depreciation rate of 10 per cent. continuing for a further five years till the value is reduced to £150. A new boiler would then be required costing £200, and the rate of 10 per cent. again go on on the renovated value of £350. In the case of a portable or semi-portable engine and multitubular boiler an annual rate of 15 per cent. would be necessary, which in five years would reduce an original value of £300 to £133. If then £50 be spent on repairs, the book value might be increased to £183, and the 15 per cent. rate go on, so that at the end of another four years the value would be reduced to £96. If then patched up at an expense of £50, it might at a low pressure of steam have a few years longer life. No exact rule can, however, be made for steam engines of this kind. The deterioration depends first on the size of the engine—small sizes wearing out quickest—on the care in firing and kind of fuel and water; on whether the working is forced; on the care given to repairs; on the protection from dirt; and on the hours the engine is kept at work. In extreme cases a portable engine is quite worn out in five years, and its value to be broken up would be about one-twelfth part of its original price. Contractors' locomotives working on imperfect railroads soon wear out, and a rate of 20 per cent. is generally required, bringing down the value of an engine costing £1000 to £328 in five years. Whatever be the exact rate adopted for steam engines, it should be estimated liberally for the first five years, revision then showing if the rate needs alteration.

In trades where steam engines, steam hammers, furnaces, and boilers form a large proportion of the total plant, they should either be classed separately from the other machinery, or the rate appropriate to them should determine that for the whole. But in engineering factories, an inclusive average rate is generally adopted which, as already stated, will generally be found between 5 and 10 per cent.; but even from this average it is sometimes considered expedient to exclude certain things, such as patterns and foundry boxes, which may either be included in loose plant, presently to be referred to, or be classed separately. Before, however, leaving this part of the subject, it may be said that the slower the deterioration the greater the importance of establishing a proper system. Where the deterioration is rapid, as in boilers and furnaces, the need for renewals forces itself on the attention of users, and the justice of charging expenditure on this account to revenue is so obvious that any other plan, though it might be deemed only delusive in the case of private firms, would in the case of joint-stock companies be rightly considered dishonest. Where, however, the deterioration of plant is slow, an insufficient rate of depreciation may by mere inadvertence go on for many years before the error becomes apparent, and the loss, when at last it is realised, too often falls upon the wrong shoulders.

Loose plant and tools cannot always be satisfactorily treated in the accounts by the system just described for buildings and fixed plant. The various articles are of a more miscellaneous kind, and a suitable depreciation rate cannot be so easily established. There are two other methods available. One is to value the miscellaneous loose plant every year, and the other is to write off nothing, but to maintain and renew entirely out of revenue, revaluing occasionally, say every fifth year; or, as a third plan, part of the loose plant may be treated according to the first method, and part according to the second. Such a system is carried out in some engineering factories by dividing the loose plant into classes somewhat as follows: —Foundry boxes; foundry patterns; rapidly wearing plant, such as iron and steel tools, belting, chains, ropes, portable forges, carts, wheelbarrows, and ladders; horses. Taking these in their order, a list is kept of foundry boxes, and this is assisted by casting on each box the year in which it is made, and marking on each its weight. The value is, in some factories, at once taken as that of pig iron, but more often is written down to that level in a few years. Supposing one box has been made, weighing one ton, at a cost of £12, then if of peculiar shape or size not likely to be wanted again, all the cost—less that of the iron—should be charged to the first set of castings and the box at once broken up. But if the box be considered useful enough to keep for future use, one-half or even less may be charged to the first castings, and the remainder treated as an addition to capital; but this remaining value should be written down in three years to pig iron value. Another and simpler plan is to value all the boxes, old and new alike, at 10s. or 20s. above pig iron price—that is to say a moderate average price, and not that which may be current at the time, although of course the current price would need consideration in case of valuation for a change of ownership. This summary method does not apply to the elaborately fitted boxes specially prepared for repetition work such as are usual in the processes of machine moulding. Such boxes may be properly classed among machine tools, and depreciated accordingly.

Foundry patterns form a serious item of cost in an engineering works, and one which is often the most unsatisfactory. As a safe general principle or starting point, every casting or set of castings should pay for its pattern; and where some exceptional or peculiar shape is to be made, with no immediate prospect of using the pattern again, this is necessary if loss is to be avoided. There is a natural reluctance to break up costly patterns or core boxes, and an equal reluctance to treat them as valueless. The storing of them is often continued for many years without return, and ultimately the patterns are broken up for firewood or scrap iron, as the case may be. On the other hand, it is often expedient in a repetition trade, where a succession of orders may be reckoned on, to spend much money on the patterns, which may have a value many times that of the castings made from them in the first year. Even, however, if durable iron patterns have been made they often become obsolete before worn out, and therefore should be rapidly depreciated. Toothed wheel and pulley patterns may be said to have a permanent value; but since the introduction of wheel-moulding machines it is much less common to store such patterns. Many expensive patterns, especially of an ornamental kind, have a value quite dormant, because they are unknown to purchasers; and it is for this reason that the publication of illustrated catalogues may give life to a stock of patterns otherwise useless. But while this may extend the time over which the cost is to be distributed, the value should generally be written down to one-tenth of the cost in ten years. If not used often they have little value; if used often they soon wear out. Copyright designs or patterns protected by patent may, of course, have a special value; but, as between partners, this should be written off rapidly, as such rights last only a short time. In this category should be included the engraving blocks used for catalogue illustrations.

In regard to the miscellaneous and minor loose plant previously enumerated, it is a simple plan to value all, old and new alike, at half their original cost, such a plan being assisted, in the case of tools, chains, and other articles of iron and steel, by weighing them. The other and simpler plan is to attempt such valuation only at intervals of three or five years, and to take credit in the accounts for the last preceding valuation on the assumption that if the constant renewal of loose plant be entirely defrayed out of revenue, the aggregate value will never diminish. The tendency will probably be upwards in the case of a growing factory, and the proportion which the annual capital account for fixed plant bears to previous years will afford the necessary check. If the fixed plant has increased, notwithstanding a depreciation rate, it is generally safe to assume that the loose plant is also growing in value. By this plan of writing off nothing from loose plant and adding nothing to the capital account for new purchases, the articles so treated may be regarded as consumable stores.

Horses deteriorate more rapidly than the inanimate fixed plant of a factory, and need a special rate or system of depreciation. Assuming that sound, well-seasoned animals have been purchased, that they are well cared for, and that all veterinary expenses are charged to revenue, an annual depreciation rate of from 15 to 25 per cent. will be necessary to provide a fund for renewals. Between these limits, the exact rate will be found to depend on the conditions of working, principally on the kind of roads. On the paved streets of a city the deterioration will be more rapid than on macadamised roads, and especially if the horses have to trot on the paved streets. The experience of omnibus proprietors, tramway companies, and others, shows that the working life of a horse is from three to five years, according to the care paid to feeding, shoeing, stabling, and moderate working; while the easier conditions under which the carting work of a factory may be performed would allow a life to the horses of from five to ten years. Taking all risks into account, a minimum rate of 15 per cent. should be adopted till the experience of a course of years had shown whether a lower rate sufficed, or whether a higher rate was necessary to maintain the original capital value by the purchase of new animals.

Horses, like the loose plant just referred to, may in many cases be excluded with advantage from the general depreciation rate, and either the plan of an annual valuation be adopted, or that of maintaining the full value by purchasing new horses out of revenue. The latter plan is the simplest, and is safe if the horses are numerous enough to allow a fair average of annual expenditure. The tendency in modern engineering works is to avoid the use of horses by constructing branch railways, by using hydraulic or other capstans for haulage, and in the factory itself by mechanical traction.

EXPLOSION OF A SHELL.—At the new drainage excavation at Eastbourne on Saturday the workmen discovered a charged shell buried in the earth a short distance from the local military forts east of the Martello towers. The shell exploded and struck a man named Thomas Fox, and tore open his arm and other parts of his body in a manner that nearly proved fatal. It is supposed that the shell has been in the soil seven years, and was discharged from the fortifications during practice. Fox lies in the hospital in a dangerous condition.

SOCIETY OF ENGINEERS.

DUNDEE STREET IMPROVEMENTS AND DRAINAGE OF LOCHEE.

THE second ordinary meeting of the Society of Engineers for the present session was held on Monday evening, November 5th, in the Society's new hall in the Westminster Town Hall. For long past the necessity of having additional accommodation for the ordinary meetings has been felt, the Society having outgrown its present premises; but, in common with a number of other scientific institutions having no domicile of their own, the Society of Engineers have experienced great difficulty in finding suitable rooms. The Council, however, have recently been enabled to effect the desired change, and the improvement was apparent to every one who attended the meeting on Monday, and it was very full. The chair was occupied by the president, Mr. Jabez Church, and a paper on the "Dundee Street Improvements and Drainage of Lochee," by Mr. Andrew Greig, was read.

The following is an abstract:—The population of Dundee in 1831 was 45,355, and in 1871, 121,975. The assessed rental in those years was £78,821 and £387,544 respectively. The town had thus greatly increased in population and importance. There was need, however, for improving portions of the town. Many of the buildings in various parts of the burgh had been erected in such a manner, and had become so old and rickety that they were inconvenient, and even dangerous in many cases; and were so densely inhabited as to be highly injurious to the welfare of the inhabitants, and detrimental generally to the best interests of the burgh. Many of the streets, too, were narrow and circuitous. It was therefore found necessary by the Police Commissioners, who are also the Local Authority, to apply to Parliament in 1870 for an Improvement Bill, to enable them to take down various buildings; to re-constitute portions of the burgh; to construct several new streets, and to drain the suburb of Lochee. The value of the property bought was £395,000. When the commissioners commenced operations they invited by circular the owners of the scheduled properties to meet with the convener and others to make private arrangements for the purchase. The negotiations were numerous and successful, and were carried on in a strictly private manner. No negotiations were begun with any owner of property until the property had been reported on and valued by the professional valuators employed by the commissioners. The principal improvements were:—The removal of Union Hall at west end of High-street; the removal of Clydesdale Bank at east end of High-street; and the widening of Murraygate, Seagate, Commercial-street, and Gellatly-street. The narrow part of Murraygate was about 100 yards long. The width of carriage-way was 12ft. The width of new street is 60ft., each footway being 11ft. and the carriage-way 38ft. The altered gradient is 1 in 54·8. Seagate was widened to 50ft., and the lower part of Commercial-street to 55ft. The extension of Commercial-street northwards was 60ft. wide. Bucklemaker Wynd has been widened throughout, and re-named Victoria-road. The average width of carriage-way is 37ft. A stone bridge of three spans, and costing £2499, was thrown over Mill Ponds at top of Wynd; and a new street was opened from the bridge eastwards, thus making a direct route to Baxter Park. The old buildings were sold in lots covering on the average 10 poles. Printed forms containing the conditions of sale and specification were prepared for the use of the offerers, and small lithographed plans showing the different lots were affixed thereto. All walls and portions of old buildings near to shops and thoroughfares were taken down before nine o'clock a.m. To prevent opening the streets for connections to the main sewers when buildings were erected after the completion of the paving, branch drains were laid at the lower end of the new feus nearly as far as the building line of the streets, and were of sufficient depth to drain cellars 8ft. deep. The gradient was 1 in 24. The feuing plans were made at various times, and were drawn to the $\frac{1}{360}$th scale. The lots were exposed by public roup from time to time. A general design was fixed for the front elevations of the buildings to be erected in the new streets, and reduced lithographs of the plans were prepared for the use of intending feuars. Feu duties began to run at the expiry of one year from the term following the purchase, and are payable half-yearly. A duplicand has also to be paid every twenty-fifth year. The feuars were bound to erect and always maintain upon the feus good and substantial stone and slated buildings of a value that would produce a yearly rental equal to at least double the amount of the yearly feu duty. They are also bound, at their own expense, to pave and flag the new and improved streets in front of the feus, to the extent of one-half of the breadth of the streets. The bottoming for the curb, channels, and carriage-way was of whin metal, and the depth being 8in., it was put on in two layers. On this was laid a bed of concrete 6in. deep. The curb of footways of several of the streets was of Aberdeenshire granite, 8in. deep, 12in. broad, and in lengths of not less than 3ft. The other footways had curbs of whinstone of similar dimensions. The channel stones were 7in. deep, 12in. broad, and not less than 2ft. 6in long. They were hollow on top the full width, the depth of groove in centre being ⅜in. The paving of the streets was done with granite and whin setts 3in. to 3½in. thick, 7in. deep, and 6in. to 10in. long, and set on coarse sand 2in. deep. At the intersection of streets the paving stones were laid off to particular angles, to enable horses to turn easily from one street to another. The joints of the setts in some cases were filled with a grouting made of one measure of newly-slacked lime, two measures of sand, and one measure of clean iron mine dust. In other cases bitumen was used. The contour of streets was segmental. The level of the crown of carriage way of paved streets with easy gradients was obtained by adding to the level of she channel $\frac{1}{50}$th of half the horizontal distance between the channels. If the contour be made flatter, the street will not be clean in wet weather. Where there is a cross fall the surface is also segmental, but the curve is flatter. The curve depends principally on the longitudinal section, there being less necessity for a rise on the carriage way where there is a good gradient. At one part of the Murraygate, where the cross fall was 9in., the centre was 4in. above a straight line drawn over the channels. The levels of circular curbs of large radii at junction of streets were plotted on paper to a large scale. The best connections are obtained by fixing the levels, so that the curbs, if produced to a point outside the circle, would meet at the same level. In streets which are quite level longitudinally, the only way of removing the surface water is by giving a proper inclination to the channel stones, and putting in a sufficient number of gullies. For channels laid with stones 15in. long and 9in. broad, the gradient 1 in 100 was found to suit very well. In September, 1882, the unsold lots were valued, and the loss at that date was found to be £104,863. This item includes a sum for unpaid interest amounting to upwards of £52,000. Many of the improvements, however, could not yield any direct money return; and as the expense of forming the streets opposite the new feus has to be borne by the buyers of the ground, a considerable sum is in this way outstanding. Lochee is a suburb of Dundee, and has a population of about 12,000. The area to be drained contained over 560 acres. A large portion of the village lay too low to be drained into the sewers at the north end of Dundee. An outfall was therefore constructed from the west end of Lochee to the sewer in Perth-road, thus bringing the sewage to Dundee. Power was obtained in the Bill to purchase land for sewage utilisation and irrigation purposes; but nothing has yet been done in this matter. The outfall is egg-shaped, and built of brick in Portland cement. One portion is 3ft. 1in. by 2ft.; and the other 2ft. 10in. by 1ft. 10in. The ring is of single brick 4½in. thick. The greatest distance between manways is 2000ft., and the shortest 645ft. The sizes of the pipe sewers in the village range from 6in. to 21in. The average depth in the main streets is 9ft. 6in. The manways are generally fifty yards apart, and the gullies about the same distance. The covers of manways are perforated; and to prevent mud and *débris* getting into the sewers through the openings, iron trays are placed inside of manways immediately underneath the covers. The catch pits

are 14ft. long, 3ft. deep below the invert, and are made same width as sewer. The water is carried by a short diversion sewer past the catch pits while they are being emptied. Cast iron gates are used to prevent the water from the diversion sewer entering the catch-pits. The flattest gradient in the outfall is 1 in 530·7, and the steepest 1 in 41·26. The inclinations of sewers in the village vary from 1 in 5·5 to 1 in 448·3. The outfall is 2 miles 1252 yards long; and cost, exclusive of surface damage and way leave, £6615. The pipe sewers are 5 miles 386 yards long, and cost £7506.

LETTERS TO THE EDITOR.

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

HOLLOW CARBON LAMPS.

SIR,—I shall feel exceedingly obliged if you will please to publish the following remarks in reply to Mr. C. H. W. Biggs' letter inserted in your impression for October 19th, 1883. Mr. Biggs gives the results of the Munich experiments on the different lamps, but the Cruto lamps exhibited on that occasion were the very first manufactured by the inventor's own hands. Mr. Cruto was at Munich with me, and considering the unsatisfactory results of his own lamps in comparison with the others, he found the means of modifying and improving the manufacture of the carbons so far that the lamps of sixteen candles made by the Cruto Company have now the following constants:—E = 56 volts I = 0·800 ampère; therefore the number of Cruto lamps per horse-power may be increased to twelve of sixteen candles with a result about 40 per cent. superior to the Edison A lamp.

Mr. Cruto has succeeded in making lamps from half-a-candle to 100, always with the same hollow carbon having the same diameter. He manufactures lamps with two, four, six, eight carbons, which can be coupled both with regard to quantity and to tension. With thinner carbons he has reached an electro-motive force of 150 volts. As far as I know the Cruto lamp, regarded from an efficient point of view, far from being the worst of the lot, has left all the others behind, so that there are none at the present moment that can be compared with it. If you wish to ascertain what I have had the honour to state I have no objection to send you some Cruto lamps which you and Mr. Biggs may experiment on at your leisure. Please to bear in mind that I have not the least interest in the Cruto Company, and only speak for the truth that the readers may not be lead to erroneous conclusions.

Turin, November 4th. TADDEI GIROLAMO.

[We shall be glad to receive a few lamps for experiment.—ED. E.]

LIGHTING BOILERS BY ELECTRICITY.

SIR,—On account of the novel application, and as we think it will interest many of your readers, we take the liberty of informing you that we have found the possibility of lighting up the interior of our steam boilers with electricity. Having adopted for some of our sectional boilers on Root's and other systems, reservoirs of considerable diameter, within which are placed deflectors for separating the steam from the water which circulates throughout the system, we thought it would be instructive to render visible the action which goes on. The application, which has been carried out by our engineer, Mr. Lane, with whom the idea originated, is perfectly successful, the cascades, currents, and miniature whirlpools being clearly observed.

We think the system of lighting up steam boilers very important to the world at large, as the cause of priming and most effective mode of separating the steam from the water may in that way be more thoroughly investigated. We shall be pleased to show our arrangement by appointment to all interested.

Pro THE PATENT STEAM BOILER COMPANY,
THOS. LAPWORTH, Manager and Secretary.
Sectional Boiler Works, 28, Heneage-street,
Birmingham, October 5th.

DEPRECIATION IN FACTORIES.

SIR,—I have in common, no doubt, with very many of your readers been greatly interested in the clever articles on this subject, by Mr. E. Matheson, which have appeared in your columns. Perhaps that gentleman or others may be willing to state their objections to the plan I have of late years adopted. Alterations and repairs I formerly charged direct to profit and loss, new machinery only being added to machinery account, off which account I annually wrote a fixed percentage. For the last six years I have charged alterations and repairs, as well as new machinery, to machinery account, and at the end of each year have written off an increased fixed percentage from the account.

On this system the alterations and repairs do not vary annually so much as if they were debited to profit and loss. Provided a sufficient percentage be written off, I fail to see the objection to my plan, and therefore, through your columns, I ask for enlightenment.

London, November 2nd. Z.

THE GLADSTONE.

SIR,—Referring to "Young Engineer's" letter in your issue for Friday last, I wish to state that locomotive engines were built by Mr. P. Stirling, Great Northern Railway Works, Doncaster, in the latter part of the year 1871, with 19in. inside cylinders, but in this case the steam chest was at the bottom of the cylinder, but he had built engines with inside 18in. cylinders before that time, I am informed, with the steam chest in the middle, and the slide valves working between.

Mr. James Stirling, South-Eastern Railway Works, Ashford, has in hand an engine with 19in. inside cylinders, with steam chest in the middle and slide valves working between them. Mr. P. Stirling's 19in. cylinders were cast together as twin cylinders and weighed about two tons. F. M.

November 5th.

SIR,—It is no doubt correctly stated by your correspondents "Young Engineer" and F. A. Field that engines have been made and are at work with cylinders larger than 17in. diameter between the inside frames, and with the slide valves placed between them. It would be of advantage, however, if either of these correspondents could show what was the length of the axle bearing and the thickness of the web of the crank in the engines to which they refer, so that their proportions may be compared with those of the Gladstone. A. W. PARKHOUSE.

Brighton, November 7th.

SIR,—Mr. Field's sketch of the arrangement of cylinders on the Glasgow and South-Western Railway is very interesting. It shows the frightful shifts to which locomotive designers are put when they try to do what ought not to be done. The ports, especially the exhaust ports, are more throttled than in any other locomotive I ever saw. The back pressure will be so great at good speeds that a better result would have been got out of a 17½in. cylinder with proper slide valves, and I shall not be surprised to hear that a slide valve collapses now and then as they used to do on the North London Railway when they tried to get big cylinders between inside frames. I should much like to know the thickness of the crank webs and the length of the bearings of the driving axle in these engines.

We have been all through this kind of thing many years ago, and big cylinders cannot be got between inside frames, with the valves between them, in well designed engines. J. D. R.

Crewe, November 7th.

GERMAN MEN-OF-WAR.

A VERY curious article has appeared in No. 70 of the *Deutsche Heeres Zeitung*, of which we give a translation, purposely kept as literal as possible:—"English and French technical papers lately reproduced an article from the *Times* on the result of the trial shooting on board the Chinese armour corvette Ting Tuen, built by the Stettiner Maschinenbau Actien Gesellschaft Vulcan, which took place on the 19th July last in the harbour of Swinemünde. The *Times* article, in its remarks, has for its text the report of the *Norddeutsche Allgemeine Zeitung*, No. 337, and is full of misapprehensions and errors of every description. On looking over the report of the *Norddeutsche Allgemeine Zeitung* it must at once be clear to anyone at all acquainted with such matters that the article has been written in a rather ingenious manner by an unscientific hand, and is therefore void of all claim to authority. Nevertheless, the *Times* does not only deal it out to their readers as an unmistakeable truth, but it cannot even refrain from maliciously disfiguring it and presenting a most derogatory criticism. To an unscientific person who has scarcely ever seen a man-of-war of the present type, to whom the arrangements of such large armour ships are entirely strange, and who has no knowledge of the effect of such heavy artillery as is carried by the Ting Tuen, everything on board of such a steamer must appear enormous, especially in the comparatively colossal proportions of whatever is connected with it. Such a reporter, being suddenly placed in such an unaccustomed position, can easily be excused if he does not know how to distinguish the midge from an elephant.

"It is, however, a very different matter with the staff and reporters of the *Times*, whose technical knowledge cannot be disputed, and it must therefore have occurred to them at once how far such a report could or could not correspond to actual practical relations. If, disregarding this, the *Times*, as already said, does not hesitate on the strength of such a report further to disfigure and criticise derogatorily the German man-of-war building industry, the why and wherefore will soon be clear to the intelligent. England has for a long time been jealous of German industry, which is striving to compete successfully with her own.

"In the building of men-of-war, as in general iron industry, she has until lately ruled the market with an almost complete monopoly, and therefore watches with envy the rise of industries in Germany which must naturally curtail her markets. Neither does the English press omit to give powerful expression to its opinion, based upon this report, and brings strongly to the foreground in a most unfriendly manner anything that seems to suit their purpose. The above-mentioned article of the *Norddeutsche Allgemeine Zeitung* was therefore very welcome to them. On the other hand, the English press abstains from publishing any authentic reports, such as the German paper gave in the present case in No. 357. We therefore doubt whether the *Times* will take any notice of the report of Mr. Krupp upon the result of the shooting in question, and which is based on the strictest truth. As, however, there are people who read other papers than the *Times*, we beg leave to refer to the report in our No. 61. Let us now contrast the report of the *Norddeutsche Allgemeine Zeitung*, and the report which the *Times* bases upon it. First it says: 'A large number of deck glasses and window panes were shattered.' Let us admit that there were six window panes broken, this should not astonish the technical assistant of the *Times*; let him just call to remembrance the result of the late shooting with English 80 cm. batteries at Dover, when the thick lantern panes of the lighthouse miles distant from Dover were shattered to pieces, and when three 30½ cm. Krupp's cannons are discharged together from one side, the gas pressure thereby produced would surely not be less, but greater than that of a single shot from an 80 cm. cannon. What does the breaking of some common window panes in the immediate neighbourhood in this case denote? Further: 'The deck was covered with coals flying out of the coal bunkers.' That a cover which chanced to be lying loose on a bunker was lifted and thrown aside, and that some of the topmost small pieces of coal were thrown on deck by the draught, is easily understood, and occurs everywhere. Such might seem wonderful to a novice who had never witnessed any such trials, but not to a scientific man who is accustomed to such daily occurrences. It further says that one of the gentlemen who was present at the trial was thrown to the deck by the pressure of the air, and that the same would most likely have occurred to the others if they had not clung convulsively to the riggings. This story is simply an invention, and rests apparently on the lively imagination of the German reporter. One of the gentlemen certainly stumbled once, but it was on account of an open hatchway, over which he wanted to step, sometime after the discharging of the shot. It is the same thing with the wood splinters which the visitors put into their pockets in memory of the trip. The most comical, however, is the story of the broken chimney made of 10 mm. iron plates, which was reported to be reduced to the dint of the head of a ½in. copper plate ventilator which stood in the neighbourhood of the battery. The chimneys did not suffer at all, and the destruction caused by the simultaneous firing of the three 30½ cm. battery was in no way tremendous or immense, but, as the official report already quoted correctly relates, was confined to the springing of a few bolts and rivets, and, therefore, against all expectation small. The astonishment of the *Times* reaches its climax when it learns that at the first shots the crew was removed for precaution's sake from the turrets and the neighbourhood of the guns. Should it be unknown to the reporter of the *Times* that on all trials of cannons, especially of such heavy artillery, the men always retire under cover? If such be the case, we must deny to him as to the correspondent of the *Norddeutsche Allgemeine Zeitung*, any technical or scientific experience or knowledge. Such trials are made to ascertain practically if everything is in good order and thorough, and which cannot be accomplished in any other way. Before this is ascertained, it would be heedlessly risking lives to leave the men in the battery. The *Times* should know that even in the English navy many a young sailor's life has found a sudden end through the bursting of a cannon, which till then was thought to be in perfect order, and that, therefore, the greatest prudence and care must never be neglected. Considering the extraordinary and splendid success which the Vulcan Company have obtained by the building of the Ting Tuen, show us an English armour-built ship of similar size which has attained a speed of 15·384 knots per hour, not English miles. We conclude by reminding the *Times* and other similar papers of the various failures in the construction of English men-of-war, such as the Captain and lately Polyphemus, and beg them for the future kindly to regard a little more the beams in their own eyes rather than the mote in the eyes of their neighbours. After all, so far as it has been proved by the trials of the Ting Tuen, the ship is a complete success, as very few others are, and notwithstanding the scornful outburst in the *Times*, the German man-of-war shipbuilding industry is perfectly justified to be proud of the youngest child and to hail the same in triumph."

SOCIETY OF ARTS.—The 130th session of the Society of Arts will commence on the 21st inst., with an opening address from Sir William Siemens, the Chairman of the Society's Council. Previous to Christmas there will be four ordinary meetings, in addition to the opening meeting, and for these the following arrangements have been made:—November 28th, A. J. R. Trendell, "The International Fisheries Exhibition of 1883;" December 5th, Thomas T. P. Bruce Warren, "The Manufacture of Mineral Waters;" December 12th, Thomas Fletcher, F.C.S., "Coal Gas as a Labour-saving Agent in Mechanical Trades;" December 19th, W. H. Preece, F.R.S., "The Progress of Electric Lighting." There will be six courses of lectures delivered during the session, under the bequest of Dr. Cantor. These will be—1st, "The Scientific Basis of Cookery," by W. Mattieu Williams, F.C.S.: 2nd, "Recent Improvements in Photo-Mechanical Printing Methods," by Thomas Bolas, F.C.S.; 3rd, "London Houses," by Robert W. Edis, F.S.A.; 4th, "The Alloys used for Coinage," by Professor W. Chandler Roberts, F.R.S., Chemist of the Royal Mint; 5th, "Some New Optical Instruments and Arrangements," by J. Norman Lockyer, F.R.S., F.R.A.S.; and 6th, "Fermentation and Distillation," by Professor W. Noel Hartley, F.C.S. The usual short course of Juvenile Lectures will be delivered during the Christmas holidays. The subject will be "Crystals and Crystallisation," and the lecturer Mr. J. M. Thomson, of King's College, London.

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

(From our own Correspondent.)

WITH the exception of the plate mills and the best bar mills, most of the mills and forges in South Staffordshire are running full time. Makers are booked forward well into next month, and some into the new year. There is, however, this week somewhat of a decline perceptible in the number of new orders coming forward and in the inquiries reaching the works; but prices are for the present firmly upheld. Earl Dudley's common bars are £8 2s. 6d., and bars of the other list houses £7 10s.; best crown bars are £9, and best best £10; branded plating bars are £8, and best ditto £9 10s. per ton. For charcoal bars the best firms quote £16.

The demand for iron of engineering sections keeps up, as the constructive engineers are busy. Good angle bars are £7 5s. to £7 15s., and for best best qualities £8 5s. to £8 15s. is quoted; but common sorts may be had at £6 10s. Tee bars, as to all the qualities, are 10s. per ton in advance of angles.

Strip and hoop makers keep busy. Prices in this branch were never more varied than now. For good hoops £7 to £7 10s. is asked, and for hoops of ⅞in. and 20 gauge £7 15s. to £8 5s. is demanded by best makers; but the general run is on £6 10s. per ton qualities. Bedstead strip varies from as low as £6 up to as high as £8. Nail strip is £6 5s.

Sheet makers continue pretty stiff in their quotations to the galvanisers, notwithstanding that these buyers do their best to pull the prices down by pleading the lowness of the prices which they are getting for corrugated galvanised sheets. £16 5s. per ton delivered Liverpool, and £16 10s. delivered London is the Association quotation for these latter, but it is difficult to be got. Black sheets are still £7 15s. to £8 for singles, and £9 5s. to £9 10s. for lattens. Tank plates are dull at £7 12s. 6d. to £8.

Messrs. Phillips, Punnett, and Thompson, sheet iron makers and galvanisers, of the Regent Grove Works, Birmingham, the Stork Galvanising Works, Birmingham, and the Bank Quay Galvanising Works, Warrington, have just made a change in their partnership. They have admitted Mr. P. W. Baynes, who has for many years been manager of their Warrington Works, and the title of the firm will in future be Phillips, Punnett, and Co.

Vendors of pigs made outside Staffordshire are not pressing sales, since to do so would mean the dropping of prices, which are at present too high for the market. Thorncliffe pigs were quoted this —Thursday—afternoon at 57s. 6d., and the Ainsworth and similar Derbyshire brands at 47s; Lincolnshires were still 50s.; hematites were 60s. to 61s. nominal; Staffordshire all mines, 63s. 9d. to 60s. net for hot blast sorts; good part mines, 57s. 6d. to 50s.; cinder pigs, 40s.

Ironstone and cokes are in limited sale at date, but heavy supplies are coming into the district under former contracts. Northampton stone is selling at 5s. 6d. to 6s. 6d. per ton delivered according to station. In cokes competition is severe. South Yorkshire best sorts are 16s. per ton delivered. Nottingham gas cokes are 12s. 6d. to 13s., but are very difficult to sell against North Staffordshire sorts at 10s. and 10s. 6d. per ton. Pottery mine from North Staffordshire is still very scarce and dear.

The coal trade is a little better. Common forge collieries are here and there advanced 6d. per ton, making them 6s. per ton. Superior forge is 7s. to 7s. 6d. Furnace coal is 9s. to 10s. per ton. In a few exceptional cases even 11s. is being got, with 6s. as the price of rough slack. Forge coal rough slack is 3s. 6d. and fine 2s. 9d. House coal raised from the old Staffordshire field is 9s. per ton, and second qualities 8s., but raised from the new field—Cannock Chase—11s. is demanded for best deep qualities, and 10s. for second qualities.

The death is announced this week, after a short illness, of Mr. Jno. Adams, who for many years, and up to the time of his death, was the general manager of the Hollingswood Iron Company, Shropshire.

Ironworkers who have most experience of the operations of the Iron Trade Wages Board desire its maintenance and its prosperity. The difficulty in carrying out its decisions lies in the very partial knowledge which many of the ironworkers have of its beneficial working. Such men are not subscribers to the board. With a view to increase the board's authority, the chairman of the operative section, together with the secretary on the same side, are doing their best to organise into one association the ironworkers of South Staffordshire, North Staffordshire, East Worcestershire, Shropshire, Derbyshire, Lancashire, and South Yorkshire. With that object there was a meeting of ironworkers in Birmingham on Monday, which, it is estimated, represented 5000 men directly and about 40,000 indirectly. In the end it was resolved to associate the men in the districts named in an organisation to be termed the General Association of Ironworkers for the Midland Counties. Some of these are already members of the Society, which has its headquarters at Darlington, and it is designed that the new Association shall have not only arbitration and conciliation as a part of its purpose, but that it shall likewise possess other of the features which distinguish the Northern Association. The general offices of the Association are to be at Walsall; Mr. Capper, the operative secretary of the Wages Board, is to be the general secretary, and it was decided to divide the Association into twelve districts, whence shall come the General Council, who shall elect the president. A sub-committee is now engaged in drawing up a code of rules, which will be submitted to another meeting of delegates.

There is considerable expectation among the engineers of Staffordshire who use the blast fan that one of higher power than that to which they have been accustomed may soon be available. Experiments have recently been made in Birmingham with the Capell fan. These were discussed on Monday at a meeting of the South Staffordshire Institute of Mining Engineers at Dudley, where they were pronounced "most surprising," Still, there were some discrepancies in the water gauge which needed explanation. Upon the suggestion of Mr. Alexander Smith, who intimated that the figures given would show that "Mr. Capell was creating power," it was determined that an opportunity should be given to that gentleman to try the fan at a colliery. Meanwhile, Mr. Capell offered to lay down at any colliery a 5ft. fan complete with an engine ready to bolt down for £150. This would be guaranteed to give 20,000ft. of air. If it was not successful he would, he said, remove the fan free of expense.

NOTES FROM LANCASHIRE.

(From our own Correspondents.)

Manchester.—There is still comparatively little actual movement in the iron trade of this district, but there are fair inquiries in the market, which encourage anticipations that there is business to come forward. The remarkable steadiness with which prices for both local and district brands of pig iron have stuck at practically one point during the dull trade of the last month or so would seem to indicate that they had actually got to the bottom, and buyers are evidently beginning to recognise the fact that makers, on the basis of the present current rates, have so slight a margin over the bare cost of production that no further material giving way can scarcely be legitimately looked forward to. The very low prices now ruling at Glasgow and Middlesbrough of course tend to keep back buyers here, but the difference between buyers and sellers, which apparently stands in the way of a considerable business being done, is not a large one. It is, however, only in a few odd cases that makers will give way, and occasional transactions, representing in the bulk a moderate weight of business, on which full rates are obtained, encourage producers to hold out against taking prices which, so far as any profit is concerned, render the orders practically valueless when they are secured. In finished iron a somewhat similar struggle is going on; buyers hope to be able to utilise the usual lull following

the close of the shipping season to their benefit, and some merchants on the strength of this are underselling in the market. But although forward buying just now is very restricted, makers in most cases have enough work to go on with for the present, and hold pretty closely to their prices. The point at issue is whether the makers will be able to hold out longer than the buyers, but in any case it is scarcely possible that makers can give way very much on the present low prices.

There was a tolerably full attendance at the Manchester market on Tuesday, and so far as pig iron sellers were concerned a rather more cheerful tone seemed to prevail, although it could not be said that this was based on any actual improvement in trade. Fairly large inquiries were reported for forge pigs for delivery next year, but as buyers offered prices about 6d. under those wanted by makers, not much real business resulted. In district brands there are one or two sellers of forge Lincolnshire at about 44s. 4d. less 2½ delivered equal to Manchester, and on this basis orders are not very difficult to get, but the leading makers ask 44s. 10d., with foundry qualities, for which there is not much inquiry, quoted at 45s. 6d. to 45s. 10d. less 2½, whilst local makers are firm at 45s. 6d. less 2½ for both forge and foundry delivered equal to Manchester. Moderate sales have been made on the basis of 44s. 4d., and a few orders have been secured at the top quotations, but no large business is reported.

Most of the finished ironmakers keep working on with orders for present delivery, and prices remain at about £6 2s. 6d. to £6 5s. for bars; £6 10s. to £6 12s. 6d. for hoops; and about £8 for sheets delivered into the Manchester district. The general tone of the market is, however, if anything less buoyant, and buyers for forward delivery are holding back.

The heavy tool making branches of engineering are being kept fairly well employed, and large orders for exceptionally powerful lathes and other tools have recently been given out in this district. The ordinary general run of engineering work, however, continues to quiet down, and where orders are got they are only at low prices.

An interesting discussion on artesian well boring took place at the last meeting of the Manchester Association of Employers and Foremen. A number of the members having visited the works of Mr. Chapman at Broughton for the purpose of inspecting his patent system of obtaining water from artesian wells, a paper on the subject was afterwards read by Mr. T. Baldwin. Mr. Chapman's system has been in use for some years, and it is not necessary to enter into a minute description further than to say that in the place of allowing the water to rise up through the boring into the bottom of the well, and there form a reservoir from which it is pumped up, an air-tight pipe is placed in the bore hole to which the pumps are attached and draw the water direct from this pipe. The advantage claimed for the system is that by the introduction of the pipe the full effect of the natural pressure acting upon the water in the strata from which it is drawn is utilised without any counteracting pressure from the outside atmosphere, and a more abundant flow of water thereby secured. The discussion which followed the reading of the paper brought out, however, a pretty general expression of opinion that the advantage claimed for the air-tight pipe was more imaginary than real. In some cases it might be applied with useful results; in fact, apart from Mr. Chapman's patent, the same principle had been applied many years back to overcome special difficulties in obtaining a supply of water. It was urged, however, that practically when water did not rise naturally through the bore hole into the well bottom the same results as were secured by the introduction of an air-tight pipe could be obtained by lowering the barrel of the pump to the requisite distance down the bore hole.

In the course of his paper Mr. Baldwin gave a detailed description of the plant that has been put down to sink a boring at the works of Messrs. Macfie and Co., Liverpool, which he said when finished would be the largest bore hole in the world. The whole depth of the boring is to be about 1000ft., passing entirely into or through the red sand-stone rock; for a short depth it will be 2ft. 10in. in diameter and afterwards it will have a diameter of 2ft. 6in. In the boring machinery which had been put down a special feature had been introduced, in that it was constructed entirely of steel and wrought iron. The boring head was made of cast steel, and with the cutters, rod, and guides weighed about 30 cwt. The steam cylinders had a diameter of 20in., and would work the boring tackle through a stroke of 8ft. if required, but could be so modified by the action of tappets on the inlet and outlet steam valves so as only to raise the piston and boring bar about one foot. If it only raised the boring head and its attachments 4ft., and the whole mass fell that distance, it would strike a blow equivalent to about 24 tons. The boring head and its attachments were suspended by a flat hemp rope 5in. broad and 1¼in. thick, passing over a pulley fixed on the top of the piston-rod of the lifting cylinder, and when this rope was made fast between the pulley and the winding drum, the piston lifting 4ft. would cause the boring head to lift 8ft., or double the lift of the piston. The boring head when at work would after each blow revolve about one-eighth of its circumference, so that each time it fell the rock was struck at a different part until an entire revolution was made. For the purpose of lifting and lowering the heavy boring tackle a pair of horizontal engines with 10in. cylinders and 1ft. 6in. stroke were attached to the framing, and geared by a pinion and spur wheel to the winding drum, and the boring head would strike the rock from twenty-four to thirty times per minute. The pressure of steam used for both the boring and the hoisting cylinders was 70 lb. to the square inch above the atmosphere, and could exhaust either into a low-pressure boiler or into the atmosphere as required.

Business in the Lancashire coal trade continues in what may be termed a depressed condition for the time of the year. The present output of round coal is going away; but there is no pressure for supplies, and although in exceptional cases advances have been put in force with the commencement of the month, it has only been where prices were exceptionally low, and as a rule it may be said that prices are not being more than maintained at the current rates of last month. Engine classes of fuel continue bad to sell, with slack plentiful in the market, and the advance on common furnace coal, burgy, and slack, attempted by one of the Manchester firms, has not been followed elsewhere. At the pit mouth prices average about as under:—Best coal, 9s. 6d. to 10s.; seconds, 7s. 6d. to 8s.; common house coal, 6s. 6d. to 7s.; steam and forge coal, 5s. 6d. to 6s.; burgy, 4s. 6d. to 5s.; good slack, 3s. 6d. to 4s.; and common sorts, from 2s. 6d. to 3s. per ton.

Shipping has shown less activity, and for good steam coal, delivered at the high level, Liverpool, or the Garston Docks, the average price does not exceed 7s. 9d. per ton.

Notwithstanding the bellicose attitude taken by the recent miners' conference at Manchester, with regard to the demand for an advance of wages, which the employers so far have distinctly declined to entertain, there does not appear to be much apprehension of any serious strike, and buyers certainly show no anxiety. It may be taken for granted that after the experience of the last strike, the Lancashire miners will take no definite action until they are sure of the course which the Yorkshire colliers will adopt.

Barrow.—There is still a very steady tone of quietude in connection with the iron and steel trades of this district. The business doing is very limited, and the inquiries recently made are so small that the outlook is anything but good, and an early reduction of output may be looked for. Stocks are much too heavy considering that the winter season is only just being entered upon, and it is evident they must either be reduced or the output lessened. Prices remain unchanged, no quotable alteration having taken place, but they are a little easier all round. No. 1 Bessemer, ordinary heavy section, is quoted at 49s. per ton net at works; No. 2, 48s.; and No. 3, 47s. per ton; while inferior samples are in request at from 45s. per ton and upwards. Steel makers are well employed in both the rail and merchant departments, but they have few good orders coming to hand. Rails are quoted at from £4 15s. to £5 per ton net, prompt delivery. Mild steel is in fair request for cutlery purposes, and the deliveries are increasing. Shipbuilders are indifferently employed, and have few good inquiries. Iron ore is in quiet demand at from 9s. to 11s. 6d. per ton at mines, with heavy stocks. Coal and coke steady at unchanged prices. Shipping quiet, as freights are low.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

As I anticipated last week, the Derbyshire miners have decided to follow the example of their Yorkshire brethren. At a meeting held at Chesterfield, on the 3rd inst., over 20,000 men were represented. Resolutions were passed endorsing the action of the Manchester Conference, "to give in notice for 15 per cent. advance upon the present rate of miners' wages," and ordering 20,000 notices to be issued to the various collieries in Derbyshire, each notice to be tendered so as to terminate at the making-up day in the first week in December. If any colliery owner makes an offer of advance, the men are instructed to forward it to the secretary of the conference, which was adjourned until Monday, November 26th. These resolutions are practically identical with those passed by the Yorkshire miners, and there will thus be simultaneous action on the part of the men. Whether the coalowners keep united or not, one point is very clear, viz., that if Yorkshire and Derbyshire decide to "come out" on strike without any regard to the action of other colliery districts they will simply be injuring themselves for the benefit of Northumberland, Durham, and other coalfields.

The Corton Wood Collieries, between Wombwell and West Malton, have passed into the hands of a new proprietary, with a capital of £175,000 in £10 shares. The first subscribers are Mr. B. Whitworth, M.P., London; Mr. W. D. Ellis, ironmaster; Mr. J. Holder, of Southport; Mr. H. D. Pochin, of Denbigh; Mr. Pochin, of Salford; Mr. T. Whitworth, of Withington; Mr. S. Roberts, London; Mr. R. Baxter, Westminster; and Mr. Charles Bartholomew, of Ealing; each of whom are subscribers for one share. The colliery is one of the largest in South Yorkshire, having a heavy daily output. The company has expended a large sum of money in coke ovens, which are of the most modern construction. Most of the workmen are housed in cottages belonging to the company, and which are built of concrete.

The chairman of one of the largest collieries in South Yorkshire told me this week that he did not believe there was any colliery in the whole of this extensive district which paid its shareholders more than 2 per cent., and the great majority of them, he was certain, were not paying any dividend whatever.

The Wath Main Colliery Company is sinking a new shaft in the direction of Bolton village, and at the Aldwarke Main Colliery operations are being pushed forward towards the Silkstone bed.

There is at present a fair demand for steam and gas coal, but prices do not improve. An order for 30,000 tons for a West Riding Gas Company has recently been taken at a very low figure. Slack and smudge are in poor request, and supplies can be had at as low as 9d. to 1s. per ton at the Barnsley pits. Though a great strike is threatened, the demand does not increase, while the advices received by large firms from their London representatives continue to state that prices are in favour of buyers, and where sales are forced slight concessions have to be made.

A local firm in the saw trade have lately arranged with their workmen for a reduction of wages to the extent of 10 per cent.

Particulars of the late ivory sales in London have reached me. English and German dealers and manufacturers were the largest buyers, the French and American buyers being languid in their offers. Egyptian ivory, of which 15¼ tons were offered, were of very fair quality, and realised good prices. Alexandrian tusks—soft—showed an advance of £3 on the average; hard sold firmly, and the more inferior lots went at £1 to £2 advance. Malta tusks—soft—sold at steady rates for the large sizes, the small and medium bringing £1 to £2 advance; hard went early in the sales at £1 to £3 more. Bangle tusks of all descriptions £2 to £3 cheaper. The quantity of newly-imported elephant ivory was about 80 tons—all sold.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

THE Cleveland pig iron trade shows no signs of improvement. There was a fair attendance at the market held at Middlesbrough on Tuesday last; but the general tone was very dull. The returns for October show a large reduction in stocks, and the shipments have lately been remarkably good. Nevertheless, prices are slightly weaker, and buyers continue to order only what they require for early delivery. Some makers on Tuesday accepted 38s. 3d. per ton for No. 3 g.m.b., though the general quotation was 38s. 6d. per ton. Merchants accepted 38s. 1½d. for that grade, and some business was done at as low a figure as 38s. There is now no difficulty in obtaining No. 4 forge at 36s. 6d. per ton.

Warrants are seldom asked for, and 38s. is the most that can be got for them.

The stock of Cleveland pig iron in Messrs. Connal and Co.'s store at Middlesbrough was 65,895 tons on Monday last, or 667 tons reduction for the week. In their Glasgow store the stock was 588,264 tons.

The exports from the Tees during October were highly satisfactory. The quantity of pig iron shipped amounted to 98,500 tons, and of manufactured iron and steel to 27,131 tons. Scotland took 30,008 tons of pig iron; Germany, 23,176 tons; France, 7335 tons; and Holland, 6285 tons.

Finished iron manufacturers are well supplied with work for the next few weeks, but have difficulty in securing orders for forward delivery, even at the reduced rates. For prompt delivery ship plates are offered at £6 per ton, angles at £5 12s. 6d., and common bars at £5 15s., all free on trucks at makers' works, less 2½ per cent. discount. Orders can be placed for forward delivery at 2s. 6d. per ton less than the prices named.

There is no change in the steel rail trade, either as to price or demand.

The ironmasters' returns for October were issued on Saturday last. There are the same number of furnaces in blast as at the end of September, namely, 118, 83 of which are producing Cleveland and the remainder hematite, spiegel, and basic iron. The output of Cleveland iron amounted to 157,627 tons, and of hematite, spiegel, and basic iron 80,631 tons, giving a total of 238,258 tons. This is 15,144 tons more than September, and the largest quantity ever produced in any one month. Stocks show a reduction of 19,814 tons for the month.

The first meeting of the session of the Cleveland Institution of Engineers was held on Monday last. Mr. E. F. Jones presided. Mr. William Ripper, of Sheffield, read an interesting paper on "The Education of Mechanical Engineers," the discussion whereof will be taken at the next meeting six weeks hence.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

THERE was a slight improvement in warrants towards the close of last week, but the prices continue very low, and not at all appropriate to the amount of business being done. Since the damping down of a number of blast furnaces several weeks ago, it has been apparent that at least any former addition to stocks had been arrested, and there is now good reason to believe that a material reduction is taking place. Of course the steady continuance of shipments on a satisfactory scale has operated in producing this result, and were the cargoes to fall off, which would not be surprising, we might soon again have the stocks accumulating both at the warrant stores and in makers' yards.

Business was done in the Glasgow warrant market on Friday forenoon at 44s. 9½d. to 44s. 9d. and 44s. 11½d. cash, and 44s. 11½d. to 45s. 1½d. one month; the transactions in the afternoon being at 44s. 11½d. to 44s. 10½d. cash, and 44s. 1d. to 45s. 0½d. one month. On Monday transactions took place at 45s. 1½d. to 44s. 10d. cash, and 44s. 11½d. to 45s. one month. Tuesday's market was flat, with business at 44s. 9d. to 44s. 7½d. cash, and 44s. 11d. to 44s. 10d. one month. Business was done on Wednesday at 44s. 4½d. to 44s. 3d. cash, and 44s. 6d. to 44s. 4½d. one month. To-day—Thursday—business was done down to 44s. 1½d. cash, firmer a little towards the close of the market.

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

At most of the malleable ironworks there is a continuance of activity, and the wages question excites considerable interest. In the foundries good orders are on hand; fresh business to a considerable extent has been recently obtained. Still there is not an assurance of confidence as to the future.

The export coal trade in the Glasgow district has been quiet during the week, and there are fewer orders in hand for immediate shipment; but an extension of the domestic requirements in a great measure makes up for what it is hoped may be only a temporary lull in shipping. The coalmasters and merchants have been endeavouring to establish an increase in the price, ranging from 6d. to 1s. for the different qualities, and 3d. to 6d. for dross. There is an impression in Fifeshire that, owing to the low prices prevailing in summer, many continental customers bought larger stocks than was usual, and the consequences, it is further alleged, are now apparent in the reduced shipments. The prices f.o.b. at Burntisland are 7s. 9d., 8s., and 8s. 3d. per ton. On the other side of the Firth of Forth the coal trade is in a comparatively favourable state.

It does not yet appear what will ultimately be the result of the conference between the colliery-owners and miners of Fife. The declaration was made on behalf of the masters at the conference, that unless they raised the existing prices of coal from 1s. 1d. to 2s. per ton, they would not be in a position to give the advance desired by the workmen. After much discussion the coal-masters declined to change their position, but they intimated that they were willing to negotiate with the men with the object of arranging a sliding-scale of wages. In Weir, the secretary of the miners has since issued a circular to the men at the various collieries, asking them to determine whether the proposal for a sliding-scale shall be entertained, or if they prefer to curtail the period of labour. Should they resolve upon the latter course, they will have to give fourteen days' notice of their intention to finish present contracts.

The coal-masters in the principal mining districts of Lanarkshire have, as was anticipated, given their colliers an advance of 6d. per day, in fulfilment of an obligation undertaken several weeks previously.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

As I anticipated, the colliers belonging to the Monmouthshire and Glamorganshire Coalowners' Association are entitled to an advance, and will forthwith work upon it. The audit of the books justifies a 2½ per cent. advance, and the coalowners are very pleased to pay it. These advances are so many proofs of the wisdom shown in the formation of the scale, and its equitable action.

The coal trade continues busy, and prices very firm. Cardiff exceeded 180,000 tons in exports last week, Newport 60,000, and Swansea nearly touched 30,000 tons. The aspect in all the coal valleys and at the ports is very encouraging. The house coal season is setting in, and has given a good deal of additional stimulus, and brought into port a good class of buyers in addition to the old, and, as may be expected, instead of a falling price, coal is decidedly looking up. Customers able to get large figures entered on books for distant deliveries may congratulate themselves. Best coal rules 11s., superior 10s. 9d., and I have a strong impression that prices are going up. Pit wood is advancing, and this week is 22s. 6d., instead of 21s. 6d., the market rate last week.

Generally the colliers are working with great regularity, and few questions of any serious character are in discussion. In the Rhondda Valley there has been an attempt made to kindle a doctors' dispute, at Clydach Vale, the same as at Mountain Ash. Two names are before the colliers, Davies and Jones, and strife seems imminent. The manager, Mr. Hayhurst, has taken a broad-minded view. "You can have whom you like," is his statement. "Have both, if that will please you, only settle the matter amicably, and don't waste your time." The question of doctors, by whom elected, and mode of election, is an important one in Wales amongst the colliers, and it would be well if the governing body, composed of representatives of men and masters, had the matter before them for settlement.

With the exception of a dispute at Tredegar, there is not much to be noted in connection with the iron and steel trades. The Tredegar dispute, principally amongst the steel men, looked awkward at one time. The men thought that higher wages for similar work was being given in neighbouring steel works, and remained out for several days. Fortunately the manager adopted judicious tactics, and the mills have been busy this week again. The iron trade is, however, flat, and the most that can be said is that the outlook is no worse than last week.

There has been some little upset at Dowlais with the hauliers, but it was of temporary continuance. The tin-plate works appear finally closed. This was a speculation of Mr. Menelaus, and was one of his few errors. The iron man nodded occasionally, and perhaps never more so than in connection with the Miners' Provident Fund. He regarded this scheme of Mr. T. W. Lewis's as visionary. It is now a great success, a large capital is banked, enough to meet the biggest contingency, 20,000 members are enrolled, and the lamentable spectacle of thousands of colliers' wives and children scattered away over the land in pauperism or worse will never be repeated. When will science and humanity get the decorations that stream on so plentifully to the battle-field?

I am glad to note that renewed effort is making to get an increase of sub-inspectors of mines.

Steady progress continues to denote the tin-plate trade. This week the Waterloo Works will restart under its new proprietory.

There is an agitation amongst the Taff Vale employés for alteration of hours of labour, and I believe a meeting will be held between men and directors on the matter.

AGRICULTURAL LOCOMOTIVES.—In an official report on the exhibition of implements at York, written for the Royal Agricultural Society's *Journal*, Mr. John Coleman expresses his opinion that the efforts of the Society might be advantageously directed to test the comparative merits of the various applications of springs to agricultural locomotives. There is very little doubt, as he points out, that an efficient spring adds to the life of these increasingly valuable savers of animal power. "The trial system," he continues, "as it was pursued during the earlier life of the Society, has been very wisely abandoned. It would be a useless expenditure of time and money to go over ground which has been so thoroughly investigated, but it is a most important branch of the Society's usefulness to guide its members as to the practical value of novel discoveries in mechanical science, and a strong feeling exists that information is urgently needed as to this new introduction in agricultural mechanics." Mr. Coleman does not state how the information is to be obtained without trial of some kind.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

**** It has come to our notice that some applicants of the Patent-office Sales Department, for Patent Specifications have caused much unnecessary trouble and annoyance, both to themselves and to the Patent-office officials, by giving the number of the page of* THE ENGINEER *at which the Specification they require is referred to, instead of giving the proper number of the Specification. The mistake has been made by looking at* THE ENGINEER *Index, and giving the numbers there found, which only refer to the pages, in place of turning to those pages and finding the numbers of the Specification.*

Applications for Letters Patent.

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

30th October, 1883.

5133. MOTOR ENGINES, J. Hargreaves, Widnes.
5134. CLEARING ROADS, &c., from SNOW, J. Forster, St. Helens.
5135. LAMPS, &c., J. Rogers, London.
5136. BELT-CABLE RAILWAYS, H. J. Allison.—(*California Belt Railway Company, San Francisco, U.S.*)
5137. COMBINED BOILER and STEAM VACUUM PUMPS, H. J. Allison.—(*C. L. Riker, Brooklyn, U.S.*)
5138. STEAM PUMPS, F. and S. Pearn and T. Addyman, Manchester.
5139. SHIPS' BOWS, H. J. Haddan.—(*J. B. B. Vautré, Toulouse.*)
5140. FURNACES, A. G. Brookes.—(*L. P. French, U.S.*)
5141. TELEPHONES, W. Gillett, Flushing, U.S.
5142. LIGHT ESSENCES, N. A. Hélouis, Paris.
5143. FIXING HANDLES, &c., to CAST IRON UTENSILS, E. Green, Deepfields.
5144. MOUNTING WHEELS of CARRIAGES. J. E. S. Thornhill, T. Forknall, & E. Thornhill, Manchester.
5145. BOTTLE-STOPPER, M. Haymans, London.
5146. STOPPING WOOL-COMBING MACHINES, H. Priestman and F. K. Adcock, Bradford.
5147. PREVENTING POLLUTION of RIVERS, T. D. Harries, Aberystwith, Wales.
5148. PEROXIDE of HYDROGEN, F. C. Glaser.—(*M. Traube, Germany.*)
5149. PRODUCTS resulting from FLATTENING BEANS, &c., J. A. Fawcett, Wakefield.
5150. SEWING LEATHER GOODS, L. A. Groth.—(*F. Schumacher, Germany.*)
5151. TRANSMITTING SIGNALS by ELECTRICITY, G. A. Cassagnes, Paris.
5152. PLUMBERS' TRAPS, W. R. Lake.—(*F. N. du Bois, New York.*)
5153. ELECTRIC CLOCKS, S. Schisgall, St. Petersburg.
5154. OBTAINING RAISED PATTERNS on STEEL, J. Brown, London.
5155. GAS STOVES, E. P. Alexander.—(*J. G. Dupuy, Canderan, France.*)
5156. FERTILISING MANURE, E. Edwards.—(*A. Chénard, Paris.*)
5157. SAWS, J. H. Johnson.—(*F. Troemé-Becker, Paris.*)
5158. INCANDESCENT ELECTRIC LAMPS, A. Swan, Gateshead.
5159. INCANDESCENT ELECTRIC LAMPS, J. Swinburne, Gateshead.
5160. BLEACHING PAPER PULP, J. H. Johnson.—(*E. Hermite, Rouen.*)
5161. MEASURING FLOW of LIQUIDS, F. Hill, London.
5162. APPARATUS for PLAYING a GAME, J. M. Richards. (*J. D. O'Donoghue, New York. U.S.*)
5163. REVOLVING FIRE-ARMS, W. W. Colley, London.
5164. TIPPING TRUCKS, A. M. Clark.—(*W. Fallon, Newburg, U.S.*)
5165. SECONDARY BATTERIES, &c., I. L. Pulvermacher, London.
5165. GALVANIC BATTERIES, I Pulvermacher, London.

31st October, 1883.

5167. PORTABLE BUILDINGS, E. E. Allen, London.
5168. CHLORATE of POTASH, E. K. Muspratt, Liverpool, and G. Eschellmann, Widnes.
5169. LIFE RAFTS, A. H. Williams, London.
5170. DETACHING COAL and STONE, T. W. Asquith and R. E. Ornsby, and T. Nicholson, Northumberland.
5171. DIFFERENTIAL DRIVING GEAR, C. Boys, London.
5172. LOOMS, J. S. Hargreaves, Ashton-under-Lyne.
5173. MUSICAL INSTRUMENTS, J. H. Johnson.—(*W. R. Elmenhorst, Montreal, U.S.*)
5174. AUTOMATICALLY MOVING POINTS, E. C. Urry, London.
5175. STEAM and HOT-AIR GENERATOR, W. Turnbull, New Hampton.
5176. MOUNTING CARRIAGE BODIES, H. A. G. Somerset, Badminton, and F. Mulliner, London.
5177. ARMATURES, F. C. Glaser.—(*Messieurs Kuksz, Luedtke, and Grether, and A. I. Gravier, Warsaw.*)
5178. COLOUR BOXES, T. Foxall, London.
5179. HYDRAULIC LIFTS, &c, J. S. Stevens and C. G. Major, London.
5180. ELECTRIC ALARM, F. J. Harrison, London.
5181. FLUID-PRESSURE ENGINES, H. Coppinger, Cork.
5182. STOPPERS for BOTTLES, W. J. Brewer, London.
5183. CHLORATE of SODA. E. K. Muspratt, Liverpool, and G. Eschellmann, Widnes.
5184. NAILING MACHINES, W. F. Watson.—(*J. H. Swift, New York, U.S.*)
5185. MAKING HEELS of BOOTS. &c., H. A. Oldershaw, Leicester.
5186. MACHINES for SEWING CARPETS, W. R. Lake. —(*A. Neustadt, San Francisco.*)

1st November, 1883.

5187. DRILLING HOLES in METAL, R. K. Jones, Birkenhead.
5188. MINERS' SAFETY LAMPS, T. Thomas, Treorky.
5189. INDICATING by FOG SIGNALS the DIRECTION of a SHIP'S COURSE, C. Thomas, South Shields.
5190. TWIST LACE, W. Birks, jun., Nottingham.
5191. SERRATING the EDGES of KNIVES, &c., H. Theaker, Sheffield.
5192. MIXING SUGAR, J. Richards, Tavistock.
5193. OBTAINING COMPOUNDS of LEAD, A. French, Morriston.
5194 SHAPING ANGLE IRON, D. G. Reid and D. Thomson, Renfrew.
5195. POROUS POTS, T. Coad, London.
5196. CARDING ENGINES, H. J. Haddan.—(*R. F. Barker, Massachusetts, U.S.*)
5197. GRAIN PURIFIERS, H. J. Haddan.—(*L. Bandeville, Arras, France.*)
5198. ELECTRIC TELEPHONE INSTRUMENTS, A. F. St. George, London
5199. BICYCLES, R. C. Thompson, Brixton, and W. Spence, Surbiton.
5200. CLEANING YARN, W. R. Lake.—(*J. H. Lorrimer, Pennsylvania, U.S.*)
5201. TELEPHONE TRANSMITTERS, G. Anders, London.
5202. ELECTRIC METERS, R. Belfield, London.
5203. OPERATING RAILWAY POINTS, &c., S. Pitt.—(*R. Bianchi, Turin.*)

2nd November, 1883

5204. PRODUCING SURFACES for PRINTING, H. Garside, Manchester.
5205. ALKALINE EARTHS, A. C. Henderson.—(*J. E. Maumené, Lyon.*)
5206. TREATING PEAT, W. Browne, jun., Cookstown, and H. Gregg, Belfast.
5207. PRODUCING DESIGNS upon FABRICS, C. Moseley, Manchester.
5208. BLEACHING PETROLEUM, &c., R. Baynes and J. Fearenside, Liverpool
5209. SLIP HOOKS, &c., H. Bezer and P. A. Thomas, London.
5210. ELECTRO-MAGNETIC MACHINES, N. Rolland and H. B. Ford, London.
5211. FLOORS, &c., G. W. von Nawrocki.—(*Messieurs F. Arnecke, Blankenburg Germany.*)
5212. STEEL, E. W. Crebbin, Liverpool.
5213. CARPETS, T. Tempest-Radford, Kidderminster.
5214 MOUNTING SEATS of VELOCIPEDES, J. Harrington, Coventry.
5215. ORNAMENTING CLOTHS, H. H. Cook and H. Hepworth, Leeds.
5216. VENTILATING BUILDINGS, F. A. Wendt, Croydon.
5217. TREATING HIDES, W. Lake.—(*P. Garnier, Paris.*)
5218. BLOWING MACHINES, F. C. Glaser.—(*B. Glöckner, Germany.*)
5219. PICK and HANDLE, J. Crooks, Masbrough.
5220. RELIEVO MAPS, H. E. Newton.—(*J. J. de Mendonca-Cortez, Lisbon.*)
5221. PREVENTING SPREAD of FIRE, F. N. Seyde, Birmingham.
5222. RELIEVO-MAPS, H. E. Newton.—(*J. J. de Mendonca-Cortez, Lisbon.*
5223. CARBONISING VEGETABLE MATTER, G. and J. E. Tolson, Dewsbury.
5224. PENCIL-CASES, &c, A. Woodward, Birmingham.

3rd November, 1883.

5225. SPRING SEATS, W. P. Thompson.—(*C. E. Duryea, St. Louis, U.S.*)
5226. STATIONERY, G. A. Robinson.—(*R. E. Ogilby, California, U.S.*)
5227. TREATING ZINC ORES, L. von Neuendahl, Breslau.
5228. SPINNING MACHINERY, J. M. Hetherington, Manchester.
5229. WINDING FIBROUS MATERIALS, L. Haslam and C. Marshall, Bolton.
5230. CARDING COTTON, &c, B. A. Dobson and W. I. Bromiley, Bolton.
5231. SEWING MACHINES, H. Beech, Denton.
5232. PIPE SYSTEMS, J. Sturgeon and C. Hanssen.—(*T. English, Denmark*)
5233. MOTIVE POWER, W. Lake.—(*C. Emmanuel, Paris.*)

5th November, 1883.

5234. ANNEALING METAL, S. Fox, London.
5235. TREATING ORES, T. R. Jordan, London.
5236. EXTRACTING METALS from ORES, T. R. Jordan and J. N. Longden, London.
5237. SIZING YARN, A. Hitchin, Accrington.
5238. ELECTRIC GENERATORS, H. J. Haddan.—(*Bain Electric Company, Chicago, U.S.*)
5239. BEATING SCYTHES, H. J. Haddan.—(*J. Faugère, Montignac de Lazun, France.*)
5240. NET, B. J. B. Mills.—(*F. Marian, Lyons.*)
5241. SCREWING, &c., MACHINES, J. Barrow, Leeds.
5242. WATERPROOFING FABRICS, E. de Pass.—(*A. Lèbre, Paris.*)
5243. AFFIXING, &c., STAMPS, W. A. South and C. F. Sarpy, London.
5244. PRODUCING WHITE LIGHT, C. D. Abel.—(*C. Clamond, Paris.*)
5245. PENCIL-CASES, C. Abel.—(*F. Froscheis, Nüremberg.*)
5246. SELF-CLOSING UMBRELLAS, A. J. Boult.—(*F. Jorns, Berlin.*)
5247. DISPLAYING ADVERTISEMENTS, H. H. Lake.—(*G. L. Chapin, Chicago, U.S.*)
5248. MECHANICALLY PLAYING KEYBOARD INSTRUMENTS, R. H. Bishop, and W. Down, London.
5249. ENGINES for TRAMWAYS, T. Hunt, Manchester.
5250. LAMPS, A. Martin, Old Windsor.

Inventions Protected for Six Months on Deposit of Complete Specifications.

5136. BELT CABLE RAILWAYS, H. J. Allison, London. —A communication from the California Belt Railway Company, San Francisco.—*30th October*, 1883.
5152. PLUMBERS' TRAPS, W. R. Lake, London.—A communication from F. N. Du Bois, New York, U.S.—*30th October*, 1883.
5200. DYEING, &c., YARN, W. R. Lake, London.—A communication from J. H. Lorrimer, Philadelphia, U.S.—*1st November*, 1883.

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

4218. CONSTRUCTING INEXTINGUISHABLE, &c., DANGER FLARES, N. J. Holmes, London.—*1st November*, 1876.
4443. MILLING CUTTERS, A. Muir, Manchester.—*30th October*, 1880.
4487. DRINKING FOUNTAINS, T. Kennedy, Kilmarnock. —*3rd November*, 1880.
4510. BREAKING STONES, D. Stratton, Edinburgh.—*4th November*, 1880.
4534. CHAMFERING ENDS of BELTING, J. M. J. Fecken, Aix-la-Chapelle.—*5th November*, 1880.
4536. TIPPING WAGONS, A. G. Margetson and W. S. Hek, Bristol —*5th November*, 1880.
4560. SPINNING, &c., FIBROUS MATERIALS, R. Curtis and W. H. Rhodes, Manchester.—*5th November*, 1880.
4477. FORMING JUNCTIONS of RAILWAYS, R. P. Williams, London.—*2nd November*, 1880.
4581. TELEGRAPH RECEIVING APPARATUS, J. W. Fuller, London.—*8th November*, 1880.
4629. SHIPS' WINDLASSES, W. H. Harfield, London.—*10th November*, 1880.
4669. MAKING PAPER, W. H. Richardson and H. Glenny, Jarrow-on-Tyne.—*12th November*, 1880.
4516. TRANSMITTING HEAT to STEAM BOILERS, W. L. Wise, London.—*4th November*, 1880.
4562. LOOMS, P. Young and J. Mathieson, Glasgow.— *6th November*, 1880.
4218. CONSTRUCTING INEXTINGUISHABLE, &c., DANGER FLARES, N. J. Holmes, London.—*1st November*, 1876.
4468. FURNACES, W. Black, South Shields, and T. Larkin, East Jarrow. *2nd November*, 1880.
4476. ROLLER SKATES, W. P. Gregg, Boston, U.S.—*2nd November*, 1880.
4481. WIRE ROPES, F. W. Scott, Stockport.—*3rd November*, 1880.
4566. FORGING MACHINERY, W. R. Lake, London.—*6th November*, 1880.
4817. DERIVATIVES from COAL TAR PRODUCTS, C. Lowe and J. Gill, Manchester.—*20th November*, 1880.
4911. TRAMWAYS, A. H. Rowan, London.—*25th November*, 1880.
4933. ELECTRIC LAMPS, J. W. Swan, Newcastle.—*27th November*, 1880.
5014. ELECTRIC LAMPS, J. W. Swan, Newcastle.—*2nd December*, 1880.
4472. UTILISING STEEL RAIL ENDS, C. and J. D. Jones, Swansea.—*2nd November*, 1880.
4492. SWITCH-BOXES, R. C. Rapier, London.—*3rd November*, 1880
4507. CARDING ENGINES, G. and E. Ashworth, Manchester.—*4th November*, 1880.
4512. GRINDING DYEWOODS, &c, T. J. and C. H. Pickles and S. Smithson, Ravensthorpe.—*4th November*, 1880.
4523. BREECH-LOADING MECHANISM, T. Nordenfelt, London.—*4th November*, 1880.
4494. TREATING FERMENTED LIQUIDS, W. R Lake, London.—*3rd November*, 1880.
4519. AGING LIQUORS, W. R. Lake, London.—*4th November*, 1880.
4525. EMBROIDERING, A. Heaven, Manchester.—*4th November*, 1880.
4542. STEAM HEATING APPARATUS, L. W. Leeds, London. —*5th November*, 1880.

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

4412. DRYING SHEDS, &c., W. F. Beart, Baldock.—*14th November*, 1876.
4216. CARRIAGES, G. H. Morgan, London.—*31st October*, 1876.
4218. CONSTRUCTING INEXTINGUISHABLE &c., DANGER FLARES, N. J. Holmes, London.—*1st November*, 1876.
4240. VENTILATING GARMENTS, S. L. Worth and J. H. Pontifex.—*2nd November*, 1876.
4704. RAILWAY BRAKES, J. H. Johnson, London.—*5th December*, 1876.
4292. PREPARING WOOD for VARNISHING, W. R. Lake, London.—*6th November*, 1876.
4325. GRINDING, &c., MINERAL and other SUBSTANCES, W. H. Thompson, London.—*8th November*, 1876.
4271. STEAM BOILERS, &c., W. L. Wise, London.—*4th November*, 1876.
4357. WIRE FENCES, &c, W. D. Hunt, Scott, U.S.—*10th November*, 1876.

Notices of Intention to Proceed with Applications.

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

2880. GAS HOOKS, T. Ashford, Birmingham.—*9th June*, 1883.
3198. FEEDING BOTTLES, E. Brasier, New Cross.—*27th June*, 1883.
3205. BILLIARD MARKING, R. Bateman, Birmingham. —*28th June*, 1883.
3207. TABLE FOUNTAINS, W. Aubert, jun., Balham.— *28th June*, 1883.
3219. DISTRIBUTING ELECTRIC CURRENTS, H. E. Newton, London.—Com. from A. I. Gravier.—*28th June*, 1883.
3227. DRESS, &c., FASTENINGS, G. P Lemprière, Balsall Heath.—*29th June*, 1883.
3228. CLUTCH COUPLINGS, A. J. Boult, London.—A communication from M. Haas.—*29th June*, 1883.
3230. CONCENTRATING SULPHURIC ACID, W. J. Menzies, St. Helens.—*29th June*, 1883.
3231. INDICATORS, S. Goodacre, Liverpool.—*29th June*, 1883.
3236. PULLEYS, &c, T. Smith, Brockley.—*29th June*, 1883.
3239. ROTARY ENGINES, W. Frost, Manchester, and T. T. Bond, Luton.—*29th June*, 1883.
3246. OBTAINING SALTS from AMMONIA, J. Addie, Glasgow.—Partly com. from J. Addie.—*30th June*, 1883.
3247. COOKING RANGES, J. Carrick, Glasgow.—*30th June*, 1883.
3251. DRILLING ROCKS, T. R. Jordan, London.—*30th June*, 1883.
3230. TRICYCLES, &c., W. T. Eades, Birmingham.—*2nd July*, 1883.
3273. CORSETS, J. H. Johnson, London.—A communication from G. F. Levieux.—*2nd July*, 1883.
3279. COATING TIN, &c., C. Stuart, Fenny Stratford.— *3rd July*, 1883.
3297. FORGING RAILWAY SPIKES, &c., C. D. Abel, London.—A communication from A. Urban and Söhne. —*3rd July*, 1883.
3311. FLUSHING, D. G. Cameron, London.—*4th July*, 1883.
3317. SEPARATING IMPURITIES from CHINA CLAY, &c., A. S. Chinnock, St. Austell.—*4th July*, 1883
3343. ARTIFICIAL FERTILISERS, T. W. B. Mumford, Victoria Docks.—*5th July*, 1883.
3393. GASEOUS HYDROCHLORIC ACID, C. D. Abel, London.—Com. from R. Hasenclever.—*9th July*, 1883.
3407. GRINDING GLASS TUMBLERS, W. R. Lake, London. A com. from O. W. Minard.—*10th July*, 1883.
3435. BLEACHING OZOKERIT, &c., J. Imray, London.— A com. from J. C. O. Chemin.—*12th July*, 1883.
3536. ELIMINATION of NITROGENOUS MATTERS, E. R. Moritz and H. C. Lee, London.—*18th July*, 1883.
4424. GAS METERS, H. Green, Preston.—*15th September*, 1883.
4462. ADVERTISING, J. Redpath, Sheffield.—*18th September*, 1883.
4507. DAVITS, R. Hudson, J. Grantham, and J. H. Broker, Blyth.—*21st September*, 1883.
4589. ORNAMENTING GLASS, V. Blüthgen, Prussia.— *26th September*, 1883.
4650. WINDING YARN, B. A. Dobson, J. Hill, and J. A. Waite, Bolton.—*29th September*, 1883.
4651. VALVES for REGULATING FLOW of LIQUIDS, W. H. Bailey & W. Lawson, Salford.—*29th September*, 1883.
4697. WATER-CLOSETS, W. R. Lake, London.—A communication from J. P. Putnam.—*2nd October*, 1883.
4835. MAGNETO GENERATORS, M. Benson, London.—A com. from J. P. Stabler.—*11th October*, 1883.
5047. TIME CONTROLLING SYSTEM, W. F. Gardner, U.S. —*23rd October*, 1883.
5084. COUPLINGS, &c., S. Roberts, Tunbridge Wells.— *25th October*, 1883.
5090. DYEING TEXTILE MATERIALS, F. C. Glaser, Berlin. —A com. from E. Rümmelin.—*26th October*, 1883.
5133. BELT CABLE RAILWAYS, H. J. Allison, London.— A communication from the California Belt Railway Company.—*30th October*, 1883.

(*Last day for filing opposition*, 27*th November*, 1883.)

3064. LATCHES for DOORS, J. D. Sprague, Upper Norwood.—*20th June*, 1883.
3269. FOLDING BROADCLOTH, H. J. Haddan, London.— A com. from E. Tatham.—*2nd July*, 1883.
3271. TELEPHONIC APPARATUS, A. J. Boult, London.— A communication from C. S. Steele.—*2nd July*, 1883.
3278. ELECTRICAL CONDUCTOR, H. H. Lake, London.— A com. from T. H. Dunham.—*3rd July*, 1883.
3283. SAFETY VALVES, A. Turnbull, Glasgow.—*3rd July*, 1883.
3284. VESSELS for DYEING, &c., J. Woodcock, Huddersfield, and J. Coulter, Batley.—*3rd July*, 1883.
3286. SPINNING, &c., FIBROUS SUBSTANCES, J. H. Clapham, T. R. Whitehead, and T. W. Wheelwright, Bradford.—*3rd July*, 1883.
3291. ARSENIATE of SODA, F. C. Blythe, Accrington.— *3rd July*, 1883.
3294. PACKING of STUFFING BOXES, C. Schnerzel, Berlin.—*3rd July*, 1883.
3296. WINDOW FASTENINGS, E. M. Loe, London.—A communication from W. C. Loe.—*3rd July*, 1883.
3309. PREVENTING WASTE of WATER, A. Tylor, London. —*4th July*, 1883.
3315. FIRE-GRATES, &c., W. Wade, Crewe.—*4th July*, 1883.
3321. FERMENTATION of BEER, &c., F. Wirth, Germany. —A communication from A. Reiblen.—*4th July*, 1883.
3322. ROTARY ENGINES, G. W. von Nawrocki, Berlin.— A communication from L. d'Andre and L. Lowe and Co.—*4th July*, 1883.
3327. TOY PISTOL, A C. Henderson, London.—A communication from E. Barbé —*5th July*, 1883.
3330. TRICYCLES, J. Cornforth, Birmingham.—*5th July*, 1883.
3332. PORTABLE COTS, G. H. Needham, New Wandsworth.—*5th July*, 1883.
3334. ROCK PERFORATING, M. MacDermot and W. Glover, London.—*5th July*, 1883.
3335. COLLECTING VAPOURS, C. A. Burghardt, Manchester.—*5th July*, 1883.
3340. ELECTRICAL ACCUMULATORS, W. R. Lake, London.—A com. from C. Dion.—*5th July*, 1883.
3372. SEGMENT TEMPLES, F. Oddy, Bradford.—*7th July*, 1883.
3385. RAILWAY SLEEPERS, G. Gilchrist, Glasgow.—*9th July*, 1883.
3403. REFINING SUGAR, C. E. Van Haesendonck, Brussels.—*10th July*, 1883.
3413. ELECTRIC INSULATION, W. V. Wilson, London.— *11th July*, 1883.
3520. HOLDING DRAWING ROLLS, W. R. Lake, London. —A communication from J. H. Congdon and W. and A. Sprague, U.S.—*17th July*, 1883.
3730. OBTAINING COLOURING MATTERS, R. Holliday, Huddersfield, and W. R. Hodgkinson, London.— *31st July*, 1883.
3893. DUMPING BOATS, H. E. Newton, London.—A communication from the Barney Dumping Boat Company, Incorporated.—*11th August*, 1883.
3971. COLOURING MATTERS, T. Holliday, Huddersfield. —*16th August*, 1883.
4108. FURNACES for COMBUSTION of LIQUID FUEL, J. H. Selwyn, London.—*24th August*, 1883.
4122. DYEING WOOL, &c., L. Glover, Silcoates.—*25th August*, 1883.
4164. JACQUARD MACHINERY, R. Scott, Nottingham.— *29th August*, 1883.
4272. REMOVING DIRT from RAILS, R. D. Jones, Liverpool.—*5th September*, 1883.
4287. COTTON GINS, H. Haddan, London.—A communication from D. S. Chapin.—*6th September*, 1883.
4403. CARPET SWEEPERS, H. J. Haddan, London.—A com. from G. W. Gates.—*14th September*, 1883.
4549. STOPPING HOLES in SHIPS, J. Richardson, North Shields.—*24th September*, 1883.
4575. PRINTING PRESSES, W. R. Lake, London.—A communication from B. Huber and W. K. Hodgman.— *25th September*, 1883.
4706. CHAFF CUTTERS, S. Edwards, Salford.—*3rd October*, 1883.
4716. AIR COMPRESSERS, F. W. Scott, London.—*4th October*, 1883.
4732. TRANSPORTING PHOTOGRAPHIC PLATES, J. E. Atkinson, Greenwich.—*4th October*, 1883.
4738. BLEACHING COTTON, G. B. Sharples, Walmersley. —*5th October*, 1883.
4762. CLEANSING OIL, &c., J. Davids, Manchester.—A communication from A. Koellner.—*6th October*, 1883.
4764. PACKING of PISTONS, W. R. Lake, London.—A communication from J. E. Bell.—*6th October*, 1883.
4801. FORMING PLATES for use in SECONDARY BATTERIES, H. J. Haddan, London.—A communication from C. F. Brush.—*9th October*, 1883.
4964. TRANSMITTING SOUNDS, A. G Brookes, London.— A communication from T. Vail.—*18th October*, 1883.
5152. PLUMBERS' TRAPS, W. R. Lake, London.—A communication from F. N. Du Bois.—*30th October*, 1883.
5200. DYEING YARN, W. R. Lake, London.—A communication from J. H. Lorimer.—*1st November*, 1883.

Patents Sealed.

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

2254. WEIGHING YARN, &c., T. Knowles, Turton.—*3rd May*, 1883.
2257. HARNESS, E. Edwards, London.—*3rd May*, 1883.
2258. CHRONOGRAPHS, A. H. Arnold and F. H. Huguenin, Geneva.—*3rd May*, 1883.
2262. LEATHER for SETTING, &c., J. Hall, Leeds.—*3rd May*, 1883.
2275. WATER-WHEELS, G. W. von Nawrocki, London.— *4th May*, 1883.
2283. CLEANERS for FEEDING BOTTLES, F. Cook, Stamford Hill.—*4th May*, 1883.
2284. CRANES, C. J. Appleby, London.—*4th May*, 1883.
2294. TREATING HOPS, A. J. Boult, London.—*5th May*, 1883.
2305. WALL COVERINGS, S. Fisher, Herne Hill.—*7th May*, 1883.
2309. SCRAPING BOTTOMS of SHIPS, J. Fishwick, Barnstaple.—*7th May*, 1883.
2321. ARTIFICIAL STONE, B. Hess, Plymouth.—*9th May*, 1883.
2333. EVAPORATING SALT BRINES, W. T. Whiteman, London.—*8th May*, 1883.
2335. LIGHTING by GAS, D. W. Sugg, London.—*8th May*, 1883.
2371. MAKING BRICKS, H. H. Lake, London. —*9th May*, 1883.
2409. MILLING MACHINES, H. H. Lake, London.—*11th May*, 1883.
2414. LAMPS, J. Matthews, London.—*12th May*, 1883.
2421. FOUNTAIN PENS, J. Morton, London.—*12th May*, 1883.
2468. WOOL WASHING, J. Imray, London.—*17th May*, 1883.
2472. EXTINGUISHING FIRES, G. W. von Nawrocki, London.—*17th May*, 1883.
2497. BOOK COVERS, S. S. Tuckerman, Kinver.—*18th May*, 1883.
2498. NON-CONDUCTING COVERINGS, A. J. Boult, London.—*18th May*, 1883.
2551. FISHING REELS, D. Slater, Newark-upon-Trent.— *22nd May*, 1883.
2566. SULPHATE of LIME, J. H. Johnson, London.— *22nd May*, 1883.
2567. PRESERVING FOOD, J. H. Johnson, London.— *22nd May*, 1883.
2578. CLEANING FLUES, R. Sutcliffe, Idle.—*23rd May*, 1883.
2631. REVERBERATORY SMELTING FURNACES, H. J. Hodgdan, London.—*26th May*, 1883.
2667. TELEPHONIC TRANSMITTER, J. Graham, London. —*29th May*, 1883.
2709. STEAM POWER, S. J. Fear, Redland, and G. C. S. Hill, Bedminster.—*31st May*, 1883.
2820. TREATING BEET SUGAR, W. L. Wise, London.— *6th June*, 1883.
2824 COOKING EGGS, J. Darling, Glasgow.—*7th June*, 1883.
2877. TIES for BINDING COTTON, E. Ascherson, London. —*9th June*, 1883.
2952. STEAM BOILERS, W. R. Lake, London.—*13th June*, 1883.
3135. GAS ENGINES, P. Niel, London.—*25th June*, 1883.
3137. STEAM BOILERS, G. C. and J. H. Fraser, Bromley-by-Bow.—*25th June*, 1883.
3254. HORSE NAILS, J. A. Huggett and J. Swalwell, Battersea.—*30th June*, 1883.
3346. HOLDERS for KNIFE BLADES, &c , J. H. Johnson, London.—*5th July*, 1883.
3446. MARQUETRY PARQUET, G. Howard, London.— *13th July*, 1883.
3816. POLES for LAWN-TENNIS NETS, S. C. Davidson, Belfast.—*4th August*, 1883.
3870. PAVING BLOCKS, C. J. Dobbs, Middlesbrough.— *9th August*, 1883.
3915. INCANDESCENT ELECTRIC LAMPS, G. F. Redfern, London.—*13th August*, 1883.
3922. HYDROCHLORIC ACID, L. Mond, Northwich.— *13th August*, 1883.
3933. OBTAINING AMMONIA, L. Mond, Northwich.—*13th August*, 1883.
3930. ARTIFICIAL IVORY, H. H. Lake, London.—*14th August*, 1883.
3972. TREATING VOLATILE FLUIDS, S. M. Eiseman, New York.—*16th August*, 1883.
3996. MOTORS for LIFTING, &c., F. W. Scott, London.— —*17th August*, 1883.
4000. ORE ROASTING FURNACES, H. H. Lake, London. —*17th August*, 1883.
4006. LOOMS, T. Crabtree, Shipley.—*17th August*, 1883.
4010. TRIMMING GRAIN, I. A. Mack, Liverpool.—*18th August*, 1883.

List of Letters Patent which passed the Great Seal on the 6th November, 1883.)

1886. CUSHIONING VALVES, W. P. Thompson, Liverpool. —*13th April*, 1883.
2354. MOLTEN METALS, O. Trossin, London.—*9th May*, 1883.
2360. ADJUSTMENT of TRICYCLE SADDLES, W. S. Honywood, Aston, and G. T. Cashmore, Handsworth.— *9th May*, 1883.
2362. ELEVATING GRAIN, G. J. Hone, Poplar.—*9th May*, 1883.
2364. KNITTED UNDERSHIRTS, M. Grieve, Leicester.— *9th May*, 1883.
2367. WEAVING DESIGNS on SILK, W. C. Kipling and S. W. Brown, London.—*9th May*, 1883.
2374. GARDEN FRAMES, W. Wright and T. Holmes, Birmingham.—*10th May*, 1883.
2375. NET HAULING MACHINE, J. D. Jack, Elgin.—*10th May*, 1883.
2378. CHECKING MONEY in VEHICLES, J. M. Black, London.—*10th May*, 1883.
2379. LOOMS, G. H. Hodgson, Bradford.—*10th May*, 1883.
2382. CUPOLA FURNACES, A. Stewart, Bradford.—*10th May*, 1883.
2406. TUNNELS, T. R. Crampton, London.—*11th May*, 1883.
2412. SHIPS of WAR, E. J. Reed, London.—*12th May*, 1883.
2424. TEAPOTS, J. Ridge, Sheffield.—*12th May*, 1883.
2428. UTILISING an EXPLOSIVE COMPOUND, R. Punshon and R. R. Vizer, London.—*12th May*, 1883.
2450. ENGINES for CARDING FIBROUS MATERIALS, W. Tatham, Rochdale.—*16th May*, 1883.
2451. CALLIPERS, St. J. V. Day, Glasgow.—*16th May*, 1883.
2459. DOMESTIC FIRE-ESCAPE, T. Hale, Claydon.—*16th May*, 1883.
2461. PERFORATING PAPER, W. R. Lake, London.—*16th May*, 1883.
2486. TREATING INDIGO, W. Brookes, London.—*18th May*, 1883.
2493. MEASURING ELECTRICITY, J. D. F. Andrews, Glasgow.—*18th May*, 1883.
2508. GAITERS, &c., C. M. A. de Gauban du Mont, Paris.—*19th May*, 1883.
2584. STEAM ENGINES, A. M. Clark, London.—*23rd May*, 1883.
2596. GENERATING STEAM, H. Tipping, Greenwich.— —*24th May*, 1883.

2663. Rotary Screens, H. Shield and W. N. Crockett, Nottingham.—29*th May*, 1883.
2668. Dyeing Silk, T. Holliday, Huddersfield.—29*th May*, 1883.
2673. Galvanic Batteries, A. M. Clark, London.—29*th May*, 1883.
2712. Cocks, J. Ohren, Rio de Janeiro, Brazil.—31*st May*, 1883.
3134. Cooling Liquids, F. T. Bond, Gloucester.—25*th June*, 1883.
3203. Carriage Brake, W. Corteen, Sheffield.—27*th June*, 1883.
3360. Working Railway Points, S. Pitt, Sutton.—6*th July*, 1883.
3384. Boots as Substitutes for Leggings, W. R. Lake, London.—7*th July*, 1883.
3578. Synchronising Mechanism, W. S. Harrison, Barnsbury.—20*th July*, 1883.
3613. Cultivating Land, R. Hitchcock, Taunton.—23*rd July*, 1883.
3658. Treating Fats for Soap, J. Imray, London.—26*th July*, 1883.
4008. Gas Engines, E. K. Dutton, Manchester.—18*th August*, 1883.
4140. Treating Iron Ores, W. Arthur, Cowes.—28*th August*, 1883.

List of Specifications published during the week ending November 3rd, 1883.

5002, 2d.; 6042, 4d.; 311, 2d.; 369, 6d.; 943, 6d.; 1150, 6d.; 1292, 2d.; 1318, 4d.; 1320, 1s.; 1327, 2d.; 1339, 6d.; 1343, 2d.; 1346, 6d.; 1349, 4d.; 1359, 6d.; 1361, 2d.; 1364, 2d.; 1367, 2d.; 1370, 4d.; 1371, 8d.; 1376, 6d.; 1378, 6d.; 1380, 4d.; 1381, 2d.; 1384, 6d.; 1385, 2d.; 1387, 6d.; 1389, 2d.; 1390, 2d.; 1391, 6d.; 1392, 6d.; 1393, 6d.; 1394, 2d.; 1395, 8d.; 1396, 6d.; 1398, 6d.; 1399, 6d.; 1402, 2d.; 1403, 8d.; 1405, 4d.; 1406, 2d.; 1408, 4d.; 1410, 6d.; 1413, 8d.; 1416, 6d.; 1417, 6d.; 1418, 6d.; 1419, 2d.; 1420, 6d.; 1421, 6d.; 1422, 2d.; 1423, 4d.; 1424, 6d.; 1425, 2d.; 1426, 6d.; 1427, 2d.; 1428, 2d.; 1429, 2d.; 1432, 4d.; 1435, 6d.; 1436, 8d.; 1438, 2d.; 1439, 2d.; 1440, 2d.; 1441, 4d.; 1444, 6d.; 1445, 4d.; 1446, 2d.; 1447, 4d.; 1449, 6d.; 1451, 4d.; 1452, 6d.; 1453, 6d.; 1454, 8d.; 1456, 2d.; 1459, 6d.; 1460, 6d.; 1461, 2d.; 1463, 2d.; 1465, 2d.; 1469, 2d.; 1471, 2d.; 1373, 4d.; 1474, 4d.; 1478, 6d.; 1479, 2d.; 1481, 4d.; 1483, 2d.; 1485, 6d.; 1486, 6d.; 1487, 6d.; 1488, 6d.; 1490, 2d.; 1491, 2d.; 1493, 2d.; 1495, 6d.; 1498, 2d.; 1500, 6d.; 1503, 4d.; 1505, 6d.; 1507, 2d.; 1515, 6d.; 1518, 2d.; 1523, 2d.; 1524, 8d.; 1540, 1s.; 1554, 6d.; 1555, 2d.; 1604, 6d.; 1729, 6d.; 1908, 6d.; 2298, 6d.; 2651, 6d.; 2780, 6d.; 3302, 6d.; 3412, 6d.; 3598, 6d.

***** Specifications will be forwarded by post from the Patent-office on receipt of the amount of price and postage. Sums exceeding 1s. must be remitted by Post-office order, made payable at the Post-office, 5, High Holborn, to Mr. H. Reader Lack, her Majesty's Patent-office, Southampton-buildings, Chancery-lane, London.**

ABSTRACTS OF SPECIFICATIONS.

Prepared by ourselves expressly for* The Engineer *at the office of Her Majesty's Commissioners of Patents.

6042. Apparatus for Clearing Snow from Railways and Roads, *E. Barnes, Ulverstone.*—18*th December*, 1882. 4*d.*

This relates to a method of clearing snow from railways and roads by means of jets of steam or exhaust steam.

311. Tricycles, *H. Van der Weyde, London.*—18*th January*, 1883.—(*Not proceeded with.*) 2*d.*

This consists in the arrangement and combination of parts whereby the steadiness and capability of standing alone of the tricycle is obtained, as is also the adaptability for speed and for sharp turning of the bicycle.

369. Gas Burner Apparatus, *G. S. Grimston, Brockley, and A. S. Bowen, St. Neots.*—23*rd January*, 1883. 6*d.*

This relates to improvements on patent No. 900, dated 24th February, 1882. The gas is delivered in a downward direction from the lower ends of a number of small vertical tubes arranged in a circle. A larger tube or cylinder surrounds this group of small tubes, and projects below them. At the centre of the same group, a flat disc of metal or earthenware capable of adjustment, or preferably a conical deflector, is suspended. A current of heated air descends the large tube or cylinder, and issues at the lower end of the cylinder, together with the gas. The gas and air then meet the deflector, and the direction of the current is changed, becoming nearly horizontal, and radiating outwards from the centre every way. The gas being ignited forms a ring or sheet of flames. The general horizontal direction of the flame is preserved by a flange upon the exterior of the cylinder at its lower end.

943. Method of and Apparatus for Drying Animal, Vegetable, and other Substances, *W. R. Lake, London.*—20*th February*, 1883.—(*A communication from L. Maiche, Paris.*) 6*d.*

This relates to the method or process of drying in a comparative vacuum, that is to say, at a low temperature and at a low pressure, animal, vegetable, or other substances which require this mode of treatment in order to obtain products of superior quality under economical conditions, which method or process is based upon the combination, under peculiar conditions, of the action of a vacuum with that of heat.

1150. Appliance to Facilitate the Putting on of Boots or Shoes, *A. J. Boult, London.*—3*rd March*, 1883.—(*A communication from G. N. Vallery, Yvetot, France.*) 6*d.*

This relates to a frame in which the boot is fixed, and the mouth stretched open so as to insert the foot.

1291. Receptacles for Pocket Use to Carry Matches, &c., *G. W. von Nawrocki, Berlin.*—10*th March*, 1883.—(*A communication from T. Remus, Dresden.*)—(*Not proceded with.*) 2*d.*

This relates to a box made in two semi-cylindrical pieces, the one fitting within the other.

1292. Fasteners for Gloves, Boots, Cloaks, &c., *W. R. Lake, London.*—10*th March*, 1883.—(*A communication from F. J. Kraetzer, Boston, U.S.*)—(*Not proceded with.*) 2*d.*

This relates to spring catch fasteners.

1293. Traction Engines, *A. Greig and G. Achilles, Leeds.*—10*th March*, 1883. 8*d.*

The object is to facilitate the application of springs to the road wheels of traction and other engines.

1294. Railway Fog Signal Apparatus, &c., *J. Coleman and I. Henson, Derby.*—10*th March*, 1883. 6*d.*

This relates to the use, in combination with a hopper containing a column of detonator railway fog signals, of a slide to separate the end fog signal in the column from the remainder of the fog signals, and relieve it from pressure before it has to be pushed from the hopper on to the rails.

1296. Apparatus for Use in Crushing Sugar Canes, &c., *A. S. Brindley, New Radford, and J. Worsnop, London.*—12*th March* 1883. 6*d.*

This relates to the employment of fluted rollers which work together.

1297. Braiding Machines, *W. Ashton, Manchester.*—12*th March*, 1883. 6*d.*

The principal object is so to construct a braiding machine as to make a flat, thick braid with square edges. This is accomplished by the arrangement and combination of the "roses" and governors of the braiding machine in parallel lines or rows, in such a manner that the braiding spindles not only cross their own path in a zig-zag direction as usual, but also cross over from back to front or *vice versâ* from one row to to the other so as to bind the braid together, and thus make a flat braid with square edges.

1299. Cases or Holders for Cigars, Cigarettes, Needles, Pins, Lucifers, &c., *F. Mac D. Robertson, and J. E. Couté, London.*—12*th March*, 1883. 6*d.*

The object is to construct the case or holder in such a manner that the articles contained therein may, on the lid or cover being raised or opened, be fully displayed to view and ready access had thereto.

1300. Hackling Machines, *J. C. Mewburn, London.*—12*th March*, 1883.—(*A communication from J. Cardon, Lille*) 6*d.*

This relates to the construction of a machine which performs the three operations of preliminary hackling, hackling properly so-called, and finishing or combing.

1301. Forming Cast Metal Sockets Employed to Hold Tubular Handles, &c., *R. Clayton, near Bilston.*—12*th March*, 1883. 6*d.*

The object is to render the employment of chills practicable by providing against the liability of the socket to split.

1302. Fastening for Doors, Windows, and Shutters, *R. Whiston, Wolverhampton.*—12*th March*, 1883. 6*d.*

This relates to a fastening in which the bolt is worked by a screw thread.

1303. Apparatus for Producing Letters and Figures on Metal, &c., *W. P. Thompson, Liverpool.*—12*th March*, 1883.—(*A communication from E. E. Wood, jun., Northampton, U.S.*) 6*d.*

This relates to the method and apparatus for etching letters and figures on metal by the use of acid.

1305. Sewing Machines, *W. Churchill, Surrey.*—12*th March*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to simplify the construction, adjusting, and working of sole sewing and other sewing machines in which a whirl is used, and it consists in substituting for the connecting rods and cog wheels used a band or chain of leather, metal, or other material guided by wheels or rollers, so that the band connects the cam shaft to the horn spindle, by running on a wheel on the cam shaft, the cam, or other suitable position, and gives motion to the whirl.

1306. Spinning and Twisting Fibres, *E. Morley, Halifax.*—12*th March*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to apparatus for detecting and removing or breaking the yarn at points where portions of extraneous fibre have become attached to the main thread, and it also serves to detect "doubles." One or more brackets carry two adjustable plates, the inner edges of which form a gauge.

1307. Looms for Weaving, *T. Hollingworth, Blackburn.*—12*th March*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to apparatus for adjusting and regulating the weighting of the warp beam and the delivery of warp. To the lower cross rail are fixed brackets in which a stud or shaft is secured and has an arm carrying a pawl. On the stud is a loose catch wheel with clutch box, the clutch engaging with a like clutch on a lever fulcrummed on a stud. On the boss of the catch wheel is a hook for the weighting rope which passes thence round the neck of the ruffle of the warp beam.

1308. Fire Escapes, *W. Brierley, Halifax.*—12*th March*, 1883.—(*A communication from J. Hall and R. B. Holdsworth, Trinidad, U.S.*)—(*Not proceeded with.*) 2*d.*

A framework is secured to the walls of buildings and has a winding barrel around which is a wire rope ladder.

1309. Steam Boilers, *G. W. von Nawrocki, Berlin.*—12*th March*, 1883.—(*A communication from E. Völcker, Germany.*)—(*Not proceeded with.*) 2*d.*

A heating tube is placed within an arched flue and is arranged concentrically therewith in front, and somewhat inclined towards the rear, and therefore terminates below the axis of the flue. The front of the flue forms a smooth conical sleeve communicating with the fire space, and it receives the heating tube.

1310. Bicycles, *F. M. Wright, Haileybury College, Herts.*—12*th March*, 1883.—(*Not proceeded with.*) 2*d.*

The pedals are arranged so that the driver can exert power thereon when they are behind instead of in front of the axis. The driving shaft carries gear wheels, and other wheels carried by a prolongation of the fork gear therewith and their spindles carry the pedals.

1311. Engines to be Worked by Steam and Air, *H. H. Lake, London.*—12*th March*, 1883.—(*A communication from F. McMellon, Boston, U.S.*) 6*d.*

This relates to steam engines in which air is used as an auxiliary motor. The driving wheel shaft carries a wheel gearing with a wheel on a horizontal shaft, at the outer end of which is a face plate with a crank pin. A pump is mounted on the frame and its piston connected to the crank pin, this pump having an induction pipe, an eduction pipe, and proper valves to constitute either an air or water pump. The eduction pipe leads to the boiler, which it enters above the crown sheet, and has a branch fitted with a relief valve. The induction pipe has a T pipe connecting with a water tank, an air valve, and a stop cock. The pump is designed to force either air or water into the boiler as required, and the air mixes with the steam and passes to the cylinder of the engine.

1312. Twisting or Doubling Yarns, *J. Farrar, Halifax.*—12*th March*, 1883.—(*Not proceeded with.*) 2*d.*

According to one arrangement a "Rabbeth" spindle, or what the inventor calls a "self-contained spindle," is employed, and has the wharle for driving it placed above the top spindle rail of the twisting frame, the upper half being formed about midway of the length of the spindle, which passes into a long tube below, on which the lower half of the wharle is formed.

1315. Lawn Tennis Balls, *F. O. Heinrich, Wimbledon.*—13*th March*, 1883. 2*d.*

The balls are coated with a solution of india-rubber, to which fibrous or other suitable material is caused to adhere.

1316. Domestic Appliance for Cutting Beans, &c., *G. Clayforth, Kent.*—12*th March*, 1883. 4*d.*

A number of cutting blades are secured in a handle so that they are all level with each other, and serve to cut edibles into strips.

1317. Apparatus connected with the Handles of a Valve or other Closet for Preventing Waste of Water, *J. Harsant, Wandsworth.*—13*th March*, 1883. 6*d.*

The object is to prevent waste of water and also form an effectual seal for the basin of water-closets by retaining an after flush therein, the apparatus being actuated by the handle. The handle is hollow, and through it passes a spindle, the lower end of which is connected to the bottom valve, while a projection on the spindle actuates the water supply valve. A tumbler on the handle spindle is actuated so as to release the inner spindle and cause the bottom valve to close before the water supply valve.

1318. Apparatus for Condensing Wool and other Fibres, *J. Wilkinson, Yeadon.*—13*th March*, 1883. 4*d.*

The inventor employs a shaft having suitable cranks, tumblers, and excentrics; each excentric or crank carries a link; each end of each link is connected to the horizontal shafts of the rubbing rollers, upon which are endless rubbers or bands. The excentrics impart a sideways to-and-fro motion to the shafts and rollers carrying the rubbers, which are revolving at the same time.

1319. Heating and Purifying Water for Use in Steam Boilers, &c., *J. H. Johnson, London.*—13*th March*, 1883.—(*A communication from G. S. Strong, Philadelphia.*) 6*d.*

This relates to the removal from water of such impurities as carbonates of lime and magnesia and sulphate of lime, and it consists in heating the water to about 250 deg. Fah., whereby the salts are converted into insoluble particles, and the water so heated is then passed through a filter or separator, by which the insoluble particles are removed. Suitable apparatus for effecting this object is described.

1320. Apparatus for Generating and Condensing Steam, &c, *J. Hodgart, Paisley.*—13*th March*, 1883.—(*A communication from D. Provand, Valparaiso, Chili.*) 1s.

This invention, which relates to improvements in apparatus for generating and condensing steam, is especially applicable for obtaining fresh or drinking water from sea or salt water, and it consists generally in using one or a series of two or more generating condensers, which may be of any shape or construction, each consisting essentially of two chambers or compartments, or combinations of these, separated by metallic plates, which may be flat, corrugated, cylindrical, or of other form, so arranged as to permit the passage of heat by conduction through the metallic plates from one of the two chambers or compartments, or combinations of these, to the other, but preventing the passage of water or steam.

1321. Caissons, *J. J. F. Andrews, Isle of Dogs.*—13*th March*, 1883.—(*Not proceeded with.*) 2*d.*

Belts, casings, or air chambers are formed along the sides or inner skins, and all round the caissons, so as to produce sufficient buoyancy to float the caisson at any required draught of water, but not require ballast as usual to steady the caissons.

1323. Purification of Gas, *W. W. Box, Crayford, and G. Waller, Southwark.*—13*th March*, 1883. 8*d.*

This relates to "scrubber washers" for removing ammonia, tar, and other impurities from coal gas, and is based on the apparatus described in patent No. 4262, A.D. 1882. A cylindrical or polygonal case is placed horizontally, and has vertical ends, and is divided by vertical diaphragms into chambers. Within the case and above its axis is a hollow slotted polygonal shaft, with diaphragms corresponding with each alternate diaphragm in the case, such shaft being supported in bearings and caused to revolve. In each compartment the shaft carries two iron discs secured together by radial plates, so as to form pockets, each of which contains wooden sticks or metal tubes kept in position by perforated plates. The first and last chambers have each a branch, one serving as a gas inlet and the other as the outlet. The intermediate chambers are connected in pairs by pipes. Water or other liquid is supplied to the hollow shaft.

1324. Pumping or Forcing Gaseous Fluids, *C. J. Galloway and J. H. Beckwith.*—13*th March*, 1883.—(*Not proceeded with.*) 2*d.*

A vertical cylinder has the cover and bottom both curved downwards towards the middle, and in the cylinder is a packed piston with its upper and lower sides correspondingly formed. From the upper and lower ends of the cylinder lateral passages lead to valve-boxes, in each of which is a suction and also a discharge valve lying on a grating, these valves being accessible by openings with suitable covers.

1325. Hydraulic Lifts, *W. H. Johnson, Westminster.*—13*th March*, 1883. 6*d.*

This relates to hydraulic lifts in which water is employed as described in patent No. 5149, A.D. 1880, for counterbalancing the weight of the cage and plunger, and for compensating the variation of load resulting from the greater or less protrusion of the plunger, the object being to simplify the construction, economise space, and obtain facility for erection and repairs. For this purpose the counterbalancing cylinders and plungers are made annular, surrounding the lift cylinder and its plunger, so that the whole is accommodated on one foundation within the space of the lift shaft, and without requiring external pipe connections.

1326. Governors for Gas Engines, *T. Ashbury, H. Sumner, and R. W. B. Sanderson, Manchester.*—13*th March*, 1883.—(*Not proceeded with.*) 2*d.*

The governor has a central hollow spindle, into which is fitted another spindle carrying the end of a trip lever. On a stud on which this lever swivels is also a bell-crank lever to lift the gas valve by engaging with the end of the swinging valve spindle, and which is actuated by a cam on the shaft which drives the governor.

1327. Packing Rings and Springs for Pistons, *C. Mace and W. Tate, Sunderland.*—13*th March*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to the general arrangement of the rings and springs.

1328. Pipes for Smoking Tobacco, *W. C. Dean, Liverpool.*—13*th March*, 1883.—(*Not proceeded with.*) 2*d.*

The pipe is divided longitudinally, so that it may be separated and expose the interior of the bowl and stem for cleaning purposes.

1330. Sewing Machines, *H. J. Haddan, Kensington.*—13*th March*, 1883.—(*A communication from G. Wicke, Germany.*)—(*Not proceeded with.*) 2*d.*

The object is to provide sewing machines with mechanism by means of which it will be possible to use in sewing not only yarn wound on reels or bobbins, but also yarn wound in coils or on flat cards.

1331. Mechanism for Converting Motion Especially to the Shuttle Movement of Sewing Machines, *S. Pitt, Sutton.*—13*th March*, 1883.—(*A communication from L. B. Miller, New Jersey, U.S.*) 6*d.*

The inventor claims in a sewing machine the combination with a rock shaft having a slotted crank of a lever provided with a projection adapted to enter and work in such slot, said lever being attached to a bed-plate by swinging links pivotted on opposite sides of it, and also connected to regularly reciprocating mechanism.

1333. Burning Hydrocarbon Oils, together with Steam or Water, &c., *A. J. Boult, London.*—13*th March*, 1883.—(*A communication from C. Holland, Chicago.*) 6*d.*

This consists in the method of burning hydrocarbon fluids with steam and air by introducing the fluid into a heated chamber from which any imperfectly volatilised portions descend to a more highly heated compartment, and after mingling with steam therein are discharged to burners in a gaseous form and burned with air. The invention embraces improved forms of retorts and connections for supplying the hydrocarbon and water and directing the flow of fluids, vapours, or gases during distillation, and an improved arrangement of distributing pipes and burners and valves to regulate the combustion in all parts of the furnace.

1335. Centrifugal Separating Machines, &c., *F. H. F. Engel, Hamburg.*—13*th March*, 1883.—(*A communication from H. Petersen and W. Ritter, Germany.*) 6*d.*

The object is to automatically regulate the feed to centrifugal machines for separating compound fluids, and it consists in effecting this by the ring of liquid contained in the drum or vessel, which as soon as it has attained its normal height influences a tap valve or cover closing the feed pipe.

1336. Construction of Certain Parts of Bakers' Ovens, *F. Smith, Lambeth.*—13*th March*, 1883. 8*d.*

The ovens are provided with counter-balanced doors hung from the top of a door frame so as to keep in part of the top heat and of the steam when the door is open. A sight frame with valve apertures is also provided, and arrangements are described for lighting the interior of the oven.

1338. Button-hole Feeding Mechanisms for Sewing Machines, *A. W. L. Reddie, London.*—13*th March*, 1883.—(*A communication from the National Machine Company, Incorporated, Troy, U.S.*) 1s. 6*d.*

This relates to improvements in mechanisms for feeding to sewing machines fabrics having button-holes with one end rounded or eyelet-shaped.

1337. Baths, Washing Troughs, &c., *T. J. Saunders and H. W. Allen, Glasgow.*—13*th March*, 1883.—(*Not proceeded with.*) 2*d.*

This refers to the construction of the overflow and discharge valves.

1339. Apparatus for Producing Coal Gas, *H. E. Newton, London.*—13*th March*, 1883.—(*A communication from A. Klönne, Dortmund.*) 6*d.*

This consists, First, in the use of an open pan to contain water, the steam from which serves to keep the fuel support cool; Secondly, the arrangement of the regenerative portion of the furnace which permits of the primary air being heated in one part and the secondary air in another part; Thirdly, the construction of perforated bricks with tubes and flues, and their application to regenerative gas furnaces; Fourthly, the application of specially-shaped bricks to regenerative gas furnaces; Fifthly, dividing the interior of the setting into a series of chambers, and the mode of constructing or building up partition walls; Sixthly, the use in the partition walls of a number of small openings to prevent the stagnation of the heating gases.

1341. Lubricators for Journal-boxes or Bearings, *W. R. Lake, London.*—13*th March*, 1883.—(*A communication from H. R. Randall and C. G. Till, Brooklyn, U.S.*) 6*d.*

This relates to the combination with a rotary brush of a frame, in which the said brush is arranged, and elliptical springs supporting the said frame and adapted to fit within a journal-box with the ends in close proximity to the ends of the said box, and to hold the hub of the brush in contact with the journal which is received in the box.

1342. Fire-escapes, *W. R. Lake, London.*—13*th March*, 1883.—(*A communication from N. E. Braunfeld, Philadelphia.*—(*Not proceeded with.*) 2*d.*

This consists essentially of a reversible box, pulleys within the same, and a rope or a ring or loop, adapted to be attached to either end of the said box.

1343. Machine for Cutting or Dividing Paper, &c., *W. R. Lake, London.*—13*th March*, 1883.—(*A communication from O. Lelm, Paris.*)—(*Not proceeded with.*) 2*d.*

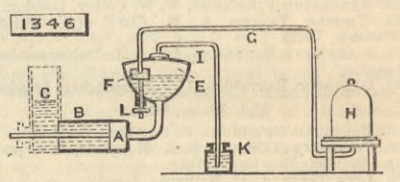
This relates to the construction of a machine which is provided with rotating cutters.

1344. Machinery for Pricking or Piercing Cards for Jacquard Looms with Mechanical Appliances for Controlling the Work, *J. Amjorn, Comte de Sparre, Paris.*—13*th March*, 1883. 6*d.*

The apparatus is based on the employment of an engraved plate representing exactly in intaglio and in relief the design to be produced by weaving by means of the cards to be pierced, the said plate acting on a row of oscillating keys, which transmit their movements to small wires with square heels; these hooks, according to whether they are or are not acted upon by the keys, act or do not act on the bars or pushers of the horizontal rods, which actuate directly the large vertical wires or hooks of the punches of an ordinary jacquard card punching machine.

1346. Air Pumps, *F. Wirth, Germany.*—13*th March*, 1883.—(*A communication from H. and J. F. Beins, Netherlands.*) 6*d.*

The cylinder B is plunged into a suitable liquid or connected with a receiver containing the liquid, and the piston-rod passes through the liquid and out by an opening. At the other end the cylinder communicates with the vessel E closed at top and also containing liquid. In this vessel is placed a vessel F containing mercury. Tubes G and I open into the cover of



vessel E, G plunging into vessel F, and I allowing free passage of air from vessel E. The other end of G terminates in receiver H, and tube I plunges into mercury in vessel K. By operating rod L the vessel F can be raised or lowered. When the piston is operated the liquid in E will fall and form a vacuum in this vessel. The air in receiver H will pass through the mercury in F and enter vessel E. On the return of the piston the water will re-enter E and the air be forced out through tube I.

1348. Securing Stoppers in Bottles, *T. le Poidevin, Guernsey.*—13*th March*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to the construction of the apparatus for attaching the stopper to the neck of the bottle.

1349. Production of Sulphurous Acid, &c., and Applying the Same to the Treatment of Wood Pulp, &c, *J. S. McDougall, near Manchester.*—13*th March*, 1883. 4*d.*

This relates to the production of sulphurous acid or solutions containing sulphurous acid or sulphite or other salts, without the use of condensing towers or columns.

1350. Envelopes for the Projectiles of Rifled Small-arms, *S. Pitt, Sutton.*—19*th March*, 1883.—(*A communication from Lieut.-Colonel G. V. Fosbery and H. Pieper, Liége.*) 6*d.*

This relates to the construction of envelopes for projectiles of cylinders, formed from thin sheet metal, and having teeth formed around their sides, or having their forward ends bent outwards.

1352. Velocipedes, &c., *W. Morgan, Birmingham.*—13*th March*, 1883. 6*d.*

This relates to the construction of the driving chains.

1353. Manufacture of Lead and Colour Pencils, *T. Lehmann, London.*—13*th March*, 1883. 6*d.*

The object is the production of pencils with a movable marking lead or stick of colour composition.

1354. Appliances to Facilitate Tramcars passing Points, *J. Rettie, London.*—13*th March*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to enable tramcars to be passed over points by mechanical means, capable of being acted upon by the driver without leaving his foot-board.

1358. Apparatus for Opening Closed Packages, *F. C. Glaser, Berlin.*—14*th March*, 1883.—(*A communication from F. H. Arnd, Weimar.*) 6*d.*

This relates to opening the packages by means of a wire.

1359. Pole-end Fittings for Vehicles, *R. Hill and W. Pollitt, Heywood.*—14*th March*, 1883. 6*d.*

This relates to the means for the attachment of horses to the ends of the poles of vehicles, and has for its object to facilitate the attachment and release of the horses.

1360. Construction of Portable Fire-proof and other Shelving, &c., *B. Harlow, Macclesfield.*—14*th March*, 1883. 8*d.*

The shelving or racks are constructed with pedestals having two or more rows of sockets or holes and having longitudinal bars fitting said sockets or holes, the whole forming a rigid structure capable of being rapidly erected or taken to pieces.

1363. Manufacture of Compound Applicable as Cement or Mortar, &c., *J. Imray, London.*—14*th March*, 1883.—(*A communication from E. Pick, Paris.*) 4*d.*

The principal ingredient of the compound, about 75 per cent. of the whole, is gypsum or hydrated sulphate of lime, and the other ingredients are marl feldspar, and coke dust, or any matter containing iron

1361. Collar for Horses and other Animals, *D. Gaussen, Lechlade.*—14*th March*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to the construction of collars for horses and other animals made of a steel plate, or steel plates, or other metallic substances, "grooved" or otherwise united and cut or stamped to a pattern.

1364. Dynamo-electric and Electro-dynamo Machines, &c., *W. Siemens, London.*—14*th March*, 1883.—(*Not proceeded with.*) 2*d.*

A coiled armature having a non-magnetic core revolves within a stationary coil arranged in a plane passing through the axis of revolution. The commutator, of ordinary construction, has brushes made of flattened tubes, containing a lubricant fusible at a moderate temperature, and provided with holes at their points of contact. When used as a generator the stationary coil is separately excited. The machine may be provided with a "flyer" and geared to a counter to act as a meter.

1365. Manufacture of a Material for the Seats and Backs of Chairs, &c., *H. J. Haddan, Kensington.*—14*th March*, 1883.—(*A communication from R. Schimmel, Annaberg.*) 4*d.*

This relates to the treatment of wood fibre and textile material.

1366. Apparatus for the Manufacture of Illuminating and Heating Gas from Petroleum and other Oils, *H. J. Haddan, Kensington.*—14*th March*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to apparatus for the destructive distillation of petroleum tar and other oils.

1367. Tip Wagons, *G. W. von Nawrocki, Berlin.*—14*th March*, 1883.—(*A communication from A. Taechner, Berlin.*—(*Not proceeded with.*) 2*d.*

This relates to improvements in the general construction.

1368. Fire-escapes, *A. Diss, West Bergholt.*—14*th March*, 1883. 6*d.*

This relates to a fire-escape fixed inside the walls of the house.

1369. Obviating or Reducing Damage and Loss arising from Collisions of or Leaks in Ships, *G. H. Down, Cardiff.*—14*th March*, 1883. 6*d.*

This relates, First, to the application of india-rubber buffers in front of the bows; and Secondly, a guard or shield to be placed over holes or leaks.

1370. Mechanism of Electric Meters, &c., *P. Jolin and J. Parsons, Bristol, and M. F. Purcell, Dublin.*—14*th* ½*March*, 1883.—(*Not proceeded with.*) 4*d.*

This invention relates to meters measuring by means of clockwork apparatus placed in the main circuit and actuated by an electro-magnet.

1371. Commutators for Dynamo-electric Machines, *S. Z. de Ferranti and V. S. Szczepanowski, London.*—14*th March*, 1883. 8*d.*

In the hollow end of the armature axis are placed two copper rods insulated from each other and the axis. One rod is coupled to one terminal of the zig-zag coil and the other to the other terminal. At the extremity of the axis the rods are coupled to segments of copper discs concentric with it. These segments are provided with equidistant projections, against which is held a disc having upon its face equidistant radial metal strips separated by insulating material. The alternate metallic strips are coupled together, and the respective sets are coupled to insulated terminals. The projections on the segments and the radial strips on the disc are so arranged as to give a continuous current.

1372. Glazed Structures for Horticultural Purposes, &c., *J. B. and F. B. Rendle, Westminster.*—14*th March*, 1883. 8*d.*

This relates to the arrangement of metal rafters, cap pieces, and bolts.

1374. Backs of Books, *L. Dee, London.*—14*th March*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to the construction of a metal back.

1376. Wood-working Machinery, *E. Cory, Barnes.*—15*th March*, 1883. 6*d.*

This consists, First, in the use of a chain and pitch wheels for driving from a countershaft to the saw spindle of a circular saw bench, and an adjusting roller for giving the chain the necessary tension; Secondly, a toothed disc placed below the table of a circular saw bench, with its teeth slightly projecting above for the purpose of feeding the material on to the saw; Thirdly, a bridge-shaped spring and screw to give the required tension to a band saw; Fourthly, a bridge-shaped holder or casting, adapted to a circular saw bench for carrying a piece of timber to be tenoned.

1378. Fire-escape or Machine for Saving Life, *S. Bott, Birmingham.*—15*th March*, 1883. 6*d.*

This relates to the construction of the apparatus so as to regulate the rate of speed of the descent.

1379. Emery Wheel for Grinding, Polishing, and Decorticating, *T. West, London.*—15*th March*, 1883. 2*d.*

The composition consists of emery powder, hydrochloric acid, magnesian limestone, sand, iron pyrites, alum, saltpetre, and water.

1380. Preparation of Pictures and Photographs to be used in the Production of Pictures by Photography and Photo-engraving, and Production of Gelatine Reliefs and Printing Surfaces therefrom, *R. Brown, R. W. Barnes, and J. Bell, Liverpool.*—15*th March*, 1883. 4*d.*

The object is to produce pictures or photographs with a grained or lined surface, so that they are suitable for use in the production of pictures by the art of photography and photo-engraving and photo-lithography.

1381. Compound or Liquid Solution to be employed in Substitution for Wire Drawers' "Grounds," *H. Law and R. and R. Wood, Cleckheaton.*—15*th March*, 1883.—(*Not proceeded with.*) 2*d.*

To 15 gallons of water are added 40 oz. of caustic soda (of strength 45 Twaddell's test), and 1 oz. of tartaric acid. To these are added sulphuric acid.

1382. Apparatus for Injecting Insecticide Liquid or other Substance into Vines, &c., *E. Edwards, London.*—15*th March*, 1883.—(*A communication from A. B. Escourron, France.*)—(*Complete.*) 4*d.*

The apparatus consists of a funnel and an india-rubber ball, which can be filled under any pressure and afterwards inserted into the stem of any plant for the purpose of injecting any suitable liquid to kill phylloxera or otherwise act upon the plant.

1384. Fastenings for Bottle Stoppers, *J. Murray and L. Spring, Kingston-upon-Hull.*—15*th March*, 1883. 6*d.*

This relates to a fastening for bottle stoppers consisting of a bent plate, bar, or rod having a sliding limb formed with a catch to take hold of a screw or similar device either on the head of the stopper or on a collar around the bottle neck, and having another limb attached either to the said collar or to the head of the stopper.

1385. Manufacture of Bearings for Shafts or Axles and of Valves, Cocks, or other parts of Machinery, *H. H. Lake, London.*—15*th March*, 1883.—(*A communication from La Société des Couverts Alfénide, Paris.*)—(*Not proceeded with.*) 2*d.*

This relates to an alloy composed of copper 60 parts by weight, zinc 15, nickel 25, to which is added a small quantity of magnesium, say about $\frac{1}{10}$ or $\frac{1}{2}$ per cent.

1387. Perambulators, *W. H. Brassington, Manchester.*—15*th March*, 1883. 6*d.*

This relates to an arrangement for turning or guiding the perambulators.

1388. Preparatory Treatment of Flax and other like Straws and Fibrous Material, *J. R. Dry, London.*—15*th March*, 1883. 2*d.*

The material in a green or dry state is immersed in a bath of cold water containing a mixture of borax and black and yellow soap, which bath is afterwards raised to near boiling point, and kept so for about three hours, whereby the glutinous matter is removed, after which the fibres are rinsed in a hot solution of soda, and then in cold water.

1389. Storage and Treatment of Grain, chiefly for Bread-making and Manufacture of Bread, Biscuits, &c., *K. J. Dance, Clevedon.*—15*th March*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to improvements in the whole process of treating grain.

1390. Material or Composition to be Used as a Substitute for Plaster of Paris, Tripoli, or the like, and the Manufacture of same, *A. J. Boult, London.*—15*th March*, 1883.—(*A communication from E. Caspari, Paris.*)—(*Not proceeded with*) 2*d.*

For the purpose that the carbon may remain in it, plaster-stone is burnt exactly as is done for plaster of Paris. Then the following are ground together:—80 parts of the plaster, 10 parts of burnt clay, and 10 parts of gas coke or scoriæ.

1391. Latches, Locks, and Lock Furniture, *E. R. Wethered, Woolwich.*—15*th March*, 1883. 6*d.*

This relates principally to a lock in which in the closing of the door, the latch bolt being liberated by an incline and shot forward, drops behind the incline in such manner that before the door can be opened the bolt has to be withdrawn so far as to ensure its being caught and retained.

1392. Sack Lifters, &c., *T. and A. Lewis, Kettering.*—15*th March*, 1883. 6*d.*

This consists in a sack lifter of the hand-barrow type, of the combination of a steelyard weighing machine, and the sack elevator.

1393. Machines for the Manufacture of Looped Fabrics, *H. H. Lake, London.*—15*th March*, 1883.—(*A communication from La Société Coutural et Cie., Troyes.*) 6*d.*

This consists essentially in employing a double set of sinkers to effect the looping or curving of the thread or yarn in opposite directions, each one only taking half the quantity of yarn necessary for making the stitch or mesh, the sinkers of one set being formed differently from those of the other set, and these sets operating in one in or upon the other under the action of a jack with two arms or branches.

1394. Method of and Apparatus for Treating Hops for Brewing, *H. H. Lake, London.*—15*th March*, 1883.—(*A communication from F. Sláma, Tachau, and F. Felix, Kauth, Bohemia.*)—(*Not proceeded with.*) 2*d.*

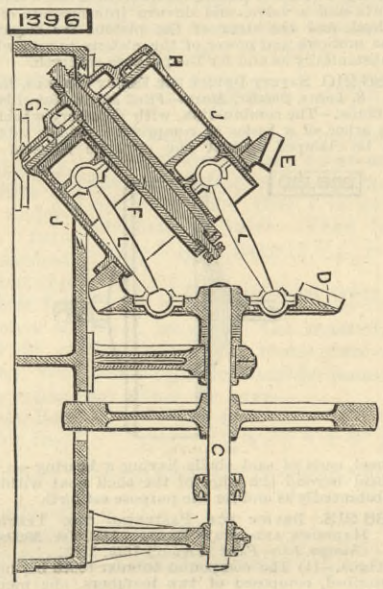
This relates to the method of extracting the active principles from hops in the boiling thereof with wort, and to apparatus therefor.

1395. Apparatus for Transferring, Raising, and Tilting Railway Coal Wagons, and Transferring Coal therefrom for Loading Vessels, *G. Taylor, Penarth.*—16*th March*, 1883. 8*d.*

This relates partly to the construction of portable staiths.

1396. High-speed Valveless Rotary Motor Pump or Compressor, *W. Dawes, Leeds.*—16*th March*, 1883. 6*d.*

At the end of shaft C is a bevel wheel D gearing with wheel E, running upon a taper pin fixed to a circular disc G forming the steam and exhaust chests, over which works a circular plate H, to which three or more cylinders J are secured at equal distances apart, the bevel wheel E being secured to the upper end of the latter. The pistons of the cylinder are each connected



to bevel wheel D by rods L, the ends of which are spherical and fit corresponding sockets in the pistons and also in wheel D. For regulating the speed of the motor a cone pulley receives the strap to drive the governor, which by means of a wedge is caused to shift the strap along the cone as the speed of the governor varies.

1398. Machinery for Straightening and Bending Metallic Plates, *C. Scriven, Leeds, and J. Tweedy, Walker-on-Tyne.*—16*th March*, 1883. 6*d.*

This consists in a machine for straightening and bending metallic plates of the use of two series of rolls so arranged that while the rolls constituting the upper series are retained with their axes in a common horizontal plane, the rolls of the lower series are movable together in a vertical sense, and can be caused to approach or recede from the upper series simultaneously.

1399. Automatic Pencil-holder, *O. Busoler, London.*—16*th March*, 1883. 6*d.*

The object is to obtain an exact self-acting adjustment of the pencil in the holder.

1402. Apparatus for Measuring and Marking Lengths of Textile Fabrics, &c., *C. A. Weckbecker and L. Schwabe, Manchester.*—16*th March*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to impress a mark or sign at any required point upon a length of cloth or other goods, in order to indicate the exact length of such piece of cloth or goods.

1403. Telephonic Apparatus, &c., *W. Moseley, London.*—16*th March*, 1883. 8*d.*

This relates to an improvement in "Blake transmitters;" also to an instrument which transmits a varying continuous current, to an indicator, to a multiple switch board, and to a photographic tell-tale

1404. Apparatus to Facilitate the Cutting of Leather Suitable for Strips, &c., *C. C. Carpenter, New Kent-road.*—16*th March*, 1883. 4*d.*

A long metal bar is supported above a table and has pins on its under side which grip the leather when the bar is lowered by means of a treadle. A slide carrying a knife works in a groove in the bar.

1405. Machines for Shearing Ropes, *P. M. von Swyndregt, Holland.*—16*th March*, 1883. 4*d.*

This relates to machines for shearing ropes so as to form a smooth surface, and it consists essentially in the use of a fixed flat knife, and one or more heloicoidal revolving knives, acting together so as to shear off the projecting fibres from the rope. A rotating brush combs the fibres, so that they are brought under the action of the knives.

1406. Flushing Apparatus, *W. Jones, Bangor.*—16*th March*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to prevent waste of water in water-closets, and it consists in arranging the stand pipe so that it projects about 1in. above the overflow of the cistern, and over this end a drum closed at top, but with an annular passage at the bottom, is hung from the pull lever, and when raised causes the water to pass into the stand pipe and flush the closet.

1408. Disintegration of Animal and Vegetable Fibres, *G. and J. E. Tolson, Dewsbury.*—16*th March*, 1883. 4*d.*

This relates to the disintegration of animal and vegetable fibres by means of gaseous mixtures, and it consists in the use of a revolving tank provided with internal agitators, so as to expose the material in the tank to the action of the gases.

1409. Loading Ships with Patent Fuel, *S. Butler, Cardiff.*—10*th March*, 1883.—(*Complete.*) 4*d.*

This consists of a travelling endless chain or band with projections or carriers for conveying or elevating blocks of patent fuel and discharging them into a ship.

1410. Carriages or Vehicles having Bodies Supported by Springs, &c., *R. Spence, jun., Yorkshire.*—16*th March*, 1883. 6*d.*

The object is to prevent the body of a carriage being depressed more on one side than on the other by the load, and it consists in the use of two or more crossed bars jointed at the centre where they are guided in a bracket attached to the body of the vehicle, so as to be capable of vertical motion, each bar being attached at one end to the body and at the other to the axle, the connection in each case being by suitable links.

1412. Lathe Chucks, *W. R. Lake, London.*—16*th March*, 1883.—(*A communication from A. B. Wadsworth, New Hampshire, U.S.*) 6*d.*

This relates to centre rests with means for centreing the work, and it consists of a collar or annular support and a bed piece preferably cast in one. A round sleeve with an annular flange works in a hole in the collar. The flange has a series of radial screws for centreing the work. The bed has a longitudinal groove on the lower side and rests on a plate with a tongue working in the groove, and a central slot. The rest is adjustably secured to the lathe by a bolt passing through the slot and a hole in the bed, and is secured by a nut.

1413. Ring and Traveller Spinning and Twisting Frames, *A. M. Clark, London.*—16*th March*, 1883.—(*A communication from J. J. Bourcart, Switzerland.*) 8*d.*

This relates to the combination with a Combe spindle (patent No. 1466, A.D. 1859), of a special bolster, a movable thread guide, and a pin fixed in the ring rail to facilitate the piecing up of broken ends. The bolster is placed below the bobbin and above the wharve. The spindle is supported by frames capable of adjustment and placed on a cross rail. The ring rail is carried by supports fixed on rods which slide up and down in guides for the winding-on motion. The thread guides are also fixed on these rods, and they and the supports are adjustable.

1414. Apparatus for Bolling, Seed Separating, Straw Breaking, and Scutching Flax, &c., *J. R. Dry, London.*—16*th March*, 1883. 8*d.*

To remove the seed bolls from the ears of flax, &c., the ears pass between skeleton rollers with blades set at an angle and caused to intercept each other as the rollers revolve. The bolls thus removed are arranged between two wire sieves and subjected to a rubbing action, which breaks them up to free the seed. The seed is then placed in a vessel with a sieve-like bottom curved exteriorly and riding on rollers, which ensure during the rotation a combined rising and falling motion, and a swerving action to the unclean seed by the constant change of place the particles are thrown into, whereby the seed is separated from the refuse which accumulates near the periphery of the bottom and is removed by creepers, the seeds and fine dust passing through the sieve to a vessel beneath, where a current of air carries off the dust. An apparatus is also described for breaking the straws by fluted rollers, and also for scutching.

1415. Laying-out and Carrying Lines of Track in Railway or Tramway Systems, &c., *A. Haman, San Francisco.*—17*th March*, 1883. 6*d.*

This relates to the construction of curves in lines of railway track, and to the mode of handling and controlling the endless cable of cable traction railways round such curves. A principal curve is made to follow the general bend to be taken, and its terminals join the straight portions of the track at both ends by a reverse curve or outward turn. The slot in which the gripper of endless cable railways works is similarly curved.

1416. Apparatus to be employed in Connection with Clocks for the Exhibition of Advertisements, *F. W. Little, Oxford-street.*—17*th March*, 1883. 6*d.*

The advertisements are caused to be presented at glazed openings in the clock case by the rotation of suitable drums actuated by mechanism independent of the clock movement, a bell being sounded when the advertisement exhibited is changed.

1417. Construction and Arrangement of Ventilating Apparatus for Railway Cars, &c., *R. H. Brandon, Paris.*—17*th March*, 1883.—(*A communication from Prince J. Pignatelli d'Aragon, Paris.*) 6*d.*

This relates principally to improvements on patent No. 4179, A.D. 1882. The mouth-piece to admit air into the apparatus is fitted with a truncated cone at its delivery end so as to narrow the delivery orifice. The invention also relates to means for preventing air entering the apparatus from passing into the vehicle, and to an overflow for the water which may collect in a pocket provided to receive it, and finally to the arrangement of pipes for distributing the air into the vehicle.

1418. Twisting Lace and other Fabrics, *L. Lindley, Nottingham.*—17*th March*, 1883. 6*d.*

This relates to improvements on patent No. 1875, A.D. 1880, and consists in placing the ironing or drying cylinder close to the chain of tentering hooks and passing the fabric direct to the cylinder from such hooks, and in order to maintain the chain of hooks always within a given distance from the cylinder, a roller carried by a weighted arm is caused to bear against the cylinder, and to it is fixed a support over which the chain of hooks passes. Two endless tapes or bands act at the edges of the fabric to assist in freeing it from the hooks and bring the edges in contact with the cylinder. The ironing cloth is distended by lacing it to parallel endless chains.

1419. Milk Cans, *J. C. Mewburn, London.*—17*th March*, 1883.—(*A communication from M. Devries, Paris.*)—(*Not proceeded with.*) 2*d.*

The object is to provide milk cans with apparatus for indicating the quantity and quality of the milk they contain.

1420. Refrigerating or Cooling Air to Very Low Temperatures, *G. H. Lloyd, Birmingham.*—17*th March*, 1883. 6*d.*

The inventor claims, First, in cooling air by compression, cooling and subsequent expansion, the process of passing the air under compression through a cooler in which the cooling medium has been previously cooled by vaporisation of a liquefied gas; Secondly, in air cooling when the cooling medium has been previously cooled by the vaporisation of a liquefied gas, the process of cooling the air below the coldest cooling medium by compression previous to cooling and expansion subsequent to it; Thirdly, in air cooling, the process of passing compressed air during the same process of cooling through coolers or sections of a cooler, the cooling medium in one section being natural water or spent air, or both, and in another section brine or a medium cooled by vaporisation of a liquefied gas; and, Fourthly, in cooling air by a medium which has been cooled by vaporisation of a liquefied gas, the process of depriving the air of some portion of its moisture previous to being cooled by the medium.

1421. Gas Stoves, *W. T. Sugg, Westminster.*—17*th March*, 1883. 6*d.*

This relates to means for increasing the heating powers of gas stoves and preventing the deleterious effects arising from the gas fumes. A cylinder closed at top is set up on a base, and inside it two or more perforated discs or baffles are arranged at equal distances apart and accurately fit the cylinder. At the bottom of the cylinder is a partition with a central opening, in which is secured a piece of wire gauze, the space below the partition forming an air chamber, to which air is admitted through an opening in the side of the cylinder from a passage, a similar opening being made in the top of the cylinder for the products of combustion to pass to another passage or flue. The two passages are in one length placed outside the cylinder, and at the centre is a transverse partition forming part of a combined air passage and chimney. The gas burner is placed centrally over the perforated opening in the partition near the bottom of the bottom.

1422. Lotion and Powder for Foot-and-Mouth Disease in Animals, *G. Jeanes, Clapham.*—17*th March*, 1883. 2*d.*

The lotion to wash the feet and mouth consists of 3 oz. permanganate of potash, ½ oz. oil of amber, and 1 gallon of water, and the powder to be given as a drench internally consists of 10 grains turpis mineral, 1 oz. chlorate of potash, 1 oz. sulphur, 2 oz. linseed-meal, with ½ oz. of bole as a colouring agent, and mixed with one quart of water as a drench.

1423. Sorting and Screening Coal, Ores, &c., *R. H. Silcock, Warrington.*—17*th March*, 1883. 4*d.*

The object is to effect the sorting according to size and the sorting according to quality simultaneously in one operation, and it consists in the use of a travelling wire screen made to travel between two planks on edge to form a kerb above a wagon. The slack falls through the screen, and the large pieces are delivered at the end, while pickers along the screen pick out the stones as the screen travels along. One mode of forming the screen is shown.

1424. Handles of Knives and Forks, and Means of Securing Blades of Knives and Forks to their Handles, *H. Walker, Sheffield.*—17*th March*, 1883. 6*d.*

The knife or fork is made without a tang, and to the bolster is secured the upper part of a ferrule, the lower part of which is formed to fit recesses formed in the handle, to which it is secured by rivets. A metallic cap or end ferrule can be secured to the handle in the same way as the ferrule secured to the blade.

1425. Elevating Apparatus for Discharging Grain from Ships, *W. Blythe, Liverpool.*—17*th March*, 1883.—(*Not proceeded with.*) 2*d.*

A casing or tube is formed so that the sides may be detached for stowing away, and is made in suitable lengths, which can be easily connected, the bottom length being provided with network or grating beneath and at the sides to admit grain to the buckets within the casing. The elevator is made to slide in grooves in the casing, and can be removed when necessary.

1426. Domestic and like Stoves and Furnaces, and Means for Feeding Fuel thereto or therein, *G. Gore, Balsall Heath.*—17*th March*, 1883. 6*d.*

The object is to enable ordinary bituminous coal to be burned in open grates without producing smoke, and it consists in supplying fuel to the bottom of the fire by means of a roller fitted in a receiver beneath the grate, and provided with a plate sliding in an opening made through the roller, and so operated by means of a fixed incline that when the roller revolves the plate first carries up the fuel, and then gradually recedes into the roller on one side and projects on the other, so as to be ready to carry up a fresh charge.

1427. Manufacture of Sulphur Compounds, *W. Ramsay, Bristol.*—17*th March*, 1883.—(*Not proceeded with.*) 2*d.*

This consists in the use of solutions of the sulphites of sodium, potassium, or ammonium for the absorption of sulphurous acid from flue gases or chimney gases, which forms, with the salts, acid sulphites, from which the acid may be expelled by heat.

1428. Tune Bands or Music Sheets for Mechanical Organs and other Wind Instruments, *A. J. Eli, London.*—17*th March*, 1883.—(*Not proceeded with.*) 2*d.*

The objects are, First, to join the two ends of music sheets by locking devices, so as to form an endless band; and Secondly, to strengthen music sheets by fixing a layer of fine gauze or net to one or both sides.

1429. Preserving Meat and other Animal Substances, Fish, Milk, Butter, Eggs, Fruit and Vegetables, Malt and other Liquors, *P. R. Conron, Lewisham.*—17*th March*, 1883.—(*A communication from S. Conron, Texas, U.S.*)—(*Not proceeded with.*) 2*d.*

This consists in the use of a compound of equal parts of boracic acid, oxide of sodium, compound borax, and saltpetre.

1432. Treating White Peat for Production of an Agent suitable for Combining with Paints, Varnishes, Paper Pulp, and other Materials, to Render same Fire-proof and Impervious to Moisture, *Sir S. J. Blane, London.*—19*th March*, 1883. 4*d.*

The object is to treat white peat so as to obtain an agent which will resist fire and be impervious to atmospheric influence. As applied to paint, the white peat is put into a kiln over a small quantity of lighted charcoal, and when thoroughly calcined it is taken out and reduced to powder, which is then mixed with methylated spirit until it forms a paste. Heat is applied, and it is mixed with size and dryers. To resist both fire and water and atmospheric influences silicate of soda and oxide of zinc are added.

1435. Spinning Machines, *L. A. Groth, London.*—19*th March*, 1883.—(*A communication from J. J. Bourcart, Switzerland.*) 6*d.*

Steel axes, each carrying two drawing rollers, run in boxes placed in the drawing mechanism, and are thus subjected to a certain friction only. The bobbins receive an independent motion, the speed of which can be brought into relation with that of the feed roller of the drawing mechanism.

1436. Isolating, Preparing, and Refining Animal and Vegetable Fibrous Material, *L. A. Groth, London.*—19*th March*, 1883.—(*A communication from C. A. Kraemar, Berlin.*) 8*d.*

This relates to the removal of gummy and gum-holding substances from vegetable material, and of fatty glue holding and gelatinous binding material from animal fibrous material. This consists in treating the materials with steam, alcohol, or refrigeration, and after loosening the parts surrounding the fibres by mechanical means, employing strong alcohol, or methylalcohol, or acetone chloroform, with the addition of alkaline or metallic salt solutions. Apparatus for splitting the raw material, and dissolving and recovering apparatus, is also described.

1438. Cutting or Slicing Vegetables, *H. J. Haddan, Kensington.*—19*th March*, 1883.—(*A communication from E. Barth and O. Spilger, Saxony.*)—(*Not proceeded with.*) 2*d.*

This consists in applying a slide to the cutting knife, so that the width of the slice can be varied by changing the distance of the slide from the cutting edge. To the frame of the cutter a grate is applied, in combination with a pivotted axle beneath, and armed with knives for cutting small strips, the axle being removable, and the grating covered by a slide when not in use.

1437. Ventilating and Exhaust Fans, *E. P. Alexander, London.*—19*th March*, 1883.—(*A communication from L. G. Fisher, jun., Chicago.*) 6*d*.

This consists, First, in a ventilating fan with blades each set at an angle to the shaft, extending between a straight front rib or leaving edge and a forwardly curved back rib or entering edge, and terminating with a segment plate at the periphery; Secondly, setting the blades with a forward pitch radially; and, Thirdly, the combination of such a fan with a casing and open framing having bearings for the shaft.

1439. Apparatus for Applying Plugs or Corks to Casks, *G. W. von Nawrocki, Berlin*—19*th March*, 1883.—(*A communication from E. Schlicht, Germany.*)—(*Not proceeded with.*) 2*d*.

This consists of a conical cork guide and a plunger, actuated by suitable means to force the cork into the bunghole of the cask.

1440. Electric Safety Lamp, *J. Imray, London,*—19*th March*, 1883.—(*A communication from G Mangin and C. A. Le Royer, Paris*)—(*Not proceeded with.*) 2*d*.

An incandescent lamp is enclosed in a glass cylinder filled with water. The glass may be shaped on one side as a dioptric lens, and have a reflecting surface on its other side.

1441. Musical Instruments, *P. M. Justice, London.*—19*th March*, 1883.—(*A communication from J. Albert, Brussels.*) 4*d*.

This consists in forming musical instruments of a metal tube, covered with vulcanised caoutchouc instead of wood.

1444. Sectional Warping, *H. Yates, Manchester.*—19*th March*, 1883. 6*d*.

The object is to perform the sectional warping operation direct on to the weaver's beam; and it consists in mounting the latter in a frame capable of sliding on a bed, so as to present different portions of the beam for the reception of the various sections in front of the half beer reed, through which the yarn passes. On the beam is a loose flange hinged together in halves, and capable of being clamped in any desired position, such flange being provided with an additional flange, arranged parallel to its inner surface, and capable of adjustment by screws, so as to run true with and at the desired distance from the fixed flange on the beam. A drum is arranged to run in frictional contact with the yarns upon the beam, so as to produce the desired hardness.

1445. Picking Motion for Looms, *H. Yates, Manchester.*—19*th March*, 1883. 4*d*.

The usual scroll, tumbler, and half circle for actuating the picking shaft in under-pick looms are dispensed with, and instead of mounting the picking shaft stationary in the bracket, a slot is arranged in the top bracket on each side the loom, to allow the picking shaft to move out of the way of a fixed striker upon the side of a fly-wheel at each alternate revolution, and which shaft moves back to the other end of the slot, and is ready to be struck by the striker at every other revolution.

1446. Locks for Purses, Bags, &c., *M. Wolfsky, Ludgate-hill.*—19*th March*, 1883.—(*Not proceeded with.*) 2*d*.

The bolt is acted upon by a spring so as to impart a longitudinal and sideway movement thereto. Parallel to and at the side of the spring the bolt carries a pin which projects through a slot in the case, and by which the bolt is forced back.

1447. Regenerative Gas-burners and Lamps, *W. B. Wicken, London.*—19*th March*, 1883.—(*Not proceeded with.*) 4*d*.

One part of the invention consists in forming the upper part of the lamp of a series of spherical chambers one within another, around which air circulates and passes to a Bunsen's burner below, from which the burnt air passes back and circulates round the air chamber. The gas chamber is placed on the exterior surface of the air chamber. The lower part of the lamp consists of two chambers, the outer formed by a glass globe constituting the combustion chamber, and the inner one serving to carry off the products of combustion.

1449. Ironing Machine, *B. J. B. Mills, London.*—19*th March*, 1883.—(*A communication from H. Schmidt, Berlin.*) 6*d*.

A reciprocating table slides on a bed fastened to a frame and supporting a wheeled carriage containing plates between and upon which the articles are clamped and flattened. The table is reciprocated by a crank connecting-rod and oscillating slotted lever. One or two hollow ironing rolls are heated by suitable means, and are journalled in a forked lever swinging round the main shaft. The rolls are counterbalanced, and can be pressed down upon the articles with any desired force by hand or foot.

1451. Portland Cement, *J. H. Johnson, London.*—20*th March*, 1883.—(*A communication from E. J. De Smedt, Washington, and R. W. Lesley, Philadelphia, U.S.*) 4*d*.

The object is, first, to produce in a moist state bricks of the materials from which Portland cement is made, the bricks being sufficiently porous to allow the water of evaporation to escape during the calcining operation without breaking the bricks, and it consists in mixing a combustible—preferably a hydrocarbon—with the materials before calcining the same. The invention further consists in combining lime with cement rocks or hydraulic limestones, either before or after the calcining operation, so as to improve Portland cement.

1452. Apparatus Employed in Electric Telephony, *J. H. Johnson, London.*—20*th March*, 1883.—(*A communication from J. A. Malloney, Washington, U.S.*) 6*d*.

The main feature of this invention is the employment of a condenser in the circuit, which is brought into action by the vibrations of the transmitter diaphragm. The condenser is in a local charging circuit which is also completed through the transmitter. The core of the electro-magnet of the receiver is a cylindrical soft iron shell split lengthwise from end to end, the contiguous edges being apart.

1453. Construction of Tobacco Pipes, Application of Tobacco to the same, and to Cigarettes, *C. Jackson, Nottingham.*—20*th March*, 1883. 6*d*.

This consists, First, in forming pipes of asbestos; Secondly, in making pipes of other materials in two halves and securing them together by means of metal rings connected by a number of reversely helically coiled wire rings, a lining of asbestos being applied to such pipes; Thirdly, in enclosing tobacco in asbestos paper before inserting it in the pipe, the top of the paper being perforated; Fourthly, in forming the covers of cigarettes of asbestos paper and saturating the mouthpiece with a solution of shellac.

1454. Means and Appliances for Working Tramcars Propelled by Means of Ropes, *C. Hinksman, London.*—20*th March*, 1883. 8*d*.

This consists essentially in the construction of the gripping apparatus.

1456. Manufacture of Boots and Shoes, *H. Abbott and A. R. Molison, Swansea.*—20*th March*, 1883.—(*Not proceeded with.*) 2*d*.

The object is to provide means of attaching the wearing soles and heels to boots and shoes without sewing, rivetting, nailing, or pegging.

1459. Manufacture of Metallic Foot Warmers, *T. H. Ash, Birmingham.*—20*th March*, 1883. 6*d*.

This relates to the general construction of a metallic foot warmer.

1460 Hydraulic Motors, *W. P. Thompson, Liverpool.*—20*th March*, 1883.—(*A communication from E. B. Benham and H. B. Richardson, Amherst, and J. W. Currier, Boston, U.S.A.*) 6*d*.

This relates to water motors, and has reference to that class thereof denominated piston motors, and it consists in the arrangement of a series of pistons within a cylinder disc, and radiating from the centre thereof, wherein, through suitable valve connections for admitting and discharging water, said pistons are caused to have successive reciprocating motions, which motions are so communicated to a ring which rests upon the ends of said pistons, and co-operatively acts with the latter, as to cause the periphery of said ring to present a continuous succession of curved inclines under a roller arm, which is attached to a pulley located by the side of said disc, whereby said pulley is given a continuous rotary motion in the plane of the movement of said pistons. The invention further consists in the combination with said pistons and their cylinders of a valve adapted to be rotated through devices connecting it with said ring, whereby water is properly admitted to and discharged from said cylinders.

1461. Fastening or Securing Paper Bags, *J. Doherty, Dublin.*—20*th March*, 1883.—(*Not proceeded with.*) 2*d*.

This consists in attaching the ends of a piece of elastic or other suitable material between the folds of the bottom of the bag, in such a manner that the loop thus formed in the elastic or other material can be conveniently drawn over the top or covering folds or flaps of the bag after it has been filled with any commodity.

1463. Breech-loading Small-arms, *T. W. Webley, Birmingham, G. Bouckley, Aston, and E. C. Hodges, London.*—20*th March*, 1883.—(*Not proceeded with.*) 2*d*.

This relates to a method of cocking the lock or firing apparatus in single or double guns, by operating the same by or in connection with the mechanism for opening or closing the breech arrangement of such guns or small-arms. It also relates to a timber safety bolt to prevent accidental discharge of the fire-arm.

1465. Trucks or Bogies for Railway Carriages and Brakes and Self-lubricating Axle-boxes for Same, *J. C. Mewburn, London.*—20*th March*, 1883.—(*A communication from E. Whiting and J. M. Smith, Brooklyn, U.S.*)—(*Not proceeded with.*) 2*d*.

This relates, First, to a truck for railway carriages, the body of which is constructed of thin metal in substantially one piece; Secondly, to a brake of the kind that impedes the movement of the carriage by pressure of the brake-shoes on the rail; Thirdly, to the construction of a self-oiling or self-lubricating axle-box.

1469. Treatment of Fish or other Animal Offal for Producing Artificial Guano and other Products, *M. Zingler, London.*—20*th March*, 1883. 2*d*.

This relates to chemical treatment of the offal.

1471. Drying Peat as a Substitute for Hair, Wool, Hay, Straw, Cotton, or Flocks, in Stuffing Mattresses, Beds, Seats, Cushions, &c., for Packing Furniture, Fish, &c., *J. A. London and J. Harbottle, Newcastle-upon-Tyne.*—20*th March*, 1883.—(*Not proceeded with*) 2*d*.

This relates to the general treatment of the peat.

1473. Repairing Last for Boots, Shoes, and Clogs, *H. Morris, Blackburn.*—21*st March*, 1883. 4*d*.

The last is constructed with four stout radial arms joined together at the centre, and two short central studs at right angles thereto.

1474. Joining of French Horn and Whalebone by Dovetailing the Ends, *E. Rosenwald, London.*—21*st March*, 1883.—(*A communication from F. Robin, Paris.*)—(*Not proceeded with.*) 4*d*.

This relates to the means of dovetailing the pieces together and securing them by metal clasps.

1478. Lawn Tennis and other Similar Boots and Shoes, *W. H. Stevens, Leicester.*—21*st March*, 1883. 6*d*.

This relates to the means of securing the india-rubber soles to the boots and shoes.

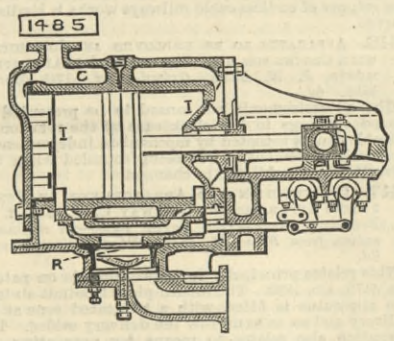
1481. Generating Electricity, *J. A. Kendal, Middlesbrough.*—21*st March*, 1883. 4*d*.

This consists of two metallic plates having between them a layer of saline or vitreous material. A continuous supply of hydrogen impinges on the outer side of one plate, the outer side of the other plate being exposed to heated air or some equivalent oxidising agent. The apparatus is worked at a red heat. Suitable conductors are attached to each plate.

1485. Apparatus for Compressing Air for Preservative or other Purposes, *O. J. Ellis, Derby.*—21*st March*, 1883 6*d*.

This relates, First, to economising space and relieving the cooler boxes of all working strains in the construction of mechanical refrigerators, and it consists in arranging the steam cylinder, compression pump, and expansion cylinder side by side at the end of the frame with their axes parallel and their valve chests downwards, such frame being secured to the top of the cooler boxes, and carrying also the crosshead

1485



guides and crank shaft bearings. The drawing shows a section of the compression pump, which has a liner G fitted within it and forming a water jacket, and the end covers are formed of a thin sheet of copper I supported by pillars on a strong cast iron cover frame, and water caused to circulate between them. The slide valves of the compression pump and also of the air expansion cylinder are hollow, and their construction will be understood by the drawing, the characteristic feature being the employment of the hollow piston or packing ring R.

1510. Apparatus for Ascertaining the Temperature within Closed or other Vessels, *H. Stopes, Southwark, and W. Crockford, Mile-end.*—22*nd March*, 1883. 6*d*.

The object is to enable an apparatus for ascertaining the temperature in vessels to be inserted and withdrawn without allowing the contents to escape. A thermometer is fitted in a metal case so that a portion is exposed near the lower end, the thermometer being packed air-tight in the case so that fluid cannot pass between them. In the vessel is formed a hole with a union piece and a cock or valve with a neck piece, terminating in a gland stuffing-box to receive the case.

1518. Manufacture of Armatures for Dynamo-electric Machines, *J. B. Rogers and H. O'Connor, London.*—22*nd March*, 1883.—(*Not proceeded with.*) 2*d*.

These are made of iron filings mixed with plaster of Paris.

1595. Feed-water Heaters for Steam Boilers, &c., *J. Withinshaw, Birmingham.*—29*th March*, 1883. 6*d*.

The object is to purify the feed-water from lime salts and to heat it to near boiling point before it is fed to the boiler. As applied to a feed-water heater heated by exhaust steam of an engine, two vessels are arranged side by side, the larger being four or five times the height of its diameter, and the smaller containing two vertical tubes of thin copper connected at top, and the lower end of one connected with the supply of water, and the lower end of the other entering into the lower end of the larger vessel. The larger vessel has one or more series of vertical copper pipes connected at top and bottom, their tops opening into a dome into which the exhaust steam enters and passes through the tubes to the smaller vessel.

1686. Ships and other Ventilators, *A. Mechan, Glasgow*—4*th April*, 1883. 6*d*.

The object is to enable the movable cowls of ships' ventilators to be turned as required from the stoke-hole, engine-room, or other part of the ship in conjunction with which the ventilator is employed, and it consists in the use of an endless cord passing over pulleys on the cowls and over guide pulleys to the part whence it is required to actuate such cowls.

2651. Laying Electrical Conducting Wires in the Ground, and an Insulating Compound for Electrical purposes generally, *H. J. Allison, London.*—29*th May*, 1883.—(*A communication from J. Greives and J. H. Bloco, Paterson, N.J., U.S.*) 6*d*.

Relates to a system of laying underground wires and a conduit; a device for discharging induced currents; a manhole connected with the conduit, and to an insulating compound.

3302. Telephonic Apparatus, *W. R. Lake, London.*—3*rd July*, 1883.—(*A communication from H. Clay, Philadelphia, U.S.*) 6*d*.

This relates to improvements in call bells, transmitters, receivers, and switch boards.

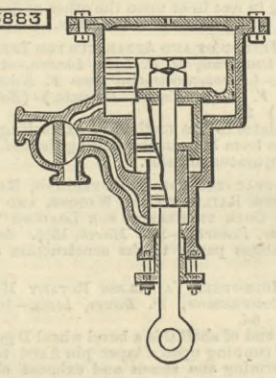
SELECTED AMERICAN PATENTS.

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

285,883 Friction Compressor for Dredging Machines, &c., *Asahel H. Fisher, Philadelphia, Pa.*—*Filed June 20th*, 1883.

Claim.—(1) In a friction compressor, a cylinder provided with pistons of different areas, whereby the degree of friction may be adjusted, substantially as described. (2) In a friction compressor, a friction wheel, in combination with a cylinder having a series of pistons of different areas and devices intermediate of said wheel, and the stem of said pistons for imparting the motion and power of the pistons to said wheel, substantially as and for the purpose set forth. (3) A friction wheel, in combination with a cylinder having a series of pistons of different areas, a series of ports and a valve, and devices intermediate of said wheel, and the stem of the pistons for imparting the motions and power of the pistons to said wheel, substantially as and for the purpose set forth.

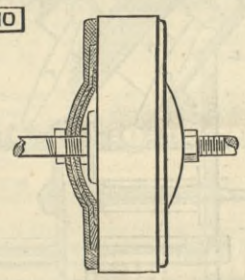
285883



286,210. Safety Device for Emery Wheels, *Heman S. Lucas, Chester, Mass.*—*Filed March 29th*, 1883.

Claim.—The combination, with an emery wheel and its arbor, of a series of compression shells adapted to be clamped against the opposite sides of said wheel, each of said shells having a bearing on said wheel beyond the edge of the shell next within it, substantially as and for the purpose set forth.

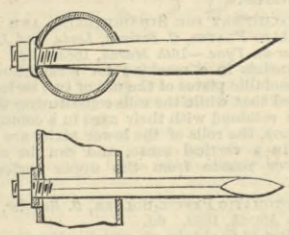
286.210



286 213. Device for Fastening the Teeth of Harrows and Hay Rakes, *Malcolm McDowell, Chicago, Ill.*—*Filed February 10th*, 1883.

Claim.—(1) The compound tubular tooth bar herein described, composed of two members, one member having the lenticular openings with flaring walls, and the other having the opposite cylindrical openings, said members adapted to be secured together by means of teeth formed to fit the openings in the compound bar, as set forth. (2) In combination with the described compound tubular tooth bar, the tooth formed so as to fit the lenticular and cylindrical openings in the bar, and having the tightening nut upon its threaded end, substantially as shown and described.

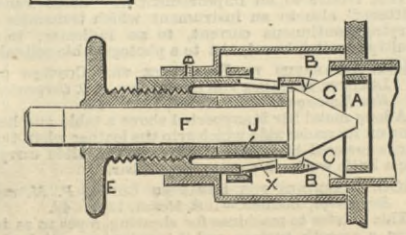
286.213



286,227 Tube Cutter and Expander, *Joshua Rose, New York N.Y.*—*Filed March 6th*, 1883.

Claim.—The combination of the sleeve A, having the holes X and B, and the interchangeable expanding and cutting rolls C, with feed nut E, spindle F, and removable sleeve J, whereby by the use or not of the sleeve J, the tool is a tube cutter or an expander, substantially as set forth.

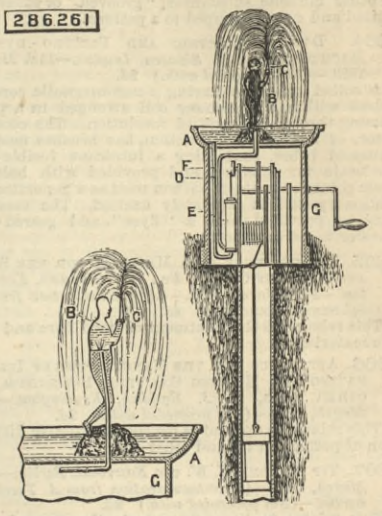
286227



286,261. Fountain, *Grant A. Bush, Clear Lake, Iowa.*—*Filed April 19th*, 1883.

Claim.—In an ornamental fountain, the basin A, air chamber B, placed above the basin, the tube C, in combination with the tubes D and F, cabinet G, and pump E, with suitable mechanism for operating the same, substantially as and for the purpose set forth.

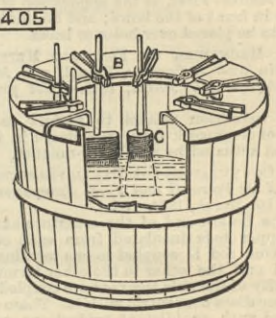
286261



286,405. Paint Brush Holder, *Albert T. Edwards, South Kingston, R.I.*—*Filed January 3rd*, 1883.

Claim.—The flanged ring B C, provided with a series of spring holders, and adapted to support the brushes at any desired height, substantially as and for the purposes herein set forth.

286405



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A plumber, H. Z. Norton, of New York City, was tried on the 11th ult., after repeated postponements, for putting or allowing his workmen to put a dummy vent pipe to a trap in the basement of a house near Madison-avenue. He was convicted and fined 50 dols. The complaint was made by the Board of Health, the assistant sanitary engineer being the principal witness. This, says the *Sanitary Engineer*, is the kind of work we like to record. It looks like business.