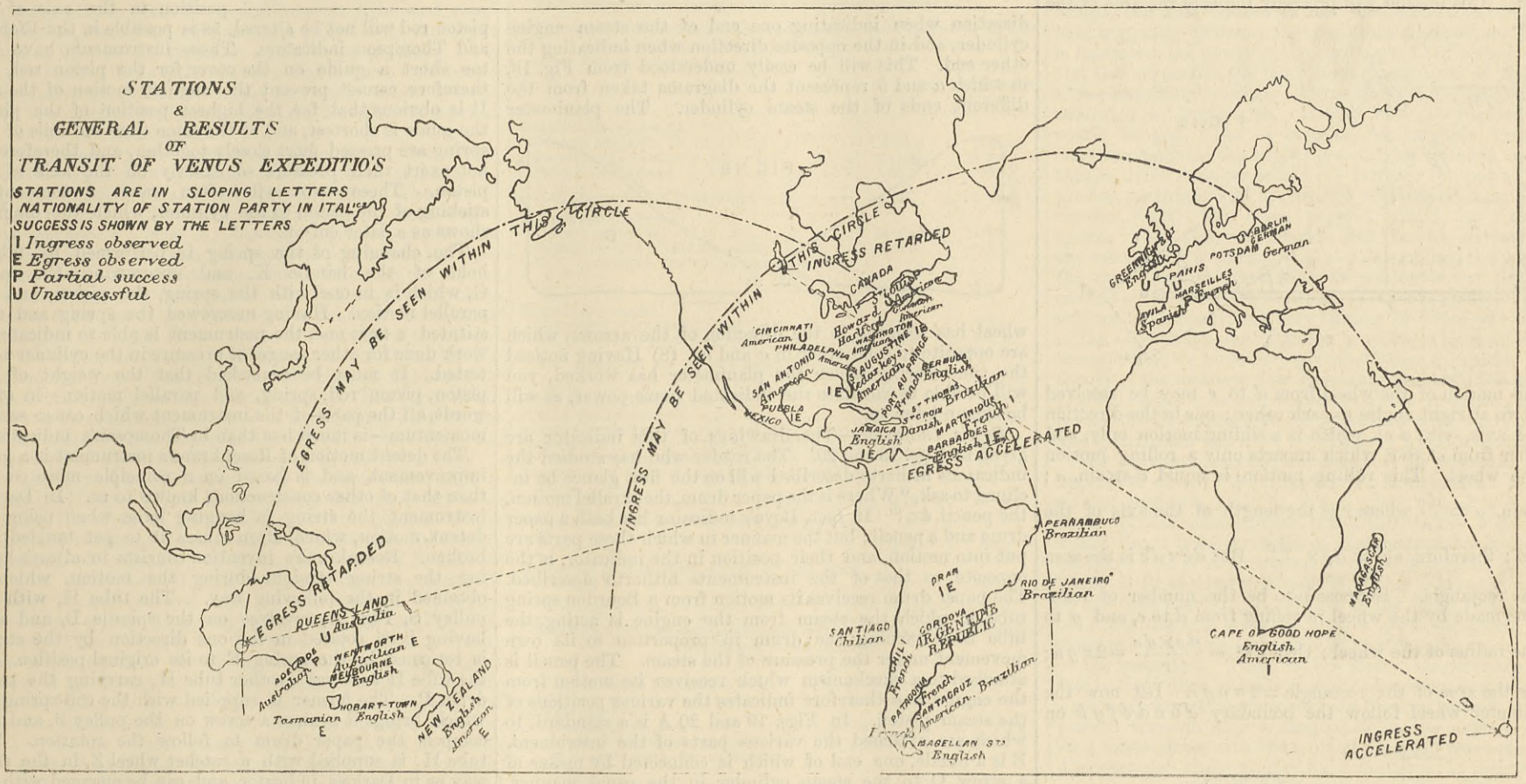
THE RESULTS OF TRANSIT OF VENUS EXPEDITIONS.

With the assistance of the map which we give we hope to convey to our readers a general idea as to the measure of success which has attended the observations of the recent transit of Venus. We do this now in preference to waiting longer, because the main points on which we depend are now fairly supplied, for although the observations made in Patagonia, not yet available, are valuable, we have in Oran a representative of them in a certain measure, and it may be some time before we receive particulars of the whole of them.

A few words will explain the map. The transit of Venus across the sun's disc is, of course, visible wherever the sun can be seen. Hence if the sky is clear it can be seen in the whole of that part of the world where it is day. In this map the two dotted curved lines—we may call them circular for convenience—enclose the portions of the world in daylight when ingress and egress respectively take place. In the places within the right-hand, or easterly one, ingress may be seen. While Venus is in transit the earth revolves sufficiently to cause the left-hand or west dotted line to be in daylight when egress takes place, which is therefore visible at all places within it. That portion of the world where the two enclosed spaces overlap is in daylight both at ingress and egress, and consequently from that part of the globe both ingress and egress can be seen.

The names only of places where stations were established are printed. These are not complete, some being selected



THE TRANSIT OF VENUS.

in places so obscure that we are not able to fix their locality. We have, however, quite enough for all general purposes. It will be seen at a glance that the great part of the printed names occur in North and South America and the West Indies, these being in the region in which both ingress and egress are visible. The names of stations are given in upright printing, the nationality of the observing parties in italics, and the success obtained is printed below, being shown by the letter I, E or I and E, according to whether ingress, egress, or both were observed. P stands for partial success, U for stations unsuccessful altogether. With regard to the value of these results, we may say generally that the observations may be classed under two heads—(1) those which are available for Halley's method, and (2) those which are available for that of De Lisle. Without attempting to explain these, the value of the results may be roughly taken in by supposing Halley's to depend on observations made on a base line extending north and south through the portion common to both dotted circles or regions, that is the region of North and South America and the West Indies, and De Lisle's to depend on observations made along the two dotted straight lines extending diagonally across the two dotted circles. When we say observations made along these base lines, we do not mean that the stations are actually on these lines, but, for De Lisle's method, the nearer they are to them the better. The value of their factor in calculation depends on where a perpendicular from them falls on these base lines, increasing just in the proportion in which they approach the ends of these lines. It would actually be best if they could be placed on these lines, because they would combine with their factor the greatest possible height of sun above the horizon for such a factor. Obviously stations near the edges of the dotted circles are near the edge of daylight, and the sun is very low. If all stations were close to the centre, with the sun right overhead, there would be really no factor. As a station moves along the line, or to a point more nearly opposite the extremities of it, its factor increases, but clearly combines the greatest possible height of sun when placed on the dotted line at whatever point it is.

Looking at the results already reported, we observe that for Halley's method we have already favourable accounts from Hartford, Washington, Philadelphia, and St. Augustine, and Cedar Keys, Puebla, Jamaica, and other West Indian Islands in the north; while the most southern station from which we have news is at present Oran, in South America. For ingress on De Lisle's method, we have abundant results from the Cape for the accelerated observation, and from Hartford, Washington, Philadelphia, Jamaica, &c., for the retarded ingress. For egress accelerated, the United States and West Indian stations above mentioned are available, as well as Oran; and for egress retarded, Wentworth and doubtless others in Australia, as well as the English and American stations in New Zealand. We have reason to expect that these will be greatly strengthened when the reports come in from the south of South America, English American, French Brazilian, and Chilian stations, from Madagascar and the various stations from which we have no direct telegraphic communication. Thus, although Europe, Canada, and part of Australia appear to have been in a great measure under heavy clouds, the weather on the whole for the time of year was fair. We regret that all the preparations in England and France were to no purpose, to say nothing of Spain and Berlin. The clouds here seem almost to have been attracted by the telescopes, for while at Brighton, Cheltenham, and the South-West the transit was seen by amateur observers, at Greenwich, Oxford, Cambridge, London, Woolwich, and in the North, wherever preparations were made for scientific work, heavy clouds prevailed. Sunny Spain, and France, from Marseilles to Paris, shared the disappointment, as did Berlin and Germany, as far as we know, except that uninteresting place Potsdam.

Having spoken thus generally of the situation, we may say a few words as to results. This we do the rather because the proceedings of many astronomers are so exceedingly deliberate that we rarely get the results until the general public has ceased to be interested in the matter. An astronomer, as far as we can speak from experience, is a wonderfully painstaking, accurate creature. He generally wears spectacles, always writes a small, neat hand, and he is scientific and conscientious, and very often, besides possessing great ability, is an enthusiast over work which is miserably paid. "Why have you adopted the making of reflecting telescopes as a profession?" we ventured to ask a remarkably able young astronomer with whom we were working once. "Because I am a lunatic; if there were no lunatics no reflecting telescopes would be made," he replied. With all this astronomers can be very trying. An astronomer has often a deficiency of push about him, and sometimes he appears almost to revel in delay, and is as wholly callous to the pressure of an outside public as certain mathematical instrument makers are to the pressure put upon them by astronomers. It would be a libel on a snail to compare him to such people; perhaps, however, such a man as we have often come across ranks somewhere between a snail and a Turkish official. To give some idea of the rate of progression of instrument making and astronomical work, we may give a few examples. An astronomer ordered an equatorial telescope of moderate dimensions from one of the best makers in the country, and wrote one or two years afterwards to inquire how far the work had progressed, and learned—and that in a matter-of-course way we believe—that there was no sign of beginning it yet. The transit of Venus work of 1874 all came home in the spring of 1875. It was no doubt a heavy job—comparatively speaking it was done quickly. An abbreviated report was drawn out as a return to the House of Commons on July 16th, 1877, the regular report of the stations sent out from Greenwich being brought out in 1881, the work of the colonial and Indian stations not being included. Thus there was a result briefly expressed for the public first given, followed afterwards by a complete report. This was not slow work; we could name an operation of insignificant extent that was carried out to determine the longitude of one place at some distance from a colonial observatory. It forms an important link in a chain of longitudes extending a great way round the world. The work of reduction might occupy some hours; at the longest it might require a few days; yet for years the worthy astronomer who had the records gave neither results nor data. We are not sure whether they have been got yet, but we hope so, as it must be at least twelve years, we think, since the work was done. We are told that some of the foreign astronomers did not think it worth while to give their 1874 transit of Venus results before those for 1882 could be supplied with them. We shall expect them, however, within ten years of the present date. To do them justice we do not think they will direct them to be kept until those for the next transit in 2004 can be combined with them, because this would be positive procrastination, and, to do most astronomers justice, they work conscientiously, and move on, only it is slowly. They analyse and correct and investigate and, perhaps, plunge into calculations of probable errors and curves, or make new instruments to measure shrinkage, &c., till an ordinary layman despairs of a conclusion.

We have given a rough idea of the value of the observations by regarding the operations as made on base lines. This must not be accepted too literally. Although the values of the factors on De Lisle's system may be so expressed, other considerations are involved in Halley's method, and were it not for elements which give a specially high value to differences of times observed, we need hardly say that our base lines would be far too short to be of use for measuring such long distances as that of the sun or Venus. For a more full explanation of Halley's and De Lisle's method, and of the nature of a transit of Venus, we refer our readers to The Engineer of January 9th and January 16th, 1874.

As to probable results, we do not expect anything more than a slight modification of our present estimates of distance based on the transit of 1874, and on other means dependent on the velocity of light or the opposition of the planet Mars. Our old estimate of 95 millions of miles distance to the sun has been long discarded in favour of a smaller result. That arrived at by the 1874 transit is 93,300,000 miles, but other investigations had led to the expectation of a still smaller distance. Eventually the opposition of Mars may furnish us with the best result, because Mars is in opposition so much more frequently than Venus is seen to transit, that it may eventually form the most trustworthy basis for calculation. At present we may consider that the transit of Venus observed in 1874 furnishes us with the best determination we have had of the sun's distance. Ninety-three million three hundred thousand miles may be considered, then, the orthodox distance to the sun until we get the results of the transit of 1882, together with those not yet brought out for 1874. These will probably come at a time when they will attract little public attention. They will, however, in the course of the next ten years doubtless appear in the proceedings of our astronomical societies, and so get into geographical books, and any middle-aged man may expect to hear them from his grandchildren, or perhaps from some precocious School Board child if the world goes on as at present. Junior candidates for the Cambridge local examination this week had the distance to the sun given from the 1874 result.

THE INDICATOR.

No. III.*

Lea's Planimeter Indicator.—This indicator was invented by Mr. Henry Lea, of Birmingham, consulting engineer. Under certain conditions of working the instrument yielded extremely accurate results, but not so under all conditions, hence the invention was abandoned. We place it on record as a link in the history of the indicator.

The planimeter indicator consists of a combination of a portion of a Richard's indicator with a simple form of planimeter, the latter being so arranged as to be interchangeable with the Richard's parallel motion, which can still be used as hitherto for ascertaining the distribution of the steam within the engine. The planimeter indicator records upon its dials, in plain figures, the sum of the area

* No. II. of this series appeared in our impression for January 28th, 1881.

in square inches of all the diagrams which the pencil of a Richard's indicator would have produced during the time for which it is kept in operation. By a simple calculation the sum so recorded may be converted into the mean indicated horse-power for the whole period of the experiment.

In Fig. 13, page 450, the ordinary steam cylinder and paper drum of a Richard's indicator will be readily recognised. Instead of the usual parallel motion and pencil, a double lever arm A is pivotted at B, and is provided with a spindle C revolving between hard steel centres. Upon the spindle C is fastened the planimeter wheel D, in form the frustrum of a cone, which is made of very hard steel, and which, when brought into contact with the reciprocating paper drum, receives a partly rolling and partly sliding motion, the proportion of each varying with the angle which the spindle makes with the horizontal. The lever arm A is attached at the point E to the piston rod F by means of links G and a screw coupling H, similar to that used for the Richard's parallel motion. Suppose that the figure which the planimeter wheel has to describe is a rectangle, as shown in Fig. 15, and now let us follow the movement of the wheel, having an axis $c\ b$ and a fulcrum b. Let the wheel rise from c to d; let it then travel from d to e, its fulcrum travelling from b to b^1; let it then descend from e to f; and finally let it return from f to c. The rise $c\ d$ of the wheel will be neutralised by the fall $e\ f$, and the return $f\ c$ being performed in a direction parallel with the axis $c\ b$, no rolling motion will be imparted to the wheel, so as to remain as a record when it arrives at e. We have, therefore, only the motion from d to e which can impart any permanent motion of revolution to the planimeter wheel. This motion will precisely indicate the area of the figure.

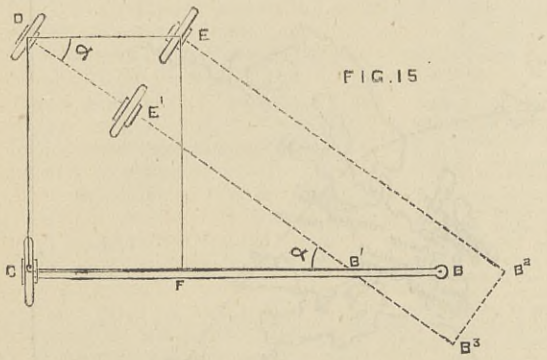


FIG. 15

The motion of the wheel from d to e may be resolved into two at right angles to each other; one in the direction of the axis, viz., $d\ e^1$, which is a sliding motion only, and another from e^1 to e, which imparts only a rolling motion to the wheel. This rolling motion is equal $d\,e \times \sin.\ a$; but $\sin.\ a = \frac{d\,c}{r}$ where r is the length of the axis of the wheel; therefore, $e\,e^1 = d\,e \times \frac{d\,c}{r}$. But $d\,e \times d\,c$ is the area of the rectangle. Suppose n to be the number of revolutions made by the wheel in rolling from d to e, and g to be the radius of the wheel; then $e\,e^1 = \frac{d\,e \times d\,c}{r} = 2\pi g n$; hence the area of the rectangle $= 2\pi n g r$. Let now the planimeter wheel follow the boundary $a\ b\ c\ d\ e\ f\ g\ h$ on

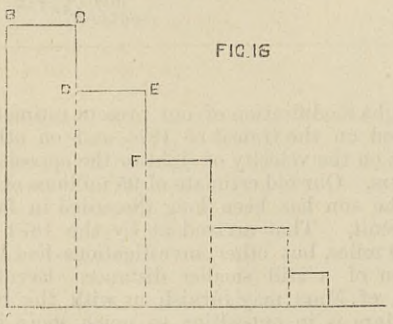


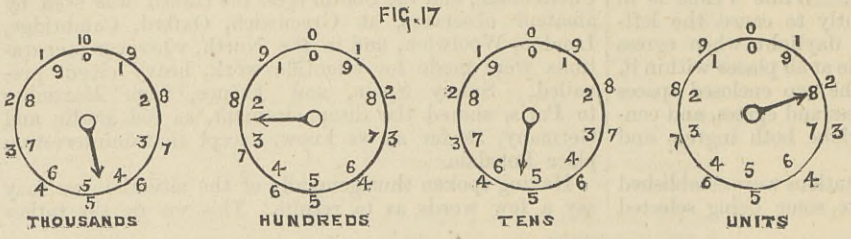
FIG. 16

Fig. 16, it will clearly indicate the total enclosed area, for any length of the steps $b\ c$, $c\ d$, $d\ e$, &c.; and, therefore, also for extremely small steps. Hence, while the planimeter wheel describes a closed curve, it will indicate the area bounded by the curve.

In order to record the permanent amount of revolution of the planimeter wheel D, a bevel pinion and wheel connect the spindle C with the axes of the several dials L L^1, &c., of which L records units, L^1 tens, L^2 hundreds of revolutions of the spindle C, and so on to the last dial. The planimeter wheel D is made of such a diameter that the numbers recorded on the dials represent the total area in square inches of all the figures which the Richard's pencil would have drawn had it been used instead of the planimeter apparatus, the same indicator spring being used. The pointers of the dials L L^1, &c., are sprung upon their respective axes, so as to be readily adjusted to zero by hand at the commencement of an experiment. The instrument is fitted with Darke's patent spring detent—already explained—by the use of which the paper drum is always stopped at, and started from, precisely the same spot. The same indicator and piston, piston-rods, spring, and cylinder cover serve for both the old and the new apparatus. Existing indicators can be fitted with the new apparatus, a slightly larger box being required to admit the new portion.

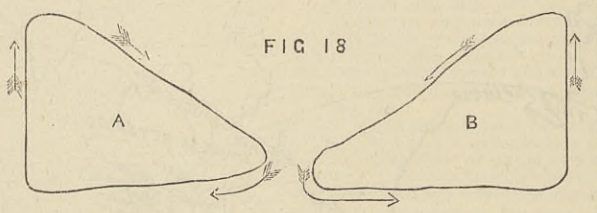
The following are instructions for using the planimeter indicator:—(1) Connect the indicator cock with the steam engine cylinder, and connect the cord of the paper drum with the piston rod or its appurtenances, both in the usual manner—as will be explained later on. Copper wire of about No. 18 B.W.G. is strongly recommended in preference to cord, as it does not stretch while at work. (2) Take a pencil diagram with the Richard's parallel motion; using a spring suited to the pressure of the steam. (3) Stop the paper drum by means of the spring detent, take off the paper, and measure with a fine scale the extreme length of the diagram in inches, and enter the length in your book. (4) Substitute the planimeter apparatus for the pencil, retaining the same indicator spring. (5) Set the silvered wheel to zero, and turn the planimeter wheel into gentle contact with the paper; then set all the pointers also to zero. (6) Now turn on the steam cock; the planimeter wheel will travel up and down the paper—the latter being still held stationary by the detent; but no permanent advance of the pointers will take place. (7) Release the spring detent of the paper drum. The pointers will now be seen to receive a permanent movement in one direction or the other. If they move forward and stop at 4258, as shown by the figures within the dial circles in Fig. 17, that number will be the actual area traversed by the instrument; but if the pointers move backwards and stop at 4258, the actual area will be $10{,}000 - 4258 = 5742$, as shown by the figures outside the dial circles in Fig. 17. The pointers will move in one

FIG. 17



direction when indicating one end of the steam engine cylinder, and in the opposite direction when indicating the other end. This will be easily understood from Fig. 18, in which a and b represent the diagrams taken from the different ends of the steam cylinder. The planimeter

FIG 18



wheel has to move in the direction of the arrows, which are opposite to each other in a and b. (8) Having noticed the time during which the planimeter has worked, you will be able to calculate the indicated horse-power, as will be shown later on.

Boye's Indicator.—The drawings of this indicator are given in Figs. 19 and 20. The reader who has studied the indicators hitherto described will on the first glance be inclined to ask, "Where is the paper drum, the parallel motion, the pencil, &c.?" In fact, Boye's indicator has both a paper drum and a pencil; but the manner in which these parts are put into motion, and their position in the indicator, is the opposite to that of the instruments hitherto described. The paper drum receives its motion from a Bourdon spring tube, in which the steam from the engine is acting, the tube thus turning the drum in proportion to its own movement under the pressure of the steam. The pencil is attached to a mechanism which receives its motion from the engine, and therefore indicates the various positions of the steam piston. In Figs. 19 and 20 A is a standard, to which are attached the various parts of the instrument. B is a nozzle, one end of which is connected by means of a screw C to the steam cylinder in the usual manner, while the other is attached to a tube of spring steel D, which is connected with the card-drum segment F, by means of a connecting link E. The steel tube may be readily exchanged for a stronger or weaker one as desired; and a set of two or more, answering to different initial steam pressures, may be provided for each instrument. The drum segment F moves on two points, which are adjustable. G is a rod which fits inside the standard A; H is an arm firmly fixed to the rod G, and forming a guide in the lower part of the standard, to prevent it from moving sideways; I is another standard securely fixed to the arm H by a nut. The arm H, the rod G, and the standard I are attached to a reciprocating part of the engine by means of a connecting rod R, and thus traverses the standard I in front of the drum segment. M is a lever fitted to a socket on the standard I, so that it may be moved about 90 deg. in a backward direction in order that the cards may be easily removed; the other end of the lever is arranged to carry the pencil, which is lightly held against the card by a small spring.

Dreyer, Rosenkranz, and Droop's Indicator.—Figs. 21 to 27 represent the drawings of this indicator as it is described by Herr Rosenkranz himself in the "Zeitschrift des Vereins deutscher Ingenieure," vol. xxv., p. 170. In our description we shall briefly call this instrument Rosenkranz's indicator. The parallel motion is that of Thompson, with some improvements, for the understanding of which we must remind the reader of the theory of the Evans' "Guide". Thus, if a straight line B C—Fig. 26—of a given length l, is moving between the sides of a right angle C E D in such a way that the end C always remains on E C, and B on E D, any joint A of B C will describe an ellipse with the centre at E, and with axes $2a$ and $2b$, where $a + b = l$, parallel to the rods E C and E D. If conversely the end B is kept on the straight line E D, and the point A is compelled to describe an ellipse of which the axes are $2a$ and $2b$, where $b =$ A B, then the point C, at a distance from it equal to a, will describe a straight line E C. If the describing point A is at the middle of B C, so that $a = b$, the ellipse will be converted into a circle, of which the centre is E. It is this construction which Herr Rosenkranz has adopted for his parallel motion. If a is greater or less than b, the ellipse can only approximately be a circle.

The construction of the guide is as follows:—Given C B $= l$, the point A on C B, and thus the lengths a and b, and also the three points C, E, and C_1 of the straight line we wish to be described. Draw the three lines C B, E D, and C_1 B, and mark the three points A, F, and A_1 by making C A, C_1 A_1, and E F equal to a. The three points A, F, and A_1 must belong to the ellipse which we want to determine. If, instead of this ellipse, we use the circle passing through the above three points, this circle and the ellipse will only have the three common points A, F, and A_1; and therefore, instead of a straight line C E C_1, the end of the guide will describe a curve which contains the three points C, E, and C_1. This forms the fundamental construction of Thompson's parallel motion, which we have already described in Kraft's indicator.

A Rosenkranz parallel motion, Fig. 25, is obtained, as already mentioned, by taking $a = \frac{1}{2} l$. The point B is not kept in the horizontal line E D, but is compelled to oscillate in a very small arc of the circle described by the lever. The error made by giving the end of the guide this motion is practically nothing.

The lever a, Fig. 21, can turn upon a pivot fixed to the arm E. The piston-rod is solid, but as light as possible, and is connected by a steel ball-joint with the connecting-rod p, which again is in connection with the lever H.

By unscrewing the nut r the lever is disconnected from the piston rod. As the whole parallel motion is fixed on the cap F and centred by means of a cone co-axial to the indicator cylinder, its relative position to the axis of the piston rod will not be altered, as is possible in the Richard and Thompson indicators. These instruments have also too short a guide on the cover for the piston rod, and therefore cannot prevent the angular motion of the rod. It is obvious that for the highest position of the piston the guide is shortest, and at the same time the coils of the spring are pressed most closely together, and therefore do not exert their pressure so exactly on the axis of the piston. These two evils often cause a momentary sticking of the piston to the cylinder, which the diagram shows as a later cut-off.

The changing of the spring is performed by taking hold of the handle K, and unscrewing the plate G, which is in one with the spring, the piston, and the parallel motion. Having unscrewed the spring and substituted a new one, the instrument is able to indicate the work done for other ranges of pressure in the cylinder to be tested. It must be remarked that the weight of the piston, piston rod, spring, and parallel motion—in other words, all the parts of the instrument which cause serious momentum—is much less than in Thompson's indicator.

The detent motion of Rosenkranz's instrument is a great improvement, and is based on a principle more correct than that of other constructions known to us. In Darke's instrument the string is hanging loose when using the detent motion, which often causes it to get tangled and broken. Rosenkranz's invention consists in always keeping the string straight during the motion, which is obtained in the following way. The tube H, with the pulley S, Fig. 23, revolves on the spindle D, and after having been rotated in the one direction by the string, is returned by the spring F to its original position. On the tube H revolves another tube H_1 carrying the paper drum P. The former is supplied with the coil-spring F_1, which brings it against a screw on the pulley S, and this compels the paper drum to follow the rotation. The tube H_1 is supplied with a ratchet wheel Z, in the same way as in Darke's indicator, and can be engaged with the pawl K, Fig. 24, turning on the pivot T, by moving the spring R. When using the detent motion, we stop the paper drum, but not the pulley S, which continues its rotation, and thus keeps the string straight. We can now change the paper without any risk of the string being tangled. As will be remembered from our description of Kraft's indicator—see December 3rd, 1881—the fixing of the indicator cylinder to the cock piece is managed by means of a nut f, instead of the usual differential motion. The unscrewing of this nut is done by putting a loose arm into one of the holes at the side, thus obtaining a better purchase, and at the same time preventing any burning of the fingers.

The construction of the nut in Kraft's indicator, however, is not a good one, because the indicator cylinder does not become loose by the unscrewing, but it has afterwards to be shaken, and often even to be given a blow. Herr Rosenkranz has got rid of this fault by constructing the nut as represented in Fig. 27. The flange a on the nut M, situated between the ring c and the flange d, will, when unscrewing the nut, produce a pressure against d, and thus raise the tapered piece of the indicator out of the corresponding conical hole of the cock piece.

Springs and Scales.—It will be remembered from our first article—December 3rd, 1880—that Herr Pichler strongly recommended to divide the scale for the springs by actual trial, and not to use equally divided scales. Herr Rosenkranz was of the same opinion, but lately he has come to the conclusion that for good springs the errors made by equally dividing the scales are not greater than with the empirical method. It is quite true that all indicator springs do not change their length in strict proportion to the pressure on the piston, and this fault may be due to other parts of the instrument. We ought, therefore, to expect more accurate results from the empirical method, as it assumes the spring to be tested on the instrument itself; but in carrying out this test we meet with difficulties which are impossible to avoid. Those of our readers who are practically acquainted with the indicator know very well how difficult it is to keep one fixed position of the piston when the steam is pressing upon it. We are also dependent on the accuracy of the pressure-gauge used in testing the spring. We must simultaneously follow with the eye the pointer of the former and the pencil of the indicator, so that just at the right moment we may turn the paper-drum and thus

get a mark on the paper. By repeating this experiment we shall find that, as a rule, we get different marks for the same pressure, and are thus compelled to take a mean value. This method must therefore be held a fallacy, especially when we are dealing with water-pressure, in which case the leakage is much more serious. It seems, therefore, that Herr Rosenkranz is right in testing the spring out of the instrument by means of a dead load, and only adopting such springs as follow the law of proportionality, *i.e.*, for which the change of length is proportionate to the load acting on them. The determination of the maximum and minimum points, however, must, of course, be done in the instrument itself under steam-pressure and steam-heat.

Smith's Indicator.—The indicators hitherto described are all improvements of the original Richard's indicator; and all consist of a tube through which the steam from the steam cylinder enters into the indicator cylinder. To the latter is attached the paper drum. Such an indicator may be regarded as a material system connected to the motor, and compelled to take part in the reciprocating action of the latter, or the oscillation in the case of oscillating engines. But all these motions cause the different parts of the indicator to move relatively to each other, and thus diminish the sensibility of the instrument. The motion of the indicator cylinder is proportional to its moment of inertia about the point of attachment to the engine; and the motion of the paper drum is proportional to its moment of inertia about the point of attachment to the indicator cylinder. Hence, in constructing indicators the following rules are to be regarded:—(1) Make the tube connecting the indicator cylinder to the engine as short as possible; (2) make all the parts of the indicator as light and small as possible, consistent with strength; (3) bring the paper drum as near to the indicator cylinder as possible. It is on the basis of Rule 3 that Messrs. Smith have constructed their indicator, since by making the paper drum co-axial with the indicator cylinder they have brought its moment of inertia to a minimum.

Description of the Instrument.—The paper drum surrounds the indicator cylinder, and the pencil moves along a guide, which is parallel to the joint axis. The pencil-holder receives its movement from a link C^1, connecting it with one end of a lever A^1, having its fulcrum at the other end, and connected at an intermediate point with the head of the rod of the indicator piston. The length of the portion of the lever between the two links is several times greater than the length between the fulcrum and the link passing to the head of the piston-rod; and the movement of the pencil is proportionally greater than that of the indicator piston. The pencil can be taken off the barrel by means of a hinge on the slotted guide. The paper drum receives its motion by means of a spring and cord in the usual manner. The paper is also fixed in place upon the periphery of the drum by paper clips in the usual way.

Figs. 29 and 30 are drawings of the instrument as it is made by Messrs. Elliott Brothers. A is a screw for connecting the stem of the indicator to the cylinder of the engine by means of double nuts; B is entrance for steam; C, piston of indicator; D, stem of indicator; E, tube or cylinder fitted into D, and within which the piston C works; F, cap screwed into E, and through which the piston-rod works; G, spring screwed to the cap F and to the top of the piston C in the usual way; H is a spring box which contains the spring J, and is made to revolve round D by the action of a cord passing between the guide wheels K K; L is a support for the guide wheels, and also for the spring box—this is able to be turned round so as to put the wheels in any direction; M is a nut fixing the parts H and L on the stem D, and locked into place by means of two screws; P is a movable cap held by means of a pin entering a hole in the flange O and the cap F. This cap P supports the standard Q of the parallel motion, and the slotted pencil guide B^1. R is the paper drum; T, handle to slotted guide B^1, by means of which the metallic pencil U may be moved to and from the paper. The pencil passes freely through a hole in a pencil-holder U^1, which moves up and down in the slot of the guide B^1. V is a double link connecting the head of the piston-rod with the lever A^1; and C^1 is a link connecting A^1 with the pencil-holder. This link is four times the length of the double link V, and the part of the lever A^1, between V and C^1, is similarly four times the length of the part between V and the fulcrum. From this description of the instrument the reader will probably share in our conclusion, that this is undoubtedly the best high-speed indicator hitherto constructed.

THE CHERTEMPS AND DANDEU DYNAMO ELECTRIC MACHINE.

On Monday night a few gentlemen interested in electricity were shown a new dynamo-electric machine, the invention of MM. Denis Alexander Chertemps and Louis Dandeu, of Paris. Two machines were exhibited at work, under unfavourable circumstances, in a workshop at 35, Charles-street, Hatton-garden. In that neighbourhood there are a considerable number of buildings in which workshops can be rented, power being supplied from an engine in the basement of the building. Under these conditions it is clear that the tenant of one workshop cannot have control of the engine; and thus, although the inventors could drive their machines, they could not alter the speed in any way. Round the room were fixed ten Jablochkoff candles, while from two wires overhead were hung twenty Edison lamps of about 20-candle power. These were fed by a very small machine. The ten Jablochkoff candles were supplied by one a size larger.

Mr. Sabine, of 7, Great Winchester-street-buildings, has reported on this dynamo to Mr. Applegarth, Mansion House-chambers, E.C. He says:

"I have, at your request, tested two of the Chertemps machines which you have at Charles-street, Hatton-garden. In reply to the questions asked in your letter to me of the 24th November, I beg to say that:

"(1) I find that the smallest machine—alternating current—keeps twenty Edison A 16-candle lamps incandescent at an expenditure of about 2-horse power, as indicated by M. Morin's dynamometer, which is placed between the steam engine and the machine.

"The maximum number of lamps which I saw in circuit at one time was twenty-five, which number was then reduced by five at a time. The horse-power indicated by the dynamometer fell each time proportionally to the number of lamps removed from the circuit.

"(2) The medium-sized machine, when giving alternate currents with its induced bobbins parallel, was put in circuit with fifty-two Edison A lamps, which were kept incandescent at an average of 17·5 candles with an expenditure of 6·2-horse power indicated by the dynamometer. The machine was afterwards connected up so to give continuous current, the same number of lamps being kept incandescent at an average of 15·1 candles per lamp, while the indicated horse-power was 5·1, showing that in so far as lighting power goes, circuits with alternate and continuous currents generated by the same machine give much the same result. In each instance over 80 per cent. of the power given to the dynamo machine was accounted for electrically, and over 65 per cent. was accounted for in the lamps alone.

"(3) The same machine with its induced bobbins in series, and giving alternate currents, was then connected with, and kept in action ten Jablochkoff lamps, also in series, at a total expenditure of 4·9-horse power, indicated by the dynamometer as being given to the dynamo machine. The number of lamps was changed by two at a time, and the difference of the power given to the machine being observed at the dynamometer, it was seen that the power employed was always proportional to the number of lamps in circuit, the machine regulating this automatically. When maintaining the Jablochkoff lamps, about 80 per cent. of the power given to the dynamo was accounted for electrically, and, with over four lamps in circuit, about 65 per cent. was accounted for in the lamps alone.

"I consider that, having regard to their size and weight, the efficiency of these dynamo machines, both for arc and incandescent lamps, is very satisfactory.

"I enclose the details of the tests made with the larger of the two machines."

These tests are set forth in the accompanying tables:—

Chertemps (medium-sized) Machine tested with 52 Edison A Lamps (French made) connected parallel with short leads.

	Alternate current.	Continuous current.
Main circuit (external):		
Current per lamp	0·68 a.	0·66 a.
Current per 52 lamps $= c =$	35·4 a.	31·3 a.
Potential-difference $= e =$	85 v.	83 v.
H.P. accounted for in 52 lamps $= \frac{ce}{746} = w =$	4·03	3·48
Main circuit (internal):		
Current (as before) $= c =$	35·4 a.	31·3 a.
Resistance of five bobbins parallel $= r =$	0·3 w.	0·3 w.
H.P. accounted for in internal wire $= \frac{rc^2}{746} = w_1$	0·50	0·39
Magnetising circuit:		
Current in magnetising circuit $= c_1$	6·5 a.	6·5 a.
Resistance in magnetising circuit $= r_1$	7·4 w.	7·4 w.
H.P. accounted for in this amount $= \frac{r_1 c_1^2}{746} = w_2$	0·42	0·42
Speed of dynamo—revs. per min.	1180	1174
Pull on dynamometer $= k =$	49 kilogs.	45 kilogs.
Speed of dynamometer—revs. per min. s	662	648
Indicated H.P. $= 3{\cdot}21 \times 10^{-4}\, s\,(k-20) = w_0$	6·2	5·1
H.P. accounted for electrically $(w + w_1 + w_2) =$	4·95	4·29
Proportion of H.P. electrically accounted for $\frac{w + w_1 + w_2}{w_0} =$	0·80	0·84
Proportion of H.P. accounted for in lamps alone $\frac{w}{w_0} =$	0·65	0·68
Horizontal (front) candle-power of one lamp (average)	17·5	15·1

Chertemps (medium-sized) Dynamo Machine tested with Jablochkoff Candles connected in series.

No. of lamps in circuit $= n =$	10	8	6	4	2
I. Main circuit:					
Current in ampères $= c =$	5·5	5·5	5·3	5·0	5·0
Internal resistance in ohms $= r =$	7·3	7·3	7·3	7·3	7·3
H.P. accounted for internally $= \frac{c^2 r}{746} = w =$	0·30	0·30	0·27	0·24	0·24
External potential-difference of lamps —volts $= E =$	430	344	258	168	88
H.P. accounted for in lamps $= \frac{E\,c}{746} = w_1 =$	3·16	2·53	1·93	1·15	0·60
II. Magnetising (field) circuit:					
Current (ampères) $= c_1$	5·4	5·0	4·6	4·1	3·7
Resistance of wire (ohms) $= r_1$	7·4	7·4	7·4	7·4	7·4
H.P. accounted for in field circuit $\frac{c_1^2 r_1}{746} = w_2 =$	0·29	0·25	0·21	0·17	0·14
Speed of dynamo	1242	1230	1236	1260	1218
Pull on dynamometer in kilogs. $= k$	42	36	32	28	24
Speed of dynamometer—revs. per min. $= s$	665	666	678	676	678
Indicated H.P. $= 3{\cdot}21 \times 10^{-4}\, s\,(k-19) = w_0$	4·9	3·7	3·0	2·0	1·2
H.P. accounted for electrically $= w + w_1 + w_2 =$	3·75	3·08	2·41	1·56	0·98
Proportion of H.P. electrically accounted for $=$	0·77	0·83	0·81	0·78	0·81
Ditto accounted for in lamps $=$	0·64	0·68	0·64	0·57	0·50
Horizontal front candle-power of one lamp*	289	334	321	308	279

* The carbons used in these measurements were apparently of inferior quality.

The special advantages claimed for the new machine are that it is cheap, simple, and efficient, and that within certain limits it can be used at will either as a quantity or an intensity machine; and it can be made to give either an alternating or a continuous current. Furthermore it is claimed that the commutator is so constructed as to reduce sparking to a minimum or do away with it altogether; and most important of all, it is advanced that the current given by the machine is automatically determined as to quantity by the work done. To make this more readily intelligible, let us suppose that a given machine is feeding 200 incandescent lamps; the current will amount to, say, 250 Ampères, and the electro-motive force will be, say, 45 volts. If now one-half the lamps be switched out, the whole current of 250 Ampères will be thrown on the remaining lamps, and the result may be their destruction, unless the speed of the engine is reduced at the same time that the switching out takes place. It is claimed for the Burgin compound machine made by Mr. Crompton, and for the Ferranti machine, that both will automatically regulate the current to the work to be done. We have not seen the experiment tried with a Ferranti machine, and as regards the Burgin machine, its powers of automatic adjustment are exerted within previously determined limits. In the case of the Chertemps and Dandeu dynamo-electric machines, the adjustment appears from the experiments we saw tried, and from Mr. Sabine's report given below, to have in practice no limits. The small machine, to begin with, was made to drive, as we have said, 20 lamps, the current being, we suppose, about 25 Ampères. These lamps were hung across two wires in multiple arc. They were all taken off, one after the other, without affecting those which at any time remained alight. When the first three had been removed, the remaining fifteen became a little brighter, but not much, and no further change took place, the last lamp of the twenty burning just as it did at first. Thus the current, which at first traversed twenty lamps, was, apparently, at last all concentrated on one without injuring it. In reality the current was reduced as the lamps were taken out of circuit. They were then all replaced, and each lit up as it was hooked on the parallel wires, without attaining an undue intensity. The ten Jablochkoff candles were then lighted one after the other, none of them getting too much or too little current. The speed at which the machines ran was constant, because the engine had other machines to drive.

We illustrate the dynamo-electric machine by the engravings on page 446. Before proceeding to describe it minutely, it may be well to explain in general terms the principle on which it adjusts itself to the work done. The machine is of the Gordon type; that is to say, the field magnets rotate while the equivalent of the armature remains at rest. One bobbin of the armature is reserved to excite the field magnets. It plays, in fact, the part of the independent exciter used by Gramme, Ferranti, Gordon, and others, but this bobbin is not competent to saturate the field magnets. Now as the resistance in the lamp circuit is increased, the power of the exciting bobbin is augmented, and the current in the lamp circuit augments at the same time; but this only occurs because the field magnets were not saturated to begin with. If they were, no further effect would be got. Let us suppose, for example, that in a Gramme machine the exciter was driven at such a speed that to drive it faster would not increase the power of the excited machine, and it will be understood that within certain limits the main current would be fixed, no matter what the resistance. But let us suppose that the exciter was so arranged that it determined the power of the main machine, and that as resistance was put in or put out of the lamp circuit the influence of the exciter varied, and we have conditions very similar to those which exist in the Chertemps and Dandeu machine. It must not be thought that we have here given a precise exposition of the theory of the machine; we have only indicated the general principle which, as we understand the inventor, is that involved. It appears to be consistent with known facts, and electricians will have no difficulty in elaborating it.

We may now proceed to describe the machine, which appears to deserve the attention of electricians. Fig. 1 is a front elevation, and Fig. 2 is a plan; Fig. 3 is a transverse vertical section taken in the line 1, 2 of Figs. 1 and 2, and Fig. 4 is an elevation of the commutator end of the machine. A is a horizontal shaft mounted in plummer blocks B B^1 secured to a base B^2. This shaft carries a pair of cast iron discs C C^1. Fitted to the inner face of each of these discs is a set of hollow electro-magnets D D^1 arranged in a circle and forming together the rotary fields of the machines. These hollow electro-magnets are made fast to their discs by bolts or nuts. Between them is fixed a stationary armature composed of a block or plate E of wood, pierced through with a ring of holes, the axis of which ring corresponds with the axis of the field magnets. The diameter also of the ring of holes is such as to insure their standing opposite the field magnets as these magnets are rotated. The ring of holes in the block E is fitted with bobbins F, which project out from opposite sides of the block of insulating material. The coils of these bobbins are wound upon a core of iron composed of several tubes fitting the one within the other, as shown in the sectional view, Fig. 4^b, the object being to allow of access of air to the interior, and thereby to avoid the heating of the bobbins, and also to reduce the weight of metal employed to a minimum. The engraving shows the fixed armature as formed with six bobbins, the wires of which are conducted up to pairs of metal blocks $e\,e^1$ mounted on a block E* fitted preferably on armature block E. This block is built up in pieces, as shown at Fig. 3, to avoid the effects of warping, and the parts are bound firmly together and to the bobbins by means of a metal strap, which passes over the compound block and holds it down firmly to the bed-plate. Made fast by means of binding screws e^2 to the metal blocks $e\,e^1$ are pairs of wires, one of which leads off to a pair of brushes or rubbers G, and the remainder to the lamps. The rubbers G are mounted adjustably on the plummer block B^1, and are intended to supply a current led off from what may be termed the "exciting bobbin" to a commutator H in connection with the whole of the field magnets. This commutator receives alternating currents from the exciting bobbin of the armature, and these currents it is designed to rectify and transmit as a continuous current to the field magnets. For this purpose the commutator is so constructed that in its rotation one section shall not leave the rubber or brush until the next adjacent section is in contact with the same rubber and brush. Figs. 5 and 6 show the commutator detached from the machine, Fig. 5 being an end view and Fig. 6 a side view representing the two parts of which the commutator is composed, separated. The commutator may be described as composed of two hollow cylinders, each with a closed end, their peripheries being so cut away as to permit of their interlocking to the full length of the cylinders. The number of interlocking parts of the commutator depends upon the number of electro-magnets contained in the field, and the number of bobbins in the armature. We have said that the number of bobbins shown in the drawing of the armature is six, and that there are also six pairs of electro-magnets in the rotating field. This necessitates the use of a corresponding number of interlocking parts in the commutator, viz., three for each cylindrical counterpart of the commutator.

THE CHERTEMPS AND DANDEU DYNAMO ELECTRIC MACHINE.

FIG. 1

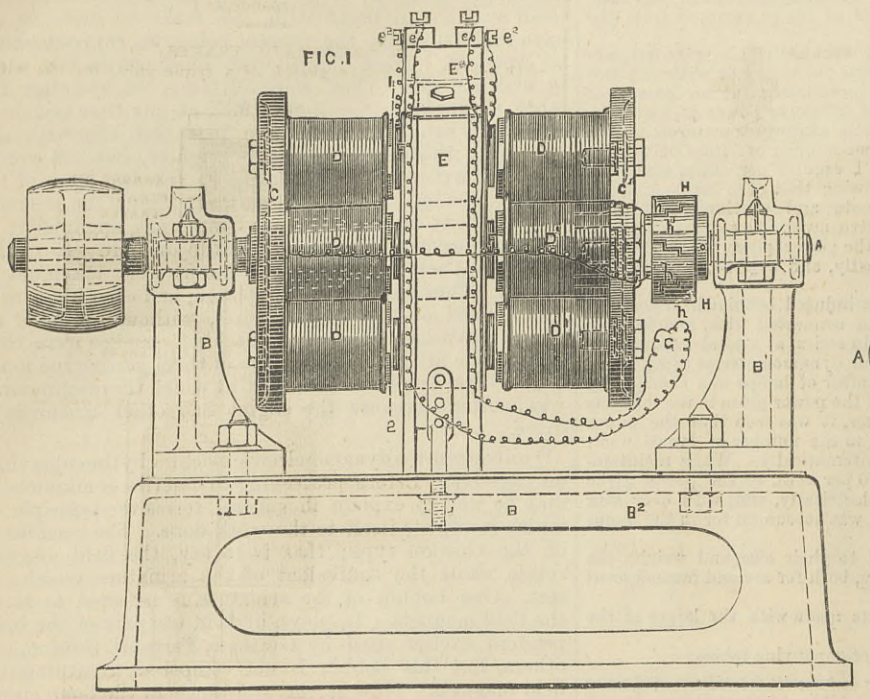


FIG. 2

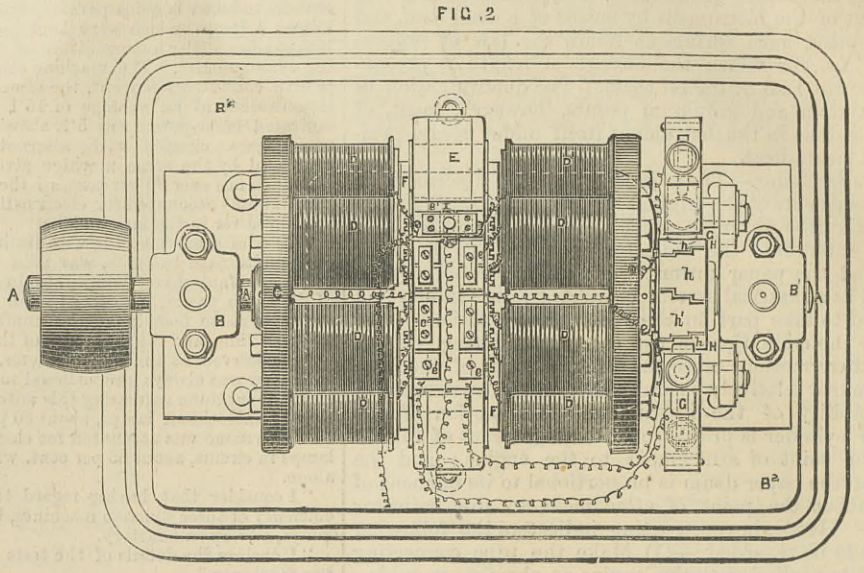


FIG. 3

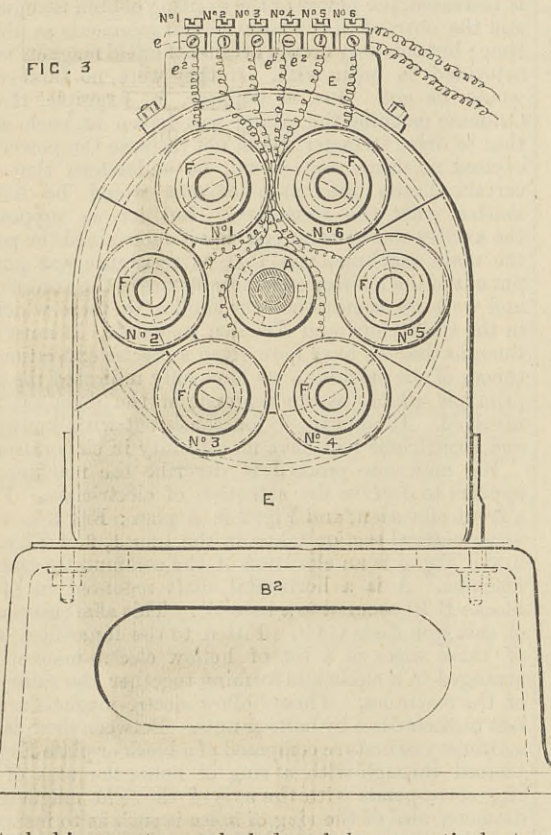


FIG. 4

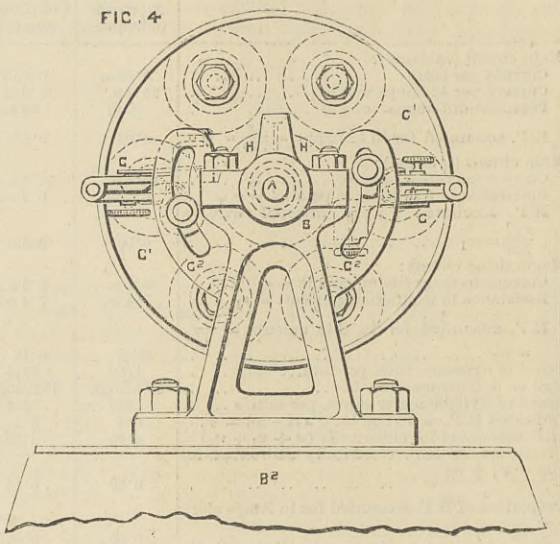


FIG. 4A

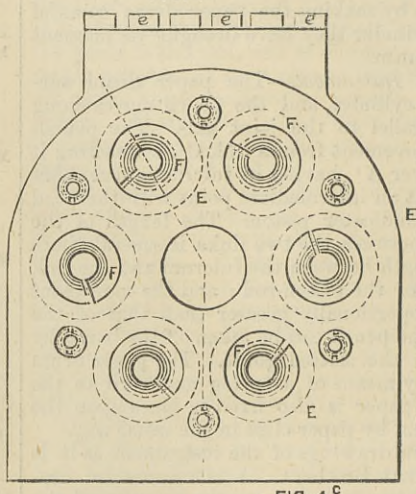


FIG. 4B

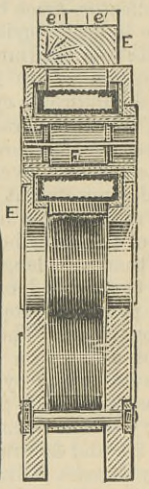


FIG. 4C

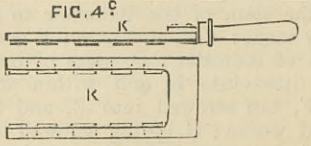


FIG. 5

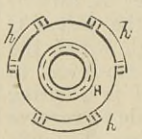


FIG. 6

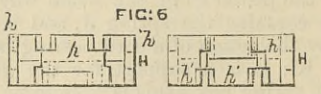


FIG. 7

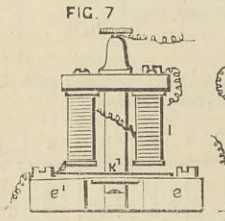
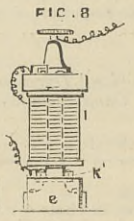


FIG. 8



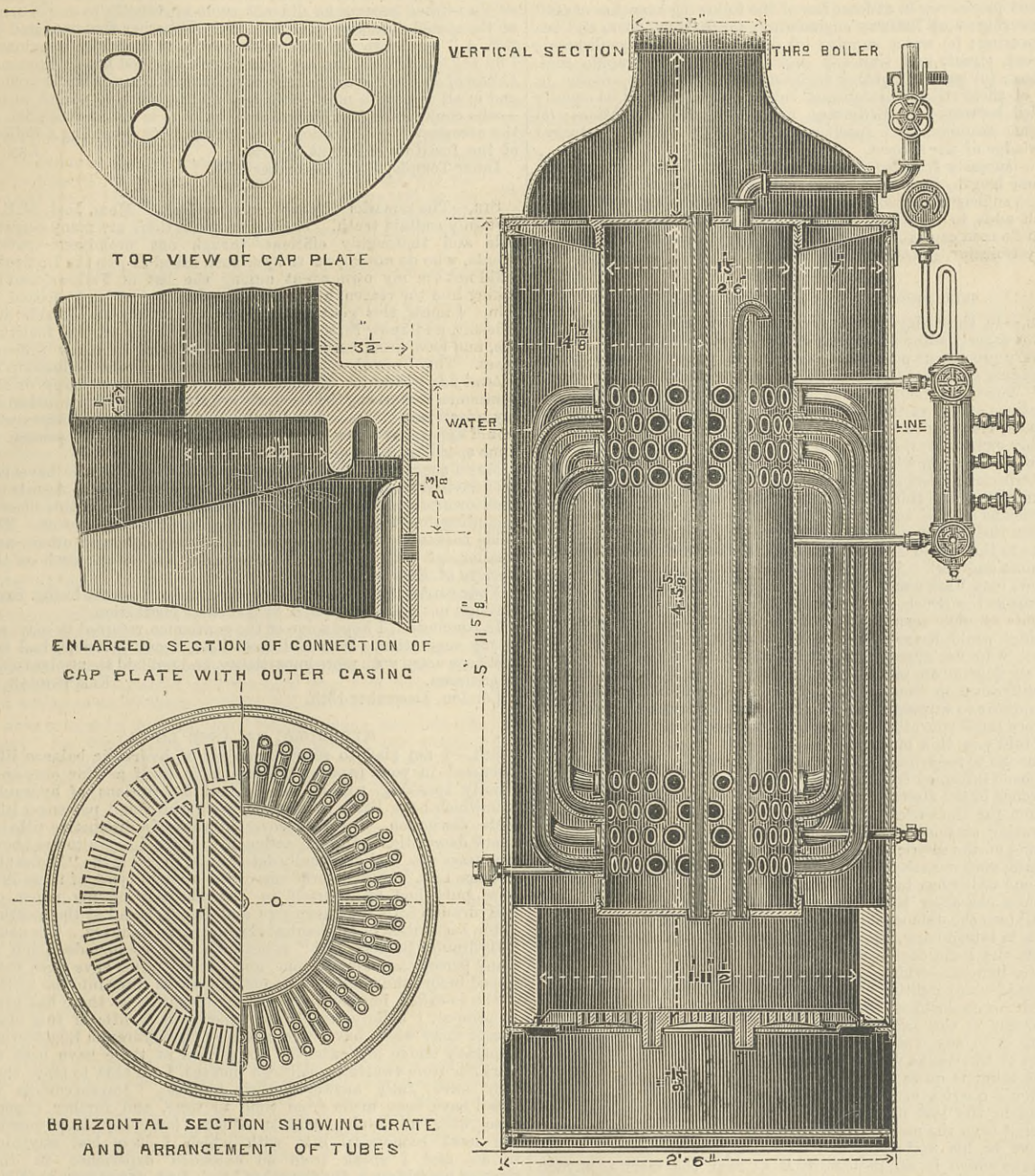
These interlocking parts, marked h and h^1 respectively, are tapered in steps, as shown in the engraving, and when fitted together, as at Fig. 2, upon the shaft A, and insulated therefrom and from each other, together form a hollow cylinder with a smooth periphery, upon the opposite sides of which the rubbers G bear. One portion of this commutator is connected with one terminal of the field, and the other portion is connected with the other terminal. Thus when the machine is in action a current of electricity is passed from the armature through the rubbers G and commutator H to the field magnets. As, however, the commutator presents practically but two surfaces to the rubbers, and these in succession, continuous electric currents will be transmitted to the field. By adjusting the commutator relatively to the field magnets, and thereby insuring the shifting of the rubbers from the middle step of one segment to the middle step of the next adjacent segment at the moment that the field magnets are passing the spaces between the armature bobbins, and consequently through neutral points, it is claimed that all liability to "sparking" will be removed. We have said that the wires of the armature bobbins are led up to the pairs of blocks ee^1. These blocks are fitted with clamping screws for connecting thereto the wires of the different circuits. In order, however, to combine together two or more currents of the working circuits, according to the work in hand, a forked sliding piece K, which is made to under-run binding screws fitted to the several blocks, and thereby to couple them up as required, is provided. To provide for closing a lamp circuit when broken by accident, and thereby to avoid the heating of the metal core of the armature bobbin, and the consequent injury to the coil thereon, within each lamp circuit is placed a small electro-magnet, as illustrated in Figs. 7 and 8 in front and side elevations. These electro-magnets I are carried by bracket pieces screwed to the block E* and they overlie a plate K^1 which is attached to a lever hinged to the block E*. This plate K^1 overlies a pair of terminal blocks $e\,e^1$, and is intended by contact therewith to short-circuit the currents generated in the bobbin connected therewith. When the machine is set in action the currents passing to one of the terminal blocks will be divided, a portion passing to the opposite terminal by the plate K^1, and the other portion passing around the electro-magnet I, and so on to the lamp and back to the terminal e^1. The electro-magnet being by this means excited will lift the plate K^1 and retain it in its raised position so long as the circuit remains unbroken. So soon, however, as the breaking of the circuit takes place, whether by accident or otherwise, the plate K^1 will fall and close the circuit, cutting out the broken portion. The English patent is No. 1747, 1882.

The Newman Testimonial.—It has been determined to commemorate the services and death of Mr. Edward Newman, late chief engineer at Portsmouth Dockyard, in a useful and permanent way. At present the engineering branch of the Navy lacks the prizes and inducements to application which the others possess. For the executive branch, the Goodenough gold medal is annually awarded to the acting sub-lieutenant, who, after taking a first-class in seamanship, passes the best examination of his year in gunnery. The Beaufort testimonial, again, which is represented by instruments or books, is bestowed upon the officer who, in qualifying for the rank of lieutenant, passes the best examination at the Royal Naval College in subjects connected with navigation. For the medical branch, also, there is the gold medal which was established by Sir Gilbert Blane in 1830, and which every two years becomes the property of the medical officer who can produce the most approved journal of his practice while in medical charge of a ship of war. The Newman testimonial is intended to reward in a similar way distinguished merit in young engineers. It will take the shape of £10 worth of books, and will be annually bestowed upon the engineer student who shall receive the highest number of marks in practical engineering while passing out of the Marlborough training ship for the prescribed course at the Royal Naval College, Greenwich. About £300 will have to be raised.

Dynamo-electric Machinery.—On Monday evening, the 6th inst., Professor Sylvanus P. Thompson delivered the first of a course of three Cantor lectures for the session 1882-83 on "Dynamo-electric Machinery," in the Hall of the Society of Arts. He said that the name "dynamo-electric machine" was first applied by Dr. Werner Siemens in a communication made in January, 1867, to the Berlin Academy. He there described a machine for generating electric currents by the application of mechanical power, the currents being induced in the coils on rotating an armature by the action of electro-magnets which were themselves excited by the currents so generated. Since the great development of electric lighting it had been found convenient to use the generating machines in certain combinations in which the self-exciting principle was abandoned. The main principle of the dynamo-electric machine was due to Faraday, who, by moving conductors across a magnetic field, caused currents to be excited within those conductors. As the term was now applied, dynamo-electric machines were machines for converting energy in the form of mechanical power into energy in the form of electric currents by the operation of setting conductors in the form of coils of copper wire to rotate in a magnetic field. The machines might be divided into three classes. The first was that in which the rotation of the coils took place in an uniform field of force upon an axis in the plane of the coil or one parallel to such axis. The second consisted of machines in which there was the translation of the coils to different parts of a field of unequal strength or opposite sign. The third class, which had not yet come into practical use, was where the rotation of the conductor was accompanied by an endless increase in the lines of force cut, this being effected by one part of the conductor sliding on or round a magnet. If he were asked what dynamo-electric machine was the best, he would say that none was theoretically perfect, one might be better for one class of work, and another for a different description. This, however, he might say, that everything was in favour of big machines. The lecture was illustrated by diagrams and by experiments. On Monday evening last he gave the second leeture, on "The Dynamo in Practice," and the subject of the succeeding lecture is "The Dynamo as a Motor."

The Society of Engineers.—The twenty-eighth annual general meeting of the members of the Society of Engineers was held on Monday evening last, the 11th inst., in the Society's Hall, Victoria-street, Westminster. The chair was occupied by Mr. Jabez Church, president. The following gentlemen were ballotted for and duly elected as the council and officers for the ensuing year, viz.:—As president, Mr. Jabez Church; as vice-presidents, Mr. F. E. Duckham, Mr. Arthur Rigg, and Mr. C. Gandon; as ordinary members of Council, Mr. R. Berridge, Mr. Perry F. Nursey, Mr. A. F. Phillips, Mr. W. Schonheyder, Mr. Arthur T. Walmisley, Mr. T. H. Hovenden, Mr. Henry Robinson, and Mr. John Waddington, the three last-named gentlemen being new members of council; as honorary secretary and treasurer, Mr. Alfred Williams; and as auditor, Mr. Alfred Lass. The proceedings terminated by a general vote of thanks to the council and officers for 1882, which was duly acknowledged by the chairman. On Wednesday evening the annual dinner of the Society was held at the Guildhall Tavern, Gresham-street, Mr. Jabez Church, C.E., president, in the chair. Among the guests present were the secretary to the Chinese Legation, Fung Yee—Messrs. Perry F. Nursey, S. Cutler, R. Berridge, A. F. Phillips, and A. T. Walmisley, members of the council; Messrs. R. P. Spice, B. Latham, and Charles Horsley, past presidents; Mr. Alfred Williams, hon. secretary, and and Mr. B. Reed, secretary. After the usual loyal and patriotic toasts, Mr. C. A. White, replying for "The Army and Navy," the president gave "Success to the Society of Engineers," and said that engineers, from the mechanical to the civil, were now of a learned profession—one not looked down upon, but considered as worthy of being practised and followed. Wherever they went, in our colonies or in foreign countries, there was to be seen their handiwork. Their works were often in advance of civilisation; and wherever they were set down in men's midst civilisation was the result. During the past year the Society of Engineers had progressed in numbers very satisfactorily. The papers which had been read, and the visits to Portsmouth and other places which they had been enabled to make for instructive purposes, during the year had been productive of valuable results. He thought a very wise step had been taken in inaugurating lectures for the instruction of young members of the Society and of the profession, and he urged them to embrace the opportunity afforded them for real, earnest, and beneficial work. Mr. Alfred Williams replied, and spoke of the useful and practical results accruing from the Society having been enabled to have trips that practical experience might be gained. He trusted more would be done in that and similar directions. "The President" and other toasts followed.

SNYDER'S 5-H.P. VERTICAL BOILER.



We illustrate above the American boiler we referred to in our impression for Nov. 24th. The outside diameter of the boiler is 30in. The material used for the central shell of the boiler, to which are connected the small side tubes which contain the bulk of water and the steam, is $\frac{4}{10}$in. lap welded wrought iron tubing. The lap welding of the edges together forms a perfect joint. The top and bottom caps are screwed on with a taper thread, the side tubes are held by bushings threaded inside and out to fit the taper threads on the outside of the small tubes, and the holes in the central shell which receive them. The stay is fastened in the same way to the top and bottom heads. Every joint in the boiler being screwed together, removing the dome top, fittings, and lifting the boiler out of the casings gives free access to the outer boiler and tubes. By clamping a lever on the flat top—with dome removed—and securing the bottom in a press or vice, the caps can be removed, giving free access to inside of boiler, so the circular of the manufacturer says. But this is by no means easy; as the top cap is screwed to the centre shell, it must be so rusted in that it is impossible to disconnect it, and under the most advantageous condition it takes about four days to examine thoroughly the interior of the boiler. A double casing is used; the inner one extends from the top of the boiler downwards behind the fire-brick lining of the furnace and terminates below the grate; the outer casing which supports the weight of the boiler is of iron. A brass band which extends entirely around the top of the boiler is arranged as a register or damper, so that it can be turned sufficiently to open or close communication with the outside air through numerous small holes. Where it is desired to economise fuel by closing the ash-pit door and opening the register or damper band at the top, the air which feeds the fire enters through the holes in the damper band, and passing downwards between the casings, absorbs heat which would be otherwise lost, and returns it to the furnace.

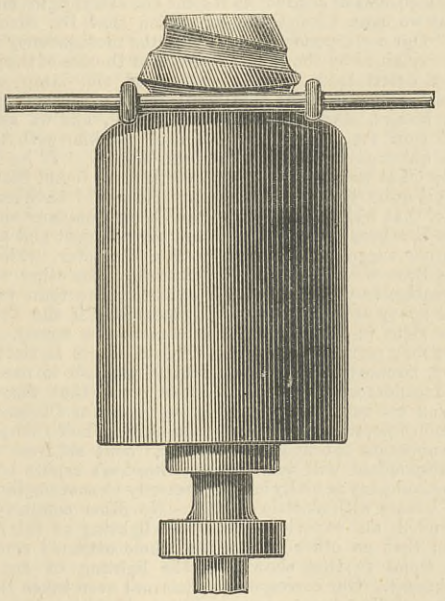
The dimensions and proportions of the 5-horse power boiler are as follows:—

Snyder's Little Giant Boiler.

Outside diameter of boiler	30in.
Diameter of main boiler or central shell	15in.
Height of boiler over all	71in.
Length of central shell	4ft. 5½in.
Number of side tubes	88.
Diameter of side tubes	⅜in.
Length of side tubes	39in. to 30½in.
Heating surface (effective)	78·7 square feet.
Grate surface (weight of grate 63 lb.)	3·01 square feet.
Heating surface of central shell	17·9 square feet.
Heating surfaces of tubes	70·05 square feet.
Area of tubes	0·27 square feet.
Area of central shell	1·12 square feet.
Area of steam pipe	0·44 square feet.
Area of chimney	0·54 square feet.
Area of water line	1·38 square feet.
Volume of water in boiler	4·06 cubic feet.
Steam room	1·63 cubic feet.
Proportion of heating to grate surface	26·2 : 1.

A NEW INSULATOR.

The accompanying engraving illustrates a new self-binding telegraph, telephone, and electric light insulator, invented by Mr. J. S. Lewis, of 28, Hamilton-street, Birkenhead, and made by Messrs. Doulton and Co., and by Messrs. Bourne and Son. The binding is effected by hooking on the line an iron clip of horseshoe shape, and then inserting the coarse conical screw, which is formed on the end of the insulator, between the clip and line wire. On giving the insulator a turn and a-quarter it becomes fixed in its position, and all chafing and friction are entirely overcome, and cut or broken wires are prevented from "running back." If in some districts it is considered desirable, the clip may be dispensed with and the binding effected with No. 8 wire. It may also be soldered fast to the line, but the insulator may still be detached and re-attached instantly, without in any way disturbing the binder. When the insulator is screwed in, the line wire is slightly bent, and owing to the weight of the wire or the tensile strain on it, the tendency is continually to straighten the wire, and it is thus kept tight. The porcelain is kept clean and free from the usual coating of rust, partly, the inventor says,



because the iron clip which encircles the insulator is galvanised after it is bent to shape, and partly because of the total absence of friction and "working" of the wires. This insulator is the only one that can be applied in any position whatever, and upon any sized wire, without the use of tools.

Launch at Barrow.—The steamship Esk, built for the Royal Mail Steam Packet Company, was launched from the Barrow Shipbuilding Company's yard on Monday. She is 300ft. long, 30ft. broad, and 24½ft. depth of hold. The Esk is a three-masted schooner, spar decked, classed 100 A at Lloyd's, and is expected to make 13 knots per hour.

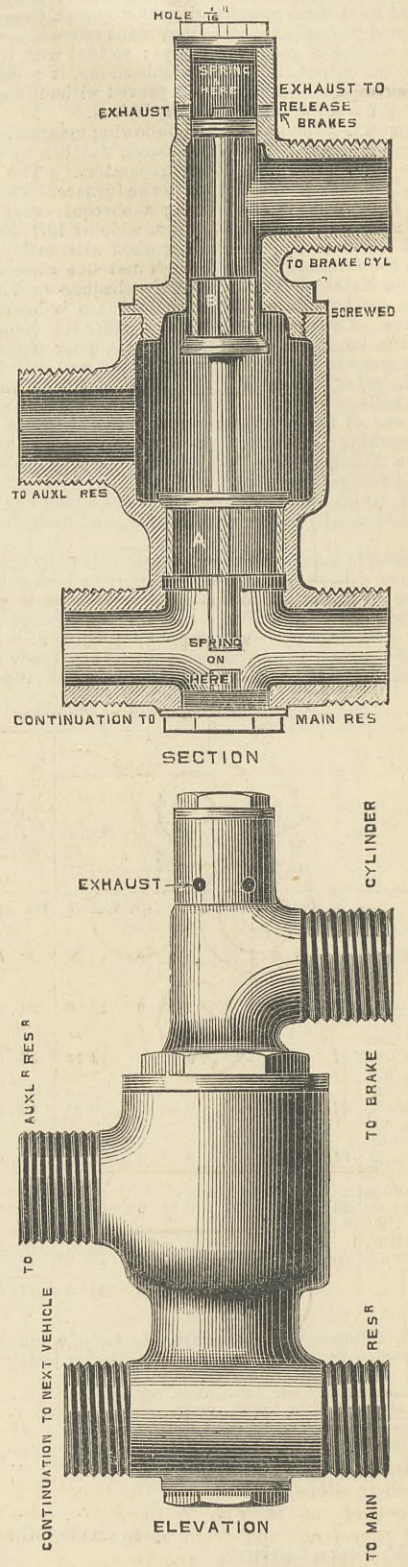
They have a curious way of clearing away wrecks in Ireland. On Monday afternoon an attempt was made to blow up the steamship Silkstone, which had sunk in the Suir opposite Waterford Quay. The force of the explosion was so great that the windows in every house on the quay, the principal street in the city, were smashed to pieces, and goods and articles of furniture dashed about the shops and houses in every direction. So great was the amount of damage done that the shutters were put up in every shop. Nor did the windows in the upper stories escape. Several shop assistants were knocked off their legs. A *Times* correspondent says the principal business concerns of the city have been completely wrecked, but leaves it to be inferred that the "silkstone" remained monolithic.

LETTERS TO THE EDITOR.

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

AUTOMATIC BRAKES.

Sir,—I enclose you a sketch of a triple valve for use with a



continuous air brake on railway trains. If you think it is worthy of mention in The Engineer, I would beg of you to insert it.

F. Harvey Rapley.

53, Holmhead-street, Glasgow,
November 20th.

THE SIEMENS DIRECT PROCESS.

Sir,—In this letter I desire to embody the result of a long practical experience of the working of Siemens' direct process, by making wrought iron direct from the ore, and of making metallic iron for the Spongy Iron and Purifying Company, at Landore and Towcester respectively.

The ore to be smelted is broken up into fragments not exceeding the size of peas or beans, to it is added lime or other fluxing material, in such a proportion that the gangue contained in the ore and flux combines with only a little oxide of iron into fluid slag. A charge, say 20 cwt. of ore, 12 cwt. of roll or hammer scale, together with 6 cwt. of soft free coal well mixed together, is charged into the furnace when fully heated. The coal is charged with the ore; during the first hour very little gas is required, but after this the rotative velocity is increased, together with the heat, for a short time. At this stage a rapid reaction is the result; the peroxide of iron being reduced to magnetic oxide commences to fuse, and at the same time metallic iron is precipitated by each piece of carbon, while the fluxing materials form a fluid slag with the silicious gangue of the ore. The slow rotative action is again resorted to, whereby the mass of iron is turned over and over, presenting continually new surfaces to the heated lining and to the flame within the rotator. As soon as the metal is gathered together a little the slag is tapped, which brings with it sulphur and phosphorus. The velocity at this point is increased to one revolution in five minutes, so as to gather up the loose masses of iron into five or six metallic balls. These are taken and shingled with a steam hammer or squeezers into a bloom, which, when reheated, will roll into a bar similar to an ordinary puddled one. I may say that the balls must be worked as quickly as possible, and then the product will stand as much work as common puddled iron.

With reference to the amount of coal used in the producers, the abstract report shows that I have succeeded in making what Dr. Siemens said could be done in his paper before the Mechanical Engineers in 1873, that is, one ton of iron made to one ton of producer coal used. With the direct process, I would suggest that Siemens' open hearth furnaces are worked in connection with this process, as all the small ore can be utilised and the blooms can be used also to a great advantage and profit. As regards the statement made by Mr. G. W. Maynard, that the blooms are only fit for the open hearth furnace, I must differ, as I have worked the blooms which have been rolled into good merchant bars. The following is the analyses:—Iron, 99·1988; silicon, ·400; carbon, ·150; phosphorus, ·0502; sulphur, trace; manganese, ·201; fracture, good.

A great deal has been said respecting the class of bricks to be used in the lining of these rotative furnaces. Experience has proved that the drum should have a 3½in. best fire brick all round, the ends to have a few bauxite or magnesia bricks just where the balls are mostly wearing. After testing the magnesia bricks made at Landore side by side with the bauxite, I find that the magnesia stand the best. Added to this is an oxide lining of about 2in. in thickness, made with scale and ore. Then I venture to state with proper care and management the rotators can be kept in working order for at least three months without stoppage, then at the end of that period probably the rings may want renewing, which would only cause a delay of about three days; so that with the cost being so low and the output good, as the table shows, it must necessarily be a commercial success. It has been proved without doubt that the chemical results are all that could be desired.

The furnace is arranged in the following manner :—The gas is made in two ordinary Siemens' producers, size 8ft. by 7ft. by 7ft., which are at the back of the regenerators. The gas comes through a fire-brick flue straight into the furnace. There are two chambers filled with bricks forming a checquer-work from top to bottom, size 19ft. 6in. high by 7ft. 6in. wide by 10ft. long. These are called regenerators, and are worked alternately, the waste heat from the furnace passing through first one chamber and then the other for certain periods, making the chequer-work hot; by this means we get hot air, and thus the furnace is heated to a high temperature. The drum or rotator is 10ft. 4in. diameter inside, and 10ft. 4in. long; there are four 1½in. diameter pipes for circulating water front to back, keeping the tubes cool, which have two large bends in for turning over the metal and for dividing it into five or six balls.

This is one of the greatest improvements that has been made since the working of plant at Towcester, as there is no danger now of having a sliding charge. There is also a water cylinder at the back of the furnace, connected with the front by means of the four 1½in. pipes, which serves as a reservoir, for keeping top pipes full of water, and especially for keeping the ring and back end of furnace cool.

The furnace is revolved on four wheels driven by a small pinion working into a large spur wheel, which is in segments, and fixed to furnace by means of brackets. The furnace is carried on a movable carriage for convenience of removing, for repairs, &c. The charge is taken up by elevators and deposited in a tank during the time the furnace is working, and then when ready to charge, a slide is removed, and the furnace is charged in about ten minutes.

Abstract Reports of Rotator at Landore.

Date.	No. of heats.	Charges. Particulars of charge.	Ore.	Coals for reducing.	Scale.	Coals delivered to gas producers.	Product; weight of blooms.
1882.		dys. hrs.	tns.	tns. ct. qr.	tns. ct.	tns. ct.	tns. ct. qr.
May 22nd, 6.30 a.m., to May 27th, 11.30 p.m.	32	5 5	32	9 12 0	19 14	38 0	35 8 2
May 31st, 8.30 a.m., to June 3rd, 1.30 p.m..	20	3 5	20	6 0 0	12 0	24 0	22 4 1
June 5th, 6.30 a.m., to June 10th, 11.30 a.m.	32	5 5	32	9 12 0	19 14	37 0	35 2 2
June 12th, 6.30 a.m., to June 17th, 12.30 p.m.	32	5 6	32	9 12 0	19 14	36 0	34 19 1
June 19th, 6.30 a.m., to June 24th, 12.30 p.m.	31	5 6	31	9 6 0	18 12	34 0	33 3 3
June 26th, 10.30 a.m., to June 29th, 5.30 a.m.	23	3 19	23	6 18 0	13 16	25 0	24 7 0
July 3rd, 9.0 a.m., to July 8th, 8.0 a.m...	30	4 23	30	9 0 0	18 0	33 0	32 0 0
		32 21	200	60 0 0	120 0	227 0	217 5 1

I give the following as an approximate cost of a ton of iron made by this process—that is, by working two rotators jointly :—

	£. s. d.
Small Sommerostro ore, 1 ton, at 8s. per ton	0 8 0
Hammer or roll scale, 12 cwt., at 10s. per ton	0 6 0
Producer coal, 1 ton, at 7s. per ton	0 7 0
Reducing coal, 6 cwt., at 6s. per ton	0 1 9
Repairs and sundries, at 5s. per ton	0 5 0
Wages for labour, at 5s. per ton	0 5 0
Total	£1 12 9

Jas. Davis, Mill Manager.

New Steel Works, Landore,
December, 1882.

THE LEGAL EDUCATIONAL STATUS OF CIVIL ENGINEERS.

Sir,—The subject of defining what should be the education of a civil engineer—or, rather, should there be any legal definition of who is and who is not an engineer—is not a new question; it has been debated for many years, and yet seems as far from a satisfactory settlement as ever. On the one side we have those who see in an examination test the cure of all the evils to which the profession is heir, and on the other side there are numbers who, from either selfishness, apathy, or indifference, treat all proposals for improvement with remarks that what was good enough for them is surely good enough for the newer and yet future members of the profession. The mere establishment of an examination test, or the erection of dozens of technical schools for the training of civil engineers, would be of little or no practical use unless some method be taken to prevent persons from practising as civil engineers who have not been duly qualified.

If all the institutions and societies to which civil engineers attach themselves really desired to get the profession legalised, such an important step could be done, and could be done with more justice to the present practitioners than would be the case when the public wake up and demand that the letters "C.E." shall not be the equal property of the President of the Institution of Civil Engineers and of any village plumber who assumes the title in order to act as engineer and surveyor to some local board. The following principles would form a basis on which such changes might be made :—(A) That all civil engineers who are now *bonâ fide* members of the profession should be placed upon a list as legally qualified civil engineers to practice in the United Kingdom and the Colonies. (B) That after a certain date no person shall be admitted upon such list unless he has produced evidence of having been—(1) a pupil under a legally qualified civil engineer for a period of three years, or has in some other way been made acquainted with such duties; and (2) has passed two professional examinations.

A committee of the various engineering societies should decide who were *bonâ fide* members of the professions, as well as settle the range of the examinations, such a body being nominated by the Act of Parliament which should give force to the proposals. Two professional examinations are mentioned, one to be passed before the termination of pupilage, and those who qualify at it should be deemed legally fit to act as assistants, resident engineers, &c.

Preliminary examination :—(1) Physical science; (2) mechanical science; (3) manufacture of metals, &c.; (4) engineering drawing; (5) calculation of strains; (6) uses and properties of materials; (7) surveying and mensuration. Each candidate ought to qualify in *four* out of these seven subjects.

Final examination :—(1) Physical science; (2) mechanical science; 3) strength and uses of materials; (4) general principles of construction. Each candidate ought to qualify in *two* of these four subjects.

The candidate should then select, according to his previous experience, &c., to be examined either *thoroughly* in *one* or show *marked proficiency* in at least *two* of the following branches of civil engineering :—(*a*) Railway engineering; (*b*) harbour, dock, and sea engineering; (*c*) water supply; (*d*) drainage and sewage disposal; (*e*) road, street, and tramway engineering; (*f*) telegraphic engineering; (*g*) gas and lighting engineering. In the examination in each of these strictly professional subjects credit should be equally divided between—(*a*) Estimates, quantities, and calculations; (*b*) designs, sketches, and specifications; and (*c*) general historical knowledge of the subject.

The subjects for professional examinations have been set forth at some length, the object being to sketch a scheme which would possess sufficient elasticity to meet the requirements of a profession which adds to its duties new branches of construction as fast as scientific men can prove their utility for the public good. O.

Westminster, December 6th.

THE PROGRESS OF ELECTRIC LIGHTING.

Sir,—In these days, when every word written on the electric light is eagerly scanned by your readers, I was surprised to find in the very prominent position it occupied in your last issue such a misleading article as that headed "The Progress of Electric Lighting." You throughout attempt to show that those now directing the operations of the various electric light companies are, one and all of them, treading on very uncertain ground. Such an opinion so forcibly expressed is, I contend, most unfair to these gentlemen, and when I see on what very erroneous opinions you have based your criticism, I feel strongly the necessity of pointing them out.

Throughout the third paragraph of your article you gird at the electricians of the various metropolitan electric light companies because their answers to certain queries put to them by Mr. Stayton as to the cost of lighting the Chelsea district do not harmonise with one another.

Now, may I ask you how you expected that the answers from such systems as the Brush, Jablochkoff, Pilsen, &c.—all of which supply currents of high electro-motive force, and depend largely on arc lighting—could harmonise with those from Siemens, Swan, and others, who use currents of low electro-motive force, and almost entirely depend on incandescent lighting? Do not you see that the difference in the size of the proposed conductors, which to you appears so surprising are inherent to the systems themselves?

Every pupil who attends Messrs. Ayrton and Perry's classes could have told you this much, and that there is no such necessity for "someone to be wrong," as you appear to think. You could also have been informed from the same source that the above-mentioned difference in the electro-motive force of the currents could equally account for the variety of the answers regarding the number of generating stations considered most suitable for the economical working of the district.

Again, your remark "that the Jablochkoff Company is really the only one which has had much practical experience," is of such an invidious character that I cannot allow it to pass unchallenged. We all owe the Jablochkoff system a debt of gratitude for its early efforts in introducing the electric light in a feasible form; but no one in the least degree cognisant of the later developments of electric lighting—which have been almost entirely in the direction of incandescent lighting for indoor use—would have seriously connected the Jablochkoff Company with the subject. The warmest supporters of the Jablochkoff system would not dream of introducing it to any considerable extent as a means of lighting the houses of Chelsea as well as the streets.

One thing is quite certain—someone must have answered Mr. Stayton's queries very intelligibly, as, judging by the figures quoted in the last paragraph of your article, Mr. Stayton has gathered from the mass of information afforded him by the various answers to his well-considered questions, the framework of an estimate which in all probability is as near the mark as anyone could have attained in the present state of our knowledge.

London, December 13th. An Electric Light Engineer.

[If our correspondent had had an opportunity of reading Mr. Stayton's report, it is possible that he would not have found it necessary to write to us as he has done. When his criticisms are analysed, it appears that he takes exception really to but the third paragraph of the article he condemns, and that he regards the last four lines of that paragraph as those which most strongly manifest our ignorance of the entire subject with which we have ventured to deal. These lines run: "Some one must be wrong in this matter of the dimensions of conductors if some one else is right, and we confess that we cannot resist the conviction that Dr. Siemens is in error." Our correspondent holds that the inconsistency in dimensions is explained by the circumstance that the size of the conductor must be determined by the nature of the lamp employed. We agree with him that this fact is known to every pupil who attends Messrs. Ayrton and Perry's school, and we ask him to take our word for it that we have been familiar with this truth perhaps quite as long as he has been himself. If he had read carefully what we have written he would have found that what he has said is quite beside the question. He would have learned, for example, that while the Metropolitan Brush Company and Messrs. Siemens Brothers both propose to use incandescent and arc lamps, the former suggests leads ⅛in. to ¾in. diameter, while Messrs. Siemens Bros. want leads 1in. in diameter. In other words, the latter gentlemen want leads from a little more than two to four times as heavy as the former. We repeat that if the Brush Company is right in this case, Messrs. Siemens are wrong. Furthermore we may point out that what Chelsea wants is electric light. The very circumstance that some firms propose to use arcs and others incandescent lights is a clear proof that unanimity of opinion on the subject of supplying the wants of Chelsea does not exist among electrical engineers. The Jablochkoff Company is no doubt competent to take care of itself without aid from us; but if our correspondent will turn to Mr. Stayton's report he will see that that company actually has the temerity to contemplate lighting private houses with electric candles. No other company has had so extended an experience in street lighting as this; and we may add that no other has on the whole attained a measure of success equal to that shown by the lighting of the Thames Embankment. Our correspondent has not even taken the trouble to read carefully what we have written. We have not said that "the Jablochkoff Company is really the only one that has had much practical experience." Our precise words are: "So far as the report goes it is difficult to resist the conclusion that the Jablochkoff Company is really the only one which has much practical experience, or is in a condition to deal with the question of lighting in a businesslike way." This is a very different statement from that to which our correspondent takes exception.—Ed. E.]

THE INSTITUTE OF PATENT AGENTS.

Sir,—I have read with interest the letters signed "M. Inst. C.E." and "P. A." in your issue of last week. The advisability of forming an Institute of Patent Agents is not, I think, a question which need now be argued. Such an Institute is formed; but the manner of conducting it may fairly and with great advantage be discussed.

I need not here repeat in full the qualifications which are necessary—or rather which are stated to be necessary—to become a Fellow of the Institute. They were stated by the President at the inaugural meeting. Now, Sir, is it or is it not a fact that certain original members do not possess any single one of the three qualifications? I challenge the Council to show that certain members have either (*a*) practised and acquired good repute as a patent agent for five years, (*b*) been engaged for seven years as a pupil or assistant in the business of a Fellow, or (*c*) passed an examination in patent law, &c. I myself do not assert or even insinuate that these gentlemen are not qualified to act as agents, I only say they are not qualified in the opinion of the Council as expressed in their own rules.

Further, is it or is it not a fact that one if not more applications have been made for admission to the Institute, and the applicant curtly refused because he did not come up exactly to one or more of the stated necessary qualifications? Whether the case cited by "P. A." applies to any particular person, or is merely imaginary, I do not know, but I can say that if such a person has an existence I know of another—a competent draughtsman, a competent searcher, and in all respects a most competent and honourable patent agent—who could teach him his business, but who is not in possession of the necessary "qualifications" to admit of his becoming a Fellow of the Institute of Patent Agents. Lex.

Inner Temple, E.C., December 12th.

Sir,—The remarks of your correspondent, "Mem. Inst. M.E.," certainly contain truth. There is no doubt there are many respectable and thoroughly efficient—though not prominent—patent agents, who do not appear to have been asked to join the Institute. I did not see my own agent among the list of Fellows, and on asking him the reason, he told me he had never been invited to join. I know this gentleman to be thoroughly respectable and efficient, and know further that certain Fellows of the Institute are, and have been, very glad of his assistance in many difficult cases. This I merely quote as *one* example. If the Fellowship be a *bonâ fide* guarantee of efficiency, may I ask how many of the gentlemen comprising the Institute are thoroughly acquainted with, say, electricity? Some few I know are, but there are others who would appear to know very little about it—at least perusal of some specifications appears to warrant this.

May I suggest to those of the respectable agents, who have not been invited to join, that they form a Society of Patent Agents for their own protection? There are enough gentlemen of this class—excluding doubtful names—to organise such an institution. The noble Institution of Civil Engineers has not debarred other—and smaller but still useful—societies being organised; such as the Society of Engineers, &c.

Your correspondent, I think, is correct about agents losing caste through not being connected with such an institution.

In conclusion, I hope some of the gentlemen referred to may act on my suggestion. It would have been more judicious had the Institute acted with more impartiality, and not laid themselves open to criticism. Electrician.

London, December 13th.

HYDRAULIC BALANCE LIFTS.

Sir,—I am glad to see the subject of hydraulic balance lifts discussed in your paper; the term is in itself a wide one, and, strictly speaking, will include several descriptions of hydraulic lifts which have little in common with the small passenger lifts under discussion. I was, however, in want of a distinctive title for a new description of direct-acting lift, which I began to use about two years ago, and eventually determined to call it the "Hydraulic Balance Lift." Full descriptions of the original types of these lifts were published by yourself in the abstract of my paper on "Hydraulic Lifts for Passengers and Goods," read at the meeting of the Institution of Mechanical Engineers last January. The name "Hydraulic Balance Lift" appears to have commended itself to many persons as a suitable one, and several forms have since been placed before the public. I do not propose to enter into the merits of the so-called improvements on my invention, as there has been at present, I believe, hardly any experience of lifts of this class except those which have been made by the Hydraulic Engineering Company under my patents. As several of these have been at work for from twelve to eighteen months, I am able to state that they have fully answered their purpose. Improvements in detail have been made from time to time, and further experience will, no doubt, suggest others, but they have proved the most economical lifts with which I have had anything to do, and I speak from an extended experience in this class of machinery. On the other hand, I am not so sure that Mr. Stevens will find that contract prices and cost prices do always fit each other easily; my experience is that a chain-balanced lift is in many cases the less expensive in first cost. There are, however, many who require the best and safest lifts, even if the cost is a little more to begin with, and it is by this class of person that hydraulic balance lifts are likely to be chiefly used. I would refer those of your readers who are interested in the subject to the "Proceedings" of the Institution of Mechanical Engineers, for the main arguments which go to show that the more the use of chains and ropes can be avoided the better, and therefore that a system which does away with them altogether is *primâ facie* to be preferred to any other.

Before I introduced this system it was only very rarely that such lifts were made for passenger use. Almost the only one in London is that at the Civil Service Supply Association in Bedford-street, which was erected by the Hydraulic Engineering Company some years ago. This lift carries nearly 500,000 persons per annum, making 400 to 500 journeys a day. It has never required repair. Compare this with another, that at Palace-chambers, by the same company, doing rather less work. It has a direct-acting ram, but with wire ropes and balance weights. The wire ropes require to be renewed at least every twelve months. The addition of an hydraulic balance to either of these lifts only necessitates having a second shorter ram in motion, and the wear and tear is practically nothing.

As to efficiency, Mr. Stevens states 78 per cent. as that of an ordinary chain-balanced lift. This statement requires explanation, but on the same basis I have found hydraulic balance lifts give as much as 85 per cent.; but Mr. Stevens is probably right as to the efficiency of the balance, as illustrated in your recent issue. My point is that, when properly constructed, there is a real economy in the use of my hydraulic balance lifts as compared with those chain balanced.

I am afraid I am trespassing too much on your space; but I should like to add a few words stating the chief objects I had in view in designing these arrangements. First, I considered the type—the details have since been improved—of lifts as erected at Bedford-street the best and safest conceivable, and wished all passenger lifts to be similar, if possible. Secondly, I was aware of the immense advantages attending the use of high-pressure water for hydraulic power purposes. The scheme of supplying London with public hydraulic power was occupying my attention, and it was important that direct-acting ram lifts worked with high-pressure should not only be safe and handy, but economical in consumption of power. This object has been attained, and as the General Hydraulic Power Company is now carrying out the contemplated works in London, I have no doubt that hydraulic balance lifts will be extensively used and appreciated. Where low-pressure water only is available the hydraulic balance enables something of the effect of a high-pressure supply to be obtained. Thirdly, it is essential that in the case of high lifts the varying weight of the lift ram during motion should be balanced. With a chain balanced lift this object is accomplished without special appliances, but simply by adopting proper proportion of parts. The hydraulic balance, when correctly made in accordance with my specification produces this peculiar effect, and, as in the chain balanced ram lift, it is obtained without any special apparatus, but depends also on proportion.

Mr. Turner, in his letter last week, supposes that no engineer would adopt the hydraulic balance. I can only say that several have already done so, and amongst others Mr. F. W. Webb, the distinguished mechanical engineer of the London and North-Western Railway. But no engineer of experience would advocate any system to the exclusion of all others, and there are numerous cases in which I should myself be content with a chain lift or a wire rope lift. I maintain, however, that the hydraulic balance lift is the safest type yet constructed, and that where life is at stake it is especially to be preferred. E. B. Ellington.

Palace-chambers, Bridge-street, Westminster, Dec. 13th.

RAILWAY MATTERS.

THE plans for the Great Western Railway Company's extension in South Staffordshire exhibit a branch line from Coseley-road Station at Bilston to a point near the Birmingham Canal at Spring Vale Furnaces. This line will cross the London and North-Western Railway.

THE following new lines are passed for working by the French Minister of Public Works: State Railways, Port Boulez and Port de Pilez, 15 kilometres; Northern Company, Lens and Armentières, 12 kilometres; Eastern Company, Châtillon-sur-Seine and Is-sur-Tille, 70 kilometres; and Revgny and Vouziers, 81 killometres.

IT is understood that at a representative meeting of the chief railway companies, to be held in London on January 4th, the subject of the issue of blank consignment notes to traders will be discussed, with a view to a probable reform. Traders in various parts of the kingdom complain that the present practice is liable to much abuse.

A PARLIAMENTARY return just issued shows that there are now in the United Kingdom twenty-six tramways belonging to local authorities, the total length open of which is 150 miles 71 chains, and upon which the total amount expended has been £1,860,742, whilst to tramways belonging to other than local authorities there are 109, with a length of 413 miles 31 chains, and upon which has been expended £6,401,073.

THE plans of the proposed "Midland, Birmingham, Wolverhampton, and Milford Junction Railway" show that the main line will be commenced by a junction with the Shrewsbury and Hereford Railway at Stokeshay, and terminate by joining the Wolverhampton and Walsall branch of the Midland Railway at Willenhall. At Rough Hills the plans show a branch line by a long curve towards Wolverhampton, which comes into the London and North-Western line, and Wolverhampton will be reached by this branch.

THE jury engaged on the inquiry respecting the death of the platelayers killed by the fall of a brick bridge at Bromley having, after hearing the evidence, consulted in private for nearly an hour, expressed their opinion "that the deceased men met with their deaths accidentally, but that there was an error in judgment on the part of those responsible in not seeing that proper steps were taken to support the south arch or otherwise to prevent the sudden falling of the bridge." From the evidence as recorded this want of judgment is not apparent, and the men who were killed were ordered not to go under the arch which fell and killed them.

WE have received a copy of the "Railway Diary and Officials' Directory" for 1883. This diary is well got up, and contains besides the calendar and diary, a list of the directors and officers of the independent lines of railway in the United Kingdom; the weekly traffic returns for 1882, with blank columns for 1883; and an abstract of four half-years' accounts of some of the principal companies; as well as salaries, interest, annuity, wages, and other tables; postal, stock, stamp, City officers, and other information. The diary is arranged with a week on a page, the page being crown 8vo. It is bound in cloth, and is one of the cheapest diaries published. It has one fault. The back has an advertisement upon it instead of the name of the diary and directory as a book.

THE *Weser Zeitung* has recently published an interesting article on the speed of continental trains. It is remarked that the express train from Stendal to Lehrte is as quick as the express train from London to Dover, and claims that for speed on short distances it is therefore proved that Germany is not behind England. The regulations in France and Austria enjoin a maximum speed—on gradients of not more than 5 per 1000—of forty-seven miles an hour. Under exceptional circumstances a speed of fifty-six miles an hour is allowed if the conditions under which it is proposed to run at this speed are such as to make it relatively safe. In Germany a maximum speed of fifty-six miles an hour is recognised, but is not apparently attained by any of the trains whose speed is quoted to illustrate the preceding remarks.

MR. W. GRANTHAM, Q.C., M.P., headed a deputation last week to the directors of the London, Chatham, and Dover Railway Company on the question of the overcrowding of trains. If the directors were unable to increase the number of trains, the deputation asked for an increase in the number of carriages attached to trains between Moorgate-street and Brixton and Snowhill and Peckham between the hours of 7.33 and 9.28 a.m. and 5 to 9.30 p.m. Mr. Forbes, chairman to the company, said it was easier to admit the whole charge than to find a remedy. The company was about to spend a large sum of money in providing a new station, but it would not be ready for two years. Mr. Dresser Rogers contended that the enormous traffic on the line was no answer to the grievance, and application would have to be made to Parliament on the question. In one instance 113 persons travelled in a third-class carriage only intended to hold sixty.

A SERIOUS collision occurred on the main line of the Manchester, Sheffield, and Lincolnshire Railway at Dinting Junction on Monday afternoon. The 4.15 slow passenger train from Manchester for New Holland was standing at Dinting station discharging passengers for Glossop. The rear guard, named Calvert, had just got in the brake van and the train was about to proceed, when he heard two sharp whistles indicating danger. Looking round he saw the Liverpool express coming over the viaduct, which here crosses the Glossop Valley at a height of 75ft. The express was travelling at a rate of about forty miles an hour, and came so suddenly round the curve that it was impossible to avert a collision or even to decrease the speed. Calvert had barely time to jump from his van and run up the embankment before the express dashed into his brake, completely telescoping it and rearing it on end. The force of the collision was such that the carriage next to it, a third class, was also telescoped, and the engine at the other end was dislodged from its shackles and sent spinning down the line. The driver, William Ulyett, of Sheffield, jumped off and escaped unhurt, but the stoker, George Warner, also of Sheffield, who remained on the engine, had his arm injured. Two compartments of the telescoped third-class carriage were completely smashed. They contained three passengers, who were all seriously injured. One man was killed.

MR. J. W. BILLINGHURST, vestry clerk of St. Mildred's, Poultry, writes to the *Times* thus:—"I am requested by the churchwardens of St. Mildred, Poultry, and St. Mary, Colechurch, to draw the attention of the public to two railway schemes which, if carried out, would ruin hundreds of shopkeepers in some of the most important thoroughfares in London. The plans have been deposited with me, as representing the above parishes, and relate to the Mid-Metropolitan Railway—a proposed line from Lancaster-gate, in the West, to Aldgate, by an underground tunnel under the roadways of Oxford-street, Holborn, Newgate-street, Cheapside, the Poultry, Cornhill, and Leadenhall-street. To acquire ground—for which the projectors will not have to pay—no doubt would be satisfactory to them, but can it be possible to estimate what will be the loss to the unfortunate occupiers of shops and other premises in these, perhaps, the most highly-rented streets in London? The traffic would be stopped, or nearly so, for months during the construction of the railway; many shopkeepers must be simply ruined, and, as the law stands, the railway company would not be liable for one penny by way of compensation. This must not be. The project must be strenuously opposed, and speculators who bring forward a scheme, for their own profit, which would be so disastrous to the interests of thousands, must be told at once what resistance they may expect. It is the more important that the matter should be publicly discussed, because very few notices to occupiers—perhaps not any—have been given, and owners of property so seriously menaced are as yet unaware that such a railway is contemplated. These observations apply equally to the other scheme—that of the Waterloo and Charing-cross Electric Railway (Extensions). Parliament last year authorised the construction of a railway from Waterloo to Charing-cross. Notice is now given for extensions east and west."

NOTES AND MEMORANDA.

A CORRESPONDENT in Paris says:—"You are probably not aware that india-rubber is now adulterated with finely pulverised cork. Pulverised cork is worth about 4½d. per lb., while the india-rubber, to which it is added, "floating quality" is worth 9s. per lb. or more.

PROFESSOR O. SILVESTRI, of Catania, has found that the basaltic lava, in the neighbourhood of Etna, contains small geodes filled with crystallised paraffine. The paraffine is in large translucent plates of waxy appearance and yellowish-white colour, with a melting point of 56 deg. It is soluble in ether and in boiling alcohol.

A PATENT has been granted in Germany for a leather lac, consisting of 3 parts of wax and 2 parts of castor oil, as well as colouring matter, added to a filtered solution of 80 parts of shellac in 15 parts of alcohol. The whole is evaporated in a vacuum to the constituency of syrup. This lac is put on the leather with brushes, which are wetted with spirits of wine or colourless spirit lac.

M. DUMAS recommends water saturated with alum for extinguishing fires, its value being supposed to be due to the coating it gives to objects wet with it, which prevents contact with the oxygen of the air, and thus diminishes the rapidity of the combustion. The Minister of the Interior has recommended that the firemen of the French towns be supplied with facilities to use such solutions of alum.

A PAPER was recently read before the Academié des Sciencés on "Electro-chemical Deposits of Various Colours, Produced on Precious Metals for Jewellery," by M. Weil. He presented pieces of gold and silver jewellery, polychromised industrially with oxides of copper, by his processes. The colours resist friction, dry or moist air, air vitiated by sulphuretted hydrogen or coal gas, and light. M. Edm. Becquerel recalled the colorations obtained by his father with oxides of lead and iron.

FOR drilling glass M. Gougy, of Paris, says it is not sufficient to know that spirits of turpentine, or spirits of turpentine with garlic, forms the best lubricant for the drill. The drill must have a certain form. An ordinary drill will often split the glass. A three-cornered saw-file sharpened up to a point like a three-cornered scraper is often recommended, but M. Gougy says the best drill is the three-cornered file sharpened in this way, but with one corner taken off, so that the cross section of the drill near the point is that of a truncated cone, and the point of the drill is a chisel point from ·5 to 1 millimetre in width.

THE Registrar-General's return for the week ending December 2nd shows that the annual rate of mortality in that week in twenty-eight great towns of England and Wales averaged 22·3 per 1000 of their aggregate population, which is estimated at 8,469,571 persons in the middle of this year. The six healthiest places were Bolton, Portsmouth, Leicester, Birkenhead, Bradford, and Derby. In London 2535 births and 1605 deaths were registered. Allowing for increase of population, the births were 76 and the deaths 142 below the average numbers in the corresponding weeks of the last ten years. The annual rate of mortality from all causes, which had been equal to 20·0, 21·1, and 22·5 in the three preceding weeks, declined again to 21·5 last week. During the first nine weeks of the current quarter the death-rate averaged 20·5 per thousand, against 20·7 and 20·8 in the corresponding periods of 1880 and 1881.

A GERMAN chemist named Puscher states that he has met with great success in using glycerine together with glue. While generally, after the drying of the glue, the thing to which it is applied is liable to break, tear, or spring off, if a quantity of glycerine equal to a quarter of the quantity of glue be mixed together, that defect will entirely disappear. Puscher also made use of this glue for lining leather, for making globe frames, and for smoothing parchment and chalk paper. He also used it for polishing, mixing wax with glycerine, and using it as an underground for laying on aniline red colour. The red was found to exceed all colours in which glycerine is not used. The glycerine has also some properties in common with india-rubber, for it will blot out pencil marks from paper, so as to leave no mark whatever. The Boston *Journal of Chemistry* says a paste made of starch, glycerine, and gypsum, will maintain its plasticity and adhesiveness longer than any other cement, and therefore recommends itself for cementing chemical instruments and apparatus used by pharmacists.

STATEMENTS on the melting point of selenium are at variance, for it sometimes becomes soft long before it is really fluid. When melted and allowed to cool very slowly, selenium becomes granular, or crystalline, with a leaden gray to reddish violet colour. In this form it melts at 217 deg. C (423 deg. Fah.) without previously softening. According to Bettendorff and Wüllner, the amorphous selenium begins to soften between 40 deg. and 50 deg. C. (104 deg. to 122 deg. Fah.). Berzelius says it softens when warmed, at 100 deg. C. (212 deg. Fah.) it is semi-fluid, and perfectly liquid at a slightly higher temperature, but on cooling remains soft like sealing wax, so that it may be drawn out in long, elastic, transparent threads. Sacc says that selenium has no definite melting point, for it softens and hardens gradually; that it probably melts at 200 deg. C. (392 deg. Fah.), for at that temperature it ceases to adhere to the bulb of the thermometer. The *Scientific American* says it is completely melted at 250 deg. C. (482 deg. Fah.), and when cooled to 150 deg. C. (302 Fah.) it is entirely solid.

SOME interesting statistics have been communicated to the *Times* by a Berlin correspondent as to the experiment tried this year of establishing summer post and telegraph offices on mountain peaks, and other remote and solitary spots in Germany much visited by tourists. The result has been such as to encourage a repetition of the practice. In all, 103,585 letters and 8064 telegrams were thus forwarded; more than 23,000 of the former alone having been despatched from the Bastei, a lofty precipice in the Saxon Switzerland. From the Wartburg, in Thuringia, 20,000 letters have been sent, and an equal number from the Schneekoppe, in the Giant Mountains, from the Brocken, in the Harz, 16,000, and so on. From the Brocken and the Schneekoppe were sent 1576 and 1279 telegrams respectively. The inventiveness of Dr. Stephan, the Postmaster-General of the Empire, is notorious. Several bodies of officials from St. Martin's-le-Grand have come over to Berlin within the last year or two to study the working of the General Post-office—an institution in which the most captious foreigner could find little to criticise.

AT the last meeting of the Chemical Society, Mr. Toms read a paper "On the Chemistry of Hay and Ensilage." The author has analysed various samples of hay, and contrasted them with analysis of ensilage, *i.e.*, grass buried whilst green in a water-tight pit or "silo," and subjected to pressure. It is well known to chemists that hay-making is not a mere drying of grass, but that a fermentation also takes place, which developes the well-known perfume of hay, and during which the grass loses its green colour. A specimen of good hay dried contained fatty matters, 2·17 per cent.; free acetic acid, 1·89; sugar, 3·42; starch, 12·46; gum and mucilage, 27·25. A specimen of brown hay from the same rick as the last, but from a portion of the stack which had heated, contained fatty matters, 4·26 per cent.; aldehyde, which formed a mirror with ammonia silver nitrate; free acetic acid, 5·38; sugar, 6·94; starch, 3·42; gum and mucilage, 24·77. More than two-thirds of the starch had thus disappeared, and apparently had been converted into sugar, &c. Three specimens of ensilage were analysed: One differed very little from ordinary grass; the second was brown, and smelt strongly of tobacco, it contained more acetic acid and sugar, but less starch; the third specimen represented fodder which had been buried eighteen months—it still contained starch-sugar, but was not acid, but was mouldy. Mr. O'Sullivan did not think that the author had proved the presence of starch in the hay or ensilage, because other substances, such as gum and mucilage, when boiled with dilute sulphuric acid, furnished cupric oxide reducing substances.

MISCELLANEA.

THE American papers received at Cork on Monday night announce the deaths of Samuel Remington, the inventor of the Remington rifle, and of Mr. Henry C. Murphy, president of the trustees of the Great Brooklyn Bridge.

A FEW days since the steamer Polam left London for Galatz with two torpedo boats on her deck constructed by Messrs. Yarrow and Co., for the Roumanian Government, for service on the Danube. These torpedo boats are of the size usually termed second-class, and had a speed on the official trial of sixteen and a-half knots.

A CORRESPONDENT in the *Contract Journal* asks, "How it is our paper makers are compelled to go to America for the best chilled rolls for glazing calenders?" and says, "Neither our English nor Scotch engineers can, or do, produce any as good as the Americans. It appears strange, but it is nevertheless true." We may ask, is this true?

THE following notice to Parliamentary agents has been issued from the Committee Clerks' Office, House of Lords, viz.:—"The Parliamentary Office will be open on Saturday, December 16, from 11 a.m. to 8 p.m., for the reception of Bills to be deposited under Standing Order 32; and the agents are particularly requested to make the deposits as early in the day as possible."

AN automatic electrical appliance for giving notice of the approach of trains, invented by M. Mors, has been successfully tried on the Paris-Lyon-Méditerranée line. It consists of a box filled with mercury placed under the rail at the required distance from a bell; the trepidation, caused by the train passing over it, agitates the mercury, and forms contact with the wire communicating with the bell, thus causing it to ring.

THE North Staffordshire Mining Institute have decided to communicate with other institutes with a view to taking action upon the recent ruling of the Lord Chief Justice in the case of Plant *v.* the Cheadle Valley Colliery Company. In that decision the wording of the Act, that a certificated manager must daily inspect every part of the working of a mine, was interpreted literally, and the North Staffordshire engineers contend that the carrying out of such a regulation is an absolute impossibility.

THE *Ship Canal Gazette*, of which we have received the fourth issue, published by John Heywood, Manchester, shows that a sixteen-page paper may be filled week after week with matter concerning one important industrial scheme. It might be suggested that the *Gazette* could usefully occupy some of its space with more detailed technical and statistical information concerning the canal and its working; but this, perhaps, is to be given hereafter. The issue of the 6th inst. says:—"The event of the week has been the official approval of the ship canal by the Manchester Corporation."

WE are informed that on Saturday, shortly after the Prince of Wales visited the ruins of the fire in the City, Messrs. Forster, Porter and Co. were able to reach their strong room, the entrance to which is secured by a pair of Chubb's massive steel doors. With very little trouble Messrs. Chubb's men opened the doors, and the room was then entered by the directors, who found all the contents uninjured. Several tons of books were quickly removed, and it may be mentioned that though there were safes inside the room, the books which were lying outside the safes were uninjured by fire.

THE extensive railway carriage building works of Messrs. Brown, Marshalls, and Co., Limited, at Salsley, near Birmingham, extending over an area of 10 acres, are now lighted by electricity. The lighting is effected by means of forty Brush arc lights of 2000 nominal candle-power each, driven by one of Fowler's 16 N.H.P. semi-portable engines, the work having been carried out by the Birmingham and Warwickshire Brush Electric Light and Power Company, Limited. The result is very satisfactory, both as regards efficiency and economy. This is believed to be one of the largest, if not the largest installation of arc lights in the Midland counties, and Messrs. Brown, Marshalls, and Co. have concluded a contract with the Birmingham and Warwickshire Company, extending over a considerable number of years, for the maintenance of a supply of light, which though many times more efficient, will compare favourably, as regards cost, with their previous illumination by gas, and, when added to this, the character and quality of the light are taken into consideration, and the general cheerfulness and stimulating effect which an abundant supply of good light has upon workmen, it is apprehended that a positive saving can be shown by the increased amount of work which can be turned out in a given number of hours.

H.M.S. DOLPHIN, the first of two similar vessels built by Messrs. Raylton Dixon and Co., for H.M. Navy, under the superintendence of Mr. J. G. Allen, Admiralty overseer, assisted by Mr. Adam, was recently launched. The chief dimensions are—Displacement, 1000 tons; engines of 750-horse power; armament, two 6in. breech-loading guns, placed in forecastle and poop for chase guns, and two broadside breech-loaders of 5in. bore, one 7-pounder boat gun, and two Gardner guns, which are somewhat similar to the well-known Gatling guns. The vessel is very similar to the Condor, which did such excellent service at the Marabout Forts. She is built on the composite principle, that is, she has iron frames, steel bulkheads and flats, and the shell consists of two thicknesses of teak 3in. each, copper fastened and screw bolted to the frames, stem and keel of English oak, bottom covered with copper up to water line; lining of poop cabins and all the bulwarks are of thin steel plates instead of wood, to prevent splinters; horizontal engines of 750 indicated horse-power are made by Messrs. R. and W. Hawthorn, and will be put on board at Middlesbrough Dock. They were exhibited complete at the recent Tynemouth Exhibition, where they were much admired. This is the seventeenth vessel launched by Messrs. Dixon this year, and H.M.S. Wanderer will be launched in about five weeks. They have now in hand building and to lay down nineteen steamers, mostly of large size, some of them being over 4000 tons.

THE arrangement consisting of a combination of the Robinson cups used for meterological purposes and an electric current acted upon at each revolution of the cups, which was described by Mr. Joseph Thompson at the last Wigan meeting of the Manchester Geological Society, and which he proposes to introduce into mines for the purpose of recording on the surface at any moment the state of the ventilation in the mine, was under discussion at the meeting of the society in Manchester on the 5th inst., and was very favourably commented upon. The chief objection raised was the liability of the mechanism of the cups to be injuriously affected by the dust in the mine; but this Mr. Thompson said he proposed to overcome by enclosing the mechanism in a dust-proof box, which might be made air-tight if required. It was suggested whether governors might not be attached which would indicate any partial stoppage of the air; but Mr. Thompson, whilst admitting the great importance of securing such a means of giving an alarm in case of the ventilation being wrong, said he did not at present see how it could be applied to his arrangement. Mr. C. E. De Rance, of the Geological Survey, at the same meeting read an interesting communication with reference to an important discovery of manganese ore near Abergele, in Denbighshire, occurring in the old red sandstone. The deposit, he explained, occurred in a bed and not in a vein, as in the ordinary way, and reached a thickness of 17ft. of solid ore. The deposit had been opened out by the Abergele Hematite Company, and its existence had previously been so little suspected that the ore had actually been used for paving purposes. He was of opinion that close investigation of similar localities throughout North Wales would lead to the discovery of other deposits of like nature, which would be of great value, considering the present demand for manganese for the manufacture of Bessemer steel by the spiegeleisen process. The source of this ore, he was of opinion, was the basement beds themselves, the metal being concentrated by the percolation of water downwards until arrested by the impermeable floor beneath.

STEAM ENGINE INDICATORS.

(For description see page 448.)

FIG. 28

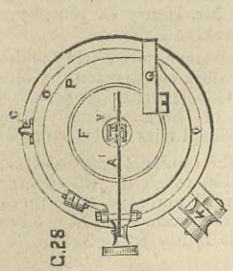


FIG. 29

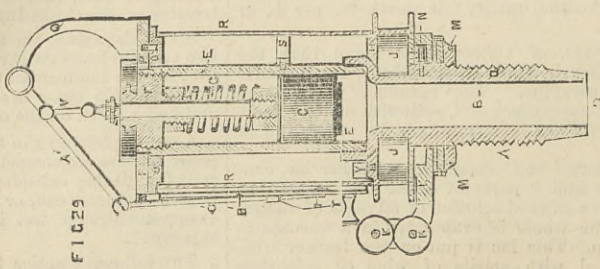


FIG. 19

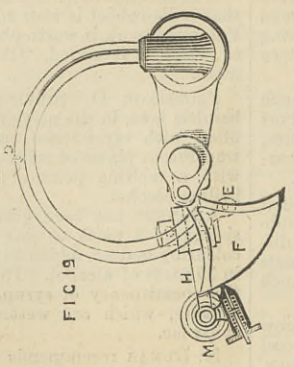


FIG. 20

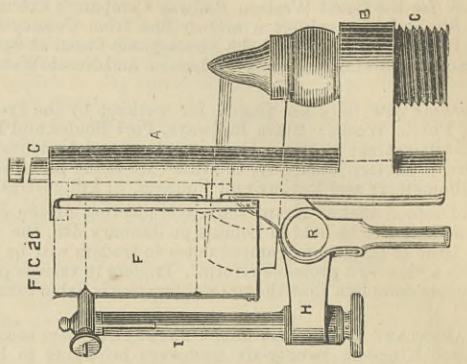


FIG. 13

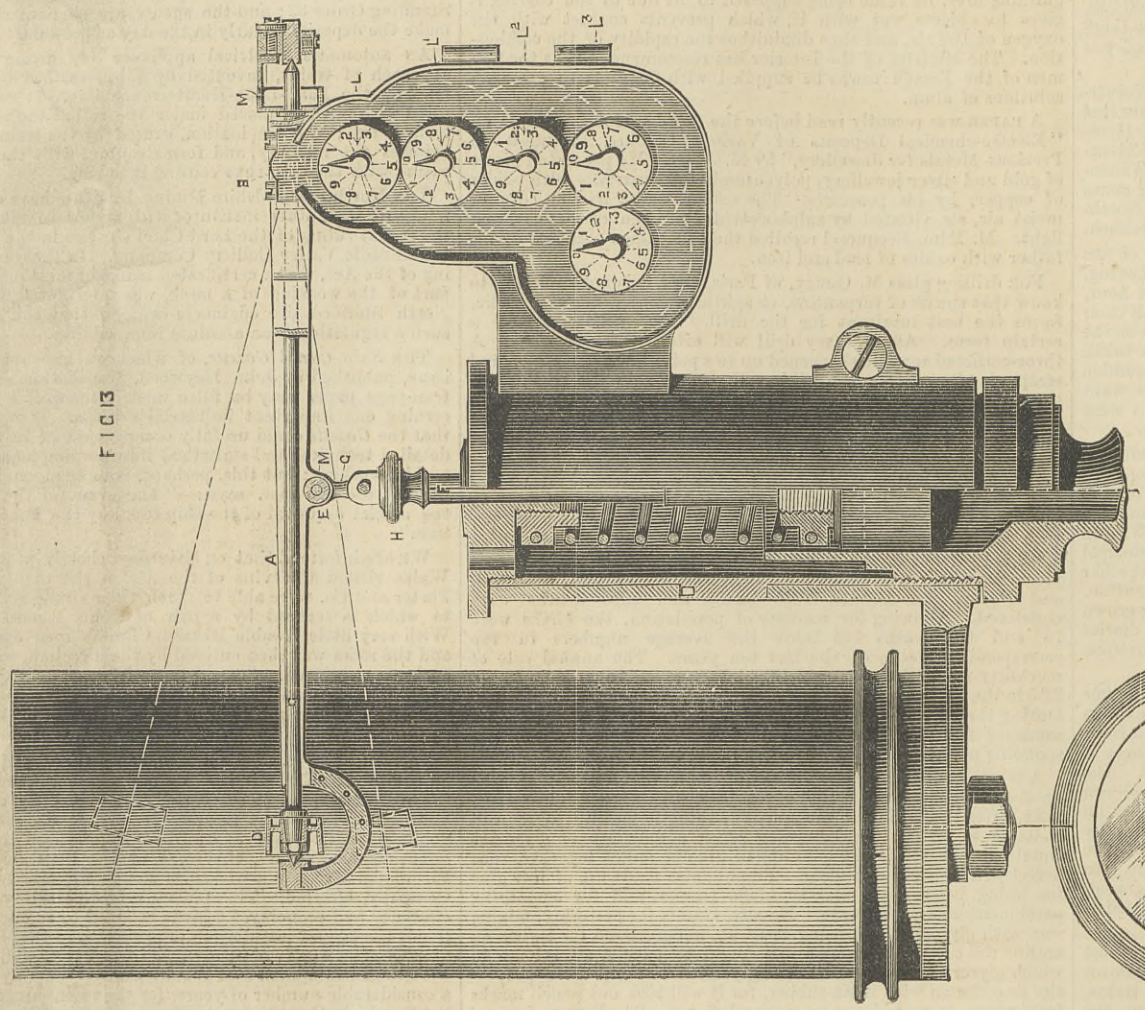


FIG. 14

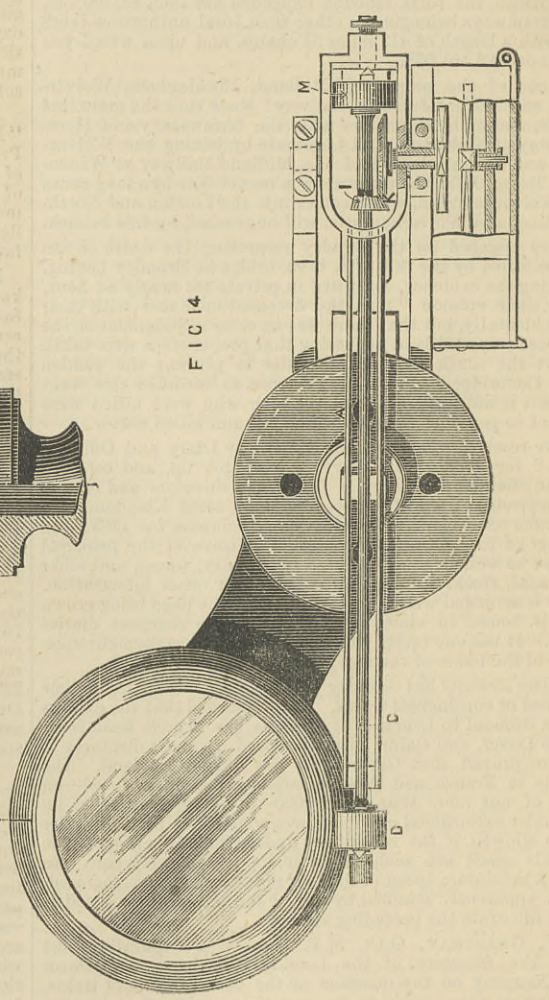


FIG. 23

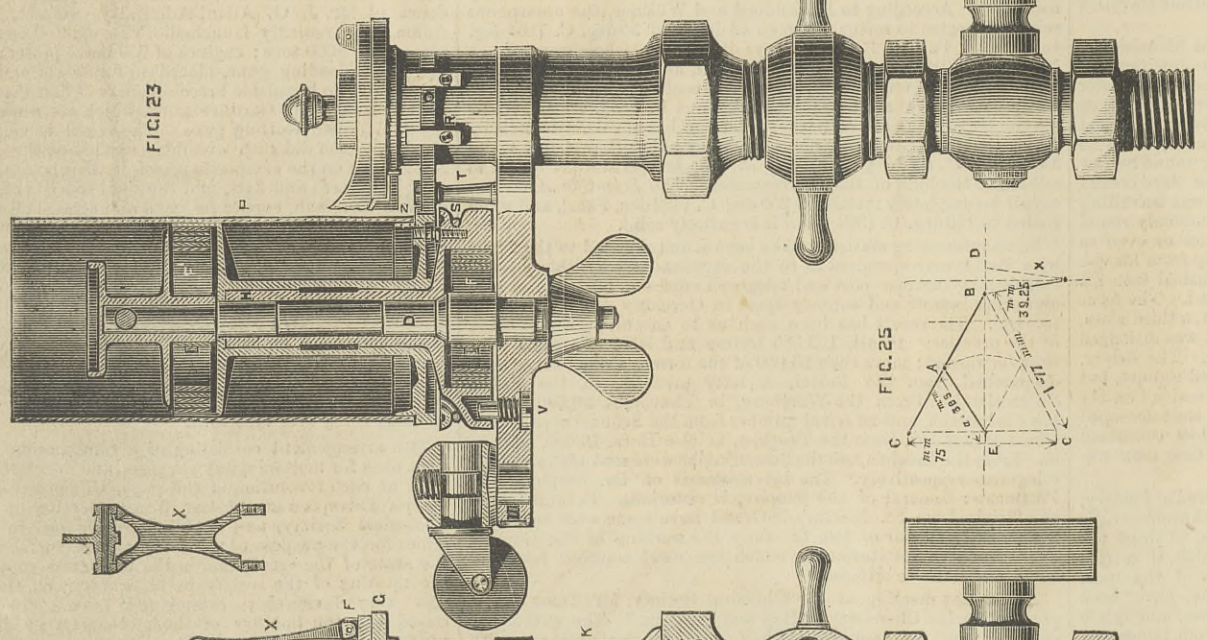


FIG. 25

FIG. 24

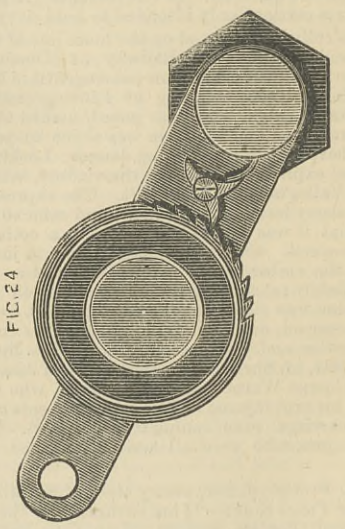


FIG. 21

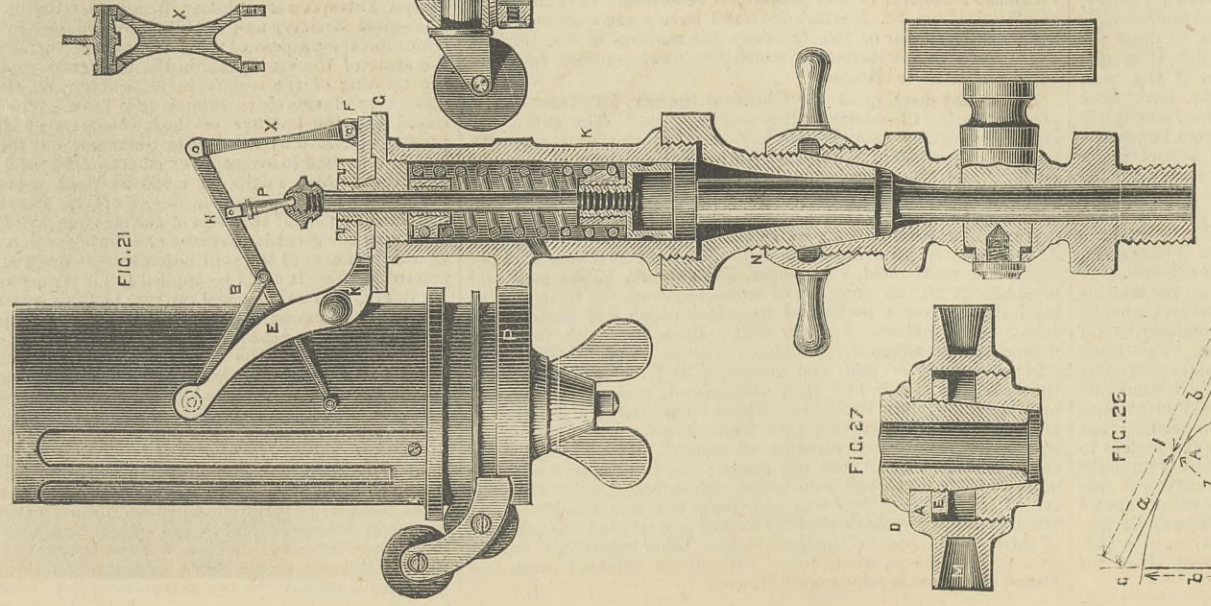


FIG. 27

FIG. 26

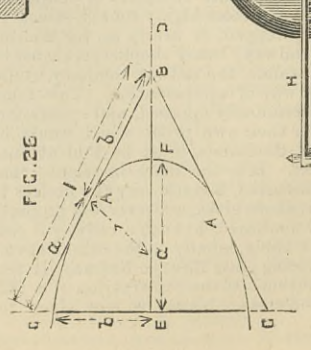
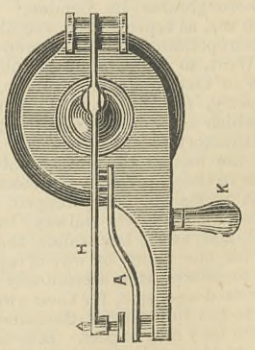


FIG. 22



AMERICAN MOGUL LOCOMOTIVE, NEWFOUNDLAND RAILWAY.

MR JAMES CLEMINSON, M.INST.C.E., WESTMINSTER, ENGINEER.

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*** *With this week's number is issued as a Supplement, an illustration of an American Mogul Locomotive, Newfoundland Railway. 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.*

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

J. O. G.—*Johnson's "Patentee's Manual," Agnew "On the Law of Letters Patent."*

PAPER-MAKER.—*No advantage would be gained by the change you propose. No alteration in gearing can affect the fact that you want to lift a certain number of tons of water a given height in a fixed time. By reducing the weight of water or increasing the time you can diminish the power required, but not otherwise.*

CEMENTING LEATHER TO IRON.

(To the Editor of The Engineer.)

SIR,—I shall be obliged to any of your readers who will tell me how I can permanently secure or cement leather facings to the flat rims of small cast iron friction wheels 6in. diameter by 1½in. face. W. P.
Birmingham, December 13th.

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MEETINGS NEXT WEEK.

THE INSTITUTION OF CIVIL ENGINEERS.—Tuesday, Dec. 19th, at 8 p.m. Annual general meeting of Corporate Members only, to receive the annual report and elect the Council for the ensuing year.

THE METEOROLOGICAL SOCIETY.—Wednesday, Dec. 20th at 7 p.m.: The following papers will be read:—"Popular Weather Prognostics," by the Hon. R. Abercromby, F.M.S., and Mr. W. Marriott, F.M.S. "Report on the Phenological Observations for 1882," by the Rev. T. A. Preston, M.A., F.M.S. Mr. J. S. Dyason, F.M.S., will exhibit (1) a series of typical clouds in monochrome, and (2) a series of sketches of clouds in colour made in June, July, and August, 1882.

CHEMICAL SOCIETY.—Thursday, Dec. 21st, at 8 p.m.: Papers to be read. (1) "On the Condensation Products of Oenanthol," Part II., by Mr. W. H. Perkin, jun., Ph.D. (2) "On the Behaviour of the Nitrogen of Coal during Destructive Distillation, with Observations on the Estimation of Nitrogen in Coal," by Mr. W. Foster. (3) "On the Absorption of Weak Re-agents by Cotton, Silk, and Wool," by Messrs. E. J. Mills, D.Sc., F.R.S., and Jokichi Takamine. (4) "Note on Nitrobenzyl Cyanide and some Derivatives with Diazo Bodies," by Mr. W. H. Perkin, Ph.D., F.R.S.

SOCIETY OF ARTS.—Monday, Dec. 18th, at 8 p.m.: Cantor Lecture, "Dynamo-Electric Machinery," by Professor Sylvanus P. Thompson, D.Sc. Lecture III., "The Dynamo as a Motor." Wednesday, Dec. 20th, at 8 p.m.: Sixth ordinary meeting. "The Utilisation of Waste: A Quarter of a Century's Progress," by Mr. Peter Lund Simmonds.

THE ENGINEER.

DECEMBER 15, 1882.

OBSTACLES IN THE WAY OF ELECTRIC LIGHTING.

IN our last impression we dealt at some length with the report on electric lighting prepared by Mr. Stayton, C.E., for the Chelsea Vestry Board. Mr. Stayton considers in general terms the difficulties which stand in the way of the general adoption of the electric light in Chelsea, and what he has said, and the information on the subject which he publishes, are worth more consideration here than we have yet given them. We have already called attention to his estimate for lighting Chelsea, viz., £375,000. He does not give particulars of the way in which the sum is made up, but we may presume that it is obtained by merely extending the items of his smaller estimate for lighting a portion of the district, namely, £85,000. Of this £25,000 is for conductors, or very nearly three-tenths of the whole. On the same basis the cost of conductors for the whole of Chelsea would amount to £112,500. Whether three-tenths of the entire outlay on an electric light installation is too great a proportion for the conductors we are not prepared to say, but if we read this statement in connection with that made by Dr. Siemens, in his address published in our pages last week, it will be readily understood that the paramount obstacle at present to the extension of electric lighting is the cost of laying it on, so to speak; and this is much greater when incandescent lamps are used than it is when arc lamps are employed. This may not be clear to engineers and others who are not electricians, but the reason why admits of very simple explanation. The capacity of a wire as a conductor of electricity may be said to refer only to the quantity of electricity sent through it. Quantity is measured by Coulombs, a Coulomb being the quantity of electricity equivalent to one Ampère per second. In practice, however, the Coulomb is never used. The time unit is taken as understood. Certain relations exist between the number of Ampères of current that any given wire can conduct and the heating of that wire, and the heating is, so far as is known, only a function of quantity, and has nothing to do with electro-motive force or tension; that is to say, a wire will be heated just as much by transmitting a current, say, of 10 Ampères with an electro-motive force of 5 volts as it would be if the current had an electro-motive force of 200 volts. Much the same thing may be said of a steam pipe. Its temperature is not exalted in the same ratio as the pressure of the steam passing through it. Thus the temperature of 5 lb. steam is 228 deg., while that of steam of 150 lb. is 366 deg. We have a rise in temperature here of but 138 deg.; but it is evident that the pipe is in any given period—as a second or an hour—transmitting thirty times as much power when the high-pressure steam passes through as it is when the low-pressure steam is flowing. In the case of electricity it is desirable, as pointed out by Dr. Siemens, that the current should have a high electro-motive force, because the higher it is the greater, other things being equal, is the amount of work in lighting that any given conductor can perform. The efficiency of a current can be measured in horse-power by multiplying the number of Ampères by the electro-motive force in volts and dividing by 746. Thus let us suppose that the current which a given wire will just bear without undue heating is 45 Ampères. If the electro-motive force of this current be 10 volts, then $\frac{10 \times 45}{746} = 0{\cdot}6$-horse power nearly. If the electro-motive force were augmented to 250 volts we should have $\frac{250 \times 45}{746} = 15$-horse power nearly, the work done by the wire being twenty-five times as much in the latter case as in the former.

Now, unfortunately, the incandescent system does not require a high electro-motive force; indeed, cannot deal with it. About 45 volts is the measure of the current with which incandescent lamps can deal; and if the dynamo sends them a current of higher tension it must be reduced by working the lamps in multiple arc, or other devices known to electricians, such as subdividing the current from a given machine, or winding for quantity rather than intensity, but these devices in practice mean more wire and consequently more outlay. In the case of the arc lamp, however, the matter stands on a different footing. These lamps can deal with and like high tension electricity, and they are always worked in series; that is to say, the current passes successively through a number of them, the quantity remaining the same but its electro-motive force being reduced at each lamp. Consequently the facilities which exist for transmitting electricity over a given conductor for arc lighting are very much greater than is the case when incandescent lamps are used. Furthermore the quantity of light got out of a given current with an arc lamp is larger than can be obtained with incandescent lamps. Thus it may be taken as certain that 1000 candles, real not nominal, can be got with one effective horse-power *expended in the lamp;* but it is well known that not more than at the utmost ten 20-candle incandescent lamps can be run by one horse-power. Measured only in terms of light-giving functions, the arc lamp is at least five times as effective as its rival. But inasmuch as incandescent lamps must be used, it now remains for electricians to devise some method of reducing the cost of conductors, and this appears to be supplied by the secondary battery. Secondary batteries have been regarded chiefly as storage batteries—means by which electricity, and with it light and power, might be carried about from place to place. The anticipations formed concerning what M. Faure's invention would effect in this way have not as yet been realised; but an unannounced use for secondary batteries has turned up. There appears to be little difficulty in using them as regulators. Thus a number of them might be laid down in any given district at what may be termed sub-stations. The engine at a central station would supply these batteries with high tension electricity, 500 volts or more if need be, and they would give out as they were called upon currents of much lower tension, which would be conveyed over short lengths of wire to houses close by. We can do no more here than sketch the general idea involved; for little is known certainly concerning the proper conditions for such working. It remains to be seen, too, whether there will or will not be much loss of efficiency; yet it is clear that if a regulator battery, as we must call it, takes in a current of, say, 100 Ampères with an electro-motive force of 150 volts, and gives out 100 Ampères with an electro-motive force of but 50 volts, a tremendous loss will be incurred. We do not say that any such result is to be feared, but that some loss will take place is certain. Concerning these batteries we may reproduce here what Mr. Stayton's report has to say on the subject. His sixteenth question to the various companies he consulted was—"Does your system include the use of accumulators; if so, of what kind and where are they to be fixed?" The replies ran as follows:—Brush: "Our system includes the use of accumulators of the usual kind, although we are not dependent on them. They would be fixed at each house having the light, or at convenient intervals in or along the lines joining the lamps or with the generators. Details not yet decided." Edison: "We do not recognise the use of accumulators as economical or necessary in the Edison system of distribution." Jablochkoff: "No accumulators necessary." Swan: "We propose to use accumulators as soon as they are fairly in the market. We consider they will be a most useful adjunct, but should be unable to tender for them at the present time." Ferranti and Co.: "No, we consider accumulators unnecessary for a compact district like Chelsea." Pilsen-Joel: "It is advisable in many instances to use accumulators." Siemens: "It might be advisable to use accumulators which would either be fixed in the houses or at the station, or in both."

Even though the conductor difficulty was got over, another obstacle to electric lighting exists which must soon be dealt with, namely, the means of ascertaining how much each householder ought to pay. The equivalent of the gas-meter must be forthcoming; but nothing likely to answer in practice has yet been invented. There are several current meters known to electricians, but they will not answer. We may name, for example, Edison's, concerning which Mr. Stayton says:—"The Edison electro-deposit meter has been devised to measure electricity by means of two zinc plates, which are carefully weighed before being placed in it. To obtain the quantity of electricity used, the plates are taken out and weighed, and the $\frac{1}{870}$th part of the current consumed is thus ascertained. It is obvious that a slight error or defect might prove a gigantic discrepancy in the total, and further, a householder would apparently be unable to check either the daily consumption or the calculations of a company, as under this system the plates are removed from the meter and taken to the office and weighed, new plates being inserted." We have not the least doubt that a good meter can be invented, but the sooner it is done the better. In conclusion we may say that we have called attention to but two of the more prominent obstacles which stand in the way of the extension of the electric light. We cannot avoid alluding to one other which is not of a technical nature—we refer to the reckless system of financing, which has distinguished the operations of but too many companies ostensibly formed to introduce new inventions. But the time cannot now be far distant when sound enterprise will be cleared from the growth of rash speculation which has surrounded and almost choked it. In finance, as in other matters, there is a law of survival of the fittest, and ere long the public will be in a position to form an opinion concerning the enterprises which are and are not likely to survive.

THE INSTITUTION OF CIVIL ENGINEERS.

THE annual meeting of the Institution of Civil Engineers takes place on Tuesday next, when the members will elect the President and Council for the coming year. There are no burning questions to discuss; the designation and rights of Associate-Members seem to have been successfully settled, and the candidates put forward by the present Council as eligible will doubtless be elected with the usual dull decorum. As regards the government of the Institution, the system of making up a "house list" has, on the whole, proved convenient and useful; without it a large number of the members and associates who vote, and who have no intimate knowledge of the leaders of the profession, would find it difficult to choose, and there would be an undesirable tendency to form cliques for the advancement of particular men. But the house list is justifiable only so long as it is fairly representative, affording sufficient range of choice to the members, and to this end it should not be restricted to names preferred by the Council who prepare the list. The right of the voting members to substitute names of their own choosing for those on the list, and that right of voting for a less number than the prescribed fifteen, which in its effect on the election of a favoured candidate is not always appreciated and understood, are the ultimate safeguards of the members' privileges, but the graceful anticipation of any popular wish by widening the field of selection would, if done voluntarily by the Council, really render their own seats at the table more secure. Some plan by which the members of Council should retire by rotation, though eligible on future occasions, is worth consideration.

It is questionable whether the present method of choosing a president is the best that is possible. The list of candidates for the Council may be made up without much difficulty. The nucleus is formed by the names of those in office, and there are always enough eligible men outside the fifteen who hold office who may with propriety be included; but any selection by the Council of one among themselves for the highest honour of all would impose an invidious task which may well be avoided. The present method of escaping this delicate duty, by naming in the house list for the post only the senior vice-president, is open to objection, for now that the custom, introduced when Mr. Bateman was president, seems established, of holding office only for one year instead of for two years as formerly, the succession of new men by mere seniority may be more rapid than the supply of suitable candidates. For, according to this system, every member of Council will hold in turn the post of president, or at any rate have the refusal of it, although it can hardly be doubted that many who are most properly elected to the lesser dignity are not, in the opinion even of those who chose them for the Council, the right men for the President's chair. It may be considered whether it would not be better, instead of presenting one name only, to nominate three, say, the president whose one year of office is expiring, and the two senior vice-presidents; or, as another plan, to nominate no one, but to let the office of President fall to the vice president who receives the greatest number of votes for that office.

At present the Institution stands high in public esteem; at no time were engineers more necessary to the interests of the community; works of magnitude and importance grow in number every year; vast sums of money are invested in enterprises almost entirely on faith in the engineer whose name is appended to a prospectus, and the

President of the Institution for the time being, in that he, by his election to that office has the supposed approval of all his brethren, carries the greatest weight of all. *Noblesse oblige.* One leading characteristic of the English engineer is the permanence and solidity of his works as compared with those of his compeers in newer countries; and a man strong in his position will decline to have his hands forced by eager promoters who desire an undue cheapness, and will even more scrupulously abstain from influencing subscriptions to his own schemes by fallacious estimates of cost. But in the engineering, as in other professions, there are short cuts to fame, and there is no greater enemy to the profession than he who, venturing on hazardous methods, or allowing too narrow a margin of safety in his structures, discredits, by the temporary success of such schemes, the estimates of prudent men. There have been too many failures in recent years by this lowering of the standard of quality; and our English freedom from that paternal supervision and interference of Government engineers which obtains in foreign countries is at stake, for loss of life as well as property are distinctly traceable to faulty design and cheap construction. Members of the Institute should give due weight to such considerations in making their choice. For our own part we should like to see a less rigid adherence to a prescribed order of election. If it be deemed best on the whole that one year rather than two should be the term of office—and good reasons are not wanting why eminent and busy men should prefer the shorter term—at any rate an occasional exception to such a rule would be advantageous; and it is desirable that members in filling up their balloting papers should remember that they may insert the name of any one they please, whether he has held office already or not, who is in other respects eligible according to the simple rules of the Institution.

THE HYDRAULIC POWER OF THE RHONE.

The question of utilising, to a reasonable extent, the hydraulic power of the Rhone at Germany has lately assumed a remarkable development, to which the attention of engineers may well be directed. In its present form the question arose from certain claims put forward by the Canton de Vaud in connection with the floods of the Lake of Geneva. These claims date back to the beginning of the eighteenth century, and have culminated in a lawsuit, brought by the Vaudois Government against that of Geneva before the Federal Tribunal. The Vaudois Government ascribe the increase of floods to works constructed in 1839-42 to obtain hydraulic power for the benefit of the water service of Geneva. The Genevan authorities, on the contrary, maintain that the floods were in no way affected by the works in question, adding that the deepening of the bed of the Rhone, which had been brought about by their construction, would have been a more than sufficient compensation, even if the level of the lake could be effected by any but meteorological causes.

In 1873 the Canton de Vaud obtained a report from M. Legler, engineer to the Linth Canal in Glarus, and Professor Pestalozzi, of Zurich, upon the best means for preventing the floods on the lake, paying, at the same time, due regard to the wants of the hydraulic service of Geneva. Somewhat later the Geneva State Council—or Ministry as we should term it—was offered the Henneberg scheme, so called from one of the principal promoters. By this scheme it was intended, with a view to promoting new industrial enterprises in Geneva, to create a much larger motive force than MM. Legler and Pestalozzi proposed to maintain, and at the same time to diminish the floods. The scheme met with little public support. Its practicability, indeed, was not contested, but it appeared doubtful whether the creation of hydraulic power was sufficient of itself to call into existence new industries. Nevertheless the Council, hoping thereby to conciliate the Vaudois, submitted to the Grand Cantonal Council—or State Parliament—a Bill which should grant the necessary powers to the Henneberg Company. But they did not attain their object. On the one hand they had scarcely presented the Bill when the Canton de Vaud formally opened hostilities; and on the other, the Henneberg Company, finding itself unable to furnish the required guarantees, demanded that the matter should be indefinitely postponed. So the question rested during 1879 and 1880, although the lawsuit continued. In the beginning of 1881, however, M. Henneberg and his friends, backed this time by an important foreign company, again put forward their scheme, and again the Council of the State submitted the question to the Grand Council. The Commission appointed to examine it did not present their report till January, 1882, when, contrary to all expectation, they advised no substantial guarantee to protect the interests of the City of Geneva and of the various manufacturers, and they agreed with the promoters in opposing certain measures which other members of the Assembly wished to see adopted.

Public opinion was averse to seeing the interests of the town sacrificed to those of a foreign company, and began to pronounce loudly against the scheme. Gradually the idea that the concession suggested should be granted to the municipality itself gained ground; and some letters in favour of this idea by M. Merle d'Aubigné, director of the waterworks, and by M. Turrettini, produced so great an effect that the grand council was compelled to adjourn the discussion of the subject till September. At this juncture the municipal elections took place, and resulted in giving a large majority to those who wished the town itself to undertake the scheme, in preference to incurring the onerous conditions with which it was threatened. M. Legler was appointed to report on the question by the new authorities, partly because he was trusted by the Vaudois, and partly because he already possessed much information on the subject. His project, though it differed from the Henneberg scheme, was equally advantageous. The commission appointed to receive it obtained also an opinion from M. Arthur Achard, a well-known engineer of Geneva, which was in its favour. These preliminaries being settled, the municipality decided, on the report of M. Turrettini, member of council, to ask that the concession should be placed in their hands, and to this the Grand Council assented on September 30th. It is hoped that these events will tend to conciliate the Canton de Vaud, as the scheme now in hand will accomplish those changes in the current of the Rhone which they desire, and there seems no reason why they should persist in fighting for that which they may obtain amicably.

So much for the history of the subject, which is very interesting as an illustration of the way in which questions of politics, law, and engineering get mixed up in our complicated state of society, and act and re-act upon each other. The actual engineering problem has now to be considered, as set forth in the reports of M. Legler and M. Achard. The problem may be stated thus:—To utilise at Geneva as much of the hydraulic power existing in the Rhone as is possible without injury to the dwellers on the Lake of Geneva. The original project proposed, with this aim, to work the hydraulic motors for ten hours per day only, impounding the waters in the lake for the rest of the twenty-four whenever there was any fear of a deficiency; and its promoters counted on thus obtaining an average of 7200-horse power. This, however, necessitated the keeping of the mean level of the lake so high as seriously to interfere with the drainage and cultivation of the marshy land along its shores. M. Legler's plan is to keep the motors always at work, unless this should be found undesirable during the winter. He takes as a basis a calculation by which the total discharge from the lake is 99 cb. m. per second when the level is 1·50 m. above datum, and 325 cb. m. when the level is 3 m. above datum. This discharge takes place through two channels, one on each side of the "Island," so well known to all residents or visitors at Geneva. Of these the left-hand branch is that which it is proposed to form into what the report styles "the industrial channel." For this purpose it is to be deepened to 4·50 m. below datum, and widened where necessary to 36 m., so as to make it in all respects equal to the right hand branch. On this will be built, immediately below the present Port de la Coulouvrenière, a large house for the turbines; and below this it will take the form of a wide tail-channel, separated from the other branch by a dyke, extending some 300 m. down the stream. This tail-race will have a fall of 1 in 10,000. At the upper end of the island, below the Pont de la Machine, a weir with movable needles, placed across the right branch, will enable any required part of the discharge to be diverted into the left or industrial channel. Between the lower end of the island and the turbine house will be a longitudinal weir with a number of sluices, by aid of which any water which has entered the industrial channel, but is not required for the turbines, may be diverted laterally into the right hand channel. By properly operating these two weirs, the power delivered to the turbines can be kept perfectly regular, whilst at the same time the variations in the level of the lake are never allowed to exceed the limits which have been found to offer full security to all interests concerned. This regulation is very necessary in view of the sudden variations in discharge. Thus in April and May the discharge is at its minimum 100 cb. m. per second, and the fall at its maximum—2·62 m.—but in June and July, owing of course to the melting of the snows, the discharge attains its maximum of 530 cb. m., and the fall its minimum of 1.30 m. With these arrangements it would be possible to obtain a power of 2700-horse power, working day and night, and 7000-horse power if the work is concentrated on ten hours, as proposed by M. Ritter. The weir with movable needles, which will take the place of the present fixed weir at the Pont de la Machine, will practically be open from June to September, and closed from October to May.

The mode proposed to utilise the power thus afforded is by Jonval turbines of 3·71 m. diameter, having an efficiency of 70 per cent., and giving each a net effect of 63-horse power. For the proposed total of 2700-horse power there would be 30 such turbines, grouped in pairs, each pair occupying a chamber 7·20 m. by 6 m., and geared to a single vertical shaft. Each of these would cost 20,000f., and the cost of the masonry, machinery, &c., which would be required for them, may be taken at 40,000f. per turbine in addition. This gives for 30 turbines, complete with house, &c., 1,800,000f. To this has to be added 200,000f. for dredging below the turbines, and 100,000f. for similar work above; 150,000f. for the weir across the right bank; 180,000f. for the dyke between the right and left branches, above and below the turbine house; and 70,000f. for contingencies. This gives a total of 2,500,000f., or just £100,000, as the first cost for providing 2700-horse power gross, or, say, 1850-horse power net. To this has, of course, to be added the cost of the transmission of this power to the manufactories where it is to be utilised.

It must be remembered that the works here enumerated are much greater than would be required in many situations where turbines might be placed on a river such as the Rhone, and that the exigencies of maintaining the proper levels have prevented the work from being carried out with anything like the maximum of economy. Nevertheless, if we take the interest in first cost as £5000, and add even £10,000 to cover maintenance and renewals and losses, it will appear that the town of Geneva will have acquired a constant service of 1850-horse power at a yearly cost of £15,000. How does this compare with the expense attending the same power if obtained by steam? It is a tolerably well-established rule that one penny per horse-power per hour is a fair allowance to make for the cost of steam power, including interest, depreciation, and all expenses whatever. But 1850-horse power calculated on this basis gives a total of £67,525 per annum; and however much we allow for the disadvantage of the water-power in going day and night—which disadvantage may be removed if necessary—it still follows that the saving on the side of water-power is much over 50 per cent. From this point of view it certainly seems little less than a national disgrace that while we are burning up our inheritance in coal at so reckless a rate, the water-power of our rivers, which costs us nothing, is almost wholly running to waste; and especially should this be taken to heart by those who are interested in the welfare of Ireland, remembering that there, if coal is dear, water is of all things cheap. Is it too much to hope that the enterprise thus thrust, so to speak, on the town of Geneva, may awaken other cities and other countries to consider the wealth of power which they are systematically neglecting?

ALUMINIUM.

No metal nor any commodities of metal manufactured in and around Birmingham is at the present time in so active request as aluminium and its various alloys, produced by the Aluminium Crown Metal Works Company, Hollywood. The works have been built some five years, yet the invention has been perfected only about a year and a-half, and it was but recently that the goods were placed upon the market. Already, however, the demand is so freely expressed that one-twentieth part of the orders that have accumulated on the books cannot be executed. The author and patentee of the invention which this company is working out is Mr. James Webster, a retired engineer and metal manufacturer of Birmingham, who is the founder and the chief proprietor of the concern. He has spent upon the works and apparatus some £30,000, and in securing patents a further £2000 or £3000. Hollywood, in the midst of the agriculture of Warwickshire and away from the railway, is now the only place in the kingdom where ordinary aluminium is manufactured. Former attempts in this country are believed to have involved an unproductive aggregate outlay of between one and two million sterling, and France had become the main source of supply. So great a revolution has been effected in the manufacture that instead of resorting to precipitation, which means the production in nine months of a ton of aluminium at a cost of £1000, Mr. Webster, by the employment first of calcining furnaces for treating ground aluminium and pitch, and subsequently of vertical retorts having steam and air forced through them, produces a ton of aluminium in a week at a cost of £100. Indeed, it is claimed that there is not only a saving of nine-tenths in the cost, but also a gain of 19 per cent. of aluminium over the method of precipitation, and an analysis made by Mr. Jones, the borough analyst of Wolverhampton, would seem to support that claim. The metal need not now be confined to the manufacture of musical and mathematical instruments, watch chains, bushings for machinery, and the like, but can be used for purposes within a very wide range. Messrs. Webster and Co. claim that their aluminium bronze, which is a combination of aluminium and tin, nickel and copper, has greater power of resistance than the best gun-metal, and that it is very much lighter. The tensile strength of the bronze is set down at 42 tons to the square inch against the 28 tons resisting power of gun-metal. The lowest resistance recorded for this bronze is 36 tons. Samples of wire made from the bronze have been sent to London and Glasgow for telegraph coils, and they are being used for electric telegraph purposes in some parts of London. Mr. Webster has also succeeded in accomplishing the very difficult operation of uniting aluminium with other metals by a welding or soldering process. For the making of aluminium jewellery the demand is so great that the company assert that they "cannot supply one-hundredth part of the requirements." Six times their present out-turn of the crude metal will soon, however, be effected at Hollywood, for six new retorts are now in course of erection. Numerous applications are reaching the patentees from manufacturers at home, who desire to use the patents; and from America and the European Continent heavy sums are tendered for the sole right to manufacture. A French syndicate offered over a quarter of a million sterling for the patent for France; for the right to make in the United States the offer from France was exceeded. Belgians and Germans are hardly less enthusiastic in their wish to possess exclusive rights in their countries respectively.

WELL-DECKED AND FLUSH-DECKED VESSELS.

At the north-eastern ports the capacities and comparative safety of well-decked and flush-decked vessels are being keenly criticised—the recent loss of one of the former class having revived an old controversy. Judging by the test of experience, the advocates of the well-decked vessels do not seem to lose in the dispute, but one point seems to be forgotten in it. It is the contention of the advocates of the well deck, or what may be, perhaps, better called the single-deck type of cargo vessel, that they are safer in a storm than the other, especially when the cargo is grain or other cargo in bulk. On the other hand, the advocates of the flush-deck type remark that the well is a source of danger, as it may be filled with water by a sea, and the additional burden may be disastrous. But it is overlooked that in the records of loss we have little or no indication of the type of build of the vessel, and, indeed, the whole system of the reporting of loss of vessels, and the inquiry thereinto, is loose in the highest degree. It will be well if we turn from what can scarcely be settled by any *ex cathedra* pronunciation of newspaper critics, and look to the machinery by which we have our maritime losses recorded and investigated. The reports that are made from time to time by the courts of inquiry figure at the period in the newspapers, but there is little or no after attempt to analyse them, to point out the causes of loss, or the types of vessel lost, and there is a still greater defection in the fact that the losses of vessels with all the crew are simply given up as mysteries that cannot be fathomed, which would yield no result to the investigator. One thing that is needed is that we should have a list kept up from time to time of all the vessels removed from the registry, the causes of removal, and where from loss, of the type of vessel, cargo, and other allied facts. It is experience that must ultimately decide all such controversies, but we have not as yet the adequate attempt to record that experience in a way that will show it to those who are interested in it. During the past two years there has been an anxious dependence upon Parliament for some methods of determining the load line controversy, but no such decision has yet been given, and it is questionable whether it would not be well for the great vessel insurance societies to take up the allied question, and to give us from their associated records facts as to the actual results of the working and loss of the various types of vessels.

THE COAL TRADE OF ITALY.

Complaints have been published in the German press that the high tariffs current on the Italian railways, connected with the St. Gothard tunnel, have prevented the German coal-mining industry from gaining all the advantages which were expected from the completion of that important engineering work. The distance from Chiasso to Milan is only about 32½ miles, and the charge for coal over this small length of railway is 3s. 9d. per ton. The rates levied on the Italian lines are described as being double those of the Swiss railways. It would, however, seem that the Italian authorities are awakening to a sense of the importance of a cheap and abundant supply of coal to the various industries of the country. The leading mine owners of Westphalia lately asked the permission of the Milan Chamber of Commerce to arrange an exhibition of Westphalian mining products at Milan,

in order that Italian consumers might become more familiar with the qualities of German coal. The success of a like experiment at Hamburg in 1878 was an example of a nature to encourage such a step. On that occasion the prejudice which existed against German coal was completely destroyed. The Milan authorities fell in with the idea, but have rather extended its scope, and have, it is said, determined upon holding an International Coal Exhibition. It is hardly expected that the needful arrangements can be completed at an earlier period than the autumn of 1883. The German press speaks hopefully of the capacity which the mines of Westphalia and the Saarbrück district possess to compete successfully with the products of the English coal mining industry on this neutral ground.

MINERS' WAGES.

MESSRS. PICKARD AND FRITH, the Union officials at Barnsley, are not alarmed by the threatened reduction of miners' wages, and are not only continuing to advocate the restriction of the output, but are determined to agitate for a further advance of ten per cent. This is a brave policy, and Mr. Pickard takes it on ground which concerns both the coalowner and the collier. He believes that if the coal-getter is paid more money in wages, the coalowner is bound to get more money for his coal. In this way he regards his action as benefitting the colliery proprietor quite as much as the collier; and there is no doubt he has imbued the great body of the mining population with his views on that score. Railway companies have long had their "hards" or locomotive fuel far too cheap, and as they consume the bulk of the hard coal, it is obvious that the first thing the coalowners have to do is to renew no arrangements with the railway companies except on remunerative terms. Manufacturing coal has also been too cheap, and latterly it has been scarce. These considerations have caused coalowners to be firm in requiring better terms from the large consumers of locomotive and manufacturing coal, for it should be remembered that the output of house coal is only one-fifth of the whole quantity raised in the country. The only point clear at present is that there is trouble ahead in the coal industry of this country.

AUSTRALIAN ARTILLERY EXPERIMENTS.

THE Governments of Victoria and New South Wales have purchased a 6in. compound plate from Messrs. Cammell and Co. They have also ordered some of Palliser's new ribbed and jacketted shot. The plate and the shot are ready, and the two Governments have applied to the Secretary of State for the Colonies to obtain permission to use the 80-pounder Palliser gun at Shoeburyness, and to have the experiments carried out under the Ordnance Committee. It appears that fifty Palliser 80-pounder shell guns—converted 68-pounders—are mounted on the sea faces at Melbourne and Sydney. The colonial authorities have now determined to try them with shot, with the view of testing the possibility of penetrating such armour as may be carried by an enemy's cruiser visiting Australian waters. On the ramparts of Quebec are similar Palliser guns, but lighter, from which have been fired 115 lb. shot and 80 lb. shells with 37½ lb. and 27½ lb. charges of R.L.G. powder, so that there is abundance of strength for heavier tests than those in contemplation even with this class of powder, and the pressure may admit of considerable reduction or the velocity of the shot may be increased when slower powder is adopted.

LITERATURE.

Measures, Weights, and Moneys of all Nations, and an Analysis of the Christian, Hebrew, and Mahometan Calendars. By W. S. B. WOOLHOUSE, F.R.A.S. Sixth edition. London: Crosby Lockwood and Co.

THIS is a new edition of a well-known volume in Weale's series. It has been revised, and received some additions, and is a useful volume. It is a pity, however, that it does not give any of the Birmingham or other standard wire and sheet gauges, and as a book of reference its value might be much increased if it had a good index.

BOOKS RECEIVED.

Electric Light Arithmetic. By R. E. Day, M.A. London: Macmillan and Co.

Minutes of Proceedings of the Institution of Civil Engineers. Vol. lxx. Edited by James Forrest, secretary. London: The Institution. 1882.

Stationary Engine Driving; a Practical Manual for Engineers in Charge of Stationary Engines. By Michael Reynolds. Second edition. London: Crosby Lockwood and Co. 1882.

Transactions of the Sanitary Institute of Great Britain. Vol. iii. 1881-2. Edited by H. C. Burdett, F.L.S., and F. S. B. F. de Chaumont, M.D. London: Ed. Stanford. 1882.

Police and Fire. Journal of Public Safety. A Weekly Record of Police Administration, Fire Prevention and Extinction, Insurance, and Ambulance Work. Conducted by Jenkin Ingram. Vol. ii. June, 1881, to May, 1882. London: Bookseller's-row. 1882.

Cutting Tools Worked by Hand and Machine. By R. H. Smith, Professor of Engineering, Mason Science College. London: Cassell, Petter, and Galpin. 1882.

The Mechanical Engineering of Collieries. By C. M. Percy, M.I.M.E., &c. Vol. i. London: The *Colliery Guardian* Office. 1882.

Des Ingenieurs Taschenbuch. Herausgegeben von den Verein "Huette." Zwoelfte Auflage. Berlin: Verlag von Ernst und Korn. 1883.

Comparative Commercial Values of Gas Coal and Cannel. By D. A. Graham. London: E. and F. N. Spon. 1882.

Professional Papers on Indian Engineering. Second series. No. 43, Vol. xi. Edited by Lieut.-Col. A. M. Brandreth, R.E. Roorkee College. June, 1882.

Professional Papers on Indian Engineering. October, 1882. No. 1, Vol. i. Roorkee: The College. 1882.

William Hedeley, the Inventor of Railway Locomotion on the Present Principle. Newcastle-on-Tyne: J. M. Carr. 1882.

Les Arsenaux de la Marine. Par M. Gongeard. Paris: Berger Levumlt et Cie.

Institute of Actuaries' Text Book of the Principles of Interest, Life Annuities, and Assurances. Part I. By William Suttin, M.A. London: C. and E. Layton. 1882.

Gold: Its Occurrence and Extraction. By Alfred G. Lock. London: E. and F. N. Spon. 1882.

The Engineer and Building Trades Almanack and Artizans' Hand-book for 1883. Manchester: A. Heywood and Son; and London: Simpkin, Marshall and Co.

Repertorium der Journal Literatur der Eisenbahn Technik. Herausgegeben von Franz Woaz, Regierungs-Baumeister. I. Jahre 1880-1881. Berlin: Julius Springer. 1882.

Some Account of My Life and Writings; an Autobiography by the Late Sir Archibald Allison, Bart., D.C.L. Edited by his daughter-in-law, Lady Allison. London: W. Blackwood and Sons. 1883.

Nautisch-technisches Woerterbuch der Marine. Von P. E. Dabovich. Erster Band; Dreizehnte Lieferung. Pola: Wilhelm Schmidt. 1882.

THE CRYSTAL PALACE GAS AND ELECTRICAL EXHIBITION.

No. I.

THE Electrical Exhibition at the Crystal Palace last winter was a great success, and the directors of the Crystal Palace Company determined to repeat that success this winter if possible. It very soon became evident that the electricians would not supply enough material for the required purpose, and it was therefore determined that the rival light—gas—would also have an opportunity of showing what it could do. The exhibition was to have been opened long ago; but delay succeeded delay, and it was not until Wednesday, the 13th inst., that the exhibition was formally opened by the Lord Mayor. We regret to say that the exhibition cannot for a moment be compared with its predecessor. What it may become further on we cannot pretend to say; but the number of exhibitors is very small, and on Wednesday very few of them were ready to make any display. In fact, the exhibition, such as it is, was to the last degree incomplete, as far as those who professed to give light were concerned. Our notice of the exhibition must, therefore, be brief and incomplete.

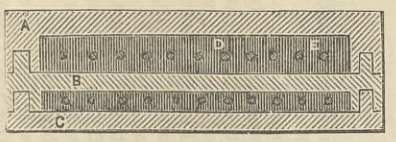
We may say at once that electricity is hardly represented at all. There is one semi-portable and one portable engine in the large shed at the tropical end of the building, which last winter held Messrs. Robey and Co.'s engines. These two have been retained apparently to work a set of arc lamps of the Fyffe-Main pattern, shown by the Light Corporation, London, S.E. Messrs. Strode show a good collection of gas fittings and lamps, and they have three arc lamps, McKenzie's patent, hanging on a wire line across the intersection of the nave with the transept. The Duplex Electric Light Company is fitting up the Roman Court, and will, so far as we can see, have the most attractive exhibit in the Palace; but its arrangements are not nearly complete. At present no other firms are exhibiting the electric light in action.

The north nave is given up to electricity, and the south nave to gas. We can dismiss this latter very quickly by stating that while there are several stands, hardly one of them is in a condition to be seen. Up to the last moment the carpenter and the gas-fitter were hard at work, and they will not complete operations for a week or two at least. The most prominent exhibits are those of Messrs. Sugg and Bray, who are lighting the south nave on systems closely resembling each other, a description of which we must, as a matter of course, reserve. Another prominent object is a huge buoy, fitted up on Pintsch's system, to give a light for about six weeks without refilling, and the end of a railway carriage fitted with apparatus to give light for forty hours continuously. We have so fully described Mr. Pintsch's apparatus that it is unnecessary to say more concerning it just now. That part of the building in which the engines of Messrs. Gwynne and Messrs. Crossley stood last winter is now being fitted up with all kinds of gas stoves and apparatus for cooking by gas, but the packing cases are not yet all opened.

Returning to the north nave, we find many cases and stands complete and worth notice. The Electric Lighting Supply and Fitting Company shows several well-made switches and safety cut-outs; one of these last deserves notice. When lead wire or foil is used for this purpose it sometimes ignites, instead of melting, and flashes up. The cut-out shown consists of a strip of foil clipped between two mica plates. This company, we notice, recommends for use the Franklin-Burgin machine, which is said to be an improvement on the ordinary Burgin; the only difference we have found is that the original machine lies flat and the Franklin stands on end.

Messrs. Dent, of the Strand, show a non-magnetisible lever watch, going, resting on the poles of a large permanent magnet. They also show a well-made relay and some other apparatus worth notice.

Mr. Meyer, of Exchange-buildings, Liverpool, shows his method of laying wires underground. They are put between two tiles and the space filled up with asphalte or pitch, as shown in the accompanying sketch, which is a cross section of a flat tile main, as we suppose we may call it. A B C are hard glazed tiles about 12in. square. At D are shown the ends of the wires, while E is the asphalte or pitch run in. It will be seen that by using tiles of the shape B any number of stories, so to speak, may be built up. Close to this stand were shown a number of full-sized models in wood of a hollow kerb to be made of cast iron, to hold wires; but we were unable to find the name of the exhibitor.



The Electric Light Carbon Company shows a case of well-made carbons for arc lamps, from 5 to 20 millimetres in diameter. We cannot say whether these are good or not, but they are well finished. The want of satisfactory carbons has done much to push the incandescent lamp into favour, and to retard the use of the arc lamp.

At the stand of Messrs. Jonas and Colyer, of Sheffield, will be found specimens of steel bars specially manufactured with which to make magnets. We commend these specimens to the attention of every one interested in steel. The character of the fracture is very unlike that of any other steel with which we are acquainted. The grain is so extremely fine that it gives no idea of crystalline texture, unless very minutely examined, and the homogeneous character of the metal is remarkable.

Messrs. Doulton show a good deal of pottery of some interest to electricians, such, for example, as D retorts for heating carbons in, accumulator battery cells, and such like.

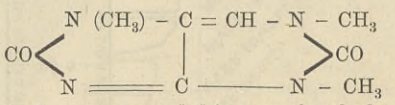
Messrs. Johnson, of Oxford-street, have a stand in this portion of the building, in which will be found some curious specimens of mica and mica lamp chimneys, which at first sight cannot be distinguished from glass. These are said to be unbreakable and indestructible. They are extremely transparent and well made.

Messrs. Legrand and Sutcliff, of Bunhill-row, show telegraph posts and the means of driving them, closely resembling that adopted in putting down their well-known tube wells.

We have now said all that admits of being said at present concerning a very inadequate exhibition. We hope that before we return to the subject more space will have been taken by additional exhibitors, and that gas lighting, at all events, will be fully represented.

THE SYNTHESIS OF THEOBROMINE AND COFFEINE—(CAFFEINE).

WE recently had occasion to direct attention to some important syntheses which have of late been accomplished, especially those of tyrosine and uric acid. Two more instances have now been made known. Theobromine, the crystalline body present in cacao beans, and first recognised by Woskresensky in 1841, and caffeine, first met with by Runge in 1820, and afterwards found in tea and termed theine, but which has since been shown to be identical with caffeine, are the two bodies which the chemist has now succeeded in producing artificially. Mr. Emil Fischer has for a long time busied himself with the investigation of the constitution of the caffeine contained in coffee and tea, and a short time since he arrived at a structural formula for this base, which he found to be:



He it is who has now succeeded in preparing the base artificially. He has not, it is true, succeeded as yet in preparing it from the elements composing it, but from a body of quite other origin, a substance present in urine, in meat, in the muscular part, that is to say, and in guano, to wit xanthine. The three bodies xanthine $C_5H_4N_4O_2$, theobromine $C_7H_8N_4O_2$ (the alkaloid present in cacao), and caffeine $C_8H_{10}N_4O_2$, are closely related to each other in point of constitution. The last two differ in formula by CH_2, and the first and second by C_2H_4 or $2 \times CH_2$; and it has been shown by Strecker that theobromine and caffeine can be converted the one into the other by taking an atom of hydrogen out of theobromine and inserting in its place the methyl group CH_3. He brought about this change by treating argentic theobromine with methyl iodide in accordance with the equation :—

$$\underset{\text{Argentic theobromine.}}{C_7H_7AgN_4O_2} + \underset{\text{Methyl iodide.}}{CH_3I} = \underset{\text{Argentic iodide.}}{AgI} + \underset{\text{Caffeine.}}{C_8H_{10}N_4O_2}$$

In a similar way Strecker tried in vain to obtain theobromine from argentic xanthine. It was reserved for Fischer to be more lucky, by treating the lead salt of xanthine in place of the silver salt with methyl iodide, to produce theobromine, as shown below:

$$\underset{\text{Plumbic xanthine.}}{C_5H_2N_4O_2Pb} + 2CH_3I = \underset{\substack{\text{Plumbic}\\\text{iodide.}}}{PbI_2} + \underset{\text{Theobromine.}}{C_7H_8N_4O_2}$$

The theobromine, thus artificially obtained, is in every respect identical with that of the natural alkaloid of the cacao bean. When converted into its silver salt and treated with methyl iodide it is changed into caffeine, and thus the characteristic alkaloids of cacao, of coffee, and of tea, had now been artificially prepared out of guano.

TENDERS.

TADCASTER BREWERY.

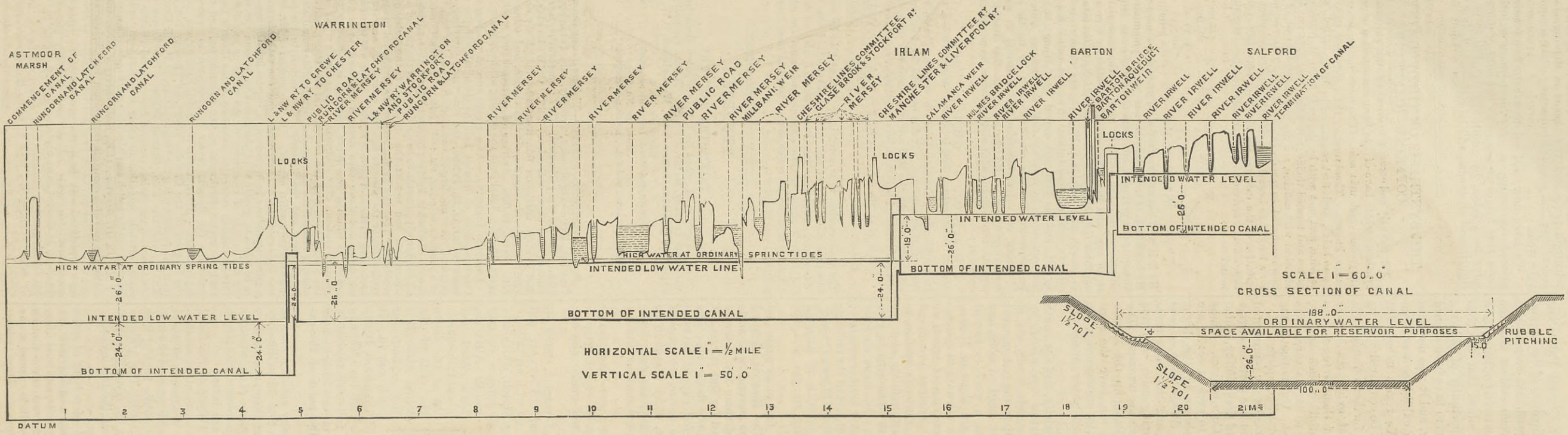
FOR extension of plant in the brewhouse department at the Tadcaster Brewery, for Mr. J. Smith. Messrs. Scamell and Colyer, engineers, 18, Great George-street, Westminster, S.W.

	£	s.	d.
CONTRACT No. 4.			
Messrs. Pontifex and Wood, London—accepted ..	1993	0	0
CONTRACT No. 5.			
Messrs. Ramsden and Sons, London—accepted ..	257	0	0

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending Dec. 9th, 1882 :—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 7877; mercantile marine, Indian section, and other collections, 2312. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. till 4 p.m., Museum, 1258; mercantile marine, Indian section, and other collections, 179. Total, 11,626. Average of corresponding week in former years, 12,167. Total from the opening of the Museum, 21,515,072.

ELECTRIC LIGHTING.—At a recent special meeting of the City Commissioners of Sewers held at Guildhall for the dispatch of business, Mr. G. M. Felton, the chairman, presiding, Mr. Moore proposed the rescinding of two resolutions which had been passed at a previous meeting, viz. :—"That while the Commission is in favour of electric lighting in the abstract, it is advisable to allow all further experiments to be conducted at the risk of the lighting companies, and not at the expense of the ratepayers;" and, secondly, "That the Remembrancer be instructed to appear on the application of the electric lighting companies, and secure clauses protecting public and private rights." This was carried by a small majority, and there then arose a discussion as to the standing orders, by which a two-thirds majority is necessary to revoke a previous motion. The chairman, being at issue with the officers of the Commission and the majority of the Court, had at the last meeting vacated the chair; subsequeutly after consultation with the Lord Mayor and the Recorder, he returned to his position and declared the motion carried. On the motion of Mr. Stoneham it was then resolved, "That, considering the vast interests at stake, a select committee be appointed to inquire into the necessary steps to be taken to enable the Commission to become the undertakers for the supply of electricity to the whole or any district of the City of London under the provisions of the Electric Lighting Act, 1882, to report forthwith to the Commission, and that in the meantime the Remembrancer be instructed to oppose all other applications." The question of electric lighting was considered at the meeting of the Chelsea Vestry, on Tuesday last, among the members present being Sir Charles Dilke, M.P., Sir Henry Gordon, K.C.B., and the Hon. Conrad Dillon. The Vestry had under consideration the notices received from several electric light companies of their intention to apply for provisional orders for the district, together with an elaborate report upon the whole question by Mr. G. H. Stayton, C.E., their surveyor. Mr. Stayton estimates the cost of a complete installation for Chelsea at £375,000, and of a limited but more practical installation at £85,000. The report concluded with the following recommendations, which were unanimously adopted :—"That it is not desirable to apply for a licence or to consent to an application for a licence until the draft has been approved by the Vestry; that it is desirable to support the application of any company likely to carry out the undertaking properly; and that the solicitors be instructed to watch the progress of the applications and to oppose them unless satisfactory conditions are obtained."

CONTOUR AND CROSS SECTIONS OF THE MANCHESTER SHIP CANAL.



THE MANCHESTER SHIP CANAL.

No. II.

DURING the present year, when the Manchester public came to consider seriously the feasibility of constructing a water way to the sea, the only scheme before them was that of a tidal navigation, or deep canal without locks, and it was deemed advisable to call in Mr. Leader Williams, in order to strengthen the engineering advice which had been tendered to the Provisional Committee who were entrusted with the organisation of the scheme.

Mr. Fulton and Mr. Williams were directed by the Committee to make a thorough examination of the ground between Manchester and Runcorn, and to submit a detailed report on the whole project. Instead of a joint report being presented to the Provisional Committee, it was found necessary to prepare two separate and distinct reports embodying opinions of the engineers, which, from the first, were widely divergent.

Mr. Fulton's report committed him to his original scheme of an open level cut from Runcorn to Manchester along the valley of the rivers Mersey and Irwell, whilst Mr. Leader Williams decided to recommend a canal laid out in the usual way with locks and level reaches of still water. To decide between the two schemes was impossible for a Committee composed of professional gentlemen and merchants, notwithstanding that it included a few members of eminence as mechanical engineers; and it was wisely determined to call in the services of Mr. Abernethy, past president of the Institute of Civil Engineers, one of the leading authorities on the subject of canal and marine engineering. The report of the referee, which was to decide the action of the Committee, was full and conclusive, leaving the Committee no doubt as to the course which they should pursue. Mr. Abernethy expressed his approval of Mr. Leader Williams's project almost without qualification, whilst he dissented from the general features of the first scheme. As a matter of course the Committee adopted Mr. Abernethy's views, and at the same time they passed a resolution to retain his services as consulting engineer for the undertaking. The canal, as designed by Mr. Leader Williams, and illustrated in our impression for Nov. 24th, will be twenty-one miles and five furlongs in length from the point at which it joins the Mersey above Runcorn Gap, to Trafford Bridge, in the borough of Salford. Speaking generally, it follows the valley line, cutting through the bends of the rivers Mersey and Irwell, both of which streams are very tortuous; indeed, the river channel, measured from the commencement to the end of the canal, which is itself not very straight, is thirty-five miles. From the entrance of the canal, however, to a point about two miles above Warrington, the line is taken clear of the river, following and absorbing the Runcorn and Latchford Canal. From Warrington to the outlet the canal will widen out until a bottom width of 300ft. is attained, to allow the tidal waters to enter and recede without causing an injurious extent of wave or an inconveniently high velocity. From Warrington up to Manchester the canal will have a bottom width of 100ft., which is 28ft. wider than the Suez Canal; but passing places will not be provided, as on the Suez Canal, it being the opinion that there will be ample room for sea-going steamers to pass each other. The slopes of the cross section are designed, as shown above, to be 1½ to 1, with a berm or cess of 5ft. at the ordinary water line, which will be 24ft. above the bottom of the canal. Along the water line the face of the slope and berm will be pitched with stone to preserve the earthwork.

The canal will be made up of straight lengths connected by curves, most of which are of large radius; but there are two curves, of half a mile radius, which appear to be rather sharp for the passage of vessels of large size. The engineer has, however, so arranged his lines of deviation, and has taken the precaution to schedule the property for a sufficient distance on each side of the line, as to admit of these bends being altered, in the execution of the work, to curves of 80 chains radius, which should be quite sufficient for all the requirements of the traffic.

The canal is divided into four reaches or pounds; the lower or tidal reach extending from the estuary of the Mersey to a point five miles from the canal entrance; but at high water of ordinary springs the tidal influence will be felt as far as the end of the second reach, a distance of fifteen miles from the entrance, the design being that a depth of 2ft. 6in. of water should be stored at each spring tide to serve for lockage. The first set of locks will be situated at Latchford, near Warrington, where the surface of the canal will rise 23ft. 6in.; the second set of locks at Irlam, ten miles higher up the stream, and near the junction of the Mersey with the Irwell, the rise at which point will be 19ft.; the third pound will extend from Irlam to Barton, a distance of nineteen miles; and the last reach will terminate at the docks in Salford, at a level of 17ft. above the pound immediately below it, the total rise from low water below Runcorn to the docks in Manchester being 59ft. 6in.

The three sets of locks at Latchford, Irlam, and Barton, will be almost similar to each other in construction. Each set will consist of a group of three locks of different sizes placed parallel with each other, and in each lock will be fixed a pair of intermediate gates to enable the locks to be used for barges and vessels of small size without waste of water. The largest locks will be 540ft. long inside, and the intermediate gate will cut off a length of the locks varying from 100ft. to 190ft. for the smaller craft. At each set of locks a tier of capacious sluices will be provided for the admission of tidal water in the lower reaches, and for the escape of surplus water all along the canal during floods. It is intended to provide steam power at each group of locks for moving the gates, sluices, and other machinery, and it is not improbable that this power may occasionally have to be employed in raising water from one reach of the canal to the other to supply the loss through lockage.

It cannot be said that, as a whole, the Manchester Ship Canal will be a difficult work, but it presents a certain number of obstacles which will have to be overcome, and to deal with these both the care and forethought of the engineers will be somewhat taxed.

There will be five lines of railway to cross, as well as the aqueduct which carries the Old Bridgewater Canal over the Irwell and Barton.

The first railway diversion will be that of the London and North-Western line from Wigan and the North to Crewe. The line at this point will have to be raised, so as to give a clear headway of 66ft. above high water in the canal, and this will involve a complete reconstruction of the line for a length of over two miles. The steepest gradient of the new line will be 1 in 873.

The second diversion is also on a branch of the London and North-Western system—that which runs from Warrington to Chester. Here the approach gradients will be 1 in 114 and 1 in 105, the gradient of the line at present being 1 in 436. The clear headway will be the same as at the first diversion, which is the ruling height throughout, all other crossings being higher than 66ft. Here a length of two miles one furlong will be constructed. At the third deviation, near Warrington, the Warrington, Altrincham, and Stockport line will have to be depressed, and passed under the canal, with approaching gradients of 1 in 60. The tunnel under the canal, which will be level, will be 165 yards long, and it is probable that some provision will have to be made for the removal of whatever subsoil water may gravitate to the lowest part of the tunnel.

The fourth diversion—that of the Cheshire Lines Railway, which runs from Liverpool to join the Midland at Marple—will carry the railway over the canal with a clear headway of 84ft., and a maximum gradient of 1 in 114. One mile and seven furlongs will have to be constructed to accomplish this diversion.

The fifth and last railway diversion will be that of the Cheshire Lines Railway from Manchester to Liverpool, the highest gradient of which will be 1 in 114. The entire length of railway that will have to be reconstructed will be nine miles seven furlongs.

The most important item of structural detail will be the arrangement for carrying the Bridgewater Canal across the ship canal at Barton. The existing aqueduct, which was designed by James Brindley, and considered in his day to be a triumph of engineering, is a stone structure of the most ordinary kind. The surface of the water in the canal stands at a level of 48ft. 6in. above the ordinary water level in the ship canal, and the engineer proposes to meet the difficulty by constructing a swivel aqueduct, by means of which the canal boats will be able to pass over the ship canal so long as no ships are passing. This arrangement would render the construction of a pier in the middle of the canal a necessity which should by all means be avoided, and further, it is not unlikely that difficulties would be found to arise in keeping the ends of the caisson, and of the canal where it would connect with the caisson, perfectly water-tight. In preparing plans for submission to Parliament, it is obviously impossible to make provision for every detail in an undertaking of this magnitude, and it is not improbable that the engineer may modify his views in respect of the aqueduct. Some means for lifting the canal boats clear over the ship canal

could without difficulty be devised, and all interruption to traffic in both canals avoided. A cardinal point to be kept in view if the undertaking is to become a commercial success is the avoidance of anything and everything that will in the least degree hinder or delay the free passage of vessels from Manchester to Liverpool, and the most perfect appliances will therefore be necessary for insuring rapidity in passing vessels through the locks, and avoiding the interference of cross traffic. The locks themselves, though they have been made the subject of objection by the few cavilers who have been found to scoff at the undertaking, will have but little effect in detaining ships, for, as Mr. Leader Williams remarks in his report, "the rise by lockage above ordinary spring tides at Irlam will be 35ft. by two locks. There are few docks which are not entered by a lock, and as a vessel going up on high tides to Manchester will pass the Latchford Lock when the gates are open, it will only have to pass one lock more than usual at seaports."

The question of the supply of water for lockage is one of no small importance. There is, perhaps, hardly a stream in England the discharge of which is less uniform than that of the Irwell. The country at the head of the valley is very steep, and the rainfall escapes rapidly, a moderately heavy fall, lasting for seven or eight hours, sufficing to fill the river channel up to the margin. These freshets, however, very soon pass away, and the discharge becomes in dry weather small as compared with the area of the watershed. In short there is little doubt that the discharge of the Irwell at the head of the canal will be found insufficient to provide the comparatively large quantity of water that will be necessary for lowering and lifting vessels of heavy tonnage.

The engineer has not lost sight of this difficulty, and is prepared to make provisions for meeting it. He proposes first to construct the upper reaches of the canal of such extra depth over and above the draught of the vessels as will enable him to impound water for the supply of the Carton and Irlam locks. Secondly, to construct a conduit from the river Mersey for the supply of the Irlam pound. Thirdly, to construct sluices and culverts from one lock to the locks adjoining, so as to use a portion of the water used for lockage twice over; and, fourthly, the steam power employed for opening and closing the gates can, when not employed for that purpose, be made available for raising water from one reach to another. Should these expedients after all be found insufficient to meet the requirements of the traffic, a second conduit could be taken from the Mersey, near Stretford, to the head of the canal. We purpose completing the description of this work in a subsequent notice.

MESSRS. R. & W. HAWTHORN'S EXHIBITS AT THE NORTH-EAST COAST EXHIBITION.

Amongst the most prominent exhibitors at the North-East Coast Exhibition, Messrs. R. & W. Hawthorn may be ranked, and no firm went to more trouble and expense to make the entire exhibition the success which it proved to be. The most prominent of their exhibits was a pair of engines which have been built for H.M. gunboat Dolphin. They are of the horizontal direct-acting type, with cylinders 32in. and 58in. diameter respectively, with a stroke of 24in. The cylinders have liners made of Whitworth's fluid compressed steel; the pistons are of cast steel; and the piston and connecting rods as well as the crank shaft are made of forged steel. There is no bed-plate, for as the intention was to design a very light pair of engines, the different parts are to be bolted to the ship's floors. Steam is supplied to the cylinders by piston valves, which in turn are worked by Marshall's valve gear. The condenser is constructed entirely of brass, and contains a cooling surface of 1500 square feet. The circulating water is forced through the tubes by one of Gwynne's centrifugal pumps, which is driven by an independent engine. The air pump and the bilge pumps are all of brass, and are worked direct from the crossheads, having the same stroke as the steam pistons. The engines are intended to indicate about 750-horse power, the revolutions being 120, and the working pressure 90 lb. per square inch. In connection with this exhibit were also shown a double-cylinder, double-acting donkey engine, with cylinders 4½in. diameter, stroke 5in., and diameters of pumps 3in, and the auxiliary bilge and fire-engine for the same vessel. This last engine is also double cylinder.

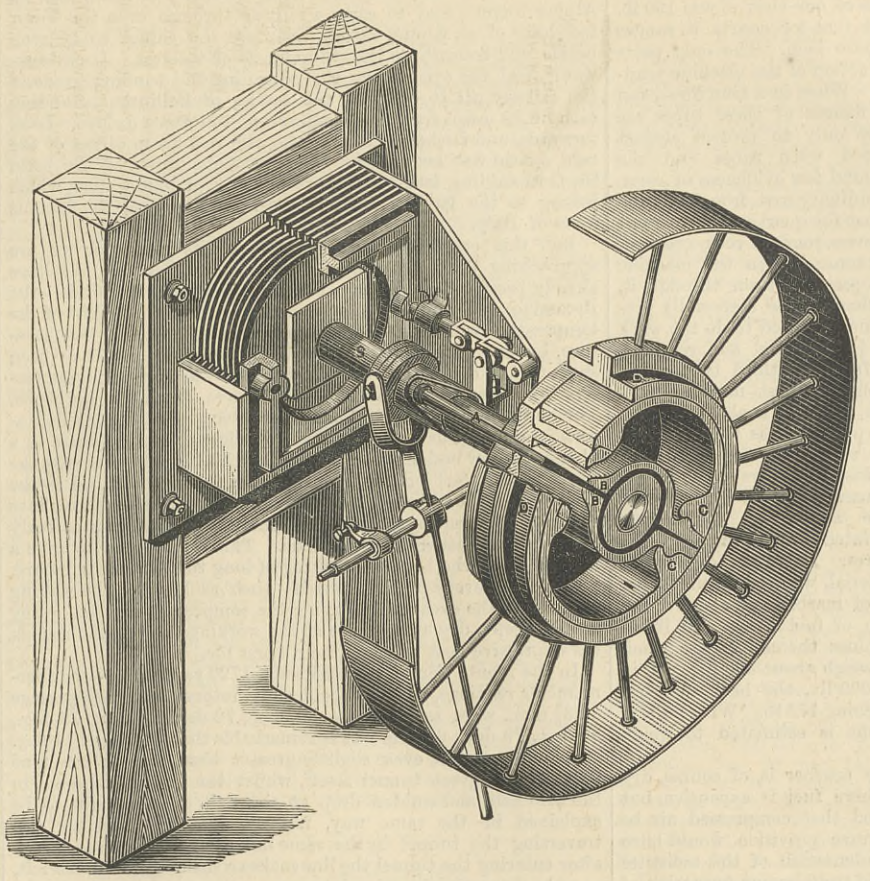
The engines of the Royal Danish gunboat Crousund are a pair of inclined direct-acting twin screw engines, of the same design as those built by this firm for the Chinese gunboats Epsilon, Zeta, Eta, Theta, Iota, Kappa, and Lambda. The cylinders are 13½in. and 24in. respectively, and have a stroke of 12in. The pistons are of cast steel, and all the forgings throughout the engines are of steel; the air, circulating, and feed pumps are all worked direct from the crossheads. When making 250 revolutions, and with a working pressure of 100 lb., these engines are designed to indicate some 400-horse power.

The shafting for a twin screw vessel of 7000 indicated horse-power which was exhibited consisted of one-half that which is required for the engines—that is to say, the shafting required for one pair of engines—and consists of a thrust, intermediate and tail end shafts. The thrust and intermediate shafts are together 38ft. 6in. long, and are 12in. in diameter, while the tail end shaft is some 48ft. 6in. long, and with a diameter of 12½in.; they have been forged of Krupp's steel, and each shaft has a hole 4½in. in diameter through the centre of it from end to end. The tail end shaft is coupled to the intermediate shaft by means of a cone fitted with a socket with feathers to prevent rotation, and a screwed collar on the tail end shaft bolted to the end of the socket on the intermediate shaft, to prevent fore and aft motion. This is necessitated through the shaft, on account of its great length, having to be got into place from the after end of the shaft tube.

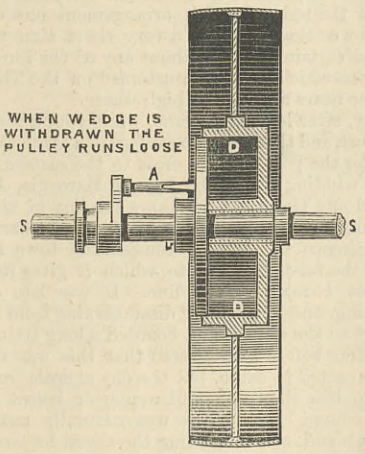
Photographs were exhibited of some of the marine engines turned out by the firm, including those of the Talabot and the Inchcona. Photographs were also shown of five types of locomotives built by the firm: (1) Great Eastern express locomotives. These engines were designed by Mr. Adams, the present locomotive superintendent of the London and South-Western Railway, whose object was to get one which should combine speed with power. The cylinders are 18in. diameter, and have a stroke of 26in. The engine is carried on a bogie and four wheels coupled, 6ft. 1in. in diameter. (2) Is a locomotive of American "Mogul" type, and was designed by Mr. Cleminson, C.E., for the Newfoundland Railway. This engine is illustrated by our supplement. The wheels are smaller and the speed is less than that of the usual type of English engines, but the boiler and fire-box are very large. The wheels are of cast iron, and bars are used instead of plates in the construction of the frames, while the elasticity of the whole engine is still further increased by carrying it on Cleminson's wheel base, which permits all of the wheels to bear upon the road however uneven. The boiler is of steel; the engine has a wooden cab for the comfort of the driver and his fireman, and this, together with the spark-arresting chimney, the cow-catcher, the large head lamp, and the bell, give it a characteristic and thoroughly American appearance; the engine has six 40in. coupled wheels, and a two-wheeled truck in front.

The firm also showed (3) photographs of a locomotive crane. The crane consists of a steam cylinder sunk in the top of the fire-box and worked by a simple motion from the foot-plate. The end of the piston-rod controls the short end of a lever which forms the jib. When the engine is drawing a train or shunting, the jib lies at rest behind the chimney, and in no way affects the working of the engine, so that it is then no more nor less than an ordinary locomotive; but when the trucks are at their destination the locomotive can go from one to another, unload them, and stack or reload the goods as desired, thus acting as a crane. The fourth photograph showed a tank locomotive of the ordinary type in use in England for contractors, collieries, &c., and the fifth is an American engine for the same purpose.

BAGSHAW'S FRICTION HOIST AND BRAKE.



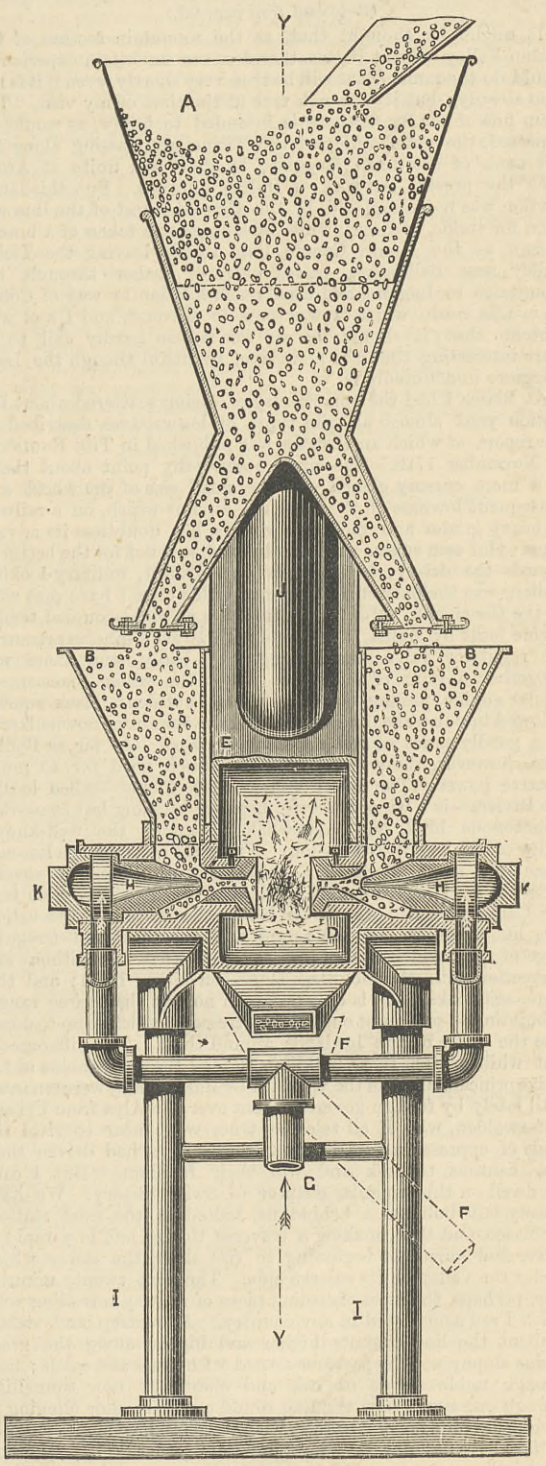
The accompanying engravings show an arrangement of friction gear designed by Messrs. J. Bagshaw and Sons, Batley, for the severe duty of hoisting, and catching twenty times per minute at bottom of 3ft. drop the blade of a guillotine weighing 5 tons. It is a combination of the well-known Addyman and the Weston clutches, and is applied to a patent machine made by Messrs. Varrell, Elwell, and Middleton, Paris, for chopping planks 2ft. 8in. wide, 10ft. long, and 1in. thick. The pulley is 6ft. diameter, 2ft. broad, attached to Addyman's clutch, which by the simple insertion or withdrawal of the wedge acts as a fast or loose pulley, and thereby starts or stops the shaft without moving the belt—a necessity when the belts are of great width. It may be connected or disconnected instantly whilst in motion with little effort, and, unlike nearly all other clutches, has no end thrust. By lubricating the surfaces also, wear and tear are reduced to a minimum, and smoothness in starting is insured. Its action will readily be understood. The wedge A when inserted opens out the levers B B and expands the friction ring C—at right angles to the direction of thrust—which consequently grips the boss of pulley D over the whole inner surface On withdrawing the wedge, the Weston brake, consisting of a series of wrought iron discs, is brought into play by means of a rock shaft connected by levers to a toggle joint.



The peculiar advantage of the Weston brake is that the frictional effect of any pressure applied is repeated as many times as there are discs in the two series, in consequence of which the remarkable result is obtained of an indefinite increase of the total amount of friction with the same pressure. These clutches or brakes are now made up to 1000-horse power.

PNEUMATIC PULVERISER.

The following is taken from the American *Engineering and Mining Journal*:—"After quite a long period of experimental work, a pulveriser which possesses striking features has been reduced to a practical form. Our accompanying illustration will serve to explain the principles of its construction, which are certainly simple; and from our examination of it when working at the establishment of the Pneumatic Pulveriser Company, in this city, we believe that it has unusual merit. Briefly, the action of the pulveriser depends upon the attrition of the particles of material to be reduced to powder produced by two currents of it being hurled against one another. The particles are thus made to act upon one another, and so the great cause of trouble in stamps and pulverisers of all kinds, with but one exception, the exposure of important parts of the machinery to constant wear, is done away with. It is a principle which we believe is more and more recognised as an important one, that it is best to allow rock to grind rock, instead of causing attrition by the grinding action of rock upon some hard metal surface. In the pneumatic pulveriser the action is as follows:—The rock or ore, presumably reduced to ¼in. size by a crusher and a pair of rolls, is fed into the hopper A, from which it is distributed into two smaller hoppers below B B, one being on each side of the machine. Simultaneously high-pressure superheated steam flows from the main pipe G through two branches into the nozzles H H, and partially enters the tubes C C. The steam flowing from these nozzles creates a suction—10in. to 12½in. have been observed—which draws the rock into the tube, and steam and rock issue



in a steady current from the mouths of the tubes C C, which are placed 3½in. apart and are very carefully placed in a line. The two currents, meeting with great force, cause the rock to be pulverised and the powder to be carried off by the hot current of steam through the pipe E, while the coarser stuff is taken through F to an elevator to be screened. Plugs K permit of easy access to the nozzles, and a door in the casing of the

machine makes it possible to get readily at the tubes C C. The steam is generated in a Schutte and Goehring sectional boiler, in which it is also superheated to about 800 deg. Fah. The pressure varies, of course, according to the character of the rock. When pulverising marble at the time of our visit it was 150 lb. at the machines. We are informed that for quartz it ranges between 160 lb. and 180 lb. per square inch. The only parts liable to wear are the tubes C C, the action of the machine tending to enlarge the orifice gradually. When in a true line—and this is carefully provided for—the flanges of these tubes are little affected, and they serve really only to protect against stray particles. We have examined worn tubes and the interior of the machine, and have found few evidences of wear. These tubes are rough castings of ordinary cast iron, weighing about ¾ lb. each. We are informed that for quartz they wear out at the rate of one pair per five to seven tons of rock crushed, and for marble per twenty to thirty tons. When the machine is started it is first heated up by passing steam through it, allowing it to escape through the exhaust pipe J specially provided for that purpose. Two machines are used to do the work of pulverising, the first working on ¼in. material and reducing down to 60in. mesh, through which from one-third to one-half is bolted. The larger material from the first machine goes to a second one, to which any coarse material is also returned. A very important advantage of this pulveriser is that it works dry and without creating dust, except in the elevating machinery. We have entered the dust chambers when working on marble, and have found them dry and the material hot. It appears, too, that the action of the superheated steam and of the heat generated by the attrition has some beneficial effect on sulphuret ores. As to the capacity of two machines, working with ¼in. material, we are informed that they can pulverise from 1½ to 2 tons of marble, and about ¾ ton of quartz per hour, the consumption of fuel being 125 lb. of anthracite fuel per hour. The machines themselves are small and light, and readily got at. They weigh about 400 lb. each in small pieces. The boiler weighs 10,000 lb., the heaviest parts being the mud and steam-drums, weighing 175 lb. With pulleys and pipe connections the entire plant is estimated to weigh 12,450 lb.

"The most important field for this crusher is, of course, dry crushing of gold and silver ores. Where fuel is expensive, but water-power available, it is suggested that compressed air be substituted for steam, although of course provision would have to be made in such a case for the condensation of the moisture in the compressed air, in order to avoid troublesome formation of ice and water at the nozzles."

THROUGH THE ALPS BY LOCOMOTIVE.

AN ENGINEER'S TRIP OVER THE ST. GOTHARD.

(*Concluded from page* 417.)

It might be thought that, as the mountain section of the Ticino Valley ends at Biasca, therefore our mountain experiences would do the same. That will be true very shortly, even if it is not true already; but it was not true at the time of my visit. The main line of the St. Gothard is intended to follow, as would be expected, the main valley of the Ticino, and passing along the left bank of the Lago Maggiore, by Pino, will unite at Arona with the present network of Italian railways. But this latter portion was not completed by the time the rest of the line was open for traffic, and meanwhile advantage was taken of a branch known as the Monte Cenere line, which, leaving the Ticino Valley near Bellinzona, passes over, or rather through, the mountains to Lugano, and then reaches Milan by way of Como. It is this route which I was now to traverse, and I was well content that it should be so, for it can hardly fail to be more interesting than the main line, beautiful though the Lago Maggiore undoubtedly is.

At Biasca I had the opportunity of seeing scattered about the station yard almost all the types of locomotives described in the report of which an abstract was published in The Engineer of November 17th. The most noteworthy point about them, at a mere cursory glance, was the small size of the wheels and consequent lowness of the engines—a point which, on a railway of heavy grades and moderate speeds, has doubtless its advantages. Our own engine was here changed, and not for the better as regards the driver; for the new one, a short, military-looking Italian, was the only surly specimen of his class I have met with on the Continent. His locomotive was an eight-coupled tender engine built by Maffei, of Munich, with 10 atmospheres pressure; the regulator valve was leaking very badly, and there was altogether a want of smartness about the whole concern. A similar engine, puffing out equal volumes of dense black smoke, followed in our wake, and behind it came the train, now enlarged to a goodly series of some twenty carriages. As far as Bellinzona, however, there does not seem much need for so much tractive power. The lower valley of the Ticino—called locally the Riviera—is a wide, flat vale, between pleasing but somewhat monotonous hills, and somewhat resembles the well-known valley of the Rhone about Sion. Nor is the resemblance lessened when we reach Bellinzona, which recalls Sion in several particulars. It is the capital of the Canton Tessin, as Sion is of the Canton Valais; the town lies in the middle of the valley, but, like Sion, is grouped round a picturesque and irregular ridge of rock, which strikes up through the flat vale without any connection with the mountain slopes on either hand; and this ridge, again like Sion, is crowned with no less than three ranges of buildings—palaces at once and fortresses—which seem to dominate the whole of the lowlands around them. The difference is that while at Sion these buildings formed the strongholds of the native prince-bishops of the Valais, at Bellinzona they were tenanted until lately by foreign governors sent over the Alps from Uri and Unterwalden, who, if all tales be true, went near to rival the deeds of oppression that, in much earlier days, had driven their own cantons to seek and win their freedom. But I cannot dwell on this singular chapter of Swiss history. We have already left Bellinzona behind us, halted at the next station, Giubiasco, and then, making a traverse to the left in a rapid S curve, find ourselves beginning to rise along the slopes which border the valley on its eastern side. The next twenty minutes offer, perhaps, the most charming piece of railway travelling with which I am acquainted in any country. At a steep and steady gradient the line mounts higher and higher along the great Alpine slope; now by pastures dotted with goats and cattle; now through noble woods of oak and chestnut; now tunnelling through one spur; now winding round another; now clinging to the hillside on a narrow terrace, with steep fascined slopes stretching far above us; now on a light and lofty girder bridge, spanning one of the many torrents that seam the mountain with deep gullies, hardly noticed from below. These torrents come thickly, one bridge succeeding another with bewildering rapidity; and in almost every case the bridge itself is probably the less expensive part of the work to be done. For at least fifty yards above and below the actual crossing place the bed of the torrent is turned into a great artificial trough, whose sides stand up like walls above the level of the adjacent woodland, while the inner slopes and bottom are carefully paved with stones laid in mortar or cement, and most elaborately fitted and dovetailed into each other. Such are the works necessary to make safe an Alpine torrent, and to carry a railway through even the lower foot-hills of an Alpine range. Nor are the things to be seen beside and beneath us the only objects of interest. Look backwards, and the eye follows the ascending and winding grade of the railway till it rests on the castles of Bellinzona, standing each on its own crag, and dominating the town below. Look forwards, and far below, intersecting the vast green carpet of the vale, spread flat beneath us, is the straight course of the main St. Gothard line, leading the eye to a bay of blue waters, which belong to the largest, and not the least lovely, of the famous lakes of Italy.

But this exquisite journey draws to its close, for we are approaching the great tunnel of the Monte Cenere. We have already passed through four tunnels, the longest of which—the Recassino, 445 yards—is very remarkable from the height of the temperature within it. I have no exact observation of temperature, but my note at the time was that it could not have been short of 100 deg. Fah. Certainly the air was moist and oppressive to a degree one seldom experiences outside a hothouse. The new driver—for we had once more changed engines at Bellinzona, and a singularly bright and intelligent young Italian in a blouse was now beside me—told me that this tunnel was always the worst and hottest on the line, and that this was ascribed to the dampness of the rocks, as at once exhaling moisture themselves into the air, and preventing the steam and smoke from passing out as freely as they would otherwise have done. This would seem to give a hint to those who have the making of long tunnels in the future, viz., that by every possible means—such as keeping the walling close up to the excavation, drying the compressed air, &c.—they should keep a dry atmosphere at the workings, and thus diminish the oppressive heat which is their worst foe.

In the Monte Cenere tunnel itself—1720 yards long—the thermometer readings, taken at about equal intervals during a passage of 3½ mm., were as follows:—69 deg., 72 deg., 76 deg., 78 deg., 80 deg., 79 deg., 69 deg. It is remarkable that the rise of 11 deg. is about equal to, even slightly greater than, that in the nine miles of the great tunnel itself, whilst the gradual increase in the first half, and sudden drop at the exit, are no doubt to be explained in the same way, namely, that the foul air was traversing the tunnel in the same direction as ourselves. Just after entering the tunnel the line makes a sharp curve to the left, so as to change its direction into one nearly at right angles to the Ticino, and from thenceforward the end of the tunnel is clearly in view. As we approach it the effect is very peculiar, for a downward gradient of 1 in 40 begins exactly under the portal arch, and from a little distance within one might suppose that the tunnel opened on the brink of a precipice. As we come to the portal, the downward road becomes visible, and in a moment more we are bowling down the trough of the lovely Val Agno, with chestnuts and acacias overhanging the line, and rich pastures stretching up to meet graceful woodlands, amid all the characteristics of sub-alpine scenery. We have here some seven miles of a 1 in 40 gradient without a single break. After stopping once, at Taverne, the ridge to our left lowers considerably to a gap or neck, towards which we turn, and after passing a long cutting, with a considerable tunnel in the middle, we run out upon a new scene altogether. To our right the ground rises in a gentle slope to the crest of the ridges we have passed; to our left it sinks at the same slope till it reaches a flat shore, brown with the tiled roofs of an Italian town, and is then lost in a great expanse of steel-grey waters; beyond this rise loftier and steeper ridges, rich at the base with vineyards and olives, and clothed almost to the summit with a dense growth of forest; while right in front of us there shoots into the sky a great irregular cone of limestone, wooded over its sides and shoulders, but bare at the top, on which a white hotel is plainly visible. We have come to one of the loveliest spots in Italy. The town is Lugano; the lake is that which in common parlance bears the same name, but is properly called Ceresio, and the conical peak is the Monte Salvatore. The view before us can hardly be surpassed by that from any railway station in the world.

It is not my business to describe Lugano—the richness of its gardens, the coolness of its wine caves, or the beauty of its environs. The last, however, was sufficient to induce me to abandon the railway for a time, and take to the steamers and diligences which convey the traveller over and among the Italian lakes. Of these lake steamers, which were swift and well-found, I have only one engineering point to record, namely, that those on the lake of Lugano carried an excellent device for lowering the funnel when necessary. The funnel is held up by a screwed inclined rod, which passes through a nut fixed longitudinally, but capable of being turned by bevel gear and winch handles. The nut is hung on trunnions, so as to suit itself to the varying inclination of the rod. By this arrangement one or two men can raise or lower the funnel in a very short time with perfect steadiness and certainty, and without any of the hurry, pushing, and shouting to which we are accustomed on the Thames whenever a steamer nears a bridge at high water.

The railway, after leaving Lugano, winds round the base of the Monte Salvatore, and then takes advantage of a causeway, originally constructed for the post road, to cross to the eastern bank of the lake. Then, winding along the bay of Maroggia, beneath the well-known Monte Generoso, it follows the line of the post road through a comparatively level country to the Italian frontier at Chiasso, and thence to Como, a considerable town lying at the upper end of the far-famed lake to which it gives its name. It was here that I rejoined the line. It was late on a lovely summer evening, and when, after disembarking from the steamer, we hurried up to the station and boarded a long train in waiting, it was some time before I discovered that this was not the local train I had expected to catch, but the day express from Lucerne, which was no less than one and a-quarter hours late at this period of its course. The driver was naturally anxious to get to his journey's end, and on getting the signal he took us briskly out of the station and set going at a merry pace, which certainly at times exceeded forty miles an hour. It was too dark to examine the engine, but it had certainly one defect in the shape of insufficient leverage to the regulator handle, which was so stiff in consequence that it needed the full strength of a stout and vigorous driver to put on or shut off steam. The line was first a cutting with a steep ascent of 1·8 in 100; then it descended sharply into a forest of acacias, through which we ran for some miles, the result being that when I was able to look back at the mountains we had left, they were already far behind, and but dimly visible. Now, however, we come out into brilliant moonlight, flooding the great level plain of Lombardy, through which we are sweeping. No curves now, no gradients, no stoppages, save once when three red lights appeared ahead of us far down the straight road, and the driver whistled, shut off steam, and drew up cautiously to a little country station. Here I found that of the three red lights, which had puzzled me, one only was a signal, and the other two belonged to a goods train, which was waiting our arrival on a siding. There seems considerable probability of confusion from this arrangement. Be this as it may, the train all but halted at the platform; somebody—I believe an officer of justice on his return to Milan—sprang on board, and away we went again, hard as ever. Soon we are running in a cutting between vertical walls, with houses and gardens looking down on us from either side. Then we pass rapidly, on the level, through what are clearly the suburbs of a great city, and forthwith there gleams in front of us the façade of a huge station, lighted by the intense glow of three large electric lamps, like globes of white fire; while, directly above these, hung like a fourth lamp—softer and calmer but hardly less brilliant—the full orb of the harvest moon. So striking a scene made a fitting end to a pleasant journey, for the St. Gothard express has reached its terminus, and we are within the walls of Milan.

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

(*From our own Correspondent.*)

Operations at the manufactured ironworks are being checked somewhat this week by the severity of the weather. There is no addition to orders since last week.

Bars are in better demand this week than last. There is, therefore, less difficulty this week in getting £8 and £8 12s. 6d. for special marked bars. At the same time the firms who are accepting £7 10s. can see the farthest ahead. Good bars were to be had on 'Change this afternoon at £7 12s. 6d. to £7 10s. Common bars were £6 10s. to £6 7s. 6d. and £6 5s.

Hoops were without change, at £7 per ton.

The price asked for tube strip was £6 12s. 6d. to £6 15s., but supplies might have been obtained at £6 10s.

Sheet firms report a great number of inquiries in consequence of the rapid growth in the number of galvanising and corrugating firms. Galvanisers' "doubles" are £9 per ton and upwards, and "trebles" £10 per ton upwards.

The galvanisers themselves reported a steady output, but not much new business at the moment. The more satisfactory news as to the condition of the market in New South Wales was welcomed. Prices were nominal on the basis of £14 10s. to £15 for 22 to 24 w.g., in bundles, delivered at outports. Spelter was firmer, consequent upon supplies being less abundant now that the northern ports are blocked by the ice.

Boiler plates were again £9 to £9 10s., according to brand.

In the pig iron market Derbyshire and Northampton sorts brought from 47s. 6d. to 50s. Hematites were stagnant at 65s. to 67s. 6d., and quotations were scarcely more than nominal.

Native pig makers reported that sales of all-mine sorts were slow, and that to get business concessions had to be made to customers; 65s. to 67s. 6d. was the average price for pigs of this quality. Second-class native pigs were 55s. to 52s. 6d., and common sorts 42s. 6d. to 40s.

Coal was rather scarce for immediate deliveries, and prices rather stronger.

The colliers continue to agitate for a further advance in wages. Having been unsuccessful in their application for a rise on the 1st inst. they have now instructed their secretary to write to the Chairman of the Coal Trade, requesting him to advance wages a further 4d. and 2d. per day or "stint" in the thick and thin coal seams respectively on January 1st.

The ironmasters are again agitating for a reform in what they term "the absurdity" in the provisions of the Weights and Measures Act, which prevents the legal employment of 1 cwt. weights. This is an old ground of dispute between our ironmasters and the Board of Trade, and it has now been decided to bring the matter before the Associated Chambers of Commerce at their next meeting.

Another attempt is being made to drain the valuable coal seams which for twelve years have been lying in the Bromley Pound in the Kingswinford district. The pumping engine which has been fixed is one with Davy's differential gear. The shafts have been widened and substantially lined with brickwork, and the platform pumps are now being put in. All the plant is of a high-class description, and it is said that the engine can be well relied on to drain the pound.

Blasting experiments have recently been conducted at the Leycett Colliery, North Staffordshire, under the auspices of the Mining Institute for that district, with the patent water cartridge of Mr. James Macnab, of London; and on Monday a report was presented to the Institute upon the result of the experiments. This showed that in none of the trials had the cartridge been successful in preventing sparks and flame when powder was used, and that no better results had been obtained than in blasting by the ordinary method. The first experiment may be specified as a sample of the rest. It was in a hole 4ft. deep and 2in. diameter. The charge was 10½ oz. of ordinary blasting powder or 8in. cartridge—the water cartridge being 18in. long and fired in the ordinary way. A little clay was placed between the powder and the water cartridge, also a little clay between the water cartridge and the sand tamping. The result was about the same as in the ordinary blasting—a great many small sparks were seen.

The Wolverhampton Chamber of Commerce have just obtained a fresh concession from the army authorities in the matter of hardware supplies for the service. Mr. Nepean, Director of Army Contracts, has arranged with the Chamber that in future hardwares to the bulk of 5 tons and upwards shall be delivered from the South Staffordshire district by canal to Woolwich at the same rates as are now charged for Staffordshire to London. These and other alterations involve a reduction of about 8s. 4d. per ton on the freightage cost of hardwares sent from South Staffordshire to Woolwich.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—Makers have at length had to give way to the continued downward pressure of the market, and during the past week there has been a fall in the price of pig iron, which, however, does not seem to have gone far enough to meet the views of buyers, and has had little or no effect in bringing forward business. Lincolnshire smelters have been the first to make the downward movement, and they have come down about 1s. 6d. per ton. With regard to Derbyshire brands it is difficult to say what the selling price actually is, as there has been so little doing in these for some time past. The makers' quotations have been reduced in some cases to the level of Lincolnshire iron. Lancashire makers have not yet followed the downward movement by any announced reduction of list rates, but this is a step which is only deferred until they are able to ascertain what is really being done in other brands. Forge proprietors are still nominally holding for late rates, but the lowering in the price of raw material must have some corresponding effect on finished iron.

The announcement of the reduction in Lincolnshire prices was made at the Friday's market, but did not lead to any business being done, and on Tuesday there was again an absence of demand. For Lincolnshire iron delivered equal to Manchester makers were quoting 47s. 4d. to 48s. 4d. per ton less 2½, bringing their prices down to about old rates, but they could not do business at these figures. Buyers still hold back in the belief that further reductions will have to be conceded, and there was not much disposition even to make offers. Where offers were forthcoming they were at less money than makers were asking, and the probabilities are that weak sellers will come down to buyers' terms rather than miss orders. For Derbyshire brands quotations vary considerably, but where makers are in the market to sell they are asking about the same price as

Lincolnshire. The quotations of 49s. to 50s. less 2½ for forge and foundry Lancashire pig iron delivered equal to Manchester have of course been altogether out of the market, but although sellers have been open to offers pending the revision of the list rates, there have been no inquiries to test what local makers would be willing to take.

In the condition of the finished iron trade there is no material change to notice. Most of the forge proprietors have still orders in hand to keep them going over the year, and although here and there good specifications could no doubt be placed at under current rates, there is generally a disposition to wait, rather than press sales at present. For delivery into the Manchester district, quotations remain at about £6 10s. for bars, £7 to £7 2s. 6d. for hoops, and £8 10s. to £8 12s. 6d. for sheets, but the business doing is of an extremely limited character.

Although local engineering firms here and there are reported to be reducing the number of their hands, and amongst cotton machinists there is decidedly less activity, some of the works in this district being now on short time, the monthly returns sent in by the various Lancashire branches of the Amalgamated Society of Engineers do not show any falling off in employment generally. The number of men actually in want of work is exceedingly few, and of the better class of workmen, capable of taking charge of jobs, there are really none out of employment. The number of members returned on the books of the Amalgamated Society of Engineers as in receipt of out-work donation in this district represents an average of less than 2 per cent. of the total membership, and shows a slight decrease as compared with the previous month. In the Manchester and Salford districts trade continues to be returned as good, and much the same report is received from the surrounding districts, although this may to some extent be qualified by the remark that generally the number of new hands being taken on is reported to be very small.

An exceptionally massive forging has just been completed at the works of Sir Joseph Whitworth and Co., of Manchester. This forging, which is for marine work, consists of a shaft 48ft. long and 15in. diameter, forged hollow in fluid-compressed steel, and having an internal diameter of 9in.

The annual meeting of the members of the Manchester Association of Employers, Foremen, and Draughtsmen was held on Saturday evening, and Mr. Thomas Ashbury, C.E., was elected president, and Mr. J. Horsley vice-president for the ensuing year.

It could scarcely be expected that Bolton should take the same interest in the construction of the proposed ship canal as is felt in Manchester; but situate as it is on the direct route of the railway transit to Liverpool, the cost of which the construction of the canal would tend to reduce, the spirit of opposition to the scheme shown by the General Purposes Committee of the Bolton Town Council seems somewhat strange. The committee being "strongly of opinion that the council should not take any part in support of the Manchester Ship Canal scheme," have decided not to accept the invitation of the Mayor of Manchester to send representatives to the meeting of municipal authorities, which is to be held next week to consider, amongst other matters, the question of placing the project in the hands of a public trust.

Another Lancashire scheme for the improvement of river navigation is in hand, and a report by Sir John Coode with regard to a project for making the river Ribble navigable up to Preston for vessels of the largest class has just been published. It is proposed to divert the river for a distance of a mile and five furlongs, at a point near the Chain Canal, and hence across the Marsh to the south end of the Victoria Quay, and about half-a-mile above the Chain Canal an entrance lock, 500ft. in length, is proposed. By the scheme a tolerably straight course to the sea would be provided, and from the lock seawards the existing channel is to be deepened by dredging and scour. The scheme also included the construction of dock accommodation, and the total cost is put down at £558,150. The scheme was brought before the Preston Town Council on Wednesday, and it was decided by thirty-three votes to five to apply for the necessary parliamentary powers.

At a meeting held in one of the residential districts of Salford during the past week, with the object of adopting a memorial to the Corporation, praying that greater effort might be used to put down the smoke nuisance, the tables were turned upon the promoters in a most remarkable manner. The meeting was practically taken possession of by a large body of workmen, and the resolutions in favour of the proposed memorial were defeated by overwhelming majorities, one of the speakers in opposition to them being Ald. Bowes, the manager of the Pendleton Ironworks, Salford.

One remarkable effect of the snowstorm last week was that the snow was driven with such force through the apertures in the belfry of the Town Hall, as to thoroughly clog the wheels of the clock machinery. At the Central station and St. Peter's Church the clocks were also affected in similar manner, and an occurrence of this kind is not remembered to have happened before.

The recent severe weather has naturally had the effect of stimulating the demand for the better classes of round coal for house-fire purposes, but otherwise no actual improvement can be reported in the condition of the coal trade of this district, and many of the pits are still working short time. The change in the weather has, however, given a check to any downward movement in values, and at the pit mouth prices are steady at 10s. to 10s. 6d. for best coals, 8s. to 8s. 6d. for seconds, 6s. 9d. to 7s. for common house coals, 6s. to 6s. 6d. for steam and forge coals, 4s. 9d. to 5s. for burgy, and 3s. 8d. to 4s. for good slack.

Vessels continue very difficult to obtain at Liverpool and Garston, and a good deal of coal on order for shipment is consequently being thrown upon the home market. There are also very heavy stocks lying on the railway sidings at Liverpool. Coal for shipment can be bought at comparatively low prices, steam coal delivered at the high-level or at the Garston Docks averaging about 8s., and seconds house-fire coal 9s. per ton.

The reports which have appeared to the effect that the colliery proprietors of Lancashire and Yorkshire had in contemplation an early withdrawal of the 10 per cent. advance in wages recently conceded to the men have caused a good deal of misapprehension both in the iron and the coal trade, and I may as well state that no such action has been brought forward by the coalowners in the above district. In Lancashire the question of wages has not been mooted, and should even the course of trade ultimately necessitate any action being taken, it is not at all probable that a reduction in wages would be attempted before the ensuing spring.

Barrow.—I have nothing new to note in the condition of the hematite pig iron trade, the business being done still continuing small. There are but few inquiries, and makers do not expect any improvement this year. I am informed, however, that with respect to Bessemer and forge qualities, there is a fair amount of business, which it is anticipated will suffer no material depression for some few months to come. Stocks remain small, as deliveries are well maintained, but from official sources I gather that the amount of metal transmitted to consumers by the local railways is not so great as has latterly been the case; but the season of the year will no doubt account in some degree for this state of things. I have but little change to note with regard to prices, 56s. per ton being the quotation of No. 1 Bessemer net at works, and No. 3 forge, 54s.; but I am told that in consequence of the recent small sales, and makers having a fair amount of orders on hand, they are not pushing trade at the present. It comes to my notice that although the steel makers have a fair amount of business, foreign trade is rather slack. Several home and foreign orders are, however, held. It is stated that the Barrow Steel Works are turning out a larger amount of metal than at any previous period, and they are further extending their plant. Shipbuilders have not received many orders lately, but there is a large inquiry both on home and foreign account for the terms of contract for the building of iron steamships. Iron ore is in good demand at unchanged prices. Steadiness prevails in the coal and coke trades, and prices are firm.

THE SHEFFIELD DISTRICT.

(From our own Correspondent.)

THE severe weather which prevailed during last week, and still continues, has considerably interfered with business, by disorganising the railways. There is no likelihood now of any effort to reduce colliers' wages receiving general support in South Yorkshire this season. In the first place, the severe weather has again given a fillip to the house coal trade, and prices are again firmer. Apart from that a large proportion of the Yorkshire coalowners are disinclined to re-open the wages' question at present. They are now engaged in renewing contracts with large consumers, and are meeting with very fair success in obtaining better prices. The largest coalowners in South Yorkshire are Messrs. John Brown and Co., the Aldwarke Main and Car House Collieries. Their output this year will exceed that of the Thorncliffe Company—Messrs. Newton, Chambers, and Co. Messrs. Brown and Co., I am informed, are among the coalowners who are opposed to any immediate disturbance of the present arrangement. Though agreeing with others that the 10 per cent. advance should not have been conceded until coalowners could afford it, they are disposed "to accept the situation," for the present, believing it is too early, after only six weeks' trial, to declare the existing arrangement a failure. The home coal trade, it is important to remember, is only one-fifth part of the coal raised in the country.

Following out the recommendations of the Government inspector and the coroner's jury, the Claycross Colliery Company abandoned the use of naked lights and served out Belgian safety lamps to its miners. The men employed in the Parkhouse pit, where the explosion occurred, accepted them without demur, but in No. 2 pit over 200 coal-getters struck work and threw the pit idle on the 8th and 9th, rather than use lamps which makes coal-getting "slow." On the 11th inst., finding the masters determined, the men thought better of it, and accepted the lamps. I remember, after the Swaithe Main explosion, when 165 lives were lost, the miners, though working in the fiery Barnsley seam, were very reluctant to abandon the use of powder in blasting coal in favour of the wedge system. Blasting is the speedy process, and the men were generally content to risk a good deal for better wage results.

The skating season has set in, and the skate merchants are busy. One firm has sent out in two days this week 22,000 pairs, and altogether fully 50,000 pairs have been sent out to country merchants by the special dealers. The old clog skate still maintains its popularity, the only other novelty which has made its way in this district being the Acme skate. All the cheap skates are of foreign make, chiefly German; anything over 1s. a pair is preferred of English manufacture.

THE NORTH OF ENGLAND.

(From our own Correspondent.)

ONLY a small amount of business was transacted at the Cleveland iron market held at Middlesbrough on Tuesday last. Prices were about the same as last week. The tone of the market was no firmer, and buyers still show little disposition to purchase. It is not likely that much buying or selling will be done until after Christmas. Merchants were quoting 42s. 9d. to 43s. per ton for No. 3 g.m.b. for prompt f.o.b. delivery, and would not take less than the former figure. Some makers quoted 43s. 6d. to 44s. for No. 3, but the firms who were well supplied with orders would not accept anything under 44s. There is no demand for warrants. The severe weather of the last few days has interfered with regular working at the shipyards and bridge-building works. The whole of the hands employed by the Consett Iron Company at its mills and collieries have been laid off through the storm.

The stock of Cleveland pig iron in Messrs. Connal's store at Middlesbrough has been reduced 77 tons during the week, the amount in stock on Monday night being 100,734 tons.

Owing to the stormy weather the quantity of iron exported this month from the Tees is so far exceedingly small. Up to Monday night only 21,795 tons of pig iron and 5997 tons of manufactured iron had been shipped.

In the finished iron trade there is a scarcity of specifications, due to the partial stoppage of the ship and bridge yards. Consumers are a little more disposed to buy since prices were reduced, and have given out a few orders, but these will not be sufficient to keep the mills fully going very long. It is expected that nearly all the plate and bar mills will be laid off for at least a week at Christmas. Prices quoted for finished iron are the same as last week, viz.:—Ship plates, £6 10s. to £6 15s. per ton; angles for shipbuilding, £5 17s. 6d.; and common bars, £6 to £6 2s. 6d., free on trucks at works, less 2½ per cent. discount. Puddled bars are £4 net.

The Consett Iron Company is putting down plant for the manufacture of steel plates by the Siemens process on a somewhat large scale.

It is expected that the blast furnaces at Seaton Carew, near Hartlepool, belonging to the Seaton Carew Iron Company, will be put to work in March next. These furnaces were formerly the property of the Hartlepool Iron Company, and have been standing idle for a considerable length of time. New hot blast stoves on the Massicks and Crooke's principle are being erected. Three of the latter have just been set to work at Messrs. Palmer and Co.'s works at Jarrow, and are said to be working well.

The second meeting of the session of the Cleveland Institution of Engineers was held on Monday evening last. There was a good attendance of members. Mr. F. F. Jones, the new president, occupied the chair. He informed the meeting that a large majority of the members had agreed to assist in freeing the Institution from debt by paying a double subscription for the present year. Mr. John Gjers read a paper on "The Successful Rolling of Steel Ingots with their own Initial Heat by means of the Soaking-pit Process." Mr. Gjers said it was easy and practical to roll a bloom into a rail or other finished article with its own initial heat. The universal practice at steel works had been to employ a heating furnace, but in June he introduced "soaking pits" at the Darlington Steel and Iron Co.'s works, and 300 ingots every twelve hours were now treated in these pits. The ingots, after removal of the moulds, are placed in the pits and remain there for about twenty minutes. By that time they have a uniform temperature throughout, and are sufficiently hot to be easily rolled in the blooming mill, and afterwards pass through the finishing mill. The economical advantages are obvious. After Mr. Gjers' paper had been discussed, Mr. Charles Wood read his "Notes upon Carbon and other Deposits from Blast Furnace Gases." This paper was of great interest, and led to a most animated discussion.

Messrs. Raylton Dixon and Co., of Middlesbrough, the builders of H.M.S. Tourmaline, have orders from the Government for two small war vessels of 1000 tons displacement each. The first of these, called the Dolphin, was launched on Saturday last, and it is expected that the second, called the Wanderer, will be ready for the water in about six weeks. These vessels are built on the composite principle, the shell consisting of two thicknesses of teak 3in. thick, the bulkheads and flats being of steel, and the frames of iron. The stems and keels are of English oak, and the bottoms are covered with sheets of copper below the water-line. They are to be fitted with horizontal engines of 750 indicated horse-power, made by R. and W. Hawthorn, of Newcastle. Each vessel will be armed with two six-inch and two five-inch breech-loading guns, a seven pounder boat gun, and two Gardner guns. Messrs. R. Dixon and Co. are very busy. They have in course of construction and on order nineteen large steamers, some over 4000 tons burden.

Messrs. Bell Bros., of Port Clarence, are making rapid progress with their salt industry, and have just purchased a salt royalty extending over 2000 acres. In addition to their present works they intend to erect chemical works close by. The new salt works, which are near the blast furnaces at Port Clarence, are now fairly at work, and turn out, with nine evaporating pans, 350 to 400 tons of salt per week. This is all sent to chemical works on the Tyne. Provision has been made for increasing the number of pans to twenty, which would give a weekly output of about 1000 tons. Messrs Bell Bros. hope to utilise the waste heat from the blast furnaces in producing salt, and are at present producing 40 tons per week in this manner.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

THE tone of the iron market this week has been less satisfactory, this being the result mainly of the drawback occasioned to business by the stormy weather. The shipping trade in pig iron has suffered from the interruptions to traffic caused by the snowstorm; but besides this element of inconvenience, it must be admitted that at present the demand from abroad is quiet. There is a marked falling off in the business done with the Continent, a circumstance, however, which need excite no surprise, as it is quite usual at the present season. The past week's shipments show a decrease of about 2500 tons in the quantities of pig iron despatched to the United States, and it is perhaps a little unfortunate that the exports in that direction should decline at a time when freights have been reduced to a figure which would afford more encouragement to shippers. There has been much less iron taken out of store this week, owing to the interruption of the shipping trade; but very considerable purchases of pigs have been made by home consumers for forward delivery in case of a rise in price. The condition of business in the warrant market has been inanimate, and values are still depressed.

Business was done in the warrant market on Friday forenoon at 49s. 2d. to 49s. cash, and 49s. 4½d. to 49s. 1½d. one month, the afternoon's quotations being 49s. to 48s. 8d. cash, and 49s. 2d. to 48s. 10½d. one month. On Monday business was done in the forenoon at 48s. 10½d. to 48s. 9d. cash, and 49s. one month, and in the afternoon at 48s. 8d. to 48s. 5½d. cash, and 48s. 10d. one month. Tuesday's market was quiet at 48s. 6d. to 48s. 7½d. cash in the morning, and 48s. 8½d. to 48s. 9d. cash, and 48s. 11½d. one month in the afternoon. Business was done on Wednesday between 48s. 9d. and 48s. 11½d. cash, and 49s. 1d. one month. To-day—Thursday—transactions took place at 49s. cash, and 49s. 2d. one month.

The prices of makers' iron are a shade easier this week, although there is little change in the actual quotations, which are as follows:—Gartsherrie, f.o.b. at Glasgow, per ton No. 1, 64s.; No. 3, 54s.; Coltness, 68s. and 56s.; Langloan, 67s. 9d. and 56s.; Summerlee, 63s. 6d. and 53s. 6d.; Calder, 62s. 6d. and 52s. 6d.; Carnbroe, 56s. 6d. and 51s.; Clyde, 54s. and 51s.; Monkland, 51s. and 48s. 6d.; Quarter, and Govan, each 50s. and 48s. 6d.; Shotts, at Leith, 66s. and 56s.; Carron, at Grangemouth, 53s.—specially selected, 57s. 6d.—and 52s.; Kinneil, at Bo'ness, 50s. and 48s. 6d.; Glengarnock, at Ardrossan, 56s. and 50s. 6d.; Eglinton, 51s. and 49s. 6d.; Dalmellington, 51s. and 50s.

The malleable iron trade is quiet, but there is plenty of work in hand, and manufacturers have within the last week or two been making considerable purchases of the raw material. The wants of the shipbuilding and marine engineering trades are great, and as many of the shipbuilders have work in hand which will carry them through the greater part of next year, makers of angles, plates, &c., are certain of a continuance of employment. The general engineering trades are still busy, makers of locomotives, sugar-crushing machinery, stationary engines and boilers, are all for the most part well supplied with work. There are a number of good contracts in course of execution by cast iron pipe makers, although they are quite in a position to receive additions to their present orders. The hardware trades are also in a fairly active state, although complaining much of excessive competition. The past week's shipments of iron manufactures from Glasgow comprised machinery to the value of £16,600; sewing machines, £5900; other iron manufactures, £25,700; and steel goods valued at £2000.

The coal trade is brisk as regards the home inquiry, but the heavy snowstorm has greatly retarded the traffic on the different railways.

As to the question of wages in the mining trade, readers may be reminded that when the salemasters granted the colliers a rise of 6d. a day some time ago, the advance was not conceded by the iron-masters either to their colliers or ironstone miners. The iron-masters' colliers are now in some cases pressing for an increase, as they fear that if it is not obtained it may not be got at all for many months. These remarks apply to the West of Scotland. In Fife, on the other hand, the coalmasters are represented as contemplating the necessity of reducing wages at no distant date.

A considerable number of fresh shipbuilding contracts have been placed, a large proportion of these being at Greenock.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

I DID not expect that the coal stagnation would last long, and so before prices had time to droop another flush has set in, and in every direction there has been the greatest animation. I noticed this especially on the Taff Vale a few days ago. Continual trains of coal with scarcely a break is now the rule. From the Pontypridd Junction, into which flows the Merthyr, Aberdare, and Rhondda coals, on several days it was only by excellent traffic management that serious blocks and mishaps were avoided. Prices are firm for all varieties, and the demand for best steam and house coals continues. Small coal, too, is in demand. Renewed interest has already been given in the bituminous coal districts by the Cardiff and Monmouthshire Valleys railway project. The Gwerna Colliery Company, for example, is being launched well. The new railway, which will have the strong support of the Marquis of Bute, Rhymney and Taff Vale Railway, will command an area of one hundred square miles of virgin coal, estimated to amount to many million tons.

There has been something like a collapse of South Wales tinplate works. Nothing else can be expected when it is notorious that makers have been losing one shilling per box on every box of tin-plate sold. With all such it was only a question of time, and a gentleman who has suffered to a large extent in his transactions tells me that he hears about a dozen in all are doomed to go to the wall. Many have held up bravely and so honourably, that it is to be hoped they will resume business. Bidulph, Wood, and Jevons, of Briton Ferry; Forrester, of Swansea; and Morris, of Llangeunech and Llanelly, are the principal so far, but several smaller ones have followed.

I fear many of the coal merchants and pig iron makers have been hit severely.

The Daltar Lock and Safe Manufactory is to be started at Cardiff, and will employ several hundred operatives. I hear that the Bute Dock management is open to encourage small or even large industries by giving sites on liberal terms.

A new company, called the South Wales Storage Company, has been started at Swansea. The aim is to supply storage for tin-plate, &c., and make advances on same. It is being well supported by influential capitalists.

It has been announced that the Cwmavon copper and ironworks have been purchased by Messrs. Leech and Co., of Neath, but this is contradicted. There are hopes of a re-start at Pontardulais.

Colliery managers and owners regard the ambulance theory with interest, but maintain that to entrust details to untrained men would be only to make matters worse than they are now. Mr. Abraham has had several interviews with the principals on the subject, and it is now generally understood that if a company of young men at every pit will acquire the necessary ambulance knowledge the movement will be a success.

The iron and steel trades are good, prices firm, and inquiries much more satisfactory than last week.

Why do not our Welsh farmers go in for growing pitwood? The fact is some have tried, but as they gave the young trees no shelter from the west the wood became stunted. A dwarf wall that would shelter until three or four years old is all that is required.

All local industries are looking up, and even in the face of the many failures the outlook is encouraging.

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.

5th December, 1882.

5776. Driving Gear, &c., for Sewing Machines, T. Murphie, Glasgow.
5777. Perambulators, A. Lloyd, Shepherd's-bush.
5778. Window-sash Fastenings, J. D. Sprague, Upper Norwood.
5779. Electric Lamps, A. Fergusson, London.
5780. Corrugating, &c., Metal Sheets, G. M. Edwards, London.
5781. Apparatus for Suspending Swing Looking-glasses, &c., G. Crofts & G. Assinder, Birmingham.
5782. Gas Engines, W. Watson, Leeds.
5783. Magneto, &c., Electric Machines, W. A. Barlow.—(*W. E. Fein, Stuttgart.*)
5784. Walking-stick Umbrellas, &c., J. T. Ford, Southsea.
5785. Preparing Fluid Isinglass, L. A. Groth.—(*C. A. Sahlström, Jönköping, Sweden.*)
5786. Preparing Fluid Glue from Fish, &c., L. A. Groth.—(*C. A. Sahlström, Jönköping, Sweden.*)
5787. Extracting, &c., Oil from Fish, &c., L. A. Groth.—(*C. A. Sahlström, Jönköping, Sweden.*)
5788. Preparing Extract from Fish, &c., L. A. Groth.—(*C. A. Sahlström, Jönköping, Sweden.*)
5789. Pneumatic Railways, &c., A. W. L. Reddie.—(*E. P. Needham, New York, U.S.*)
5790. Condensing Apparatus, A. W. L. Reddie.—(*E. Theisen, Lindenau, Saxony.*)
5791. Stoppers for Bottles, P. P. Deslandes, Jersey.
5792. Digging Machines, J. Parker, Stevenage.
5793. Mattresses, S. K. Ibbetson, Southsea.
5794. Filling Sacks, H. J. Haddan.—(*L. and E. Laplace, Issoudun.*)
5795. Sash Fastenings, J. Whitehouse and S. Peacock, Birmingham.
5796. Electric Lamps, W. R. Lake.—(*R. H. Mather, Windsor, U.S.*)
5797. Primary Voltaic Batteries, T. Jones, London.
5798. Refrigerating Machinery, W. H. Wood and G. Richmond, New York, U.S.
5799. Cake for Cattle Food, &c., T. Earp, Newark-on-Trent.
5800. Signalling on Railway Trains, R. W. Vining, Liverpool.
5801. Treating and Dyeing Loose Wool, &c., T. Fox, jun., Wellington.
5802. Coupling Apparatus, E. Lumley, London.
5803. Draw-off Apparatus for Receptacles Containing Beer, &c., T. Collingwood, London.
5804. Cruet Frames, J. F. Homer, Birmingham.
5805. Wheels, W. R. Lake.—(*F. S. Smith, U.S.*)
5806. Tightening the Felloes of Wheels, A. M. Clark.—(*A. Galbraith, Amadore, U.S.*)
5807. Metallic Inlaid Work, A. M. Clark.—(*W. C. Edge, Newark, U.S.*)
5808. Gas and other Burners, A. H. Robinson, Dublin.

6th December, 1882.

5809. Treating Hydrochloric Acid, J. Hargreaves and T. Robinson, Widnes.
5810. Treating Spoil Heaps of Collieries, L. H. Armour, Gateshead-on-Tyne.
5811. Casing and Marking of Casing for Meal, T. and T. G. Bowick, Bedford.
5812. Filters, H. Rawlings, London.
5813. Drying Corn, &c., J. E. Fox, Gloucester.
5814. Gas-lighting by Electricity, J. A. Koerber, London.
5815. Furnaces, O. D. Orvis, New York, U.S.
5816. Governors for Steam and other Motive Power Engines, F. J. Burrell, Thetford.
5817. Milling Apparatus, J. H. Carter, London.
5818. Combing Machines, F. Ambler, Bradford.
5819. Gas Motor Engines, G. Whittaker, Manchester.
5820. Mechanism for Playing Pianofortes, A. Capra, London.
5821. Corsets, J. R. Ajax, London.
5822. Bottles, &c., J. T. Creasy, London.
5823. Holding and Fixing the Globes, &c., of Lamps, T. Carpenter, Birmingham.
5824. Tramway Cars, E. C. Wickes and F. E. B. Beaumont, London.
5825. Gas Motor Engines, F. J. Odling, Derby.
5826. Heating Apparatus, A. G. V. Harcourt, Oxford.
5827. Cleaning Iron, C. A. T. Rollason, Birmingham, and C. A. Rollason, Aston.
5828. Mules for Spinning, T. Knowles, Blackburn.
5829. Mild Steel, W. Prosser, Newcastle-upon-Tyne.
5830. Brakes for Carriages, E. Robinson, Cheshunt.
5831. Confectionery, W. R. Lake.—(*Thiele and Holzhause, Magdeburg.*)
5832. Steam Generators, W. R. Lake.—(*J. C. Stead, Brooklyn, U.S.*)
5833. Incandescent Electric Lamps, J. Wavish and J. Warner, London.

7th December, 1882.

5834. Pipe Couplings, D. Drummond, Lenzie.
5835. Utilising Iron Slags, C. Pieper.—(*C. Scheibler, Berlin.*)
5836. Leather, J. Imray.—(*J. Shaw, Hindmarsh.*)
5837. Bending Metallic Plates, C. Scriven, Leeds.
5838. Panels, Plates, &c., C. L. Lammers, Gosforth.
5839. Treating Silk for Dyeing, G. W. von Nawrocki.—(*W. Meister, New York, U.S.*)
5840. Sewing Machine, T. J. Denne, Holmesdale.
5841. Reducing the Friction between Water and Submerged Bodies, F. H. F. Engel.—(*G. de Laval, Stockholm.*)
5842. Horseshoes, W. Sykes, Boxmoor, and H. J. Sykes, Lincoln.
5843. Fusible Plugs, J. Burton and R. Byrnes, Staleybridge.
5844. Suspended Lights from Existing Gas Fittings for Lighting and Heating, J. J. Royle, Manchester.
5845. Heeling Boots and Shoes, J. Keats.—(*V. R. W. Keats, Mons, Belgium.*)
5846. Rowlocks for Boats, C. W. Morris, Lowestoft.
5847. Time, &c., Indicating Apparatus, C. H. and C. W. Thompson, London.
5848. Indurating Artificial Stone, &c., J. W. Butler, Blackheath.
5849. Connecting and Disconnecting Animals from Wheeled Vehicles, J. Rexford, Edmonton.

8th December, 1882.

5850. Electro-magnets, V. W. Blanchard, New York.
5851. Ventilating Shaft, F. A. Binney, Bowdon.
5852. Converting Wheeled Vehicles into Sledges, F. A. Binney, Manchester.
5853. Velocipedes, W. R. Pidgeon, Holmwood.
5854. Metallic Alloys, W. Keep, Cornwall.
5855. Fire-grates, &c., T. E. Parker, London.
5856. Diaphragms for Gas Governors, &c., G. Porter, London.
5857. Stamps for Forging and Shaping Metals, A. W. Wills, Birmingham.
5858. Wheels, E. A. Tice, Clapham.
5859. Apparatus for Displaying Notices, &c., A. Bruckner, London.
5860. Busks for Stays, &c., W. H. Symington, Market Harborough.
5861. Gaso-electric Lamps, P. M. Justice.—(*J. H. Loder, Brussels.*)
5862. Bucket Dredgers, G. Klug, Hamburg.
5863. Watch or Clock, J. Pallweber, Salzburg.
5864. Caoutchouc, &c., W. C. Horne, Old Charlton.
5865. Gas Motor Engines, J. J. Butcher, Newcastle-upon-Tyne.
5866. Electric Commutators, J. Gordon, jun., Dundee.
5867. Ordnance, A. M. Clark.—(*A. H. J. Suel, Paris.*)
5868. Preventing Accidents with Circular Saws, J. H. Johnson.—(*A. I. A. M. Trincano, Paris.*)
5869. Beer, &c., J. Armstrong, Clapham.
5870. Telephones, W. R. Lake.—(*A. E. Dolbear, U.S.*)

9th December, 1882.

5871. Lenses for Lanterns, R. E. Frank.—(*L. Micciullo, Italy.*)
5872. Signalling Apparatus, J. Sansom, Glasgow.
5873. Preventing Corrosion in Steam Boilers, J. B. Hannay, Glasgow.
5874. Ring Spinning and Doubling Frames, J. Young and E. Furniss, Mellor.
5875. Preparing Waxes and Oils for Lubricating Purposes, J. B. Hannay, Glasgow.
5876. Ventilating Buildings, T. H. Thompson, Manchester.
5877. Perambulators, W. Hatchman, London.
5878. Iron Permanent Ways, J. E. Walsh.—(*C. Verhoesen, Utrecht.*)
5879. Joints, Bearers, &c., J. E. Walsh.—(*M. G. Mitter and Dr. L. A. Hoffman, Berlin.*)
5880. Consuming Smoke, H. C. Paterson, Glasgow.
5881. Manufacturing Sizes, J. W. Harland, London.
5882. Velocipedes, J. R. Trigwell, London.
5883. Spring Motors for Sewing Machines, A. M. Clark.—(*J. B. T. Baudouin, H. L. Mathieu, and A. F. Conchin, Paris.*)
5884. Combustion Moderator for Stoves, &c., W. H. Beck.—(*C. J. Petit-Badré, Paris.*)
5885. Controlling the Discharge of Water, &c., W. A. G. Schonheyder, Shepherd's-bush.
5886. Boots and Shoes, H. Craston, London.
5887. Voltaic Batteries, L. Hartmann, London.
5888. Safety Valves, A. Haigh, Halifax.
5889. Steel, J. A. Jones, Middlesbrough-on-Tees.
5890. Doors, A. Shelmerdine, Manchester.
5891. Pocket-knives, A. Boult.—(*J. Raugh, Germany.*)
5892. Chimney Cowls, J. White, Edinburgh.
5893. Billiard Cloths, J. and G. E. Stead, Leeds.
5894. Indicating Temperatures, G. L. Winch, London.
5895. Railway Signalling Lamps and Spectacles, H. J. Marshall, Linslade.
5896. Ships' and other Lamps, E. Martin, London.
5897. Medical Trough-pens or Boxes for Live Stock, J. P. Smith, London.
5898. Musical Instrument, F. W. Wolff, London.
5899. Lighting, &c., Apparatus, P. R. Allen, London.
5900. Pipe-cutter, W. R. Lake.—(*G. Duhayon, Paris.*)
5901. Belt Fasteners, W. H. Sleep, St. Germans.

11th December, 1882.

5902. Preventing Corrosion of Bottoms of Ships, J. B. Hannay, Glasgow.
5903. Oil, &c., Cans, T. S. Marriage, Reigate.
5904. Looms for Weaving, A. Smith, Bingley.
5905. Tricycle, E. de Pass.—(*G. Milczewski and L. Maschmann, Frankfort-on-the-Maine.*)
5906. Measuring Chains, H. J. Haddan.—(*G. Féton, France.*)
5907. Type-dressing Machines, H. J. Haddan.—(*E. Berger, Leipzig.*)
5908. Tobacco-pipes, &c., A. Barr, Glasgow.
5909. Bedstead, A. J. Boult.—(*F. Lebacq, Bruxelles.*)
5910. Electric Lamps, F. H. F. Engel.—(*F. Küppermann, Hamburg.*)
5911. Pumps, T. F. Stenson, Handsworth.
5912. Fire-arms, J. S. Jarmann, London.
5913. Magnesia Salts, F. Wirth.—(*Farbfabrik vormals Brönnèr, Frankfort-on-the-Maine.*)
5914. Oxidising Textile Fabrics, C. D. Abel.—(*G. Witz, Rouen.*)
5915. Protecting Buildings Against Fire, J. M. Hooker, Sevenoaks.
5916. Looms for Weaving, W. Adam, Kidderminster.

Inventions Protected for Six Months on Deposit of Complete Specifications.

5798. Refrigerating Machinery, W. H. Wood and G. Richmond, New York, U.S.—*5th December*, 1882.
5805. Wheels, W. R. Lake, London.—A communication from F. S. Smith, Cleveland, U.S.—*5th December*, 1882.
5850. Electro-magnets, V. W. Blanchard, New York, U.S.—*8th December*, 1882.

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

4981. Safety Lamps, W. Smethurst, Bryan. — *5th December*, 1879.
5000. Treating Yarns, A. Pollock, Dumbarton.—*6th December*, 1879.
5003. Colouring Matters, J. A. Dixon, Glasgow.—*6th December*, 1879.
5005. Steam Engines, J. Gillett, Melksham. — *6th December*, 1879.
4729. Packing-cases, T. Cockcroft, Birkenhead.—*20th November*, 1879.
4996. Indicators for Prime Movers, J. H. Storey and J. W. Kenyon, Manchester.—*6th December*, 1879.
4998. Marking Woven Goods, J. Duxbury, Manchester.—*6th December*, 1879.
5006. Unloading Grain, &c., J. Gillett, Melksham.—*6th December*, 1879.
5023. Paper-folding Apparatus, W. Conquest, London.—*8th December*, 1879.
5107. Tramway and Road-car Traction, A. S. Hallidie, Liverpool.—*13th December*, 1879.
5007. Portable Cooking Ranges, D. Wilson, London.—*6th December*, 1879.
5013. Gunpowder, H. H. Lake, London.—*6th December*, 1879.
5075. Distilling Apparatus, Dr. H. Grüneberg, Cologne.—*11th December*, 1879.
5135. Annealed, &c., Glass Articles, F. Siemens, Dresden.—*15th December*, 1879.
5150. Iron and Steel, C. W. Siemens, London.—*16th December*, 1879.
5176. Ball Castors, G. W. Heath, Crayford.—*17th December*, 1879.
5285. Axles, W. Morgan-Brown, London.—*27th December*, 1879.
5019. Combing, &c., Fibrous Materials, S. C. Lister, Manningham.—*8th December*, 1879.
5043. Tricycles, &c., H. T. Kirby, Leicester.—*9th December*, 1879.
5052. Gas Motor Engines, E. C. Mills, Dunham, and H. Haley, Moston —*10th December*, 1879.
5133. Ploughs, J. Howard, Bedford.—*15th December*, 1879.
5020. Solitaires, E. Dobell, Hastings.—*8th December*, 1879.
5040. Winding, &c., Apparatus, T. Hardy, Poole, and W. M'I. Cranston, London.—*9th December*, 1879.
5054. Lock Nuts, D. Halpin, Shepherd's-bush.—*10th December*, 1879.
5174. Metal Pipes and Rods, F. A. Clark, Hammersmith.—*17th December*, 1879.
5299. Tramways, F. C. Glaser, Berlin.—*29th December*, 1879.
5305. Colouring Matters for Dyeing, &c., J. H. Johnson, London.—*29th December*, 1879.
5059. Stands for Decanters, &c., G. W. Betjemann, London.—*10th December*, 1879.
5109. Sulphite of Lime, R. Powell, Liverpool.—*13th December*, 1879.
5153. Signal Buoys, E. E. Mann, Lawrence, U.S.—*16th December*, 1879.

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

1625. Railway Signalling Apparatus, W. and R. Thompson, Newsham.—*18th April*, 1876.
4458. Rotary Engines, R. Hodson, Blackwall. —*22nd December*, 1875.
4241. Applying Petroleum, &c., for Generating Steam, R. Walker, London.—*7th December*, 1875.
4297. Railway and other Carriages, U. Scott, London.—*11th December*, 1875.
4391. Concentrating Sulphuric Acid, &c., M. Prentice, Stowmarket.—*18th December*, 1875.
4279. Boots and Shoes, D. Mills, Birmingham.—*9th December*, 1875.
4309. Expansion Joint for Tubular Fire-bars, F. R. Ellis, Liverpool.—*11th December*, 1875.

Notices of Intention to Proceed with Applications.

Last day for filing opposition, *29th December*, 1882.

3533. Taps, W. Hunt, Scarborough.—*25th July*, 1882.
3662. Tube Expanders for Steam Boilers, G. Sonnenthal, London. — A communication from P. Revollon.—*2nd August*, 1882.
3671. Working Railway Switches, &c., P. Prince, London.—*2nd August*, 1882.
3681. Facilitating Telephonic Communication, J. Cowan, Garston.—*2nd August*, 1882.
3691. Channels or Courses for Electrical, &c., Wires, G. M. Edwards, London.—*2nd August*, 1882.
3692. Tension or Friction Winding-on Motions for Tapeing, &c., Machinery, Y. Duxbury, jun., Over Darwen, Lancashire.—*2nd August*, 1882.
3694. Wagon or Lurry, E. Hollingworth, Dobcross.—*3rd August*, 1882.
3699. Bells for Bicycles, &c., J. Harrison, Birmingham.—*3rd August*, 1882.
3701. Preventing Down Draught in Chimneys, &c., C. E. Hanewald, London.—A communication from F. Haszelmann.—*3rd August*, 1882.
3703. Making Ice, T. Watts, Newport, and W. A. Gorman, London.—*3rd August*, 1882.
3706. Combining Harmoniums with Pianos, L. Küstner, Hamburg.—*4th August*, 1882.
3714. Sulphurous Anhydride, S. Pitt, Sutton.—A communication from the Compagnie Industrielle des Procédés Raoul Pictet.—*4th August*, 1882.
3722. Mechanical Button, A. Combault and W. T. Taylor, London.—*4th August*, 1882.
3730. Regulating the Speed of Bicycles, &c., J. G. Horsey and T. Bell, London.—*5th August*, 1882.
3731. Recovering Tin from Scrap Tin-plate, A. T. Becks, Aston, near Birmingham.—*5th August*, 1882.
3736. Heating and Cooling Fluids, W. and G. Lawrence, London.—*5th August*, 1882.
3739. Rotary Engines, J. G. Jones, London.—*5th August*, 1882.
3744. Painting, &c., Woven Fabrics, D. Guille, London.—*5th August*, 1882.
3745. Regulating the Flow of Gases, &c., R. Macintyre, London.—*5th August*, 1882.
3749. Fabric for Wall Hangings, A. M. Clark, London.—Com. from A. Hutchinson.—*5th August*, 1882.
3750. Dental Plates, &c., J. H. Gartrell, Penzance.—*5th August*, 1882.
3753. Combined Holder and Switch for Incandescent Electric Lamps, C. E. Sibley, London.—*5th August*, 1882.
3754. Furnaces for Utilising the Waste Heat from Gasworks, W. R. Lake, London.—A communication from Cher Pompée de Bondini.—*5th August*, 1882.
3757. Light-emitting Conductors for Electric Lighting Purposes, R. Werdermann, London. — *5th August*, 1882.
3759. Perforating Cheques, &c., P. Jensen, London. Com. from O. A. Ericsson.—*7th August*, 1882.
3761. Impregnating Wood for its Preservation, F. C. Glaser, Berlin.—A communication from P. J. F. Röper.—*8th August*, 1882.
3763. Telephones, J. J. Barrier and F. T. de Lavernède, Paris.—*8th August*, 1882.
3773. Sulphites, &c., for Bleaching Purposes, J. Imray, London.—A communication from F. C. Kudelski.—*8th August*, 1882.
3788. Sewing Machines, J. Imray, London.—A communication from Messrs. Grimme, Natalis, and Co.—*9th August*, 1882.
3812. Electric Secondary or Storage Batteries, J. S. Beeman, W. Taylor, and F. King, London.—*10th August*, 1882.
3813. Regulating, &c., Electric Currents, J. S. Beeman, W. Taylor, and F. King, London.—*10th August*, 1882.
3817. Securing Doors, &c., H. J. Haddan, London.—A communication from W. Kilian.—*10th August*, 1882.
3819. Gas Engines, J. McGillivray, Glasgow.—*10th August*, 1882.
3841. Arm-pit Dress Shields, W. R. Lake, London.—Com. from I. A. Canfield.—*11th August*, 1882.
3875. Treating Cotton, &c., E. de Pass, London.—Com. from H. Anthoni.—*14th August*, 1882.
3903. Carriage Axles, W. R. Lake, London.—A communication from W. J. Varley.—*15th August*, 1882.
4153. Carpet Fastener, E. Edwards, London.—A communication from J. A. Wilmot.—*31st August*, 1882.
4270. Generating Electricity, &c., W. R Lake, London.—Com. from E. Brard.—*7th September*, 1882.
4459. Treating Middlings, W. R. Lake, London.—A communication from C. Brown.—*19th September*, 1882.
4567. Obtaining Mechanical Effect by Electrical Energy, E. L. Voice, London.—*26th September*, 1882.
4918. Disintegrating Fabrics, I. C. Watson, Leeds.—*16th October*, 1882.
5067. Treating Certain Waste Materials, E. Davies, London.—*24th October*, 1882.
5105. Electric Lighting, P. Cardew, Chatham.—*26th October*, 1882.
5238. Apparatus to be Used in Connection with Lamps, &c., A. H. Robinson, Dublin.—*2nd November*, 1882.
5464. Spinning, &c., Fibrous Materials, J. B. and T. H. Dewhurst and R. Cornthwaite, Skipton.—*10th November*, 1882.
5499. Railway Sleepers, W. E. Pedley, Old Brompton.—*18th November*, 1882.
5512. Barbed Wire, O. W. Malet, London.—A communication from F. B. Malet.—*20th November*, 1882.
5550. Centre Valves, R. Dempster, jun., Elland.—*22nd November*, 1882.

(Last day for filing opposition, *2nd January*, 1883.)

3531. Communicating in Railway Trains, F. Hoe, Burton-on-Trent.—*25th July*, 1882.
3758. Ventilating Railway Carriages, &c., A. R. and J. W. Harding, Leeds.—*7th August*, 1882.
3769. Sewing Machines, H. Gardner, London.—Com. from R. M. Wanzer.—*8th August*, 1882.
3775. Bricks, &c., J. C. Bloomfield, Blen-y-lung, and J. McGurn, Bally-Magharan.—*8th August*, 1882.
3781. Velocipedes, C. Crozat, London.—*9th August*, 1882.
3785. Regulating Apparatus for Steam Engines, H. Davey, Headingly, near Leeds.—*9th August*, 1882.
3787. Generating Elastic Fluid under Pressure, H. Davey, Headingly, near Leeds.—*9th August*, 1882.
3789. Oxidising Alcohols, &c., E. A. Brydges, London.—Com. from D. Sandmann.—*9th August*, 1882.
3793. Door-mat and Scraper Combined, J. S. Willway, Bristol.—*9th August*, 1882.
3798. Poles and Stakes. W. A. Barlow, London.—A communication from F. Börner.—*9th August*, 1882.
3800. Boxes, P. Jensen, London.—A communication from D. L. Caillat.—*9th August*, 1882.
3803. Telephonic Apparatus, S. P. Thompson, Bristol.—*9th August*, 1882.
3804. Timepieces, W. Morgan-Brown, London.—Com. from J. J. D. Trenor.—*10th August*, 1882.
3821. Electric Lamps, F. Mori, Leeds.—*10th August*, 1882.
3822. Batteries for Storing Electricity, F. Mori, Leeds.—*10th August*, 1882.
3825. Electric Motors, S. H. Emmens, London.—*10th August*, 1882.
3833. Combing Fibres, G. Little, J. Green, and J. Fletcher, Oldham, and T. C. Eastwood, Bradford.—*11th August*, 1882.
3850. Hermetically Closing Boxes, &c., A. J. Boult, London.—A communication from C. Dauché and P. Deniaud.—*12th August*, 1882.
3865. Stays and Busks, J. Ingleby, Manchester.—Com. from P. W. Ziegler.—*14th August*, 1882.
3866. Valve Motions for Steam Engines, J. Edge, Liverpool.—*14th August*, 1882.
3869. Dynamo-electric Motor Machine, C. Desfossés, Paris.—*14th August*, 1882.
3884. Boots and Shoes, W. Morgan-Brown, London.—Com. from H. R. Adams.—*15th August*, 1882.
3885. Car Wheels, W. Morgan-Brown, London.—Com. from G. W. Miltimore.—*15th August*, 1882.
3890. Pistons, R. R. Gubbins, London.—*15th August*, 1882.
3891. Basic Fireproof Materials, H. Ulsmann, Prussia.—*15th August*, 1882.
3952. Gas Stoves, J. F. C. Norman and A. H. P. S. Wortley, London.—*18th August*, 1882.
3957. Automatic Pump or Boiler Feeder, E. T. Hughes, London.—Com. from the Automatic Boiler and Engine Company.—*18th August*, 1882.
4076. Rotary Engines and Pumps, W. B. Espeut, London.—*25th August*, 1882.
4105. Looms for Weaving, J. Dawson, Dukinfield.—*28th August*, 1881.
4660. Operating upon the Atmosphere of Apartments, W. W. Nightingale, Southport.—*30th September*, 1882.
4876. Gun Carriages, J. Vavasseur, London.—*13th October*, 1882.
4908. Filling, &c., Bottles, A. Macdonell, Newry, Ireland.—*16th October*, 1882.
4948. Motive-power Engines, D. Clerk, Glasgow.—*18th October*, 1882.
5009. Destroying Solid Impurities from Textile Materials, O. Imray, London.—Com. from La Société Harmel Frères —*21st October*, 1882.
5021. Combining Salicylic Acid and Glycerine, J. Prosser, London.—*21st October*, 1882.
5103. Velocipedes, &c., G. H. C. Hughes, Birmingham.—*26th October*, 1882.
5131. Coloured Photographs, H. H. Lake, London.—A communication from J. Chaine, A. Durand, and S. de Chaligny.—*27th October*, 1882.
5188. Gas-motor Engines, T. Ashbury, H. Sumner, W. Lees, and R. W. B. Sanderson, Manchester.—*31st October*, 1882.
5252. Treating Coal, &c., G. R. Hislop, Paisley.—*3rd November*, 1882.
5537. Drying Grain, &c., W. R. Lake, London.—Com. from F. W. Wiesebrock.—*21st November*, 1882.
5572. Antiseptics, &c., C. T. Kingzett and M. Zingler, London.—*23rd November*, 1882.
5604. Benzol, &c., S. Mellor, Patricroft.—*25th November*, 1882.
5622. Tubular Steam Generators, C. D. Abel, London.—A communication from L. C. Uhler.—*27th November*, 1882.
5714. Paper, W. C. Horne, Old Charlton.—*30th November*, 1882.
5850. Electro-magnets, V. W. Blanchard, New York.—*8th December*, 1882.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the 8th December*, 1882.)

2503. Leads for Pencils, G. Daubenspeck, London.—*26th May*, 1882.
2731. Revolvers or Pocket Pistols, E. G. Brewer, London.—*10th June*, 1882.
2737. Antifriction Bearings for Vehicle Wheels, W. J. Brewer, London.—*10th June*, 1882.
2739. Adjusting the Rollers of Roller Mills, J. Higginbottom and O. Stuart, Liverpool.—*10th June*, 1882.
2743. Finishing Textile Fabrics, E. Edwards, London.—*10th June*, 1882.
2750. Miners' Safety Lamps, W. Morgan, Pontypridd.—*12th June*, 1882.
2752. Electric Lamps, J. Lane, London.—*12th June* 1882.
2753. Gas-motor Engines, C. T. Wordsworth, Leeds, and J. Wolstenholme, Radcliffe.—*12th June*, 1882.
2754. Apparatus to Print, &c., Sugar Medals for Advertising Purposes, H. Faulder, Stockport.—*12th June*, 1882.
2755. Electric Lamps, W. Chadburn, Liverpool.—*12th June*, 1882.
2758. Extracting Glycerine from the Residuary Liquors of the Soap Manufacture, A. M. Clark, London.—*12th June*, 1882.
2764. Single-rail Railways, &c., A. M. Clark, London.—*12th June*, 1882.
2788. Vehicles for Facilitating the Unloading of Timber, &c., E. Rayner, Liverpool.—*14th June*, 1882.
2789. Supplying Air to Furnaces of Steam Boilers, &c., J. Howden, Glasgow.—*14th June*, 1882.
2792. Centre-second Watches, J. H. Godsell, Coventry.—*14th June*, 1882.
2805. Ornamenting, &c., Designs on Tin Plates, A. N. Hopkins, T. Baker, and T. W. Burt, Birmingham.—*14th June*, 1882.
2806. Securing Sheets of Glass, &c., S. Deards, Harlow.—*14th June*, 1882.
2827. Wire Ropes, F. C. Guilleaume, Cologne, Germany.—*15th June*, 1882.
2840. Measurement, &c., of Velocity, H. S. H. Shaw, Bristol.—*16th June*, 1882.
2841. Steam Boilers or Generators, A. D. Barclay, Kilmarnock.—*16th June*, 1882.
2849. Presses for Expressing Oils or Liquids from Seeds, &c., J. H. Johnson, London.—*16th June*, 1882.
2863. Checking Money, H. R. Landon and G. L. Dezille, London.—*17th June*, 1882.
2878. Dry Centre Valves, E. M. Simpson, London.—*17th June*, 1882.
2880. Sewing Machines, W. Fairweather, Manchester.—*19th June*, 1882.
2931. Umbrellas, &c., B. J. B. Mills, London.—*20th June*, 1882.
2934. Suspending or Mounting Electroliers, &c., A. W. Brewtnall, Warrington.—*20th June*, 1882.
2944. Carts, &c., W. March, London.—*21st June*, 1882.
2955. Treating Nitrogenous Matters to Obtain Useful Products, J. C. Mewburn, London.—*21st June*, 1882.
3030. Floating Lights, C. D. Abel, London.—*27th June*, 1882.
3061. Magnetic Compasses, F. Betbeder, London.—*28th June*, 1882.
3162. Dressing or Preparing Ores, F. Wirth, Frankfort-on-the-Maine, Germany.—*4th July*, 1882.
3182. Securing, &c., Mail Bags, A. M. Clark, London.—*5th July*, 1882.
3523. Regenerative Gas-burners, D. and W. H. Thompson and W. J. Booer, Leeds.—*25th July*, 1882.
3588. Safety or Miners' Lamps, W. L. Wise, London.—*28th July*, 1882.
3602. Clearing Wool and other Textile Fibre from Fragments of Straw, &c., Matter, O. Imray, London.—*29th July*, 1882.
4068. Moulding Tobacco, &c., into Packets, H. Clarke, London.—*25th August*, 1882.
4097. Wheels, J. Fry, London.—*26th August*, 1882.
4126. Speed-accelerating Driving Mechanism, W. R. Lake, London.—*29th August*, 1882.
4164. Working Hydraulic Lifts, J. M. Day, W. R. Green, H. C. Walker, and R. Carey, London.—*31st August*, 1882.
4198. Galvanic Batteries, E. B. Burr, Walthamstow, and W. T. Scott, Stratford.—*2nd September*, 1882.
4240. Lifts and Hoists, J. S. Stevens and C. G. Major, London, and D. P. Edwards, Roath.—*6th September*, 1882.
4258. Setting-up and Distributing Type, J. C. Mewburn, London.—*7th September*, 1882.
4294. Raising, Lowering, and Conveying Substances, F. J. Harrison, Rock Ferry.—*9th September*, 1882.
4304. Electric Lamps, J. G. Statter, Snapethorpe, near Wakefield.—*9th September*, 1882.
4312. Carbonisation of Coal, &c., J. Hardman, Milton, near Stoke-on-Trent.—*11th September*, 1882.

460. BATTERIES FOR GENERATING ELECTRICITY, G. G. Skrivanow, Paris.—16th *September*, 1882.
4464. DRIVING SCREW PILES, T. Wrightson and W. Clark, Stockton-on-Tees.—10th *September*, 1882.
4508. TREATING STEEL OR IRON INGOTS, P. M. Justice, London.—21st *September*, 1882.
4512. PORTABLE VOLTAIC BATTERIES, J. Mackenzie, London.—21st *September*, 1882.
4721. STEAM BOILERS OR GENERATORS, G. F. Redfern, London.—4th *October*, 1882.

(*List of Letters Patent which passed the Great Seal on the 12th December*, 1882.)

84. DYNAMO-ELECTRIC MACHINES, W. R. Lake, London.—6th *January*, 1882.
85. GENERATING, &c., ELECTRICITY, W. R. Lake, London.—6th *January*, 1882.
1391. PREPARING TABLETS for PRINTING, F. Rath, London.—22nd *March*, 1882.
2000. LIFE-SAVING, &c., APPLIANCES, D. P. P. de la Sala, London.—27th *April*, 1882.
2776. CARBONS for ELECTRIC CANDLES, &c., F. H. Varley, London.—13th *June*, 1882.
2779. HAYMAKING MACHINES, J. C. Float, Maldon.—13th *June*, 1882.
2796. BUOYANT SPEED WHEEL, W. Teague, jun, Tincroft, Redruth.—14th *June*, 1882.
2797. ABDOMINAL BELT, W. A. Barlow, London.—14th *June*, 1882.
2803. DYNAMO-ELECTRIC MACHINES, F. L. Willard, London.—14th *June*, 1882.
2804. EMPLOYING ELECTRICITY for TELEGRAPHIC, &c., PURPOSES, W. R. Lake, London.—14th *June*, 1882.
2808. FLUTING METAL ROLLERS, J. A. A. Buchholz, London.—14th *June*, 1882.
2810. RATCHET BRACES, T. W. Cheesbrough, London.—14th *June*. 1882.
2826. LEAD, F. J. Cheesbrough, London.—15th *June*, 1882.
2828. ATTACHING KNOBS and HANDLES to their SPINDLES, E H. Baxter, Birmingham.—15th *June*, 1882.
2832. FLAP VALVES, E. Edwards, London.—15th *June*, 1882.
2844. PANELS, &c, J. H. Browne, Cleobury Mortimer.—16th *June*, 1882.
2855. ADJUSTING DOORS, S. A. Say, London.—16th *June*, 1882.
2856. METEOROLOGICAL INDICATING, &c., MACHINES, F. H. F. Engel, Hamburg.—16th *June*, 1882.
2857. INJECTORS, A. H. Smith, Nottingham.—17th *June*, 1882.
2858. SAFETY SADDLE-BARS, R. S. Garden, London.—17th *June*, 1882.
2870. CALORIC ENGINE, A. M. Clark, London.—17th *June*, 1882.
2887. COUNTING, &c., APPARATUS, F. Petersen and J. H. R. Dinsmore, Liverpool.—19th *June*, 1882.
2943. PRIMARY, &c., GALVANIC BATTERIES and CELLS, H. Aron, Berlin.—21st *June*, 1882.
2947. BICYCLES, &c., J. S. Edge, jun., and F. W. Ticehurst, Birmingham.—21st *June*, 1882.
2967. SHOE, &c., FASTENERS, H. J. Haddan, London.—22nd *June*, 1882.
3060. SECURING BUTTONS, &c., E. C. Barron, London.—28th *June*, 1882.
3090. SELF-ACTING MULES, C. A. Barlow, Manchester.—30th *June*, 1882.
3120. GALVANIC BATTERIES, J. H. Davies, Ipswich.—1st *July*, 1882.
3122. COATING, &c., CERTAIN METAL SURFACES, A. M. Clark, London.—1st *July*, 1882.
3306. SCRAPERS, A. Lowcock, Shrewsbury, and J. Taylor, Salford.—12th *July*, 1882.
3316. UNDERGROUND, &c., CONDUITS for GAS, W. R. Lake, London.—12th *July*, 1882.
3320. SAFETY APPARATUS for LIFTS, A. M. Clark, London.—12th *July*, 1882.
4112. BATHS, W. Morgan-Brown, London.—29th *August*, 1882.
4152. SUPPLY of INK to PENS, G. R. Hughes and T. Carwardine, London.—31st *August*, 1882.
4438. BLIND ROLLER FURNITURE, J. W. Andrews, Whittlesea.—19th *September*, 1882.
4515. LOOMS for WEAVING, W. Smith, Heywood.—21st *September*, 1882.
4653. CHECKING the PERIODICAL ARRIVAL, &c., of EMPLOYEES, W. M. Llewellin, Bristol.—30th *September*, 1882.

List of Specifications published during the week ending December 9th, 1882.

965, 2d.; 1339, 2d.; 1355, 2d.; 1381, 2d.; 1545, 2d.; 1565, 2d.; 1573, 2d.; 1759, 2d.; 1827, 2d.; 1847, 2d; 1953, 2d.; 1964, 6d.; 1978, 6d.; 1981, 6d.; 2009, 2d.; 2037, 2d.; 2039, 8d.; 2101, 4d.; 2119, 2d.; 2121, 6d.; 2126, 6d.; 2127, 6d.; 2131, 2d; 2133, 10d.; 2136, 4d.; 2137, 6d.; 2138, 2d.; 2139, 6d.; 2141, 2d.; 2143, 2d.; 2146, 6d.; 2147, 4d.; 2148, 6d.; 2149, 2d.; 2150, 2d.; 2151, 2d.; 2152, 6d.; 2153, 6d.; 2155, 2d.; 2156, 4d.; 2157, 2d.; 2158, 6d.; 2159, 6d.; 2161, 4d.; 2162, 2d.; 2163, 2d.; 2164, 6d.; 2165, 6d.; 2166, 4d.; 2167, 6d.; 2169, 2d.; 2170, 2d.; 2171, 6d.; 2174, 1s. 4d.; 2175, 6d.; 2176, 2d.; 2177, 4d.; 2173, 4d.; 2180, 6d.; 2189, 6d.; 2190, 6d.; 2191, 2d.; 2193, 2d.; 2195, 8d.; 2196, 6d.; 2197, 8d.; 2198, 6d.; 2199, 6d.; 2200, 8d.; 2201, 6d.; 2202, 6d.; 2203, 6d.; 2206, 2d.; 2209, 6d.; 2212, 6d.; 2213, 4d.; 2215, 6d.; 2217, 2d.; 2219, 2d.; 2220, 4d.; 2227, 8d.; 2232, 6d.; 2233, 4d.; 2234, 6d.; 2236, 4d.; 2242, 4d.; 2243, 6d.; 2272, 6d.; 2287, 4d.; 2471, 4d.; 2536, 6d.; 3046, 6d.; 3944, 6d.; 3982, 6d.; 4094,, 10d.

*** 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.*

965. MANUFACTURE OF HATS, &c., *E. C. Vickers, London.*—28th *February*, 1882.—(*A communication from S. Gutmacher, Paris.*)—(*Provisional protection not allowed.*) 2d.

The body of the hat is covered with a coating of composition, which is embossed to give the hat the appearance of straw, leghorn, &c.

1339. UTILISING CAST-OFF ARTICLES OR GARMENTS FOR RE-MANUFACTURE INTO TEXTILE FABRICS, *G. Rydill, Sheffield.*—20th *March*, 1882.—(*Provisional protection not allowed.*) 2d.

The articles are unravelled and then the yarns or threads are utilised.

1355. COMBINED PANTOMIMIC TRICK AND PACKING CASE, *A. H. Lowe, Brixton.*—21st *March*, 1882.—(*Provisional protection not allowed.*) 2d.

This relates to the construction of the case.

1381. MARINE ENGINE GOVERNOR, *J. J. Tyler, Bromley-by-Bow.*—22nd *March*, 1882.—(*Provisional protection not allowed.*) 2d.

This relates to the employment of a pendulum for actuating a valve regulating admission of pressure, so as to work a piston either from condenser or from boiler.

1545. LAMPS, *C. D. Aria and J. Davies, London.*—30th *March*, 1882.—(*Provisional protection not allowed.*) 2d.

This consists in substituting for the cup or saucer of glass, &c, a cage or netting of wirework or the like over or around which are arranged artificial flowers.

1565. ORNAMENTATION OF VARIOUS ARTICLES, *J. B. Dubois, Maule, France.*—31st *March*, 1882.—(*Provisional protection not allowed.*) 2d.

Leaves of various plants are treated to obtain the skeleton, which is then employed for ornamentation.

1573. HAND SCREENS, *M. O. Hund, London.*—31st *March*, 1882.—(*Provisional protection not allowed.*) 2d.

This relates to the construction of hand-screens, and to the manner of exhibiting photographic portraits.

1759. DINNER AND OTHER TABLE PLATES, *W. E. and G. Plant, Moseley.*—13th *April*, 1882.—(*Provisional protection not allowed.*) 2d.

Wells are formed in the rim for reception of salt, &c.

1827. SLATE, SLAB, OR TILE ROOFING, *W. P. Thompson, Liverpool.*—17th *April*, 1882.—(*A communication from H. Prodhomme, Bruxelles.*)—(*Provisional protection not allowed.*) 2d.

The slates instead of being double, and in some places treble, are only laid single with a sufficient lap. They are laid in the form of diamonds or fish-scales.

1847. APPARATUS EMPLOYED IN PRINTING, *J. F. Haskins, London.*—18th *April*, 1882.—(*Void.*) 2d.

One part relates to the distribution of the ink in cylinder printing machinery in which two cylinders are employed. Another part relates to the means for securing the printing surfaces or plates or blocks carrying the same to the type or main cylinder. A third part relates to the holding of the sheets to be printed and the delivery of the printed sheet. Other improvements are described.

1953. MEMORIAL PLATES FOR TOMBS, &c., *H. J. Haddan, London.*—25th *April*, 1882.—(*A communication from E. Olive, Paris.*)—(*Provisional protection not allowed.*) 2d.

This consists in an ornamental frame or plate adapted to receive a photographic or other portrait and an inscription.

1964. BRAKES FOR WHEELED CARRIAGES, *A. Archer, Liverpool.*—26th *April*, 1882. 6d.

This relates to a brake band worked by a lever.

1978. DECORTICATION OF THE CHINESE NETTLE, &c., *W. R. Lake, London.*—26th *April*, 1882.—(*A communication from P. A. Favier, Villefranche, France.*) 6d.

This consists essentially in the division of the mechanical operations into two parts, viz: First, the decortication to deprive the stalk of its internal woody portion, and then the crushing or bruising of the bark or outer portion to free it from the external pellicle which covers it.

1981. APPARATUS FOR CHARGING HAND-PRINTING BLOCKS WITH COLOUR, *A. M. Clark, London.*—26th *April*, 1882.—(*A communication from J. Hutchison, Newark, U.S.*) 6d.

This consists of a box containing as many rollers as there are separate patterns on the printing block, these rollers each dipping in separate colour boxes, and mounted on shafts provided at the ends with friction rollers on which a frame rests for carrying the printed block. By moving this block over the rollers the distance of one pattern field, each pattern will be provided with its colour, and thus a number of colours can be applied on the block in operation.

2009. RAILWAY SIGNALLING APPARATUS, *E. J. Chabrel, London.*—28th *April*, 1882.—(*Not proceeded with.*) 2d.

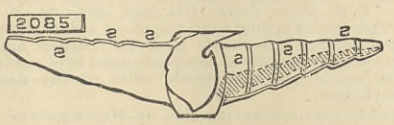
This relates partly to apparatus for causing an audible signal upon the engine to be sounded at required times and places, such apparatus being worked by the signalman in the ordinary way of working the semaphore signals now employed.

2039. WRITING AND DRAWING PENS, *M. Fischer, Halle-on-the-Saale, Prussia.*—29th *April*, 1882. 8d.

One part relates to the peculiar form of the slit of any penholder wherein the pen is put and held; a Second part consists in the application of a ring or several rings to the handle of any penholder; a Third improvement consists in arranging the front piece of a penholder, which carries the pen, to turn upon a rivet, like the blade of a knife. Several other improvements are described.

2085. SCREW PROPELLERS, &c., *J. Davison, Sunderland.*—3rd *May*, 1882. 6d.

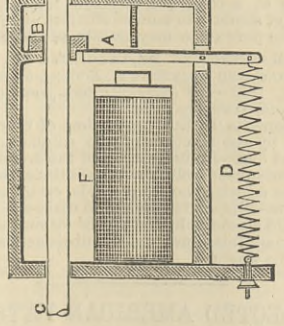
This consists, First, in forming the blades of screw propellers with corrugations forming sectors of concentric circles, at suitable intervals over the whole surface of the blades. The corrugations on the driving face may form grooves with sides of equal or unequal angles, but they preferably form a series of steps, the distance between which is considerably greater than the depth of each step. The corrugations of the back



surface follow those on the front surface, but the angles are rounded. The dotted lines in the drawing show a section of one blade on the radial centre line from boss to point. The invention further consists in making the stern pipes or tubes with openings on its upper portion fitted with removable doors, so as to enable the propeller shaft to be examined.

2092. IMPROVEMENTS IN ELECTRIC LIGHT APPARATUS, *C. Lever, Bowdon, Cheshire.*—3rd *May*, 1882. 8d.

This relates to arc lamps, and more particularly to a clutch for regulating the arc. The clutch is shown in the figure. The arc is struck as follows, C being



the upper carbon:—When no current is passing, carbon C is raised a certain distance by the action of spring D on A and B; when, however, the current is turned on, F, which is a high resistance shunted electro-magnet, is energised, and attracts A; the gripping piece B falls to a right angle position and allows carbon C to descend until it touches the lower carbon, then the current is diverted from magnet F, and D again pulls down its end of A and raises B, this grips C, and the arc is struck. In this manner also the arc is regulated. The inventor also claims a means of shunting the current past a lamp, or from one pair of carbons to another, &c.

2101. RAILWAY AND TRAMWAY WHEELS, &c., *R. Hadfield, London.*—4th *May*, 1882. 4d.

This consists in the making a railway, tramway, or other similar wheel with either wrought, rolled, or forged steel or iron spokes, united or welded to a cast steel tire.

2112. EXHIBITING ADVERTISEMENTS, *J. Hickisson, Hackney.*—5th *May*, 1882.—*Not proceeded with.*) 2d.

This relates to a frame in which suitable tablets or plates bearing advertisements may be inserted, suitable means being provided for illuminating the same at night.

2119. CALCULATING INSTRUMENT, *A. J. Boult, London.*—5th *May*, 1882.—(*A communication from G. Charpentier-Page, Valdoie, France.*)—(*Not proceeded with.*) 2d.

The instrument is based on the same principals as the ordinary calculating or slide rule.

2121. WATER-CLOSET BASINS, &c., *T. W. Helliwell, Brighouse.*—5th *May*, 1882. 6d.

The objects are, First, to construct water-closet basins so that they can be used as water-closet basins and as urinals; Secondly, to convey the noxious gases away which issue from water-closet basins and their fittings.

2125. IMPROVED METHOD OF PRODUCING ELECTRIC CURRENTS FOR GENERAL PURPOSES, *K. Payzelski, Warsaw, Russia.*—5th *May*, 1882.—(*Not proceeded with.*) 2d.

The inventor digs two large holes in the earth close together or "thousands of miles away," deep enough to always have water in them. In one of these he places zinc, and in the other carbon, coal, or some metal. The two are then connected by a wire. He also proposes to use veins of minerals for the same purpose.

2126. GAS MOTOR ENGINES, *S. Worssam, London.*—5th *May*, 1882. 6d.

This relates to a gas motor engine wherein a motive power cylinder and a pump for the compression of the explosive mixture are arranged end to end in one and the same axial line, the respective pistons being both fixed on one piston rod; the use of a slide valve arranged to oscillate or partially rotate around the piston rod.

2127. APPARATUS FOR MECHANICAL PLAYING OF KEY-BOARD INSTRUMENTS, *R. H. Bishop and W. Down, London.*—8th *May*, 1882. 6d.

This relates to improvements in apparatus for mechanically striking the keys of pianos and such like instruments, the principal objects being to reduce the cost and simplify the construction of the apparatus; to provide for the regulation at will of the force with which the keys are struck, thus producing the effect of crescendo and diminuendo; and to facilitate the insertion and removal of the metallic web or plate of perforated music, by which the movements of the strikers are governed.

2128. IMPROVEMENTS IN REGULATING AND UTILISING ELECTRIC CURRENTS, *W. Arthur, Cork-street, Middlesex.*—5th *May*, 1882. 6d.

The inventor provides a group of accumulators of equal resistance with each group of lamps in any circuit, into which he causes the current to flow when the lamps are turned out, thus preventing any bad effects on the generator by the throwing of such lamps out of circuit. Each group of lamps has its own group of accumulators.

2129. MERCURIAL AIR PUMPS, *D. Johnson, Chester, and S. C. Tisley, Brompton-road.*—5th *May*, 1882. 6d.

This relates to improvements on "Sprengle's pump," by which the quantity of mercury and the power required to produce a given result are reduced, a better vacuum is produced, and the apparatus is rendered capable of being worked more rapidly than the ordinary apparatus and by means of any suitable motor. The invention consists, First, in enclosing the upper ends of the dropping tubes in an air-tight chamber to which the article to be exhausted is connected, and from which it can be disconnected without admitting air to the chamber, and causing the mercury to pass to said chamber from the vessel at the lower end of dropping tubes without being exposed to contact with air. The invention further relates to Geissler pumps, and consists in substituting a flexible box containing mercury for the ordinary lifting bulb, and alternately forcing the mercury into the tubes and exhausting chamber and allowing it to return therefrom, by alternately compressing the bag and allowing it to expand, for which purpose it is placed in a closed chamber, to which steam, compressed air, or water under pressure is first admitted, and then allowed to escape.

2131. LEADS FOR PENCILS, *G. Daubenspeck, London.*—5th *May*, 1882.—(*Not proceeded with.*) 2d.

This consists in combining together violet of aniline, oxide of alumina, or some equivalent substance, and soap.

2133. CONSTRUCTION OF STOVES AND LAMPS, *F. J. Duggan, Bristol.*—6th *May*, 1882. 10d.

This relates to several improvements in the construction of stoves and lamps, whereby the same are rendered more suitable for burning petroleum and other oils.

2134. WET GAS METERS AND LOW-PRESSURE WATER-METERS, *W. C. Parkinson, City-road.*—6th *May*, 1882. 6d.

This consists mainly in dividing the measuring drum into three compartments only instead of four as hitherto, provided with three inlet and three outlet hoods suitably shaped and arranged.

2135. AN IMPROVED PROCESS FOR FORMING LEAD FOR SECONDARY BATTERIES, *T. Cuttriss, Leeds.*—6th *May*, 1882.—(*Partly a communication from C. Cuttriss, Duxbury, Mass., U.S.A.*) 4d.

The inventor rapidly coats lead plates with peroxide in the following manner:—In a vessel containing dilute sulphuric acid he places a porous pot containing a solution composed as follows: Saturated solution of bichromate of potash in water, 100 parts; sulphuric acid, 10 parts; nitric acid, 1 part. The lead plate to be formed is placed in this solution, and connected with the positive pole of a battery. A plate of metal or carbon being placed in the outer vessel is connected to the negative pole of the battery. The circuit is then completed, the result being that peroxide of lead is rapidly and thickly formed on the lead plate.

2137. REVOLVING HARROWS, CLOD CRUSHERS, AND FORKS, &c., *E. Button, Stainway, Essex.*—6th *May*, 1882. 6d.

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

2139. VELOCIPEDES, *B. Bennett, Coventry.*—6th *May*. 1882. 6d.

This relates principally to improvements in the driving and steering gearing.

2141. APPARATUS FOR TEACHING THE RUDIMENTS of MUSIC, *E. M. Easson, Slough.*—6th *May*, 1882.—(*Not proceeded with.*) 2d.

This relates to a board upon which separate musical notes can be arranged.

2143. BOILING OR PREPARING ESPARTO GRASS, &c., USED IN THE MANUFACTURE OF PAPER, *D. Smith and C. Robertson, Sydney.*—(*Not proceeded with.*) 2d.

This relates to the application of a multitubular steam chest or chamber in the bottom of the boiler used for the boiling or preparing or esparto, &c.

2140. SAFETY PINS, *G. F. Redfern, Finsbury.*—6th *May*, 1882.—(*A communication from F. S. Peshine, Newark, U.S.*) 6d.

This relates to a new form of shield for the point of the pin, and formed in one piece of wire with the pin itself.

2144. IMPROVEMENTS IN ELECTRIC LAMPS, *J. H. Johnson, Lincoln's-inn-fields.*—6th *May*, 1882.—(*A communication from J. M. A. Gérard-Lescuyer, Paris.*) 6d.

This relates to arc lamps. Each carbon is vertical and fixed in a socket on a conducting plate. Two cups containing mercury are provided on another conducting plate. One carbon is carried in a socket attached to a horizontal plate supported by a pair of legs or pivots, the lower extremities of which are immersed in the mercury. This carbon leans against the other upright carbon when no current passes. When, however, they are in circuit the current passes up the stationary and down the movable carbon, the parallel but opposite current in which causes it to move away and establish the arc.

2146. LIQUID MEASURING AND REGISTERING APPARATUS, *E. G. Rivers, Thornton Heath.*—6th *May*, 1882. 6d.

This consists of a cup or vessel having a two-way plug or tap passing through the same, in combination with registering mechanism.

2147. TOBACCO POUCHES, *B. L. James, Wanstead Park.*—6th *May*, 1882. 4d.

This consists in constructing vulcanised india-rubber tobacco pouches with a cap piece opening laterally of the pouch.

2148. TRICYCLES, &c., *W. Dawes and J. Tankard, Leeds.*—6th *May*, 1882. 6d.

The object is the production of a tricycle or other vehicle, in which the muscular power of both the legs and arms of the rider is, or may be, employed for propelling, and a means is also embodied in the arrangement and construction of the whole, whereby the guiding or steering can at the same time be as easily and safely effected as heretofore.

2149. APPARATUS FOR SEPARATING AND PURIFYING MIDDLINGS IN THE MANUFACTURE OF FLOUR, *J. Beal, Sheffield.*—6th *May*, 1882.—(*Not proceeded with.*) 2d.

This consists chiefly in the arrangement and use of horizontal rotary beaters in conjunction with an exhaust fan, a sieve, and other known appliances used in similar machinery.

2150. SELF-CLOSING VALVES FOR CLOSETS, &c., *A. Sweet, London.*—6th *May*, 1882.—(*Not proceeded with.*) 2d.

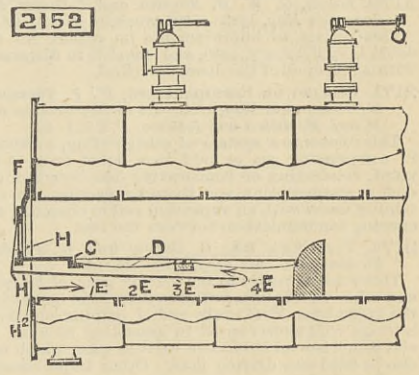
This relates to improvements in the construction of diaphragm valves.

2151. GAS PRODUCERS, *F. W. Dick and G. S. Packer, Glasgow.*—8th *May*, 1882.—(*Not proceeded with.*) 2d.

This relates to improvements in the general construction of the gas producer.

2152. COMBUSTION OF FUEL AND CONSUMPTION OF SMOKE, *W. Beasley, Birmingham.*—8th *May*, 1882. 6d.

Underneath the dead-plate C and the fire-grate D is fitted the trough E, which forms a channel E^1, E^2, E^3, which passes longitudinally along to E^4, leaving the gap between E^4 and the bridge, which may vary in length. Upon the front of the fire-door F is fixed a box



or cover H, which projects downwards to H^1, and continues under to H^2 to make junction with the edge of the front end trough E, thus forming an internal communication with it. The body of the fire-door itself is perforated or has a large hole in its body covered with wire gauze.

2153. PENHOLDER, *W. Sinclair, East Linton.*—8th *May*, 1882. 6d.

This relates to means for preventing the fingers becoming dirty.

2155. PIPE CONNECTIONS, *C. L. Hett, Brigg, Lincolnshire.*—8th *May*, 1882.—(*Not proceeded with.*) 2d.

This relates to improvements in pipe couplings.

2156. PREPARATION OF PHOTOGRAPHIC PLATES, *F. Wirth, Frankfort.*—8th *May*, 1882.—(*A communication from G. Meisenbach, Munich.*) 4d.

The inventor claims the one or more times exerted moving or shifting of the hatched plate on the photographic negative or positive plate during the production of the definite negative or positive form, from which afterwards the typographic or other printing block is made.

2157. COMPOSITION FOR CLEANING, COLOURING, &c., STONE STAIRS, HEARTHSTONE, &c, *J. M. Gray, Kingston-upon-Hull.*—8th *May*, 1882.—(*Not proceeded with.*) 2d.

The composition consists of pipe-clay, Paris white, whiting, China clay, mixed together, to which is added ultramarine and yellow ochre.

2158. LAMPS FOR BICYCLES, &c., *H. F. D. Miller, Birmingham.*—8th *May*, 1882. 6d.

This consists in the construction, combination, and arrangement of parts, whereby the body or bulk of the lamp is so reduced that it can be passed through the spokes of the vehicles and arranged upon the axis or shaft, and secured with the employment of one hand.

2159. APPARATUS FOR AUTOMATICALLY PLAYING PIANOFORTES, *A. Wilkinson, Bradford.*—8th *May*, 1882. 6d.

This consists in the construction and employment of an oscillating cylinder, over which is passed an endless apron, or an apron without having the ends secured together; the apron being made of calico or any other suitable textile fabric and covered with a paper face, in which are punched holes and fitted with pegs, according to the notes of the music to be played.

2161. REFINING SUGAR, *A. Scott, jun., J. D. Scott, and T. R. Ogilvie, Greenock.*—9th *May*, 1882. 4d.

This consists in a process for separating gummy and other insoluble matters from saccharine solutions, wherein an insoluble compound or salt of an alkaline earth is employed to form a precipitate.

2162. SHOES FOR HORSES, &c., *R. C. Eames, Westminster.*—9th *May*, 1882.—(*Not proceeded with.*) 2d.

This relates to the formation of a groove or grooves on the working face, which grooves are pierced at certain distances apart. The grooves are filled in with india-rubber.

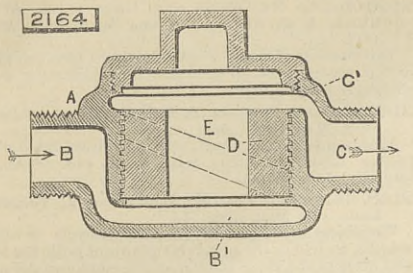
2163. PYROMETER, *A. Sauvée, Westminster.*—9th *May*, 1882.—(*A communication from E. M. Amagat, Lyons.*)—(*Not proceeded with.*) 2d.

The invention is based on the principle that when a rather thin metallic tube is kept in contact with a heated body, if a current of water flows at the same time through this tube at a proper speed the increase of temperature of the water is limited to a few degrees.

2164. APPARATUS FOR REGULATING AND CONTROLLING THE FLOW OF WATER, &c., *T. S. Borrodaile, London, and E. J. C. Welch, Westminster.*—9th *May*, 1882. 6d.

In the drawing A is the body or casing, B the inlet for the fluid whose flow has to be controlled, and C the outlet. D is a piston working in a box or cylinder having communication with the inlet passage B^1 at one end, and with the outlet passage C^1 at the other. The bore E through the middle of the piston is in this case the controlling orifice or passage. The small grooves in the piston itself are to receive any small particles of dirt which might otherwise jam the piston. In the present case the piston itself also forms the outlet checking valve, for as it rises it closes the outlet orifice C^1, and checks the outward flow of the fluid, thus causing the pressure above the piston to be

maintained at the same amount as that below it, less an amount due to the weight of the piston itself, and this being constant the difference of the pressures at B^1



and C^1 is constant also, and the water flows through the controlling orifice E at a constant velocity.

2165. Holders for Programmes, &c., *F. Steitz, London.*—*9th May*, 1882. 6*d*.
This relates to a means of suspending or fastening to the person programmes and similar articles.

2166. Utilising Heat to Produce Force as Motive Power, *T. Charlton and J. Wright, London.*—*9th May*, 1882. 4*d*.
The object of the invention consists in producing and inducing energy within an aeriform or fluid elastic medium, and converting the said energy into a motive power, so as to perform work.

2167. Rotary Engines, *W. P. Thompson, Liverpool.*—*9th May*, 1882.—(*A communication from D. D. Hardy, Chicago.*) 6*d*.
This relates to a rotary engine having an internally toothed cylinder made to revolve within a stationary outside shell with recesses between said cylinder and outside, for the purpose of counterbalancing the steam pressure on the inside of said cylinder, and preventing the friction which would otherwise result from the steam pressing said cylinder against said outside shell.

2169. Advertising, *E. P. Alexander, London.*—*9th May*, 1882.—(*A communication from J. Hernardinquer, Paris.*)—(*Provisional protection not allowed.*) 2*d*.
This consists in attaching to a board, &c., a number of advertisements which may be detached.

2170. Kilns, *G. W. H. Brogden and E. Casper, London.*—*9th May*, 1882.—(*Not proceeded with.*) 2*d*.
This relates to improvements on patent No. 654, dated 14th February, 1880, and consists in dispensing with some or all of the doors described.

2171. Cooling or Refrigerating, *W. P. Thompson, Liverpool.*—*9th May*, 1882.—(*A communication from Messrs. McMillan and Johnson, U.S.A.*) 6*d*.
This relates to a system of refrigerating, consisting in compressing gas or fluid to a liquid form at one point, conducting or transporting the liquefied product to another point, and there connecting the containing vessel with an expansion coil or chamber, and opening communication between the two.

2174. Tricycles, &c., *C. Harvey and W. Paddock, Birmingham.*—*9th May*, 1882. 1*s*. 4*d*.
This consists partly in the driving gear of tricycles and other velocipedes, with the purpose of quickening the speed upon level roads, and of gaining additional leverage with slower speed in ascending inclines. It also comprises an automatic balance gear, which may also be used as a driving gear. Other improvements are described.

2175. Horseshoes, *A. Vanderkerken and J. Mans, Brussels.*—*9th May*, 1882. 6*d*.
This consists in a shoe for horses, &c., provided with a channel filled with india-rubber in combination with a splayed or dovetail groove for the nail holes and nails.

2176. Machine for Making Wire Bale Bands, *A. W. L. Reddie, London.*—*9th May*, 1882.—(*A communication from G. Nicholson, New York.*)—(*Not proceeded with.*) 2*d*.
The bale bands consist of a pin of wire of the required length, and the fastening device consists of an oblong link provided with two holes or eyes. The invention consists in a machine for producing the above.

2177. Purification of Water, *P. and F. M. G. Spence, Manchester.*—*9th May*, 1882. 4*d*.
This consists in the purification of water by precipitating soluble and other impurities contained in such water by means of soluble sulphates of alumina or alumina and iron when the water contains bi-carbonate of lime or lime and magnesia, or when prepared so as to contain such salts of lime or lime and magnesia.

2178. Colouring Matters for Dyeing and Printing, *J. A. Dixon, Glasgow.*—*9th May*, 1882.—(*A communication from the Farbwerke vorm Meister, Lucius, and Brüning, Höchst-am-Main, Germany.*) 4*d*.
The object is the production of alpha-naphthylamine-trisulpho-acid, and the further production of a yellow dye-stuff therefrom.

2180. Apparatus for Recording Distances Travelled by Ships or Vessels, &c., *G. C. Lilley, London.*—*9th May*, 1882. 6*d*.
This refers to apparatus in which a fan or screw in the water is connected by a flexible connection, such as a cord or line, to counting or recording mechanism placed on board a ship or navigable vessel where the speed of such is to be recorded, or connected to some stationary object where it is the speed of the tide that is to be ascertained.

2186. Improvements in Incandescent Electrical Lamps, *H. Lea, Birmingham.*—*9th May*, 1882. 6*d*.
This relates to improvements in the construction of the holders of incandescent lamps, whereby they are simplified, and the lamps rendered easy to remove and replace.

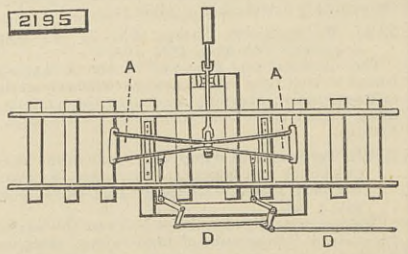
2189. Apparatus for Sharpening Razors and Knives, *A. Payne, East Moulsley.*—*10th May*, 1882. 6*d*.
This relates to apparatus in which a pair of rollers is employed.

2190. Apparatus for Automatically Working Signals, *W. Goalen, London* —*10th May*, 1882. 6*d*.
The object is to enable a railway train to work its own signals automatically, so that as it passes a signal post it shall raise the signal up to the "danger" position, and at the same time lower the last signal into the "line clear" position.

2191. Apparatus for Finishing and Velouring Hats, *S. Wilde and H. Beech, Denton.*—*10th May*, 1882.—(*Not proceeded with.*) 2*d*.
The object is to impart at will to the block which carries the hat under operation, either one elliptical or excentric movement as required when finishing or "velouring" the brim and body, or a true circular motion as required when finishing or velouring the tip or central portion of the crown of the hat.

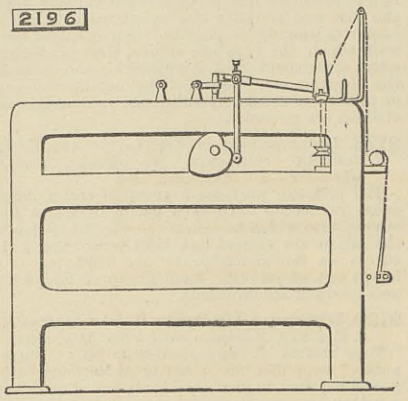
2193. Manufacture of Nitro-sulphuric Acid, *W. Brookes, London.*—*10th May*, 1882.—(*A communication from T. Holliday, Barcelona.*)—(*Not proceeded with.*) 2*d*.
This consists in condensing nitric acid in iron vessels in which concentrated sulphuric acid is previously placed, the sides of the vessels being protected against the action of the gases by a lining of stone, tiles, or other acid gas-resisting material, and the covers of the vessels being composed of similar materials.

2195. Signalling and Registering Signals on Railways, *A. Smith and S. A. Taylor, Kibworth.*—*10th May*, 1882. 8*d*.
This relates to the use of signals on the locomotives operated and controlled from the signal-boxes by means of a special apparatus or device placed on the line at suitable intervals, and connected with the usual signal levers, so that it can be set either to move or not move the signal when the train is passing. It is preferred to employ suitable registering mechanism in combination with the signal, and also to cause the steam whistle to be opened simultaneously with



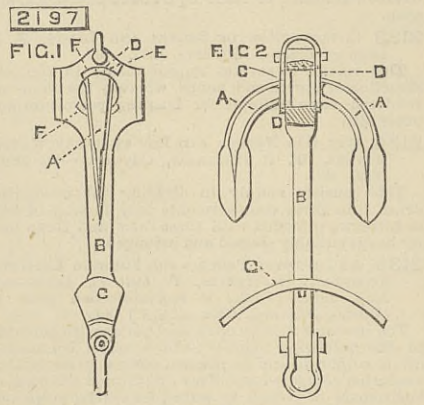
the actuating of the signal. The actuating device consists of the frame A composed of the curved bars united by cross bars and operated by the lever D leading to the signal-box, so as to place it in either of three positions, and thereby cause the signal to indicate "danger," "caution," or "line clear."

2196. Machinery for Winding Cotton and other Yarn and Thread, *H. C. Hill and H. H. Brown, Staleybridge.*—*10th May*, 1882. 6*d*.
On the ordinary faller shaft are fixed spring levers, or flexible or other guides, one to each spindle, and at one end of the shaft is fixed a lever which is actuated by a cam or heart driven by the drum shaft, or in any other convenient manner. When the machine is in motion the faller shaft is turned backward and forward by the cam acting on the lever fixed at its end, and the end of each spring lever or guide, through which the yarn or thread passes that presses



against the spool or spindle, is moved up and down, thus winding the yarn or thread spirally on the spool or spindle, so that it is traversed from end to end of the spool or bobbin. The chase or pitch of the thread or yarn thus wound is so great that it is tied securely in forming the spool and will not ravel, and as the guide presses against the spool or bobbin on which the yarn is being wound it causes the yarn to be wound on the spool as nearly as is practicable the exact distance traversed by the lever.

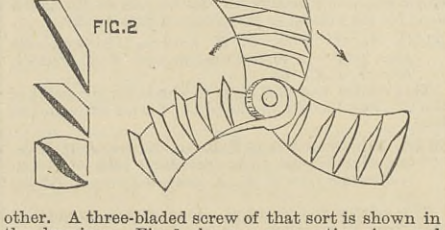
2197. Anchors, *C. Martin, Brighton.*—*10th May*, 1882. 8*d*.
This relates to improvements on patent No. 1632, A.D. 1872, one form or modification being shown in the drawing. The fluke piece or pair of arms A is secured in the head of shank B by a shoulder C on one side, and a key D passing completely through the fluke piece on the other side, the ends of the key projecting and working in recesses F formed in the face of the shank head, and which limit the angular movement of the fluke piece. The key is introduced through a groove E leading from the outside of the shank head



into one of the recesses F. The journal of the fluke piece A has a groove round it to reduce the bearing surface. The shank head has slightly projecting ribs at its corners. The fluke arms A are made with a straight taper from shoulder to point, but the flukes are bevelled so as to have a lozenge-shaped section. The fixed arms G are curved, and are also of a curved section.

2198. Machinery Employed in the Preparation of Hides, Skins, and Leather, *J. S. and B. Stocks, Leeds.*—*10th May*, 1882. 6*d*.
The inventors claim the arrangement, construction, and application of a hollow drum, cylinder or beam, having in combination a pressure bar and parts connected therewith for retaining the material in position.

2199. Steamship Screws, *J. W. von Nawrocki.*—*10th May*, 1882.—(*A communication from F. Maringer, Düsseldorf.*) 6*d*.
The screw blades are made with parabolas, and on the convex side they are furnished with ribs or paddles, which are arranged helically parallel to each



other. A three-bladed screw of that sort is shown in the drawings. Fig. 1 shows a perspective view, and Fig. 2 section of blade at the nave, in the middle of the blade, and at the periphery of same.

2200. Indicating a Ship's Position by the Display of Signal Lights, *A. W. Tuer, London, and J. Cleminson, Westminster.*—*10th May*, 1882. 8*d*.
This relates to the arrangement of the lamps to show white lights only, so contrived that the white port signal shall be readily distinguishable from the white starboard signal.

2201. Railway Signals, *A. W. Tuer, London, and J. Cleminson, Westminster.*—*10th May*, 1882. 6*d*.
This relates to the use for railway signalling of a semaphore rendered visible by the light displayed within it.

2202. Motor Engines Worked by Gas or Combustible Vapour and Air, *S. Clayton, Bradford.*—*10th May*, 1882. 6*d*.
This consists essentially in the construction and employment of engines actuated by air, gas and air, or combustible vapour and air, such engines being double-acting, an explosion of compressed air, gas and air, or compressed combustible vapour and air being effected at both ends of the working cylinder, thereby actuating the in and out stroke of the cylinder piston.

2203. Printing Machines or Presses, *W. R. Lake, London.*—*10th May*, 1882.—(*A communication from J. T. Hawkins, Taunton, U.S.*) 6*d*.
The object is to construct a double-cylinder printing press which shall print two sheets for each double stroke of the bed, and deliver the sheets from the two cylinders alternately at each end of the press, at a much higher rate of speed, and at the same time accomplish much more accurate work.

2205. Compound for Curing "Gapes" in Pheasants, &c., *J. H. Clark, Tarbigge.*—*10th May*, 1882. 4*d*.
The compound is about 12 oz. quicklime, 1½ oz. flowers of sulphur, 1 oz. assafetida, and 1 grain arsenious acid.

2206. Filling Sacks, *H. J. Haddan, Kensington.*—*10th May*, 1882.—(*A communication from L. Rohmer, Rambervillers, France.*)—(*Not proceeded with.*) 2*d*.
The sacks are placed on trucks and filled by means of sleeves.

2209. Graining and otherwise Ornamenting Surfaces, *T. J. J. Kelly, London, and C. B. Lindsay, Blackheath.*—*10th May*, 1882. 6*d*.
This relates to a transfer process.

2212. Wire Woven Fabric, *G. Arnold, Halifax.*—*10th May*, 1882. 6*d*.
This relates to the improvement in the manufacture of wire woven fabrics, comprising the employment of steel wire or iron and steel wire combined, the steel being afterwards hardened and tempered.

2213. Treatment for Softening, Unhairing, &c., Hides and Skins, *A. M. Clark, London.*—*10th May*, 1882.—(*A communication from J. L. Moret, Paris.*) 4*d*.
This relates to the chemical treatment of the hides and skins.

2215. Sights for Rifles and Shot Guns when both Eyes are Kept Open, *T. Gilbert, London.*—*11th May*, 1882. 6*d*.
This relates partly to a sight for small arms having a number of notches on one side thereof.

2216. Supplying Water to Water-closets, *T. C. Summers, Portsea.*—*11th May*, 1882. 6*d*.
This relates to the use of a hydraulic piston or plunger, in combination with a rocking or oscillating seat, which with the other parts makes the system of supply and regulation perfectly automatic.

2217. Knife Cleaner, *H. Woodward, London.*—*11th May*, 1882.—(*Not proceeded with.*) 2*d*.
The cleaner consists of three superposed blocks, or pieces of wood, or other suitable material, enclosed in a frame. The upper two blocks are movable, and are provided on their interior or opposed faces with leather or other suitable polishing surfaces.

2219. Manufacture of Steel and Ingot Iron, *T. N. Muller, Middlesbrough-on-Tees.*—*11th May*, 1882.—(*Not proceeded with.*) 2*d*.
The object is to cause or facilitate the escape of the gas or gases from molten metal, and to render the metal more uniform in quality, for which purpose it is caused to pass through an apparatus that will divide it into streams and agitate it in its passage to the casting ladle, wherein further agitation is effected by the falling streams of molten metal.

2220. Ornamenting Ribbons, &c., *A. H. Horsfall, Coventry.*—*11th May*, 1882. 4*d*.
This relates to ornamenting ribbons by means of lithography.

2227. Pneumatic Brake Apparatus for Railways, *F. W. Eames, Leeds.*—*11th May*, 1882. 8*d*.
This relates mainly to an improved construction of double-acting pneumatic lever for railway brakes, which lever permits of being exhausted or of receiving compressed air on opposite sides of the flexible diaphragm.

2234. Life-preserving Bed or Mattress for Use on Board Ship, *A. M. Clark, London.*—*11th May*, 1882.—(*A communication from M. H. Holmes and J. R. Steiner, St. Paul, U.S.*) 6*d*.
This relates to a buoyant frame-bound life-preserving mattress, having a removable filling piece or portion, and constructed and provided with means whereby it may readily be converted from a bed into a boat or raft.

2236. Alcoholic Beverage, *J. H. Loden, Leiden, Holland.*—*11th May*, 1882. 4*d*.
The beverage is prepared by the fermentation of a solution of sugar or glucose and tartaric acid in the presence of red, or Brazil, or yellow, or fustic wood, and sorrel paste.

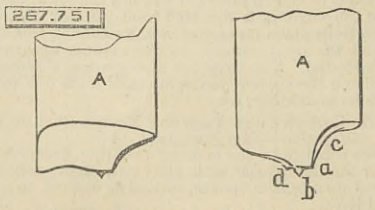
2239. Separating Sugar from Molasses and Syrups, *C. Scheibler, Berlin.*—*11th May*, 1882. 4*d*.
The invention consists in the separation of sugar from molasses and syrup by causing the sugar to combine at a comparatively low temperature with hydrate of strontia to monosaccharate of strontia from which the pure sugar may readily be obtained.

2242. Manufacture of Colouring Matters for Dyeing and Printing, *J. Erskine, Glasgow.*—*12th May*, 1882.—(*A communication from C. Rumpff, Aprath, Germany.*) 4*d*.
This consists in the production of new colouring matters by the reaction of the sulpho acids of the diazo and diazo-azo derivatives of the aromatic hydrocarbons on aqueous solutions of naphthylamine, effected by means or with the aid of acids, or by the reaction of the non-sulphonated diazo and diazo-azo derivatives of the said aromatic hydrocarbons on such solutions of the said naphthlamines and by subsequent sulphonisation of the product.

SELECTED AMERICAN PATENTS.

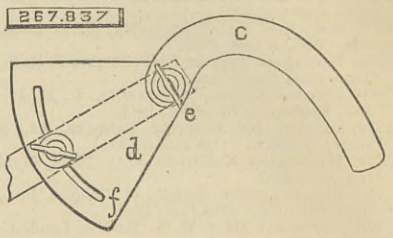
From the United States' Patent Office Official Gazette.

267,751. Metal Punch, *De Lancy Kennedy, New York, N.Y.*—*Filed May 11th*, 1882.
Claim.—(1) In the spiral shearing punch A, the cutting face, having a part E, removed between the



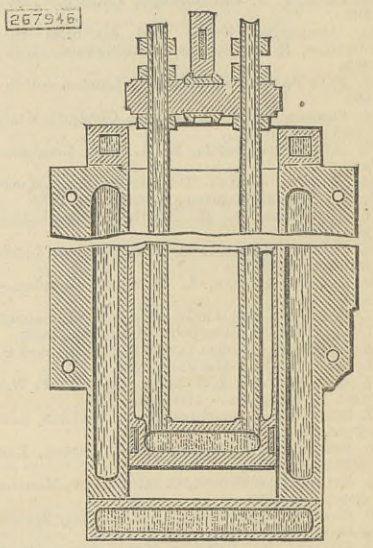
centre and first cutting point of the periphery, substantially as and for the purpose set forth. (2) In the spiral shearing punch A, two first cutting points at opposite sides of the periphery, united by spirals, the cutting face, having parts E, removed between the centre and first cutting points, substantially as and for the purpose set forth. (3) In the spiral shearing punch A, a central bearing or narrow base A, and a centre point B, together forming the mechanical centre of the tool, combined with a guiding or easing edge C, uniting the first cutting point D of the periphery with the spiral, substantially as and for the purpose set forth.

267,837. Adjustable and Detachable Handle for Ploughs, &c., *James M. Clark, Lancaster, Pa.*—*Filed July 1st*, 1882.
Claim.—The combination, with the handle beam of a plough or other implement, of handle C, having



slotted attaching and adjusting plate D, said handle being pivot-bolted to the hand beam at E and stay-bolted through slot F, as described.

267,946. Hydrocaron Engine, *Amos E. Stettin, South Abington, Mass.*—*Filed August 28th*, 1882.
Claim.—In a hydrocarbon motor, a cylinder prolonged beyond the working stroke of the piston sufficiently to prevent the combustion against the working



face of such piston from directly heating that portion of the cylinder beyond such working stroke, in combination with a trunk piston so extended as to present a designedly large surface to such prolonged and unheated portion of the cylinder, and a water circulation, substantially as shown and described.

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