

THE TREATMENT OF SILVER TAILINGS IN NEVADA.

By T. EGLESTON, Ph. D.

IN every silver mill there are two streams, discharging one from the battery, and one from the settlers. As they are treated differently, different names are given to the residues which accumulate from them. The pulp which runs out of the settlers and agitators is called "tailings." That which comes from the stamps, and is not deposited either in the pulp or slime vats, is called "slimes" or "slums." The tails have been in contact with mercury, the slimes or slums have not. There are thus slimes from the slime vats in the mill, which are treated with the pulp, and slimes outside of the mill, which if caught are collected in reservoirs.

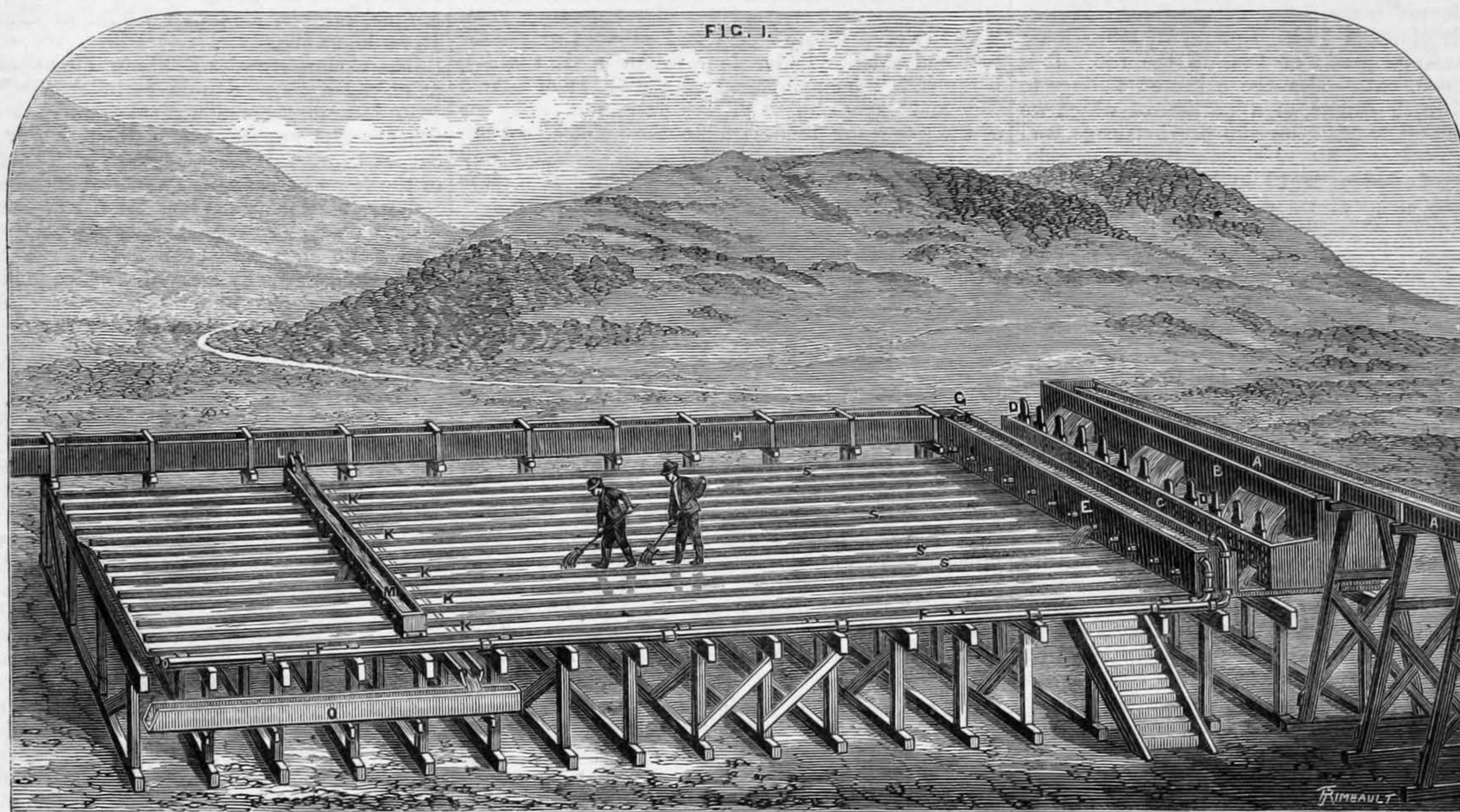
special arrangement being made for it, as all the water from the slime vats is pumped up with the slimes in it, and passes again through the mill.*

By this method, there are no battery slimes. It is well worth consideration whether this method would not pay even when water was plenty. The amount of water to be paid for would be less, and the gain in yield would probably more than pay for the pumping, if properly managed.

The pan tailings and slimes could be caught with a sufficient number of tanks, but the mills have not usually been built with reference to it, and could often not be altered, as there is generally not sufficient space around them for the purpose. Frequently the slimes are not valuable enough to justify much expense, so that in most of the mills only a rough attempt is made to catch the mercury

they are taken up and washed. The tarring is done by drawing the blanket over a bath of hot liquid tar.

As the stream of tailings runs over these blankets the heavier portions are caught; the lighter portions are washed away. The loose blankets are taken up at intervals of about 12 hours, and washed in tanks, the tarred ones are cleaned by a man who walks over the blankets, brushing the surface lightly with a broom, thus disturbing and distributing the material, and aiding the action of the water. The material caught in the blankets is thus swept into under sluices beneath the main sluice, and is caught in tanks. While the blankets of one sluice are being cleaned by washing or sweeping, the stream is turned on to the others; so that whatever the number of sluices required to do the work may be, there must always be one more.



THE WOODWORTH SLUICES AT DAYTON, NEVADA.

The part of the pulp which has been reduced to a slimy condition in the pan, is called pan slime, and hence there are three kinds of slimes: mill slimes, collected in the slime vats of the mill, which are treated in the pans; battery slimes, which are the overflow of the slime vats; and pan slimes, which discharge from the agitators with the tailings, and are only accidentally separated from them in the lower parts of large reservoirs. The battery slimes are usually allowed to escape, or are caught in large reservoirs below those for the tailings. The pan slimes and tailings are treated together in concentrators, or on blanket sluices principally, to catch the mercury and amalgam, and heavy particles of ore, and the concentrates are treated in pans.

If the ore has been properly worked in the pans, no gold or silver can be extracted directly from the tailings and pan slimes. It is in the state of sulphurets, which cannot be separated without thorough oxidation, produced either by roasting, by chemical action, or long exposure to the action of the weather. They contain, however, a certain portion of mercury and amalgam, and sometimes sulphurets containing gold which will pay to concentrate and separate.

The battery slimes are poorer than the ore, but they generally will assay about 60 per cent. of its value. They contain proportionately much less gold than the ore. The quantity of slime depends upon the amount of water used in the battery, the method of settling, and the quantity of clay in the ore. With hard ores, the amount of slimes in the best mills will be 2 to 3 per cent., with soft ores it will be more than double that quantity. Whatever gold there is in them is very flaky and likely to float; the silver is in a very fine state of division and also likely to float, and is also to some extent in the form of sulphurets. The slimes are worth from 15 dols. to 20 dols., and often more, and can be profitably treated. When water is scarce the slimes are very advantageously treated without any

and amalgam, and very large quantities of them go to waste.

The treatment of the slimes varies but slightly from the treatment of the ore, differing only in these respects, that pans of much larger dimensions are used, and that the slimes do not require grinding.

Generally the battery slimes are settled in a series of reservoirs. The richest material will always be in the first one. There are a large number of such slime reservoirs of great extent, that have been filled to the depth of 8 ft. to 10 ft. in Dayton Cañon, below Virginia City, Nevada, where a number of mills have been established to treat them; but the best of them do not get more than 60 per cent. of the assay of the slimes, even where they use very large amounts of chemicals, as most of them do. The bullion produced is never fine, and is less so as the amount of sulphate of copper is larger. The loss of mercury is so great that some of the tail mills (as mills treating tailings and slimes are called) purchase ore to mix with them. This loss has given rise to the invention of a number of machines for saving it.

The tailings are generally treated in blanket sluices, the attempts to treat them on concentrators not having been successful. The sluices are troughs 20 in. wide with sides 2 in. or 3 in. high, and sometimes 1700 ft. or 1800 ft. long, with a grade of 6 in. to 10 in. in every 12 ft.; a number are usually placed side by side, generally three. Sometimes as many as 15 to 20 and even more are arranged together. They are covered with strips of coarse blanket, which are laid on the sluice, and can be easily removed to be washed. When the sluices are long, they are tarred on the underside to keep the blanket from rotting, in which case they are nailed to the sluice and swept. When not tarred

These sluices are sometimes owned by the mills, but generally by contractors; they usually cost about 1 dol. per foot, including the blankets. The concentrations from both kinds of blankets are worth from 18 dols. to 30 dols. per ton, and are treated in pans.

What passes the short blanket sluices is generally accumulated in reservoirs. Below Virginia City, there are immense quantities of these tailings, collected in artificially constructed reservoirs, from which when they are full the water is turned off, the dam and the sides removed, and the material, which soon becomes thoroughly dry, carted to the mills for treatment. It is doubtful whether it will pay to save the residues of long sluices. As illustrations of the way this work is done, the Eureka Mill and Woodward sluices have been selected.

At the Eureka Mill, the discharge from the agitators is run into a large tank from which it is raised by an Archimedeal screw, 32 ft. long and 16 in. in diameter, which discharges into a head box 10 ft. long, 1 ft. wide, and 16 in. deep. This box has six gates which open on to the same number of sluices built side by side, each of which is 1200 ft. long. They are 20 in. wide, and are separated by strips of $\frac{1}{2}$ in. board, 3 in. high. Five of these sluices are used at a time; the sixth is held in reserve in case of accident. The blankets are 10 ft. to 12 ft. in length, and are not cut. They are tarred on the underside, and are fastened with five tacks at the upper end, and by a cleat tacked to the sides. The lower end is loose and laps over the blanket below it from 6 in. to 12 in. Every 200 ft. there is an opening across the sluice 3 in. wide, which is covered during the time the tails discharge over it, with a sheet-iron cover, which communicates with a trough running across the sluice below. This opening is always placed at the head of a blanket, so arranged that the lap of the blanket covers it while the tails are running. When the blanket is to be swept the

* See articles on "Pan Amalgamation," ENGINEERING, vol. xxvii.

cover is removed, the end of the blanket drops over the edge of the opening, and the blanket concentrates are carried into the trough below. The upper end of the sluice is swept every four hours, the lower end once in six hours. Six tons of concentrates are collected in a day. It takes three men per shift of 12 hours to do the work. The concentrates here have the same assay value as the ore, and are treated in the same way with the addition of one third of slimes.

The best example of long sluices is the Woodworth sluices of Dayton, Nevada, which were designed and constructed in 1874 by W. H. Armstrong, for the Dayton Mill, of which he was superintendent. They are the largest which have ever been built, and are designed to treat all the tailings from 25 to 30 mills in Gold Cañon, or 262 stamps, being an average of two tons a day for each stamp. These are all collected in the sluice at the Bacon French Mill. This sluice is 18 in. square, $\frac{3}{4}$ miles long, with an average grade of 4 in. to the rod. It is never cleaned, but carries the collected tailings to the Woodworth sluices, of a portion of which we give a perspective view on the previous page, and which are composed of 12 sluices, S, side by side, each one of which is 19 in. wide. They are separated by strips of wood $1\frac{1}{2}$ in. wide, and 3 in. high, and form together a table 22 ft. wide and 1700 ft. long. These sluices have a grade of 2 in. to the rod, and are supported on trestles $4\frac{1}{2}$ ft. apart. For convenience of working, the group is divided into sections of 150 ft., but each sluice is continuous. At the head of the sluice the tails are discharged from the sluice A into a head-box B, made of two compartments included in the same structure. These are each 3 ft. long and 2 ft. deep, and the whole width of the sluices. The bottom of the first one, B, is 20 in. above the bottom of the sluice, and has three openings, 3 ft. wide and 4 in. high, which discharge into the distributing box C, which has 12 openings, 4 in. by 8 in., one for each sluice. All the openings in C are provided with gates D, so that all or any number of them can be closed at a time. In front of the box B is another one E, of the same size and shape, which is fed by clear water, from the two lines of galvanised iron pipe F, 5 in. in diameter and 2156 ft. long on one side of the sluice, and on the other supplies it through the gate S, to the side box H, which is $8\frac{1}{2}$ ft. wide and $10\frac{1}{2}$ ft. deep, and carries the clear water to the head of the sections; it is consequently 150 ft. shorter than the whole sluice. Here it discharges through the openings L into boxes M, 6 in. by 6 in., which cross the sluice at right angles, and have, like the clear water head-box E, a 3 in. round hole I for each sluice, which can be closed with a plug when the blankets are not being washed. These troughs are 1 ft. above the sluice, and are supported on four inclined pieces shaped so as to leave the current free. At the end of each section, there is a slot K in the bottom of the sluice, 3 in. wide and 17 in. long, closed by a sheet-iron cover, which opens into an inclined sluice 6 in. wide and 12 in. deep, which runs under the whole width of the table, and at right angles to it, and discharges into a trough O of the same size, which runs parallel to the table, and carries the concentrates to the reservoirs. This slot in the bottom of the sluice is closed when the sluice is working, and the blanket laid over it, as at the Eureka Mill.

At the end of 1200 ft., there are ten settling tanks, 9 ft. long, 8 ft. wide, and 4 ft. deep, into which the sweepings are discharged. At the end of 1600 ft., there are two of the same size, and at 1700 ft. two more, making 14 in all; 140,000 ft. of lumber, 24,000 ft. of blankets, 19,000 ft. of which are in use at a time, 2 tons of nails and spikes, and 1600 gallons of coal tar were used in the construction of the sluice. The total cost of construction was 21,500 dols. We shall give perspective views of the whole sluices in a future issue.

(To be continued.)

THE BELGIAN NATIONAL EXHIBITION.

(Concluded from page 124.)

III. STEAM AND OTHER ENGINES.

THE Exhibition contained a large collection of steam engines, over fifty in all, besides steam pumps, all the more important being in motion with the exception of the winding engines. After an examination of the whole it must be said that the average excellence attained both in workmanship and design was very high. It seems natural to suppose

that an exhibition of this kind should fairly represent the industries of the country in which it is held, and if this be so in this case, it is very much to the credit of the Belgian engine makers that they can make such a good show. Naturally there are a few whose zeal for economy has outrun their discretion, but it cannot be doubted, on the other hand, that if we had a similar exhibition in London we should find not a few whose discretion had not admitted of any zeal for economy at all. The workmanship of the engines was in some cases first-rate, and in the great majority of cases very good. As to the general characteristics of Belgian engine design, they do not appear to differ much from the characteristics of Continental design generally. The under bedplate is practically abandoned in favour of some form of direct framing between cylinder and bearings—slipper guides and crossheads have made way for bored guides of satisfactory area. The use of separate steam and exhaust valves for each end of the cylinder (four valves in all, that is), is the rule, the employment of a slide, or of a main slide and expansion valve, the exception. The use of the governor to determine the point of cut-off, lastly, has become almost universal—scarcely any stationary engines were shown in which the cut-off is not varied automatically in this way.

After this much of introduction we may proceed to describe some of the chief engines exhibited at Brussels; commencing at the north end of the building and working our way southwards. The 35 horse power engine driving the machinery of the agricultural section was made by the Grand Hornu Works on Waay's system. It has a fork bedplate, with double bearings for the crankshaft. There are four slide valves, working longitudinally, all on one side of the cylinder, the steam valves above the exhaust. The exhaust slides are worked from the crosshead, moving, therefore, only at the ends of the stroke. The principle of the automatic cut-off resembles the Correy gear used by Messrs. Powell, of Rouen, and illustrated in our columns,* but the details of the disengaging gear seem far too light to last.

Passing over a neat engine with Sulzer valves, shown by M. L. van Acker, of Brussels, and a type of engine introduced by Mr. P. J. Raze, with four single-acting trunk cylinders for eight horse power—rather a good allowance—we come to the Seraing exhibit, which was a very large one. The largest engine exhibited by the "Société John Cockerill" was, as usual, a pumping engine. This time it was a compound engine of 1000 (maximum) indicated horse power, ordered for the Mansfield Copper Mines in Prussia, the engine whose forgings we have already mentioned. The cylinders are inverted and placed at the top of the machine, working down to a steel rivetted crosshead, from the outside of which connecting rods work, driving crank-pins on the outside of the immense flywheels. The cylinders and guides are supported by cast-iron braced framing. The middle part of the crosshead works, by links, the main beam, which is of steel, braced, and the journal for which is placed so as to give the pumps about two-thirds of the stroke of the engine. The beam gudgeon is carried on cast-iron brackets, and under its centre is a hydraulic ram for lifting the beam or supporting it if necessary. The normal speed of this machine is intended to be about eleven strokes per minute, at which speed it will lift 456 cubic feet of water per minute, and give an effective horse power of 650. Besides this large engine, the Seraing Works exhibited two marine engines. One was of the ordinary inverted compound type, of 400 indicated horse power, which we illustrate elsewhere in the present number, and which, therefore, we need not describe here. The second marine engine (both these machines were shown at work) was the compound paddle engine, of which we published a two-page engraving in our number of the 15th ult., and which we described at the time (*vide* page 320 *ante*).

The following leading dimensions and particulars as to the large pumping engine may be interesting:

Mansfield Pumping Engine.

Diameter of high-pressure cylinder	45.2 in.
" low "	74.7 in.
Stroke of pistons	10 ft. 11 in.
" pumps	6 ft. 6.7 in.
Diameter of flywheels	29 ft. 6.3 in.
Weight (2)	64 tons
Diameter of flywheel shaft bearings	21.7 in.
Weight of flywheel shaft	11.65 tons
" beam (Bessemer steel) with gudgeons	41.3 tons
Length of beam between centres	42 ft. 10 in.

* See ENGINEERING, vol. xxv., page 491.

Depth of beam in middle	14 ft.
Diameter of beam gudgeon (bearings)	23.62 in.
Length of each bearing	39.3 in.
Load hung from beam (to represent pit-work for 725 ft. deep)	34.5 tons
Minimum number of strokes per minute	4
Total weight of machine	403 tons

The Couillet Company's exhibit adjoined that of the Seraing Works. Their chief machine was the winding engine said to be able to indicate 1200 horse power, which we illustrated on page 374 of our last number. The same firm also exhibited a neat horizontal engine with cylinder 15.5 in. in diameter and 31.5 in. stroke, having cut-off variable from 0 to 92 per cent. of the stroke by the governor, which acts on a cast-iron valve working behind (brass) main slides. The cut-off is effected by steam pressure as in the Zimmermann engine at Paris. This engine has a flywheel 11 ft. 6 in. in diameter weighing 4 tons, and an air pump 7.9 in. in diameter with 15.75 in. stroke.

The Company "des Produits Flenu" (Mons) also exhibited a large double cylinder winding engine (680 indicated horse power) somewhat similar to the Couillet engine, but without a governor, the cut-off being only varied by hand. This firm is one of the few who have used a marine ended connecting rod in a stationary engine, the use of some form of gib and cotter adjustment being practically universal. The same firm also exhibited a large ten-bladed Guibal fan, driven by a very old-fashioned little engine with a spread-out under bedplate, and double-bar guides of such dimensions as were used before engineers had found out that guide pressures had to be looked after.

The firm of Walthère Libert and Co., of Liège, seems to be under the direction of Mr. W. Libert, "chargé du cours de construction mécanique à l'Université de Liège," the author, we believe, of a useful treatise on applied mechanics. We cannot congratulate the firm, however, on the particular application of mechanics made in a very old-fashioned and somewhat roughly made geared winding engine which they exhibited. It was a long way behind the general standard of Belgian work.

Mr. H. Bollinckx, in an engine on the whole neatly designed, which he used for working an air-cooling machine, adopted a plan in his valve gear which is, we see, used by a good many Belgian engineers, but which very seldom works out satisfactorily. The steam valves are worked by cams on the lay shaft beside the cylinder, and the governor has the work of moving these cams longitudinally on the lay shaft in order to vary the cut-off. Besides giving the governor a most undesirable amount of work to do, this plan generally seems to lead to considerable clumsiness in the valve connexions, and Mr. Bollinckx's case is no exception to the rule.

Messrs. Hanrez and Co., of Monceau-sur-Sambre, showed two engines fitted with Mr. R. Zimmermann's valve gear, a very neat type of trip gear working double-beat valves about which we shall have more to say in connexion with one of the Düsseldorf engines. The larger engine is a 500 indicated horse power winding engine, in which we noticed that the makers used a separate (Porter) governor for each cylinder, instead of only one for the two. The smaller engine is a stationary engine, indicating 80 horse power. The exhibitors give the following as the results of the trials of a similar engine, the experiments being conducted by Herr Pinzger:

Diameter of cylinder	19.7 in.
Stroke of cylinder	41.3 "
Revolutions per minute	51
Horse power on brake	100
Cut-off	19.8 p. ct.
Initial pressure	82 lb. per sq. in.
Mean back pressure in cylinder	2.27
Indicated horse power	114.3
Efficiency $\frac{100}{114.3}$	87.5 p. ct.
Water per indicated horse power per hour	18.08 lb.
Water per effective horse power per hour	20.70 "
Coal per indicated horse power per hour	2.03 "
Coal per effective horse power per hour	2.30 "

Messrs. Carels Frères, of Ghent, have taken up the manufacture of Sulzer engines in Belgium, and exhibited a compound Sulzer engine of 150 indicated horse power, similar to that shown by Messrs. Sulzer Brothers themselves at the Paris Exhibition. This engine has an eight-grooved flywheel, driving the shafting by rope gear.

Messrs. C. J. and S. Beer, of Jemeppe, did not exhibit any large machinery, but all that they did show was well made. Their principal engine is one made

for the Ecole des Mines at Liège for experimental purposes. It is a single-cylinder engine of about 15 in. in diameter, the cylinder entirely overhung at the back of the bedplate, fitted with Gooch link reversing gear, and an automatic cut-off arrangement controlled by the governor, which cannot well be described without the aid of drawings. They showed also some smaller engines, including a three-cylinder ventilating engine at work, and a neatly arranged automatic brake.

M. Prosper van den Kerchove, Ghent, the Belgian licensee of Mr. Corliss, showed a fine condensing Corliss engine, of the 1879 patent, indicating—or rather intended to indicate—285 horse power. Mr. Corliss still adheres to the use of V guides, at which we are somewhat surprised, their advantages being much less obvious than their drawbacks. The arrangement for working the valves in this case is that the eccentric rod drives a rocking lever (cast iron) about the middle of the engine's length, and this lever, by a gab-ended rod, works another, which in its turn is coupled by a link to a third. The two last-named levers come close under the levers on the exhaust valve spindles, and are connected to them by drag links so arranged as to open and close the valves quickly, and leave them almost stationary when either opened or closed. The same levers serve to open the steam valves, the closing gear for which has been very much simplified and lightened during the last few years. M. van de Kerchove also showed a small horizontal engine (20 indicated horse power) with Rider valve, in the Machinery Hall, and another similar engine drove the paper-making machinery of Messrs. De Naeyer and Co.

The Société Anonyme Vervietoise pour la Construction de Machines (late Adr. Houget and Co.), besides exhibiting some general machinery, showed a 40 horse power engine, which appears to be constructed on the plan of the Bede engine, which was exhibited at Vienna in 1873, and which we illustrated at the time.* The type of governor used is that of Proell, which seems to have found a good deal of favour, as it quite deserves to do, among Belgian engineers.

The Phoenix Company, of Ghent, drove their spinning and other machines by a very neatly made 35 horse power engine on Mr. Charles Brown's system,† made, indeed, we should imagine from his designs. A heavily loaded Proell governor is used to regulate the degree of expansion.

Messrs. Van Goethem, Reallier, and Co., of Brussels, whose firm has now become a company under the name of "Les Ateliers du Brabant," were the makers of the 25 horse power compound engine with governor cut-off, which worked the Ortmans pump used for the fountains. This pump delivered 2200 gallons per minute. In the Machinery Hall their principal exhibit was the 60 horse power compound engine which drove the greater part of the textile machinery. The cut-off in the high pressure cylinder is controlled by the governor, the arrangement adopted differs very much, however, from any of the usual plans. The admission valve is an ordinary slide, but divided into two parts (worked by the same spindle), one for each end of the cylinder, the clear space between the two valve chests being utilised for the cut-off gear. The cut-off valves are slides working on the backs of the others and opened by a rod also passing right through from one to the other. At the point of admission the two rods are locked together, so that the one eccentric moves both simultaneously; at the required point of cut-off the governor disconnects the rods, and the expansion slide, or rather one of the two expansion slides, is at once closed by steam pressure. The arrangement is one which will no doubt recommend itself in principle to many English engineers who prefer slides to any other form of valve. The two cylinders of this engine are side by side, their piston rods connected to one crosshead, driving of course a single crank. The details of this arrangement are not very neatly schemed, the distance between the crankshaft bearings would be the better for being greatly reduced, and there does not seem much difficulty in the way of making such a reduction.

A 15 horse power engine of somewhat special construction was shown by Messrs. Mennig Frères, of Brussels, driving the paper-making machinery of Messrs. Dautrebande and Thiry, of Huy. It has a Corliss bedplate and bored guides, as indeed had the majority of the engines exhibited. It has four

slide valves working across the direction of the axis of the cylinder. The exhaust valves are below the cylinder and worked by cams, the steam valves are on the upper part of the cylinder, but inclined downwards at such an angle that their spindles intersect the axis of the lay shaft. They are then pushed upwards by direct contact with cams on the lay shaft, while the governor determines the position of these cams longitudinally on the shaft.

Messrs. B. Lebrun and Co., of Nimy (near Mons), also employed slides in their engine, but in different fashion. This engine has a cylinder 15.75 in. in diameter and 35.4 in. stroke, and a flywheel of 13 ft. 1½ in. in diameter with five rope grooves. The slides are placed longitudinally on the cylinder, two above it for the steam and two below it for the exhaust. The latter are worked by cams and the former opened by cams and closed by steam pressure. The quietness with which this engine worked was very noticeable in contrast to the continual clacking of the lift valves of some of its neighbours. We illustrated this engine on pages 246 and 247 of the present volume.

M. Charles Nolet, of Gand, whose engine was intended to indicate 120 horse power, and to work at five atmospheres pressure, had thrown the back steam and exhaust valves out of gear and taken the back cover off the cylinder, so as to work single-acting only, and show, we presume, the tightness of the piston. The engine was only driving itself. The steam valves are double-beat valves placed at the side of the cylinder, and the exhaust valves cross slides below it. All are worked essentially by cams, and the arrangement and construction of the levers and cams seems to have been adopted with little regard to their cost or weight.

Messrs. Hoyois and Thomas, of Clabecq, showed an engine which was one of the most novel in construction in the Exhibition. It is a horizontal condensing engine with cylinder 19.7 in. in diameter and 43.2 in. stroke. The exhaust valves are slides placed below the cylinder and worked—go-and-stop—from the crosshead. The steam valves, constructed on Hoyois' patent, are on the top of the cylinder and work longitudinally. They are pushed open by hornplates direct from a rocking spindle driven by the eccentric and closed by steam pressure when disengaged by the governor. We hope to be able to put some details of this arrangement before our readers, it is not easily described without drawings.

M. P. Dumortier-Dupret, of Brussels, had one more variation of the arrangement of the four valves. His exhaust valves are longitudinal slides under the cylinder, and worked by a cam on a long shaft. The steam valves are of the double-beat type, and placed beside the cylinder with their spindles downwards. The lower ends of the spindles are connected to the upper ends of pairs of knuckle levers, the lower pins of which are fixed to the cylinder. The knuckle-joints themselves carry rollers, which press against cams upon the lay shaft, the position of these cams, longitudinally, being determined by the governor. The valves are therefore opened by the motion of the knuckle-joint as in the Collman gear. The arrangement seems to have necessitated here a very complex arrangement of hollow spindles and cams. An indicator was attached to this, as to several other engines, but it was so arranged that the indicator pipes must collect a most undesirable quantity of water.

Messrs. Cail, Halot, and Co., of Bitschwiller, who also exhibited some sugar-making plant, &c., showed a horizontal engine (50 indicated horse power) on Stehelin's system, with four slide valves working across the engine, the steam valves sloping down to the lay shaft, their closure being effected by a light carriage spring placed on the side of the cylinder, and suitably connected to the valve spindles. When we examined the engine it was working somewhat irregularly.

M. E. Walschaert, of St. Eilles, Brussels, exhibited an engine of 140 indicated horse power constructed on his system, and resembling the one he exhibited at Paris, which we have already illustrated.*

M. August Larochaymond, of Tournai, showed an engine (30 nominal horse power) which we should imagine was much nicer to look at than to keep in order. There is one eccentric on the shaft, which drives a square bar working in guides about the centre of the engine's length. This bar carries a vertical pin, which by a connecting rod rocks a vertical spindle beside the centre of the cylinder.

This spindle again carries four eccentrics used as levers for working the valves, which still however require several more levers and a wonderful hornplate arrangement before they are finally done with. Engine makers of reputation may fairly be expected to acquaint themselves with what has already been done in the way of automatic cut-off gear before they set to work to devise any absurdly complicated arrangement of this sort, which would hardly be admitted into practice even if there were not fifty simpler ways of attaining the same end. The most wonderful engine which we came across, however, had at the time we saw it no name on it (the maker had perhaps removed his name in a repentant moment), but might be recognised by the elegant double-ogee moulding on its connecting rod. It has valves worked by longitudinal cams—heavy enough to work the whole engine—on a lay shaft, and as far as we could see, the steam and exhaust valve spindles were rigidly connected, so that the use of the governor connexion was not distinctly obvious. This engine was not at work.

The Otto engine was represented at the Exhibition, and also the Bischof gas engine, and the Hock air engine. Neither of these, however, call for any special remark.

BOOKS RECEIVED.

Japan: Its History, Traditions, and Religions, with the Narrative of a Visit in 1879. By SIR EDWARD J. REED, K.C.B., F.R.S., M.P. Two Volumes. With Map and Illustrations. London: John Murray.

The Plumber and Sanitary Houses. By T. STEVENS HELLYER. Second Edition. London: B. T. Batsford.

The Irrigation Works of India, and the Financial Results; being a Brief History and Description of the Irrigation Works of India and of the Profits and Losses which they have caused to the State. By ROBERT B. BUCKLEY. London: W. H. Allen and Co.

Ideal Chemistry; a Lecture. By Sir B. C. BRODIE, Bart., D.C.L., F.R.S. London: Macmillan and Co.

The Magazine of Art. New and enlarged Series. Part I. London, Paris, and New York: Cassell, Petter, and Galpin. [Price 1s.]

Universal Instructor, or Self Culture for All. Fully Illustrated. Part I. London: Ward, Lock, and Co. [Price 6d.]

A Glass of Pale Ale: a Visit to Burton. London: Wyman and Sons. [Price 6d.]

Stationary Engine Driving. A Practical Manual for Engineers in Charge of Stationary Engines. By MICHAEL REYNOLDS. With numerous Illustrations. London: Crosby Lockwood and Co.

A Rudimentary Treatise on Coal and Coal Mining. By WARRINGTON W. SMYTH, M.A., F.R.S. Fifth Edition, revised and enlarged. London: Crosby Lockwood and Co.

London Smoke and Fog, with some Observations on "the Country Parson's" and other Modern Fireplaces. By FREDERICK EDWARDS, Jun. London: Longmans, Green, and Co. [Price 1s.]

Bericht über die Wissenschaftlichen Instrumente auf der Berliner Gewerbeausstellung im Jahre 1879. Herausgegeben von Dr. L. LOEWENHERZ. Mit 292 in den Text gedruckten Holzschnitten. Berlin: Julius Springer.

CANADIAN RAILWAYS.—The construction of the Montreal and Champlain Junction Railway, from Dundee, in the county of Huntingdon, and near the American border, to Montreal, is being actively prosecuted. Already the track is laid as far as St. Constant, and freight trains have been run over the completed section; the whole line is expected to be in working order by the coming spring.

IRON SECTIONS.—We have received from Messrs. G. Bailey Toms and Co., of Laurence Pountney-hill, E.C., a new edition of their lists of sections of angle, tee, bulb, and channel irons, joist irons, &c. The total number of sections included in the lists is between 1200 and 1300, and the productions of both English and foreign firms are included. The lists are very useful, particularly to engineers in search of unusual sections of iron.

A BRAVE MINER.—An act of distinguished gallantry was recently performed in one of the principal mines of the mining district of Linares in Spain. Three miners were engaged in sinking a shaft, and after charging the bore holes with dynamite, two of them climbed to the gallery above, the third, as is customary, remaining behind to light the fuses attached to the charges. Having done so, he signalled to his comrades, and was in the act of being hoisted up with a windlass and rope, when on nearing the top he, by some accident, lost his hold and fell a distance of 50 ft. to the bottom of the shaft, where he lay stunned and disabled in close proximity to the burning fuses. A chain ladder fortunately communicated with the bottom of the shaft, and on observing the fall one of the miners at the windlass, placing his drawn knife between his teeth, went down—without a moment's hesitation—to the rescue of his injured comrade, and severed the fuses as they were on the point of igniting the charges, thus saving his comrade from an awful and instantaneous death.

* See ENGINEERING, vol. xvi., page 26.

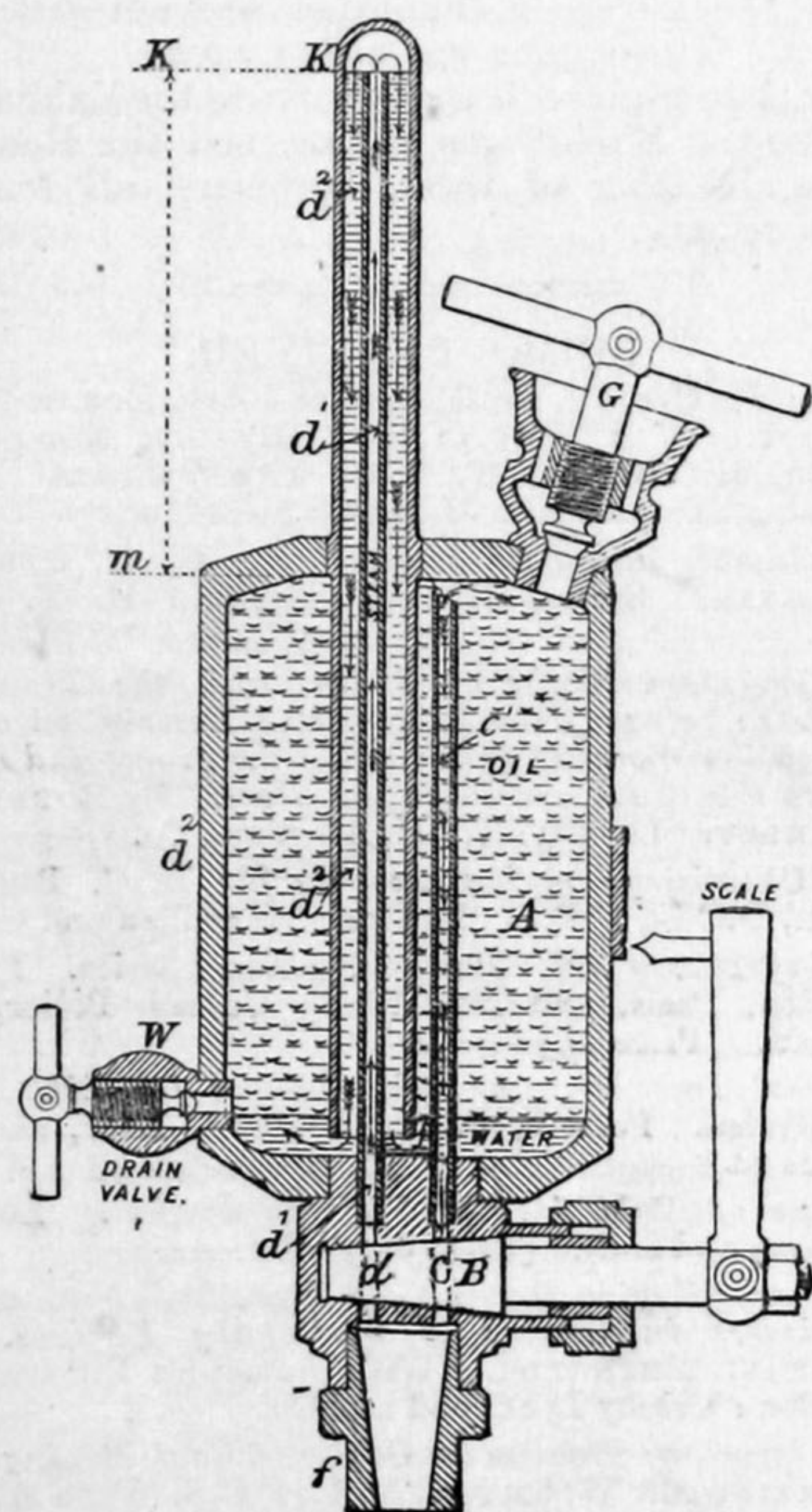
† *Ibid.*, vol. xxv., page 475.

* See ENGINEERING, vol. xxvii., p. 29.

DE LIMON'S LUBRICATOR.

WE subjoin an engraving of a form of lubricator for steam cylinders, &c., which was exhibited at the Düsseldorf Exhibition by the makers, Messrs. De Limon, Fluhme, and Co., of Düsseldorf. The principle of action of this lubricator is not entirely novel, but the manner in which the principle has been applied is very neat and convenient.

Referring to our engraving, it will be seen that the lubricator consists of a chamber A for containing the lubricant, this chamber being furnished at the bottom with a cock B, and at the top with a filling plug G. The passage in the screwed union *f* provided for attachment to the cylinder or valve chest, communicates with the body of the lubricator by two holes, *c*' and *d*', there being in the plug of the cock B two corresponding passages *c* and *d*. The passage *c*' is prolonged by a tube which rises to near the top of the oil chamber A as shown, while the passage *d*' is similarly prolonged by a tube which entirely traverses the body of the lubricator, and into the larger tube K, this latter tube being closed at the top as shown.



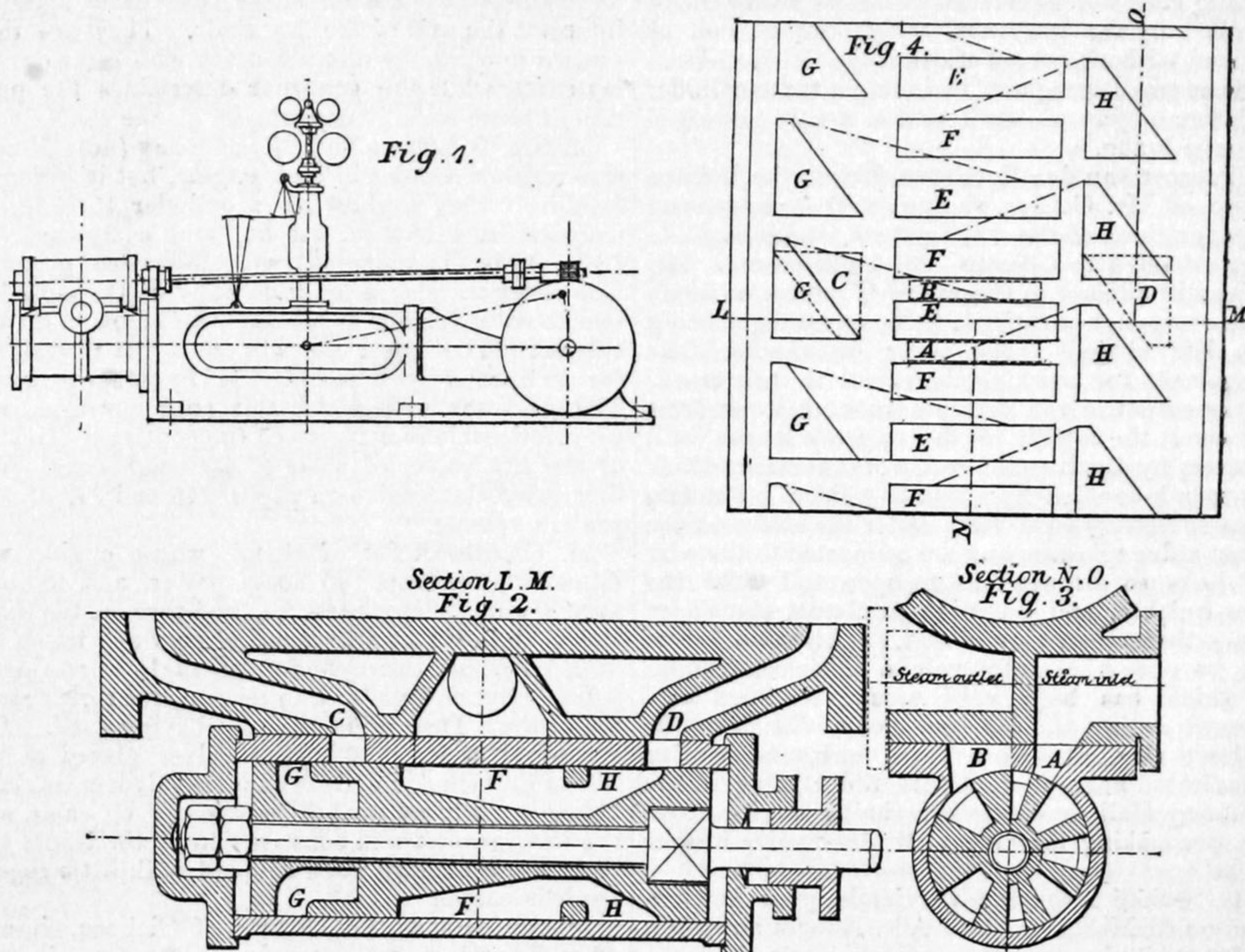
The action of the lubricator is very simple. When the plug of the cock B is turned so as to open the passages *c* and *d*, the steam from the cylinder rises through *d*, and condenses in the annular space *d*² between the tube *d*' and the outer tube K. In our engraving this condensation is supposed to have gone on until the annular space *d*² has been filled with water to the level K. Under these conditions it is evident that the flow of oil into the cylinder through the passage *c*' is opposed by whatever steam pressure may exist in the cylinder at the time, while on the other hand there is a tendency to force the oil out of the cylinder, the pressure due to the column of water in the annular space *d*² plus the pressure of steam on the surface of this water at K. The pressure of steam acting against the inflow of the oil is thus neutralised, while there remains the effective pressure due to the head of water in the space *d*² tending to make the oil overflow the top of the tube *c*' and pass down this tube into the cylinder or valve chest. With the tube *c*' flowing full, the effective head of water causing the inflow will be practically equal to the whole height of the column in the space *d*²; with the tube *c*' only partially filled, however, the head just mentioned will be reduced by the weight of the column of oil contained in the reservoir A. With the chamber A empty of oil, but charged with water, the effective head will be reduced to K *m*, the head, however, being in all cases sufficient to secure a regular inflow.

The chamber A is furnished with a plug at W for discharging the water, when the lubricator has to be refilled with oil, while a scale on the side of the chamber A, enables the handle of the cock B to be adjusted according to the delivery of oil required.

NICKEL PLATING.—The Plating Company, of the Bishopston-lane Works, Stockton-on-Tees, are nickel-plating seven full sets of locomotive fittings, including the domes and safety-valve covers, these being polished by the patent machine of Mr. Thomas Fenwick, which effects a great saving of labour. The nickel plating of these works is being very generally used for the various classes of engine fittings, and for ship and yacht fittings, also for various engineering purposes.

THE EMMERICH ROTARY VALVE GEAR.

CONSTRUCTED BY THE EMMERICH MASCHINENFABRIK, EMMERICH.



In describing the stationary engines at the Düsseldorf Exhibition, we mentioned a small engine with rotary valves and automatic cut off, exhibited by the Emmericher Maschinenfabrik of Emmerich. We are glad to be able to illustrate to-day, by Figs. 1 to 4 annexed, the essential features of this engine, namely, the construction of the valve and the method of working it. From Fig. 1, which is a side elevation of the engine to a small scale, it will be seen that only one valve is employed for the steam distribution, and this valve is of the rotating type and placed above the cylinder and parallel to it. It receives its motion (making one revolution to every four made by the engine) from a worm thread cut on the periphery of the crank disc, which works directly a screw wheel upon the valve spindle, the latter therefore extending along the whole length of the engine. By means of the connexion which is outlined in Fig. 1, the valve can receive from the governor a small amount of endlong motion in the valve chest.

The actual construction of the valve and chest is shown in Figs. 2 and 3, and Fig. 4 is a development of the valve and face, showing the form of the ports in both. From these it will be seen that the valve is enclosed in a cylindrical box bolted directly to the cylinder. In this box and the cylinder there are four openings, two rectangular A and B, the one for steam admission and the other for exhaust, and two trapezoidal C and D, one communicating with each end of the cylinder. The openings A and B are side by side in the centre of the cylinder face, C and D being beyond them at the ends. The shape and relative position of these openings is clearly shown in Fig. 4 in dotted lines. In the valve face itself there are four sets of openings lettered E, F, G, and H respectively. The openings E and F are in the middle of its length and are rectangular, and considerably longer than the ports A and B, to allow for the longitudinal motion of the valve. Each opening F communicates, as shown in Fig. 2, with a trapezoidal port H towards one end of valve, and each opening E with a similar opening G towards the other end. If one of the openings E comes over A (as it is about to do in Fig. 4) the steam passes from A through E and G to C, and so through the passage to the left-hand end of the cylinder, while the space to the right of the piston communicates through D, H, and F with the exhaust port B. The openings are so proportioned that both the point of steam admission and that of release are controlled by the edges of the ports, which are parallel to the axis, and remain therefore unaltered by any longitudinal motion of the valve. The cut-off, on the other hand, takes place against the bevelled edges of the ports, and takes place therefore earlier or later, according to the position of the valve longitudinally, just as in the Rider gear. The work which the governor has to do, in shifting a valve which is in continual rotation, must be comparatively very small, and the control over the cut-off obtained in this way seems both simple and effective.

It should be noticed, as affecting very materially the good working of the valve from a practical point of view, that owing to the quadrupling of the ports, it is only

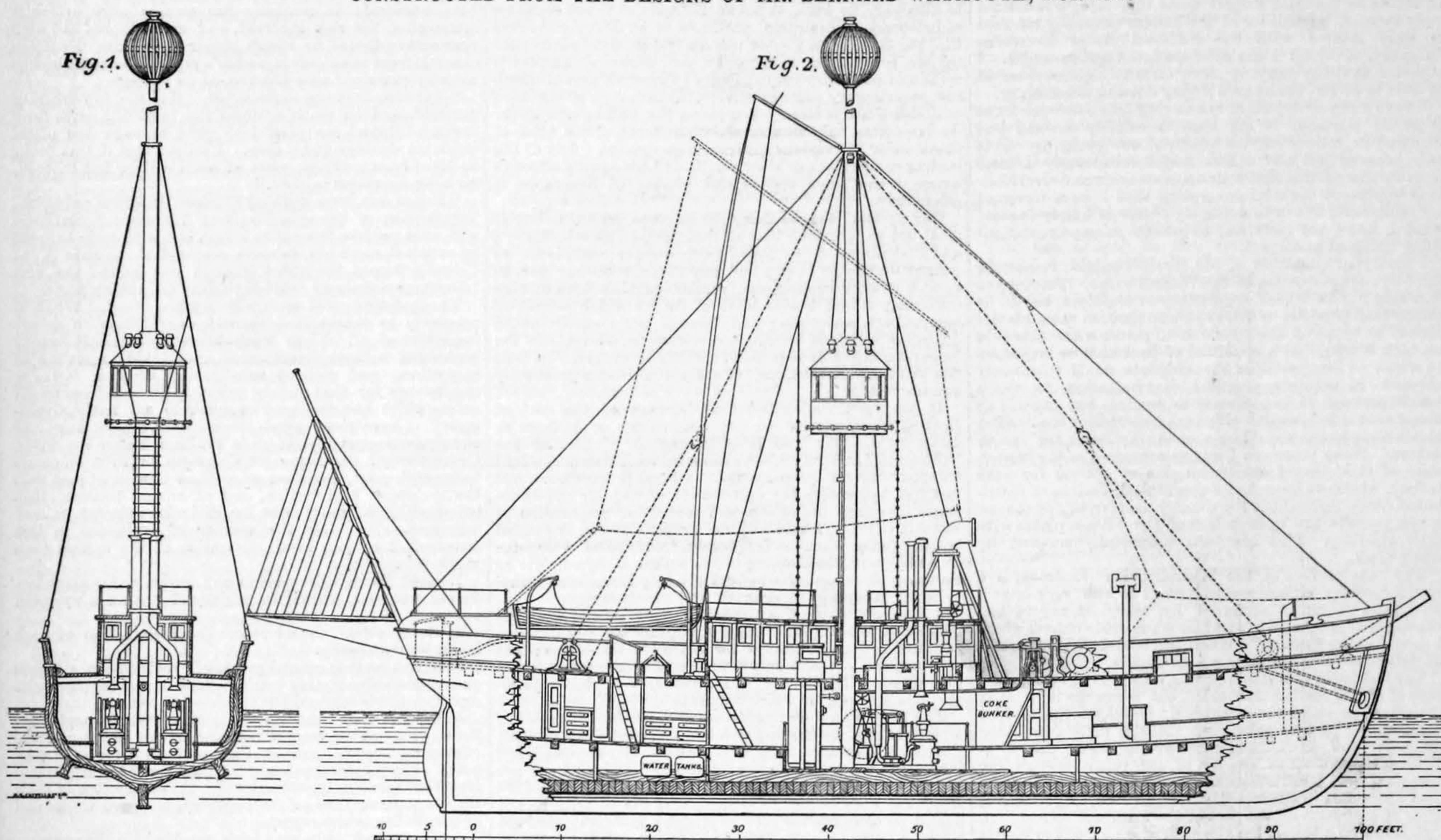
necessary for the valve to be steam-tight over a comparatively small portion of its circumference; leakage on the back will therefore only help to keep it against the face, an advantage not always possessed by rotary valves. The arrangement is not probably suited for large engines, but for small ones it forms one of the very simplest, perhaps the very simplest automatic cut-off gear which has been devised, and ought to give very good results.

THE SEVEN STONES LIGHT VESSEL.

WE reproduce on the opposite page, by permission of the Institution of Civil Engineers, the engravings of a light vessel moored off the Land's End, the description of which formed the subject of a paper contributed by Mr. J. N. Douglass to the Transactions of the Institution. Of this paper the following is a summary: The "Seven Stones" are a cluster of dangerous rocks lying between Scilly and the Land's End, with only small portions uncovered at low water. They are exposed to the full fury of the Atlantic, and the erection of a lighthouse upon them would be a tedious and costly undertaking. In 1841 a light vessel was moored about 1½ miles eastward of the rocks, in 42 fathoms, and, as may be supposed, is subject to heavy seas during westerly gales. Her moorings consist of a 40 cwt. mushroom anchor and 315 fathoms of 1½ in. unstudded chain cable. In 1871 the vessel was provided with a "Holmes" fog trumpet, worked by a 1½ horse power "Ericsson" calorific engine, and until 1879 two fixed catoptric lights were exhibited on separate masts, 20 ft. and 38 ft. above the sea. In 1878 the Trinity House decided upon making several important improvements both in the light and the vessel itself, which, as it is now arranged, we illustrate. The hull is of timber copper-fastened throughout, and sheathed with Muntz metal. The hull is 103 ft. between perpendiculars, 21 ft. 3 in. in extreme width, and the depth of the hold, from the strake next the timbers to the upper side of the upper deck beams, is 10 ft. 3 in. In the event of the vessel breaking adrift she is provided with foresail, lug mainsail, and mizen, the latter being frequently used with advantage for steadying the vessel at her moorings. The illuminating apparatus is of the catoptric group-flashing-light class, giving three flashes in quick succession at intervals of one minute, and consists of nine gim-balled Argand lamps and paraboloidal reflectors, of silvered copper, 21 in. in diameter. The lamps and reflectors are arranged on a turntable in the lantern, in three groups of three each, and are caused to rotate by clockwork at a speed of one revolution per minute. The intensity of the flashes is equal to about 8600 standard candles, and about 7½ times the intensity of the old fixed lights, with only three-eighths the consumption of oil. The lantern is cylindrical, 8 ft. in diameter, constructed of wrought iron, and glazed with curved plate glass. It is fitted with doors fore and aft, for access from chain ladders suspended from the mast, and is large enough for the proper manipulation of the lamps during the night, without the necessity of lowering. The actuating clockwork is fixed in the deck-house, and is driven by a pitch chain and weights descending in a trunk to the keelson; motion is transmitted to the catoptric apparatus by a light vertical shaft fixed on the aft side of the mast. In the day the lantern is lowered on to the roof of the deck-house. The Holmes self-acting siren fog signal is arranged for giving three

THE STONES LIGHT-SHIP.

CONSTRUCTED FROM THE DESIGNS OF MR. BERNARD WAYMOUTH, LONDON.



blasts in quick succession at intervals of two minutes: the motive power consists of a pair of Brown's caloric engines, each of five effective horse power, arranged for working singly or together. The engines are fitted with air pumps for supplying two compressed air vessels, from which the siren is sounded at a pressure of 40 lb. per square inch. The blasts are regulated by cams worked from the engines. The fuel consumed is locomotive coke, and the consumption is 18 lb. per hour per engine. The cost of the vessel—which was designed by Mr. B. Waymouth, secretary to Lloyd's—fully equipped for sea, with illuminating and fog-signal apparatus complete, was about 9500l.

THE AREA OF CURVED SURFACES.

TO THE EDITOR OF ENGINEERING.

SIR,—In one of the numbers of your reputed journal (June 18, page 473) I find an article in form of a letter treating on a mode of calculating "The Area of Curved Surfaces," at the end of which the author (Mr. van Meerten, engineer in the Dutch Navy) says that it is unknown to him that any methods for calculating such areas have been published before. With reference to this remark I will beg to be allowed to state that I have myself published a method for calculating similar surfaces in the Austrian journal "Mittheilungen aus dem Gebiete des Seewesens," 1877, vol. v., page 209, and that a translation of this article is also to be found in the "Revue Maritime et Coloniale," 1879, page 175, by Mr. A. Korn, sous-ingénieur in the French Navy, who appends to it a "Note du Traducteur," in which he points out that a very similar and, according to his opinion, more simple method has long since been taught in the Ecole Française du Génie Maritime. Mr. Korn does not however inform us if the simplicity of that method has been tested by practical application, nor if it has ever been published.

I may still add that in the article I mention I did not fail to make due reference to the labours of some other authors on the same subject, especially to Mr. Merrifield's valuable essay in the Transactions of the Institution of Naval Architects, 1865, and to Professor Rankine's well-known approximation or "mean girder rule."

I have the honour to be, Sir, your obedient servant,
CARL TULLINGER,
Naval Architect, Austrian Navy.

Trieste, October 18, 1880.

AMSLER'S INTEGRATOR.

TO THE EDITOR OF ENGINEERING.

SIR,—The mechanical integrator described in your issue of June 11 (page 462) in addition to finding areas, statical moments, and moments of inertia, will also find the cubical contents of road and railway cuttings and embankments from working sections when the gradient is level or nearly so, and from sections on a natural scale for all grades.

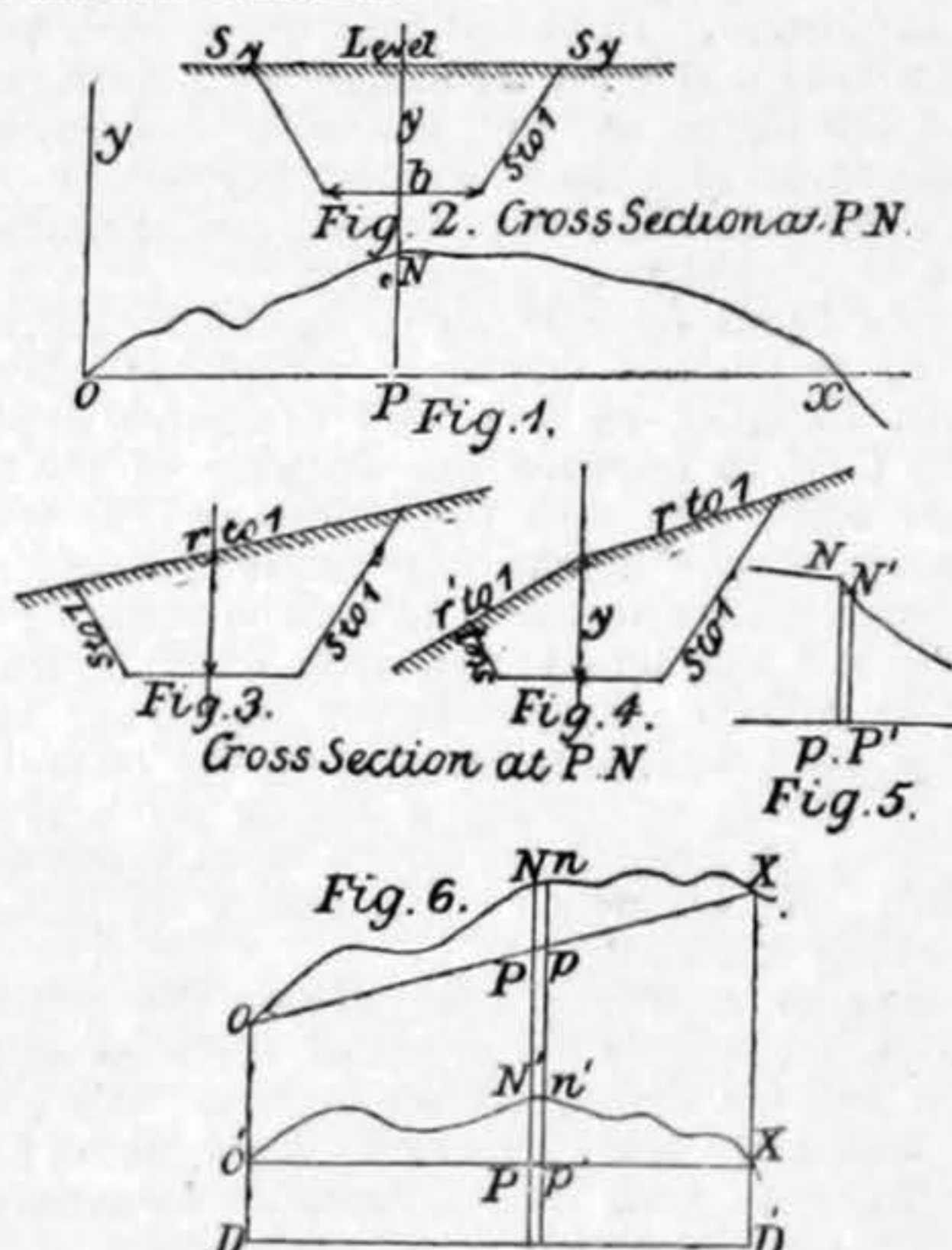
Let Fig. 1 be the longitudinal section of a cutting, take O the start as origin and ox the grade line as axis of x , oy at right angles to ox as axis of y . Let $PN=y$ be

the depth at any point P and $OP=x$, let b =breadth of base of cutting, s horizontal to 1 vertical the slope of its sides; then if the ground is level the area of the cross section at P $N=b y + s y^2$ and the cubical content of the cutting

$$= \int (b y + s y^2) dx = b \int y dx + s \int y^2 dx \quad (1)$$

the summation extending from o to x .

Now if the integrator be set as for the statical moment of the area $O X N O$ with regard to $O X$, and the pointer made to trace out the contour $O X N O$, values of $\int y dx$ and $\int y^2 dx$ will be obtained, which when multiplied by proper constants and by b and s respectively will give the required cubical contents.



2. Let the sidelong slope of the ground be r horizontal to 1 vertical (as in Fig. 3) and suppose this slope to extend the whole length of the cutting, let y be the centre depth as before, b the breadth of base, then the area of the cross section at P N

$$= \frac{1}{r^2 - s^2} \left\{ s r^2 y^2 + r^2 b y + \frac{s}{4} b^2 \right\}$$

$\therefore$ Cubical content of cutting

$$= \frac{1}{r^2 - s^2} \int \left\{ s r^2 y^2 + r^2 b y + \frac{s}{4} b^2 \right\} dx$$

$$= \frac{s r^2}{r^2 - s^2} \int y^2 dx + \frac{r^2 b}{r^2 - s^2} \int y dx + \frac{s b^2}{4(r^2 - s^2)} \int dx \quad (2)$$

As before, the integrator gives the values of $\int y^2 dx$ and $\int y dx$; $\int_0^{OX} dx = O X$ =length of cutting, whence the numerical results can easily be obtained.

3. Let the sidelong slope be different on each side of the centre line r to 1 above and r' to 1 below (as in Fig. 4) then the area of the cross section at P N

$$= \frac{s}{2} \left\{ \frac{r}{r-s} + \frac{r'}{r'+s} \right\} y^2 + \frac{b}{2} \left\{ \frac{r}{r-s} + \frac{r'}{r'+s} \right\} y + \frac{b^2}{8} \left\{ \frac{1}{r-s} + \frac{1}{r'+s} \right\}$$

$$= s.c. y^2 + b.c. y + c' \text{ (say)}$$

then cub. content of cutting $= s.c. \int y^2 dx + b.c. \int y dx + c' \int dx$ (3), and from this the numerical results can be obtained as above. For the same longitudinal section the values of $\int y^2 dx$ and $\int y dx$ are the same in (1), (2), and (3), the sidelong slope only altering the constants by which the numerical results are found.

The integrator in the form which finds areas, statical moments, and moments of inertia, will find the cubical content of any cutting or embankment when the area of the cross section at every point can be expressed in terms of the depth y in the form $a + b y + c y^2 + d y^3$, where a, b, c, d are constants including zero. Should the sidelong slope vary it will be necessary to divide the cutting or embankment in portions over which it is approximately uniform.

Let a feet vertical and n feet horizontal to the inch, be the scale of a working section; and let $P N P' N'$ (Fig. 5) represent the position of two cross sections at distance δx apart. On a natural scale of a feet to the inch these same cross sections would be $n \delta x$ apart. Hence the values of the integrals found by machine from working sections are to those from natural scale sections in the ratio of 1 to n , therefore the true results will be found by multiplying the integrals from the working sections by n .

When the gradients are level the integrator will find the true cubic contents from working sections—approximate when the gradients are nearly level—less accurate as the grade line becomes more inclined to the datum line of section; because the vertical scale cannot then be used for lines at right angles to grade line. The true cubic contents may still be found by integrator as follows.

Let $O N X O$ represent a working section with the grade line $O X$ inclined at a considerable angle to $D D'$ the datum line; draw $O' X'$ parallel to $D D'$, $O O' D X X' D'$ being vertical lines. Make the section $O' N' X' O'$ such that for any vertical line $N P N' P'$ the depth $N' P' = N P$ draw $n p n' p'$ parallel to $N P N' P'$ at distance δx from it, then since the cross sections at $N P, N' P'$ will have the same area, and also at $n p, n' p'$ the elementary volumes $N P p n' P' p' n$ are equal, and therefore the cubic contents of section $O N X O$ =cubic contents of $O' N' X' O'$, but the integrator will find the cubic contents for the section $O' N' X' O'$ and therefore for the section $O N X O$. Whether this will be more expeditious or accurate than the usual method of taking out quantities of earthwork is a question for trial.

Yours very truly,

P. S. HAY.

Public Works Department, N.Z., August 18, 1880.

BOILER INSPECTION.

TO THE EDITOR OF ENGINEERING.

SIR,—I have read the article which appeared in *ENGINEERING* of October 15 on boiler inspection. I also noted an article on the same subject some time ago, but did not reply thereto, as neither of the boilers especially referred to were insured with the National Boiler Insurance Company, of which I am chief engineer and manager. I expected that the company more directly interested would be able to defend themselves if they deemed it necessary.

I have a strong objection to entering into correspondence in public journals, as my time is entirely devoted and occupied in conducting the affairs of our company. It is only because you and others might erroneously assume from further silence that your opinions are incontrovertible. It is to prevent such misconception that I have overcome my reluctance, but in so doing my object is simply to state what I know are facts, and to prevent misrepresentations being accepted as correct.

I note your quotation of Mr. Traill's opinion respecting the *thorough* inspection of the Walsall boiler. This inspection may not have been satisfactory or complete, but if he means that previous to *thorough* examination such a boiler should be bared of brickwork at all places where this is in contact, it would be a condition of insurance or inspection to which no ironmaster in the kingdom would voluntarily submit. It requires practical discrimination to decide which portions it is necessary to remove, but there is no doubt that it is essential with such boilers that the bottom plates at any rate should be occasionally bared for examination. Many years ago I was so convinced of the importance of this, that I designed a plan of setting for such boilers, which we have had lithographed, and have distributed freely throughout the country to insurers and others, which permits the examination of the bottom plates with little difficulty. This has been successfully adopted by many firms.

The construction of the Walsall boiler (Rastrick) is a type I consider objectionable, but it is still very largely used, and is really preferred by many managers and engineers of iron works, and like many other classes which I should not recommend if consulted, is certainly not so safe as well-constructed internally fired boilers.

The test made of a similar boiler only proved the importance of strengthening man-holes, but threw no light upon the actual cause of the explosion. Opinions varied very considerably on this point, but there is little doubt that the boiler was much deteriorated by long usage and injudicious repairs. The quality of the plates though not first-class, was I believe quite equal to the average of those used for boilers in the iron districts. It may have been an error of judgment on the part of the insurance company to accept risk on a boiler, the strength of which was evidently much reduced by repeated repairs and long usage, but the acceptance or otherwise did not affect the occurrence. The firm had, I believe, confidence in the boiler, and would have continued to work it at the same pressure had it not been insured.

It is absurd to suppose that the proprietors of the Halifax boiler were rendered careless by their being insured for so small an amount as 100*l*. They had doubtless joined the company referred to, with some intention of availing themselves of the independent inspection, and that company proved by the evidence at the inquest, that they were most anxious to perform their work, and to have opportunity to *thoroughly* inspect, but through the apathy of the owners, this was not afforded. The great indifference manifested by the latter proves clearly that their being connected with an insurance company made no difference whatever. They had apparently confidence in the boilers, and neither took effective steps themselves, nor permitted the insurance company to ascertain whether such confidence was misplaced or otherwise. It appeared clear from the evidence, that the insurance of the boilers did not affect the explosion nor the time of its occurrence in the least. That disaster is only one of many illustrations of the danger involved in the principle of individual liberty of action which Englishmen so jealously preserve. The verdict stultified itself. I think that instead of being worded as it was, if the jury wished to recommend Government interference they should have stated that Government should compel boiler owners to have their boilers *thoroughly* inspected, and give suitable opportunity and make complete preparation.

I cannot understand what is Mr. Traill's object in referring to the Manchester Steam Users' Association. I presume he was not deputed to express his opinion on this matter, but infer that he is prejudiced, and from limited knowledge of the working of the leading insurance companies, has adopted an opinion which I submit is not justified by facts. I am quite aware that the workings of the Steam Users' Association and boiler insurance companies vary considerably. The former has doubtless done good work and is still doing so in a limited area, and amongst a few and very safe classes of boilers only; but it will accept no responsibility of many constructions, especially of those types which are generally used by hundreds and thousands in the various iron works and collieries of this country. I have often compared its operations to "preaching to the converted," whilst insurance companies by their commercial instincts are led into "by-places and highways," and introduce independent inspection to people previously indifferent to, or ignorant of, its great importance; and they also inspect and insure boilers which the association will not guarantee.

I am not surprised that that association's praise of its own work, and unjust and uncalled-for condemnation of others, has been so often repeated, until its committee appear to almost actually believe the accuracy of the statements, apparently made with their authority to the effect that insurance companies' inspections are a sham whilst theirs are perfection; and they appear to have influenced a few others to adopt a similar belief. I, however, unhesita-

tingly assert, that at no period of the history of the Company I manage, have our inspections been so defective as those of the much self-vaunted association, prior to the establishment of boiler insurance companies, who were the first to put inspection on a proper basis. I have no desire to disparage its work, as much credit is due to the founders of independent inspection, but there is no denying the fact that the association's work was badly done until confronted by the competition referred to, and before it adopted a system of pecuniary responsibility; the conditions of which are so arbitrary and exclusive, that although it has been established about twenty-five years, the boilers now under its inspection only number about one-tenth of the total of those under the various insurance companies. Any of the leading companies can show results at least equally effective amongst the same classes and quality of boilers as it guarantees.

Our system may be defective in some respects, but it must not be forgotten that all insurers join us voluntarily; and that although we may impose certain conditions, we cannot dictate to them; and any attempt on our part to impose greater restrictions, would doubtless tend to very materially reduce the number of boilers which benefit by independent inspection; and these if not insured, would doubtless be left in hundreds of instances, as regards the inspection in the flues at least, entirely to sweeps. In fact, non-insurance in thousands of cases would mean practically non-inspection.

It has been insinuated that because of the cost of *thorough* inspections we are not willing or anxious to make them. Our staff is quite capable of making one "*thorough*" annually of each boiler insured, if owners afford us opportunity at proper times. A large proportion of our insurers appreciate the importance of regular and systematic *thorough* inspection, and make due preparation at suitable times. Others will not prepare except at general holiday times, when too frequently, from causes which can be understood, the cleaning of the boilers is incomplete or carelessly done, and the inspector's duty is rendered unnecessarily laborious, unpleasant, and unsatisfactory.

I have in almost all my annual reports, by circulars and by special letters, made earnest appeals for suitable preparation and opportunities for *thorough* inspection; but regret that these have only been partially successful, owing to ignorance, indifference, or neglect, or to mistaken parsimonious motives, by which too many are influenced.

The most prominent inducement we hold out to boiler owners is that by our independent and skilled inspections, the risk of explosion is reduced; and that our *first object* is to assist them to reduce risk of explosion, and we ask their co-operation with this view. Of course, without the latter our work cannot be satisfactory, and we have had to decline to continue the policies of many firms who have not afforded us due opportunity, or have not suitably prepared their boilers for inspection. At the *thorough* examinations made by our inspectors full particulars are taken of the boilers, and complete sketches drawn to scale, with all thicknesses of plates and sections showing construction of boilers, positions, &c., of stays, dimensions of flues, positions of fittings, and other matters necessary to enable me to judge of their strength, &c., are supplied; these being accompanied by full reports, upon which I or my assistants report to the owners.

No company or association professes to supersede by independent inspection the general care and constant attention of intelligent and competent attendants, but we consider our inspections quite sufficient and reliable in ordinary cases where the boilers have proper attendance and are properly prepared and at suitable intervals for *thorough* inspection. In exceptional cases, such as boilers used at iron works, it is the custom of well-managed firms to examine the plates, say in "Rastrick" boilers, opposite the furnace necks as often as opportunity occurs. This is a precaution we should always recommend in similar cases in addition to our *thorough* inspection.

I endeavour to restrict our advice to matters necessary to safety or to economical working, whilst we offer other suggestions, founded on our very extensive experience, which may tend to improve the working of the boilers; but we are often met with the objection that insurance companies are always demanding unnecessary alterations, and frequently boilers proposed have to be declined, because the owners will not adopt measures which I know are necessary to safety. Proposals for insurance of many boilers have been cancelled, because of the refusal of the proposer to attach so simple a fitting as a feed back pressure valve, to boilers fed direct from towns or other water mains. We accept no boiler unless we believe it is in safe working condition.

In addition to reporting generally on the boilers submitted to us, we supply hundreds of sketches and plans for setting, and for strengthening boilers. We have sent plans for setting to many uninsured firms, as we find very many boilers so set that it is impossible to satisfactorily examine them; but owners in many cases prefer to dispense with insurance, rather than adopt our suggestions to make material alterations. Unfortunately, some firms, professing a knowledge of engineering, frequently supply plans for setting boilers, which, when adopted, render their complete examination an impossibility. Three horizontal internally fired boilers were proposed to us by an engineering firm. The lower parts of two of them were quite buried in brickwork. In another case two boilers belonging to an engineering firm were set upon side seatings about 14 in. breadth and the side flues inaccessible. It required a considerable amount of perseverance on my part to impress the owners with the danger incurred through such defective setting.

I think you will be convinced by the foregoing, that the insurance and inspection of boilers is a most difficult work; and that if we were, in the present state of the law, to adopt very stringent rules or conditions, we should lose the opportunity of inducing many proprietors to improve the

management, arrangement, &c. of their boilers, and there is little doubt that many explosions would occur, which are now averted by our inspection and advice. We have discovered some thousands of dangerous defects, and thus have prevented many a disaster which must inevitably have occurred, as generally the owners were evidently ignorant of the risk incurred, and no measures had been previously adopted to secure proper inspection. I subjoin extracts from one of our inspector's reports, on some boilers recently examined near London, as an example:

"The side flues are inaccessible. Had the top covering removed, and on reaching down and removing oxide from seating, I found my chisel had gone through the plate. Oxide on seatings 1½ in. deep. I believe that if this boiler be lifted from seatings, parts of shell will be left thereon, forming apertures in shell."

"Boiler has been working in most dangerous condition. Top portion of top cylinder about 4 ft. circumferentially, and more or less the entire length is dangerously reduced by external corrosion, in some places it is less than 1½ in. I easily tapped the chisel through just behind the first transverse seam, and could have done so in many places."

The question will naturally suggest itself, What is necessary to obtain that earnest co-operation to secure inspection of all boilers being efficiently and satisfactorily performed without Government undertaking a system of inspection, and without substituting despotic laws or regulations for that dearly prized individual freedom of action which has conducted so much to our national progress? I have given great attention to this matter, and our chairman and myself gave evidence before the Select Committee of the House of Commons in 1870, on steam boiler explosions, and I am more than ever convinced that the system of registration, and of annual returns, then proposed by us, would meet the difficulty referred to, and very materially reduce the number of explosions in this country. I subjoin brief particulars of the system then suggested:

1. Each steam boiler used in any works, or for manufacturing purposes, should be registered within a specified time.
2. Every owner should renew the registration of each boiler once annually.
3. When making annual returns of registration, a report on the condition of each boiler, signed by the engineer who reported thereon, should be furnished to the registrar.
4. Owners to engage whom they think best to inspect for them, viz., either respectable engineering firms, or the officers of a company or association formed for such purposes. The inspectors should not be allowed to inspect and report independently, but act under the supervision of their superiors, in order to secure accuracy, and give status and responsibility to the report.
5. This report to be on a form provided for the purpose, and to consist of simple replies to questions relating to the condition and safety of the boiler, which could be so framed as to be intelligible to any one.
6. The registrars to be appointed by local authorities who could combine this with other duties, especially in small towns or districts.
7. Each explosion to be strictly investigated by engineers authorised by the Government. This investigation, in fatal cases, might be in connexion with the coroner's inquest, or form, in all instances, a distinct inquiry.

A few general rules might be framed by Government for the guidance of boiler-makers and owners, but should be such as will not impede improvements; for example: That no iron of less tensile strength than 20 tons per square inch should be used in the construction of steam boilers; that the maker's name and the quality of the iron should be legibly stamped upon each plate; that all boiler-makers should stamp, in a conspicuous part of the boiler, their name, address, its year of make, and the pressure per square inch on safety valve for which the boiler is suitable; that all stationary boilers should be so set that their condition may be reliably ascertained, brickwork flues to be large enough to allow access to every part, or so constructed that the boiler may be examined *thoroughly* when desired. These flues can be thus arranged without reducing the efficiency of the boilers, &c.

It will be seen that this plan involves, in brief—registration, inspection (beyond that by attendants), and careful investigation regarding each explosion. These would neither entail useless expense nor impede progressive improvements, but would check carelessness and reduce the number of explosions.

I trust you will excuse the length of this communication. My only desire is, as above stated, to prevent mistaken conclusions, and also to manifest the valuable service rendered by one, at least, of the much-abused companies.

Writers on this subject too often appear to forget that we are entirely dependent upon voluntary support, and that we have no dictatorial power; but there is no doubt that our influence and work has an immense aggregate effect in improving the working and construction of boilers throughout the country.

Should you, Mr. Editor, favour me with a call when you are next in Manchester I think I can convince you that the work of the National Company, at least, is done in a conscientious and effective manner; and although there may be occasional failures and shortcomings, through omission either on our part or those over whom we have little control, these are only such as are likely to occur under any arrangement however perfect its details may appear to be.

HENRY HILLER,

Chief Engineer and Manager.

The National Boiler Insurance Company, Limited,
22, St. Ann's-square, Manchester, Oct. 30, 1880.

ROLLING STOCK ON THE PENNSYLVANIA RAILROAD.—The Pennsylvania Railroad Company has recently built 23 new passenger locomotives, 65 freight locomotives, 99 passenger cars, and 2000 freight cars.

PATENTS.

TO THE EDITOR OF ENGINEERING.

SIR,—As an old inventor and patentee I have perused with much interest the letters of your correspondents, Messrs. W. H. Northcott and Arthur Paget, and I assure you I am among those who fully appreciate the great public benefit you have conferred by initiating the publication weekly of illustrated abridgments of inventions forming the subjects of patents and applications for patents. Whilst on this point I may add that I do not think it just to compare (as some have done) your excellent abridgments with the often very imperfect productions in the Official Gazette of the United States Patent Office, with which I am familiar, as my firm takes it in weekly.

Unquestionably, our Patent Office ought to issue, regularly, abridgments, properly illustrated where needful, of all specifications; and I well remember that many years ago—before the days of the illustrated United States Official Gazette—the compiler of your Patent Record (with whom I have served on patent law committees) not only personally urged this upon the then clerk to the Commissioners of Patents (the late Mr. Bennett Woodcroft, F.R.S., originator of the Patent Office abridgments, &c.), but also, later on (in May, 1870), suggested in a paper, read to the Society of Engineers, the publication of illustrated notices of inventions in the Commissioners' of Patents Journal, and likewise (by arrangement with the Patent Office) in other periodicals. The answer of Mr. Woodcroft was that the Treasury could not be induced to provide the needful funds. Yet what the Treasury of this great and wealthy country has so far not been prepared to provide for, is now, thanks to you, actually done by private enterprise; much to the disgrace of our Government.

I concur with the suggestion in Mr. Northcott's letter that the proposed petition should be for something further than illustrated abridgments, and also I cordially agree with him that the present state of the patent laws is unsatisfactory. On the other hand, however, I altogether dissent from his suggestion (which I consider unjust) that from the patent agent's and lawyer's point of view, the existing law is excellent.

If Mr. Northcott will refer to the reports of the Select Committee of 1871-2, on the patent laws, he will find that a number of eminent lawyers and patent agents, including the late Mr. Webster, Q.C., F.R.S., Mr. Theo. Aston, Q.C., Mr. A. V. Newton, Mr. Johnson, Mr. W. Carpmal, and Mr. Lloyd Wise, gave evidence in favour of reform. Not only so, but he will find that the last-named gentleman actually suggested to the committee (among other desirable things), that the Patent Office Library should be kept open at least until nine o'clock in the evening.

For many years past the patent agents above-named, with other members of their profession, have, as is well known, taken an active interest in matters of patent law reform, and I do not think I am far wrong in saying it would be difficult to discover a more earnest and energetic advocate of reform (of a kind advantageous alike to inventors or the public), than is to be found among them.

If satisfactory changes have not been made, one cannot justly blame patent agents. Probably one cannot say as much as regards some of our great lawyers and manufacturers.

Your obedient servant,

EDWARD FIELD.

London, November 2, 1880.

TO THE EDITOR OF ENGINEERING.

SIR,—As one of the first amongst your correspondents to write approving of your very liberal enterprise on behalf of inventors, in publishing a weekly illustrated patent list, I am glad to observe in the last two issues of ENGINEERING, that others have come forward to thank you for the excellent manner in which you have supplied the shortcomings of Her Majesty's Patent Office.

Whilst, however, concurring in the suggestions of your correspondents respecting a petition to Government for certain amendments, &c. in our patent system, I must dissent from Mr. Northcott's observation that "from the patent agent's and lawyer's point of view the existing law is excellent."

As a patent agent of many years' practice, I would inform your correspondent that patent agents are as anxious as any section of the community for reform in the administration and laws affecting inventions in the United Kingdom, and I believe (and in this I dare say most of my colleagues will agree), that a very much more lucrative business would be done in patent matters, were the laws simplified and patents cheapened so as to enable working inventors to have protection for their inventions and discoveries, which would then be brought out and developed into something useful, not as at present smothered in embryo upon the would-be patentee learning the heavy expense of a patent. To support my remarks, I would respectfully refer your correspondent to a controversy which recently appeared in the columns of your contemporary, in which the present writer took part on the subject, English v. American Patent Law.

I am, Sir, yours faithfully,

J. ANGELO FAHIE, C.E.

Patent Office, Dublin, Nov. 2, 1880.

SAFETY-HOOKS FOR COLLIERIES.

TO THE EDITOR OF ENGINEERING.

SIR,—I notice in your last week's number a short account, amongst your "Notes from the South-West," of what took place at the meeting of the South Wales Engineers on the 21st ult. at Cardiff, and am surprised to find that the remarks made by one gentleman (Mr. Massey) during the discussion of a paper on "Safety-Hooks," should have been considered important enough to be noticed in your valuable paper. His objection is a very old one, and I will not take up your space by answering it, but will

merely say that the Home Secretary's recent circular on the subject of safety-hooks settles the question.

Mr. Massey himself owned that he knew very little about hooks, and he ought to have thought twice before saying anything that might in any way hinder the good work that has been, and is being, done by the inventors of appliances which are the means of saving so many lives every year.

I am not a member of the Institute of South Wales, and, consequently, I was not present at their meeting, but many of my friends were, and it is from them I learned the facts of the case.

Yours obediently,

October 2, 1880.

NEWPORT, MON.

TORPEDO BOATS.

TO THE EDITOR OF ENGINEERING.

SIR,—I do not know how Mr. Schönheyder makes his calculations regarding the horse power developed in the high and low-pressure cylinders of our boats, but as a matter of fact the mean indicated horse power on the official trial of the boat illustrated in your issue of September 17, was 210.6 in the high-pressure cylinder and 258.4 in the low-pressure cylinder, the sum being, as given by you, 469 indicated horse power.

I was in hopes that Messrs. Normand and Co. would have answered my questions regarding the indicated horse power of their boats in your last issue, but they did not do so. Perhaps they may give the information in your next.

I am, Sir, yours faithfully,

JOHN DONALDSON.

P.S.—The mean indicated power of the Lightning's engines, as taken by the Admiralty officials, on the official trial at Stokes Bay on May 22, 1877, was 198.12 in the high-pressure cylinder and 202.76 in the low, making a total of 400.88 indicated horse power. The engines were the same size, but the slides and the screw were different.—D.

Church Wharf, Chiswick, London, W., Nov. 4, 1880.

THE RADIOGRAPH.

TO THE EDITOR OF ENGINEERING.

SIR,—I am gratified by the publication of the very complete and excellently illustrated description of my radiograph which appeared in your issue of October 15. There are, however, a few of your remarks to which, if you will allow me, I will make some observations in reply.

You suggest that that rising of the line at midnight which I have attributed to a maximum of nocturnal solar radiation may in reality result from instrumental error. This I have satisfied myself is not the case. The cylinders rotate in 18 hours and not in 24 hours, for in designing the clock by which they are impelled, I did so in the belief that the shorter of these periods would abundantly suffice in the latitude of London to make a record of the solar radiations of the day. Accordingly were they fixed to the spindle on which they turn, and if the curve we speak of were an error resulting from its motion it would recur at midnight once in each four days. Its recurrence, however, is sporadic, sometimes happening two or three times together, and sometimes missing for a week. The plate which holds the cylinders is accurately coned on to the stem which turns it and the point of juncture oiled so that it is capable of being independently rotated with the greatest ease. The cylinders, of which two are used, alternately rest upon this plate and are kept concentric with it by a flange carefully turned out to fit. When the instrument is set the paper is wrapped around the cylinder so as to join on no particular side, for hitherto its extremities have been gummed. It is introduced through the manhole of the copper box with no other care than that it is properly on its bed. It is then turned round to draw the datum line and left in a position which shall insure the passage of the central portion of the sheet beneath the style at 12 o'clock at noon. It will thus be seen that any error of the cylinders or the disc is located by the purest chance and is exceedingly unlikely to recur at one specific time, and the fact of the datum line being drawn by the rotation of the cylinder itself is reasonable evidence that that rotation will not subsequently cause a departure from the line. The clock is of exceedingly excellent construction and regulated by a balance wheel no larger than those employed in carriage clocks.

I think I may say with certainty that its movement is accompanied by no shocks. But if it were I cannot understand how they would produce a gradual rising of the style to an elevation of the tenth of an inch or so, and occupying seven or eight minutes in its production, and followed by a counterbalancing decline. I might recount other evidences that the midnight rise is due to other causes than those of instrumental error; but what I have already said will, I apprehend, suffice.

I believe myself that it is due to a midnight wave of solar radiation, and I agree with your correspondent, on page 380, that its presence is caused by refraction round the earth. I know of no reason why rays of low refrangibility should not, by the feebly refracting capacity of the upper air, be bent so gradually as to only reach the ground at its greatest distance from the sun, and there streaming from every part of the horizon, form what I may call a thermal and anti-solar pole. I am, I think, corroborated in this view by the circumstance that the midnight rise practically disappears in summer, and assumes its greatest magnitude in the winter solstice when England at midnight attains its smallest distance from this anti-solar pole. I look forward with eagerness to the results the radiograph will yield in those regions of the tropics which lie in the plane of the ecliptic at the anti-meridian passage of the sun.

It must not, as you say, be accepted yet as an established fact that solar radiation is perceptible in those regions of the earth which have the sun upon their nadir. But my observations show, I think, that this is probably the fact, and I agree with you that if it is the issue is stupendous, for it seems to me to account at once for certain grand

phenomena of nature which, so far as I have seen, have up to the present baffled all attempts to find their causes out.

Yours faithfully,

November 1, 1880.

D. WINSTANLEY.

JORDAN'S GLYCERINE BAROMETER.

TO THE EDITOR OF ENGINEERING.

SIR,—With reference to the remark in your notice of the *Times* glycerine barometer, that no explanation is given as to how the correction for temperature is effected, I beg to send you a copy of the tabular corrections prepared for that purpose. The figures are founded upon experimental determination of the coefficient of expansion by heat of glycerine, made in the laboratory of the Royal Naval College, Greenwich by Professor Reinold.

Yours truly,

JAMES B. JORDAN.

Museum of Practical Geology, Jermyn-street, S.W.,

October 30, 1880.

[We are obliged to Mr. Jordan for the information afforded in his letter. In the table of corrections which he has sent us the observed heights are given for intervals of one inch and the temperature is shown at the head of the columns in degrees Fahrenheit. The corrections are subtractive in each case and a note to the Table states that the values on it have been calculated by the formula:

$$H = h - \{.000303 \times (t - 32 \text{ deg.}) h\},$$

in which h = observed height of column in inches; t = temperature in degrees Fahr.; H = corrected height at 32 deg. Fahr.; and .000303 = expansion of glycerine for one degree Fahr. It is added that the specific gravity of glycerine is 1.2608 at 60 deg. Fahr.—ED. E.]

LOCOMOTIVE FIREBOXES.

TO THE EDITOR OF ENGINEERING.

SIR,—I have read with much pleasure the letter of your correspondent, Mr. George L. Scott, who is evidently desirous of giving honour where honour is due, and makes a clear statement as to the late Mr. William Stubbs having introduced the plan of firebox with water space under the grate at least twenty-five years ago, thus establishing his priority of claim to others at present before us.

Since reading Mr. Scott's letter I have been informed that a portable engine with firebox such as he describes was exhibited at the Royal Agricultural Show held at Newcastle-on-Tyne in 1864.

In the last letter of Mr. Hannah he wishes to attribute to me what he certainly seems to have done himself, viz., *drawn upon his imagination*; however, the object of my letter of the 18th ult. was not to raise discussion upon irrelevant statements made, apparently, for personal glorification, but simply to do justice in the matter to the late Mr. William Bouch, and as I consider that object attained, the subject in question, so far as I am concerned, is at an end.

I am Sir, yours, respectfully,

November 1, 1880.

VERITAS.

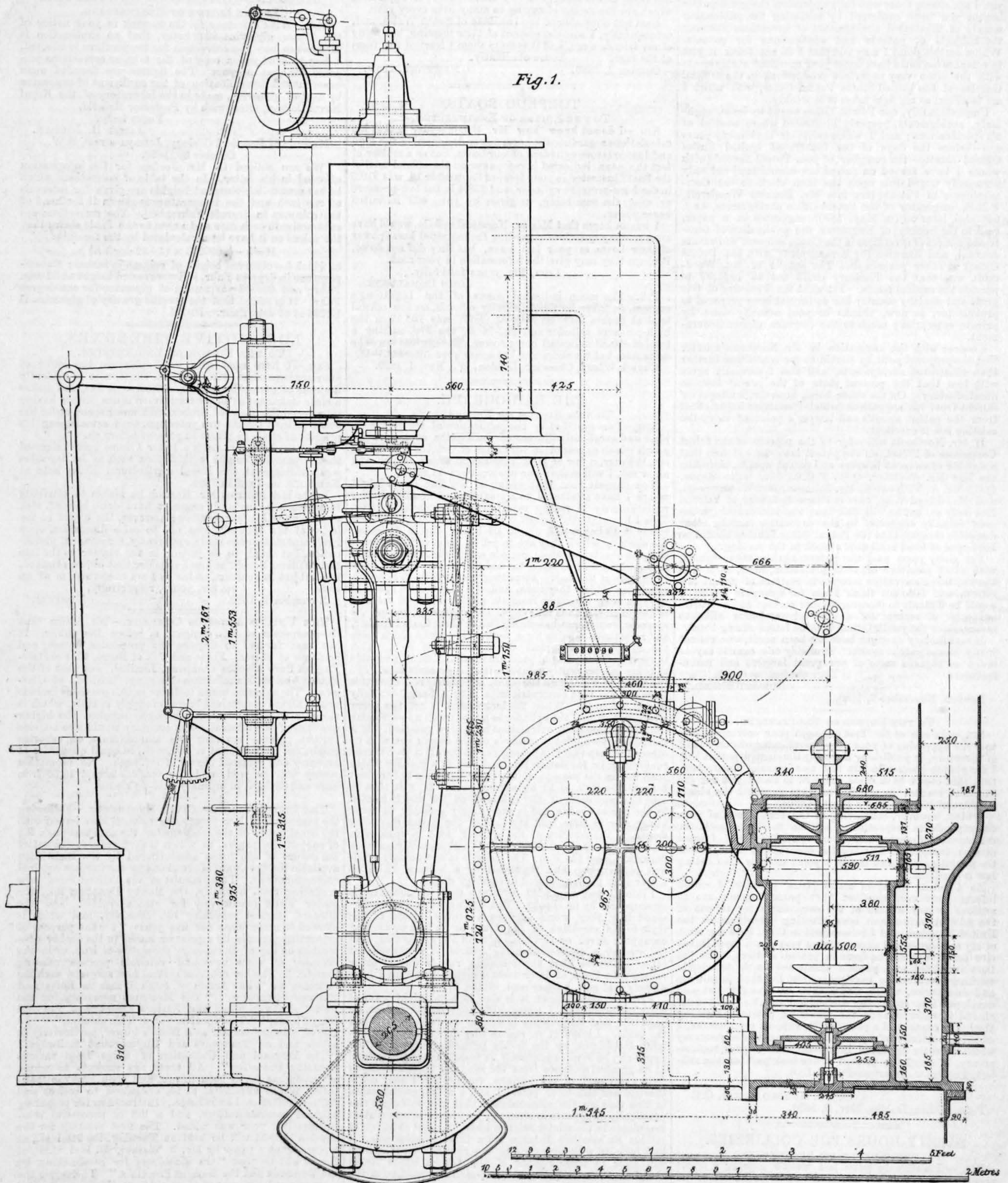
THE UNITED ASBESTOS COMPANY.—We notice that the prospectus of this company is before the public. It has been formed to acquire the properties, mines, and business of Messrs. Furze and Co., of Rome, that of Italo-English Pure Asbestos Company, Limited, and that of the Patent Asbestos Manufacture Company, Limited, of Glasgow. The asbestos mines included in this purchase include nearly all the ascertained source of supply in Italy, which is the only country which has hitherto supplied the higher qualities of the mineral. The company would also acquire various patents covering the manufacture of asbestos goods, &c. The capital is 200,000*l.*, in equal quantities of ordinary and deferred shares of 10*l.* each. No promotion money will be paid, and the vendors accept 15,300*l.* in cash and 33,300*l.* in ordinary paid-up shares.

THE INSTITUTION OF CIVIL ENGINEERS.—Following the precedent of late years, the Council have issued with the usual notice of the meetings for the next session, a list of subjects for papers, to which is prefaced a statement of the nature of the funds administered by the Institution available for the award of premiums to meritorious original communications. These consist of the Telford Fund, now producing 260*l.* annually, the Manby Donation 10*l.*, the Miller Fund (exclusively for students) 150*l.*, and the Howard Bequest producing 16*l.* annually, and which is allowed to accumulate for five years "for the purpose of presenting periodically a prize or medal to the author of a treatise on any of the uses or properties of iron, or to the inventor of some new and valuable process relating thereto." The list contains several new subjects, such for instance, as "The Action of High Winds on lofty and Exposed Structures," "The Measures necessary for the Relief of the Midland and Eastern Counties of England from Floods," "The Construction of Tide Gauges," "The Use of Compressed Air as a Motive Power, particularly in Mines and on Tramways and Underground Railways," "The Disposal and Utilisation of Slags from various Smelting Processes." All these are subjects to which attention has lately been drawn, and show that the Institution is not unmindful of its obligation to collect and diffuse professional knowledge. Instructions for preparing original communications, and a list of successful competitors last year was added. The first meeting for the Session 1880-81 will be held on Tuesday, the 9th inst., at 8 p.m., when a paper by Mr. B. Walker, M. Inst. C.E., of Leeds, will be read "On Machinery for Steelmaking by the Bessemer and the Siemens Processes." Thereafter the meetings will be continued weekly, on the same day and time until the end of May. Mr. Walker's paper will be followed by one "On the Erection of Metallic Bridges," by Mr. T. Seyrig, M. Inst. C.E., of Paris, after which a discussion will be held "On Mountain Railways," based upon papers by two colonial members. The annual general meeting will be held on the 21st of December next.

COMPOUND SCREW ENGINES AT THE BRUSSELS EXHIBITION.

CONSTRUCTED BY THE SOCIÉTÉ JOHN COCKERILL, ENGINEERS, SERAING.

Fig. 1.



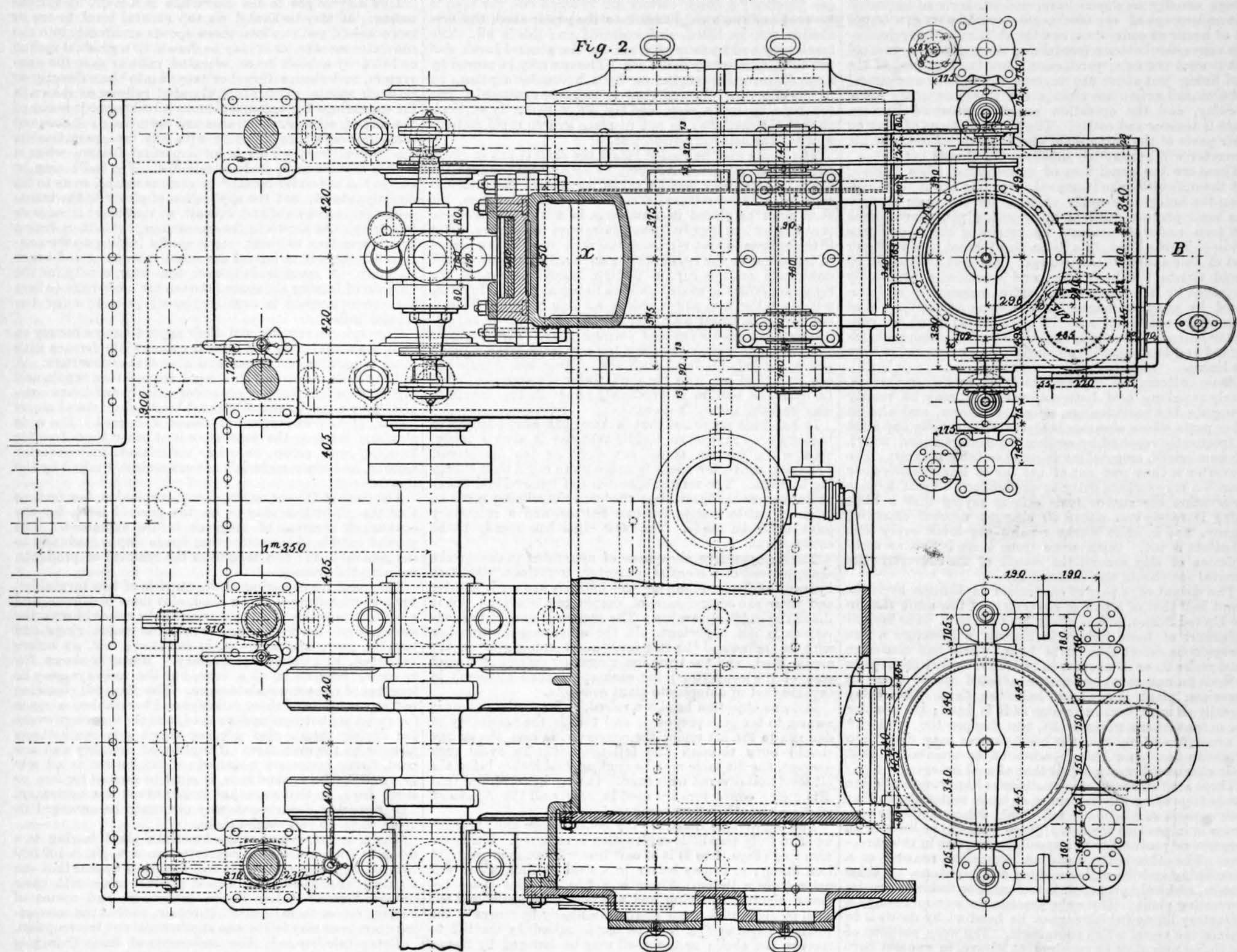
THE compound surface condensing marine engine which forms the subject of our illustration on the present and opposite pages, is one which was exhibited at the Belgian National Exhibition by the Société Cockerill of Seraing. These engines are intended for the fifth vessel of a small fleet which the company possesses for the transport of its

materials and products, and especially for the conveyance of iron ore to Belgium from its mines at Somorostro in Spain. The engines are of the ordinary inverted vertical type, the cylinders resting on cast-iron standards at the back and supported by four wrought-iron columns on the starting side. The standards form part of the condenser

casting, the condenser itself being a cylinder of 38 in. internal diameter, traversed by horizontal tubes 7 ft. 0½ in. long between plates. The condenser communicates through the bedplate with the foot of the air pump, as shown in section in Fig. 1, the pump with its chambers forming a separate casting. This pump is worked from the

COMPOUND SCREW ENGINES AT THE BRUSSELS EXHIBITION.

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high-pressure piston rod by links and levers in the usual way, and the two feed pumps are placed beside it (Fig. 2), and worked off the same crosshead. The bilge pumps are worked similarly off the crosshead of the circulating pump, which is a double-acting piston pump, worked from the low-pressure piston rod. The exhaust pipe leads down to a chamber or passage extending along the top of the condenser and communicating with it by a number of holes, as shown in Fig. 2. An auxiliary injection cock is fitted to the side of this passage, just at the entry of the exhaust, to use in case it should become necessary to employ jet condensation at any time.

The arrangement of the main guides is clearly shown in section in Fig. 2. For working the valves the ordinary link motion reversing gear is employed, the links being of the double-bar type; the gear is worked by a steam cylinder placed in front of the engine. The crankshaft is made in two pieces, with a flange coupling in the middle. The arrangement of the starting valve, stop valve, pet cock gear, &c., is shown in the figures.

The leading dimensions of the engine, and of the boiler and propeller connected with it (and also exhibited at Brussels), are as follow:

Diameter of high-pressure cylinder	... 27 in.
" " low " "	... 45 "
Stroke of both " "	... 33 "
Diameter of air pump	... 19.7 "
Stroke " "	... 18 "
Diameter of crankshaft	... 8.1 "
Length of bearing	... 13.5 "
Diameter of boiler	... 12 ft. 1 1/2 in.
Length " "	... 10 ft. 8 1/2 in.
Number of furnaces	... 3
Total heating surface	... 1668 sq. ft.
Working pressure	... 67.5 lb.
Diameter of screw propeller	... 10 ft. 6 in.
Pitch " "	... 15 ft.
Number of blades	... 4

The following particulars of trials made with s.s. Concha, a vessel similar to that in which these engines

will be placed, and having exactly similar engines, are of very considerable interest. The trials were made upon a trip between Antwerp and London on February 5 and 6, 1878, and we give the particulars, of course, on the authority of the Société Cockerill. The Concha has the following dimensions:

Length between perpendiculars	... 216.6 ft.
Beam	... 27.9 "
Depth of hold	... 17.0 "
Tonnage, B.M.	... 822 tons
Draught of water (with a freight of 1350 tons in rails, bridgework, and fuel) 15.3 ft. forward, and 16.3 ft. aft.	

The average speed of the vessel was 8.25 knots per hour; the weather being very favourable. The stoking with weighed coal continued for over 23 hours. The average indicated horse power from Antwerp to Flushing was 336, from Flushing to Gravesend 320, and from Gravesend to London 386, the average of all the diagrams giving 330 indicated horse power.

The consumption of good coal ("Marie" pit, at Seraing) was at the rate of 1.58 lb., 1.55 lb., and 1.30 lb. per indicated horse power per hour for the three sections of the route given above. The reduction at the end is no doubt greatly due to the fact that it was then possible and indeed necessary only to keep up small fires, whereas at starting the boiler was sometimes forced. The general average consumption of fuel, from Antwerp to London, was 1.53 lb. per indicated horse power per hour, which we need not say is a very remarkably low consumption over so long a distance.

The boiler of the exhibited engine was fitted with an apparatus for burning naphtha residue in the furnace instead of other fuel, which the Société Cockerill have fitted with success on several vessels, and among others upon one having engines like the pair exhibited at Brussels and now working on the Caspian Sea. This vessel is 250 ft. long, 36 ft. beam, 15 1/2 ft. depth of hold, and 10 ft. draught of water with cargo on board. She has twin screws, with a pair of engines similar to that

illustrated to each screw. The results of the use of the liquid fuel are said to have been very favourable. The petroleum is pumped into a tank above the boilers, whence it is led by a pipe to the front of the furnaces, into which it is thrown by a jet of steam, and in this finely divided state it is very inflammable. No smoke was produced, and the evaporative power of the fuel is said to have been about 25 per cent. greater than that of ordinary good coal. At the trials of this vessel (the Alexandre Gendre) a speed of 10 1/2 knots per hour was reached with only half the fires alight.

THIRD-CLASS CARRIAGE; WESTERN RAILWAY OF FRANCE.

WE give on page 406 engravings of the body of a third-class carriage for the Western Railway of France, this carriage having a body of the same length as the second-class carriage which we described rather more than a year ago (*vide pp. 169, 170 of our twenty-eighth volume*), and being mounted on a similar underframe. The engravings call for but little explanation. The body, it will be noticed, is divided into five compartments—instead of four as in the case of the second-class—each compartment accommodating ten passengers, so that there are fifty carried in all. The total length of the body outside is 22 ft. 3.3 in., and its width 8 ft. 9.5 in., this great width enabling good seat room to be given. The height inside from floor to roof at the centre is 6 ft. 4.2 in. It will be noticed that the carriage is lit by the door windows only.

AN ADAPTATION OF BESSEMER PLANT TO THE BASIC PROCESS.*

By A. L. HOLLEY, Memb. Inst. C.E., &c.

THE maintenance of refractory linings in Bessemer converters in such a way as to promote regular and maximum production, has been the subject of more experimenting than any other feature of the Bessemer system, and it is

* Paper read before the American Society of Mechanical Engineers, November 4, 1880.

still the least perfect and satisfactory feature, excepting perhaps the casting of steel. Linings are not only eroded by the mechanical action of the charge, but they are chemically decomposed by its various slags. The silica linings usually employed have, indeed, been so improved that an average of say 60 charges per 24 hours can be got out of a pair of converters, and the shifting of interchangeable converter bottoms (containing the tuyeres) is so rapid that it does not delay production; but the repairing of the fixed lining just above the tuyeres, where both mechanical and chemical action are most severe, is frequently the cause of delay, and the operation rapidly performed between heats is tedious and costly. The accumulations of slag on other parts of the lining must also be quarried out, else the converter will become too small for the charge.

These are the conditions of maintaining silica linings; but the difficulties are increased, probably about threefold, when the linings are made of lime, for the basic process. The basic process consists in removing phosphorus from the iron under treatment, by retaining the phosphorus oxidised by the blast, in a basic slag formed of say 20 per cent of lime added to the charge. An acid (silica) lining would vitiate the basic slag, and would also be rapidly destroyed by it. Lime containing some magnesia, and produced by burning magnesian limestone (dolomite), is at present the only basic material successfully used for converter linings. It is usually made into bricks, which are hard-burned and built up with mortar of similar material to form the lining.

Basic bottoms and tuyeres stand ten to fifteen charges, nearly equalling acid bottoms, and they may be readily changed; but basic linings, near the tuyeres, and also in other parts where abrasion is severe, wear rapidly and must be frequently repaired by cooling the converter and inserting new bricks, or patching in some suitable manner. The converter is thus put out of use for at least twenty-four hours—a very serious delay to production. From a wide observation the author feels safe in saying that a basic lining is rarely run above 60 charges without extensive repairs, and in some works repairs are made every time a bottom is set. With some irons there is also an accumulation of slag around the mouth of the converter; its removal sometimes also causes delay.

The output of a pair of converters in Europe averages about half that of a pair of converters of the same size in the United States, and is often less than half. The limited endurance of basic linings in Europe is therefore a less conspicuous defect than it is here, where one converter must make 25 or 30 charges in 24 hours, so that the repairs of basic linings as at present conducted would keep an American plant idle about half the time. This delay is really as important in Europe as it is here; the greater the output from a given plant, the cheaper the product.* In order, therefore, that the basic process may come into extensive use, basic linings must be so maintained that their output will nearly equal that of acid linings.

There are two reasonable conditions of improvement; the one is to prolong the endurance of basic materials, so that their repairs can be made with little delay, while the converter is in position for use. There seems to be little or no progress or probability of immediate progress in this direction. The other is the rapid and complete removal of a worn lining and the replacement of a repaired one. A third system, seriously proposed, is to double or treble the entire converting plant. The only practicable way to replace a refractory lining (which cannot be handled by itself) is to replace the vessel which contains it. The worn portions of the lining may thus be repaired at leisure, in another part of the works, rather than in position for use, where repairs would retard output.

An obvious way to replace an entire converter lining is to replace the entire converter. This system is already under construction in Europe. The method is also obvious—lifting the converter bodily out of its pillow-blocks, and conveying it to the repair shed by means of an overhead traveller; then setting a repaired converter in place by the same means. Such a plant is doubtless cheaper than a duplicate plant, and its output should be materially greater than that of fixed converters. But the operation of changing an entire converter must be slow and tedious. When the arrangement is such that pillow-block caps are required, these must be loosened by unscrewing heavy nuts; then they must be made fast to the crane chain, lifted, traversed, and set down. The blast pipe connexion must be broken, and possibly some platforms must be removed. Then the traveller is placed exactly centrally over the converter, ponderous chains are made fast, the mass is raised high enough to clear surrounding parts, and drawn laterally to the repair shed; then the converter is placed centrally over its seat and lowered and steadied (as it swings from a chain) into its pillow-blocks. The repaired converter is raised, traversed, and set in place by repeating all these operations; the blast connexion is then made, and the pillow-block caps are lifted, traversed, steadied into place, and screwed down. If the converter is removed in sections, transferring each section and making the refractory joints will occupy much more time. The chimneys and the openings in the side of the building must be high enough to make passage not only for the traveller but for the converter when lifted out of its seat, and for the chains that sustain it. A traveller of the required power, height, and length is obviously a ponderous and costly structure, and to work with reasonable speed it must have independent steam power—the hydraulic system of the works cannot well reach it.

The method of replacing the lining proposed by the author and shown in the engravings is removing only the shell of

the converter, lowering it out of the trunnion ring easily and rapidly, by means of a simple lift and car, and replacing a repaired shell by the same means. No pillow-block caps, blast connexions, nor other surrounding parts are touched; a dozen cotters are knocked out, the shell is lowered and run straight back to the repair shed, the new shell is run in, lifted, and cotted on; this is all. The machinery and transference are on the general level, and not 40 ft. or more up in the air. The car may be moved by a small reversing engine or by a hydraulic capstan, by means of a wire rope and sheaves suitably arranged. The car runs against a stop, and the lift is perfectly vertical, so that the shell may be put in place by two rapid motions without the delay of adjustment.

The lining may be heated before the shell is put in place, and bottoms (and tuyeres) may be separately removed, as at present, or they may be taken away with the shell and repaired without removal from it. In the latter case, the shell must be placed in trunnions, in the repair shed, so that the bottom may be turned downward for repairs. But if the bottom is first removed, the shell need not be placed in trunnions in the repair shed; the shell will stand mouth downward on the car, a position most favourable for repairing both the mouth and the lining about the tuyeres, which are the two places chiefly needing repairs. This is doubtless the better plan, and it saves the cost of supplementary trunnion rings and turning gear. The diagrams (see two-page engraving) show the converter hung so high above the general level that the bottom and tuyere-box can be hauled out, with the shell, under the trunnion ring. In case the bottom is previously removed, the converter may be hung some 3 ft. lower.

It has been remarked that in American works converter bottoms are changed so rapidly that one is always ready, even when tuyeres stand but eight or ten operations. Changing converter shells is much more rapid than changing bottoms. The several operations of removal and transportation are the same, but the converter lining must be trimmed out to receive the new bottom, and a refractory joint must be made. The new shell has merely to be cotted on.

The comparative cheapness of apparatus to change the shell, instead of the entire converter, is obvious. The two hydraulic lifts for removing the bottoms are made heavier and there are several cars of simple construction; this is the entire extra apparatus. The increased cost of the converters is not important. In the other case the traveller with its engine and the standards and turning gear in the repair shed, and the trunnion rings and pinions (the chief cost of the converters) for each spare shell approach in expense that of a duplicate plant complete.

But one objection has been raised, as far as the author is aware, to the plan proposed, and that is the possibility of damage to the lift under the converter, in case the charge should burn through and fall upon it. To avoid such damage, the lift table may be sunk several inches below the pit level and covered with sand. It may be remarked that lifts under converters are used in nearly all the American works with satisfactory results.

The engravings illustrate the construction and arrangement so fully that little explanation is required. The trunnion ring (Figs. 1 to 4) is of cast iron with an inch wrought iron lining; or it may better be a steel casting, which will not require a lining. There is a 2 in. annular space between the trunnion ring and the converter shell, and the shell is prevented from shifting laterally by means of the wedges shown in Fig. 1. The car is raised by the lift to receive the shell; or the shell may be lowered by means of a fork on the lift passing through the car.

This construction of converters has led the way to a general improvement in the design of the plant. The shells and bottoms may be run out laterally into the converting house, but the space here is insufficient for convenient repairs, and the shells for one converter could not be well got to the other. In order that there may be one common place for repairs, and ample room both for spare shells and spare bottoms, they must be run out in rear of the converters as shown in Fig. 8. If blast furnace metal is brought directly to the converters, this rear space is not otherwise wanted, but if cupolas are placed there, as is usually the case, they must be so arranged that the shells can pass out under them.

But the cupolas (excepting the spiegel cupolas) may best be placed elsewhere; if there are blast furnaces the cupolas may be so arranged near them, as to utilise the same system of transportation, hoisting, blowing, and hot blast. There should be plenty of spare gas from good furnaces to heat cupola blast. These are very important considerations, regarding both cost of plant and economy of working. And judging from the experience at many works, the disadvantages of hauling fluid iron some thousands of feet in a railway ladle, are less than those due to crowding the melting department and its stock yard and appurtenances close behind the converters. Fluid iron is hauled from one to two miles* without chilling: it need usually be hauled but a few hundred feet; and the cost of the transporting plant and service should be about the same for the two systems. There are two important advantages in the arrangement shown by the engravings.

1. Placing only the spiegel cupolas, instead of the entire melting department, close behind the converting house, leaves its rear comparatively open to free ventilation, thus cooling not only the space around the converters, but also the casting pit.

2. This arrangement provides ample room for the convenient removal of slag, which in the basic process is very voluminous; one long dumping car placed under both the converter and the ladle catches it all, and as the bottom of the pit is on the general level, the slag is neither handled nor lifted—the car is simply hauled out by the yard loco-

motive and dumped. Experts well know the cost and inconvenience of breaking up and quenching slag in the pit and of lifting it out of the pit and then loading and removing it.

Iron may be got to the converters in a ladle, by various means. It may be hauled on the general level, to one or more hoists, and run into short spouts or directly into the converter mouths, or it may be drawn up a gradual incline or lifted by a hoist to an elevated railway near the converters, and thence tipped or tapped into them directly or through spouts. The short elevated railway as shown in the engravings has one conspicuous advantage—it is out of the way of all other apparatus and operations; it does not cross railways, nor interfere with any transportation on the general level. This is an important feature when a charge is made every 20 to 30 minutes. The ladle may be run to the converter mouth* by various means, so as to tip directly into it, but the application of power to the transportation is awkward and difficult, so that there is more or less delay. As shown in the engravings, the ladle is drawn by a locomotive to short, steep spouts leading to the converters; there is no lateral nor hand movement and hence no delay. A spout leads to each converter, chiefly for the purpose of leaving the space between the converters (where the common spout is usually placed) quite free for the spiegel ladle.

The spiegel cupolas and their appurtenances occupy so little room that they are placed, without interference with other apparatus, very near and above the converters. A railway ladle receives the spiegel from either cupola and tips it directly into the converter quickly and hence completely by a short run and without hoisting or lateral movement. It may be weighed in transit if desired. The wide platform between the converters is at other times free for bringing lime, scrap, or other materials to the converter mouths, and these materials are conveniently raised by the cupola hoist.

The floor of the converting house is raised a few feet, so that the pit-bottom may be on the general level, for the convenient removal of slag, as before explained. The ground outside of the converting house slopes gradually to the general level; this facilitates the removal of products, and also the drainage.

The plant for repairing shells consists of two turntables, some short railways, and a shed, also some platforms, and a lift for materials. If bottoms are to be removed with the shells, there must also be mounted trunnion rings and turning gear, also a crane, in the shed; but, as before explained, this seems unnecessary. Room is shown for repairing four shells at a time, but the railways may be lengthened to accommodate more. The plant for repairing bottoms consists of short railways and turntables, a space for ramming bottoms under a shed, and the necessary ovens for drying them; also a crane which sets the bottoms directly on the oven cars. If tuyeres of ordinary size are used, fewer ovens are required; if the bottom is all one tuyere, rammed around rods, it must be burned for two or three days, so that more and hotter ovens are necessary. The repairing department may obviously be arranged in other ways, to suit special cases.

The average output of the American plant, having two 6-ton to 7-ton silica-lined converters in one pit, is 100,000 tons of ingots per year. It will doubtless appear that the plant under consideration should produce more with basic linings, because it has 10-ton converters, and means of keeping one of them in constant repair, so that the converting operations may follow one another without interruption.

Recapitulation.—1. The endurance of basic linings is so small that the ordinary system of repairs would reduce the output of an American plant about one-half.

2. The only adequate system of repairs, with existing basic refractory materials, is to remove and replace linings bodily by removing and replacing the vessels containing them.

3. Changing converters, trunnions and all, requires very costly apparatus, and much labour and time in disconnecting parts, and in making the transference.

4. Changing only the shells of converters (leaving the trunnions and their connexions undisturbed) requires only cheap and simple apparatus; and the operation may be performed so quickly that basic linings will give the maximum output of acid linings.

5. Leaving the building open in rear of the converters, instead of placing the melting department there, gives good ventilation and ample space for bottoms and shells to be run out for repairs, and for slag to be removed from the pit. The cupolas (excepting the spiegel cupolas) may be placed elsewhere, especially by adjacent blast furnaces; and melted metal may be transported thousands of feet without difficulty.

6. Placing the pit bottom on the general level, allows slag to be hauled away directly, without rehandling or lifting. The elevation of the converting house floor thus produced, facilitates the removal of products.

7. The metal ladles are brought in behind and above the converters, and discharged by spouts, in order to avoid the delay of getting them to the converter mouths; and two spouts are used, so as to leave the space between the converters open for a short run of the spiegel ladle, and of lime and other solid materials to be charged.

8. The spiegel cupolas are placed near and above the converters, so that the metal may be run in quickly and completely, without vertical or lateral movement, by means of a ladle car.

9. The repairing plant is conveniently placed in rear of the converting house, but it may obviously be modified in extent and position, to suit local circumstances.

AUSTRALIAN TELEGRAPHY.—A new line of telegraph is being built from Adelaide to Melbourne, and a cable is to be laid between Sturt's Lighthouse, Kangaroo Island, and Kingscote.

* As at the works of Bolckow, Vaughan, and Co.

* The statement sometimes made in England that the rapid production in America impairs quality of product, is but a cover for inadequate plant. Steel is obviously no better because five hours instead of one are consumed in setting a vessel bottom, or because it may take twice as long in an English works to handle materials and product.

* At the Barrow Works it is hauled two miles, at Ebbw Vale some five miles.

NOTES FROM THE NORTH.

GLASGOW, Wednesday.

Glasgow Pig-Iron Market.—The warrant market opened dull last Thursday, but there was a recovery, and the closing prices showed no change from those of the previous day. In the forenoon business opened at 50s. 7d. cash, and improved to 50s. 11d. cash, and 51s. 2d. one month, the close being 50s. 11d. cash and 51s. 1½d. one month, and buyers offering 1d. per ton lower. The quotations during the afternoon ranged from 50s. 11d. cash to 50s. 9d. cash, and from 51s. to 50s. 11d. one month, the market closed with buyers at 50s. 9d. cash and 50s. 11d. one month, and sellers asking 1d. more per ton. The market was very strong on Friday, being affected by rumoured buying for America, and prices advanced to the extent of 10½d. per ton. On the week, however, prices closed 6½d. per ton under those of the previous Friday. Business was done during the forenoon at from 50s. 10½d. to 51s. 4½d. cash, and from 51s. to 51s. 6d. one month, the market closing with sellers at 50s. 1½d. cash and 51s. 4d. one month, and buyers near. In the afternoon the quotations ranged from 51s. 1½d. to 51s. 8d. cash, and from 51s. 4d. to 51s. 10½d. one month. The market closed with sellers at 51s. 8d. cash and 51s. 10½d. one month, and buyers ½d. per ton less. Monday's pig iron market opened with business done at 51s. 3d. cash, but the price then declined to 50s. 11d. cash prompt. Transactions also took place at 51s. 5½d. to 50s. 11½d. one month, and at the close there were sellers at 51s. cash and buyers near. There was a very steady market during the afternoon, but without much business being done. A few lots changed hands at 51s. and 51s. 1d. cash, and the market closed with buyers at the former price and sellers at the latter, so that there was a decline in prices to the extent of 7½d. per ton from last week's closing quotations. Yesterday's warrant market showed a slight recovery at the opening, but prices subsequently gave way, the close, however, was 1½d. per ton over the close on the preceding day. Business was done during the forenoon at from 51s. to 51s. 3d. cash, and from 51s. 3d. to 51s. 6d. one month, and at the close there were sellers at 51s. cash and 51s. 6d. one month, and buyers offering 1d. per ton less. In the afternoon from 51s. 2d. to 51s. cash, and from 51s. 4d. to 51s. 3d. one month, were the quotations, and the market closed with buyers at 51s. 1½d. cash and 51s. 4d. one month, and sellers holding out for 1d. per ton more. To-day's market opened in the forenoon steady, 51s. 2½d. cash, 51s. 5d. one month paid, receding to 51s. cash and 51s. 3d. one month, returning to 51s. 2d. cash paid, and the close being sellers at 51s. 1½d. cash and 51s. 4d. one month. The afternoon market was quiet, and business was done at 51s. 3d. to 51s. one month, and at 51s. to 50s. 10½d. cash, and the market closing with buyers at 50s. 11d. and 51s. one month, and sellers 1d. per ton higher. Of late there has been a good deal of speculative buying, not depending on anything but the caprice of the operators. A very large amount of business has been done from day to day. Both depression and buoyancy have been felt, the fluctuations being very much the result of jobbing operations. There is practically little or no change in the condition of trade, and the statistics compare unfavourably at all points—increased production (118 blast furnaces being in action as against 94 at the same date last year), diminished exports, and increased imports from England; there is, however, a widely-spread belief that iron is a good commodity to have, and it is being purchased freely as a speculation. To meet the demand pig iron is again being rapidly pushed into the public warrant stores. Shipping iron has been quiet of late, and prices are generally easier than they were recently. The demand for the Continent has again fallen off, and the American orders continue to be of the most moderate character, so that at the moment there is at least little prospect of the shipments being increased. The home trade is still in a gratifying state. Last week's shipment of pig iron amounted to 7556 tons as compared with 17,000 tons in the corresponding week of last year. Up till Saturday evening the stock of pig iron in the public warrant stores stood at 476,768 tons, the increase for the week being 1877 tons.

The Clyde Engineering Trades.—Last Thursday evening, a meeting of delegates from the engineering shops on the Clyde was held in Glasgow, in connexion with the movement for an increase of wages at present on foot. It was agreed that they should form themselves into an organisation to be called "The Glasgow and District Wages Committee," and it was remitted to a sub-committee to draw up a memorial to the employers demanding an advance of 10 per cent. The reports presented from the various works were all in favour of adopting this course. The memorial has since been prepared and issued to the employers. The following are given as the reasons for asking the advance of wages. "1st. During the autumn and winter of 1878-9 our wages were reduced 7½ per cent., and in addition three hours were added to the working week. 2nd. Trade has now revived, and is daily showing marked symptoms of improvement. With the revival of trade prices for shipbuilding and general engineering work have increased. 3rd. The workmen employed in the engineering trades are, when compared with other classes of skilled artisans, very poorly paid. If compared with their brethren in other competing ports, such as Hartlepool and Hull, and other places, they are paid from three to eight shillings per week less of wages. If the employers on the Thames, Tyne, Wear, Tees, Humber, and Mersey, competing in the same markets (other things being equal), are able to pay so much higher wages, surely the Clyde and district employers are able to pay at least equal rates of wages. We are convinced that they only require their attention drawn to the matter to perceive the justice of our demand. We feel assured that you will give these reasons your earnest and full consideration when deciding this appeal. We are extremely desirous that the amicable relations which presently exist between employers

and employed should be maintained, and we hope that trade will go on prospering and improving for the mutual benefit of the master and workman." A reply is respectfully requested on or before the 9th day of November.

Harbour Improvements at Fraserburgh.—The Harbour Board of Fraserburgh have resolved to proceed without delay to execute improvements in deepening the harbour and widening the piers which had last year been contracted for at a cost of between 30,000l. and 40,000l., but not carried out by the contractor.

Institution of Engineers and Shipbuilders in Scotland.—The opening address to the members of this Institution was delivered last night by the new president, Mr. J. L. K. Jamieson, and an interesting paper on hydraulic tools was subsequently read by Mr. Ralph H. Tweddell.

NOTES FROM CLEVELAND AND THE NORTHERN COUNTIES.

MIDDLESBROUGH, Wednesday.

The Cleveland Iron Market.—Yesterday there was a larger attendance than usual on 'Change at Middlesbrough. It was found that the stock in store at Messrs. Connal and Co.'s, at Middlesbrough, amounted to 110,023 tons, which was an increase of 2527 tons on the previous Tuesday. At Glasgow the stock stood at 477,068 tons. Comparatively little business was done on 'Change. During the interval of the market days there had been some fluctuation in the prices of pig iron, but only to the extent of about 3d. per ton, and yesterday, No. 3 Cleveland pig was again quoted 39s. 6d., which is the same figure for which it was sold a week ago. Although the total production of pig iron in this district is exceedingly large, the people engaged in the trade look forward confidently to a fair trade being done during the winter.

The Ironmasters' Returns.—This (Wednesday) afternoon the Cleveland Ironmasters' Association, Middlesbrough, have issued their returns. From these it appears that out of 166 blast furnaces in the north of England there are 118 in operation, 48 being idle. Last year at this time there were 165 blast furnaces, only 89 of which were in blast. There are two furnaces in course of erection.

The Finished Iron Trade.—Throughout the district the finished iron trade continues active. The output at present is larger than it has been for several years. Last year at this time most of the iron works on Teesside were idle and a great number of men were destitute. Now work is easily obtained and very few men are out of employment. Prices continue the same as those quoted last week. Ironfounders are better off for orders than they were but they are not booked far ahead. An order for 5000 tons of railway chairs and another for 1500 tons have just been secured by Stockton firms.

Engineering and Shipbuilding.—Although the season is rapidly advancing the shipbuilders continue busy. Last week work was impeded by the bad weather. There are still plenty of orders on hand. In all the big centres of engineering, Middlesbrough, Stockton, the Hartlepoons, Sunderland, Gateshead, and Newcastle, there is a great deal of work on hand.

The Coal and Coke Trades.—All kinds of fuel are in better request and prices are firmer.

NOTES FROM SOUTH YORKSHIRE.

SHEFFIELD, Wednesday.

Sewage Schemes.—It is proposed by the Normanton local authorities to provide sewage works at a cost of about 7500l. The plans have been prepared by Mr. Reid, clerk and surveyor, and it is proposed to pay him 2½ per cent. on the cost of the work for carrying out the same, thus saving 5 per cent., which an engineer specially engaged would charge. The Whitwood authorities are pressing forward their drainage and local improvement schemes; Mr. Richardson, C.E., of Methley, being engaged to assist them. An additional sum of 6000l. will be required for the completion of the sewage and water works.

Improvements at Heaton—A Peculiar Question.—Major Tulloch, R.E., on behalf of the Local Government Board, has held an inquiry at Heaton respecting an application by the Local Board there to borrow a sum of 4000l. for street improvements. The major said the application was a peculiar one, because the money had already been spent. It was no use saying the work was costly and extravagant, because it had already been done, and the only solution of the difficulty was to levy a rate which would pay the cost or borrow the sum from Government, with repayments over 20 years. The former course would be monstrously hard on the present ratepayers, as those who came after them ought to pay their share of the cost. Major Tulloch will report to Government.

Opening of the Doncaster New Water Works.—These works, constructed by the Doncaster Corporation at Ravenfield, at a cost of nearly 200,000l., were opened last week by the mayor. The works were commenced six years ago, and the whole would have been completed before now had it not been found necessary to take the puddle wall to a lower depth, owing to the treacherous nature of the rock. After certain ceremonies, Mr. B. S. Brundell, the engineer, handed the mayor a key with which to open the works. The mayor then turned on the water, and in a speech congratulated the people on the completion of the scheme. The reservoir is calculated to hold sufficient water for the supply of Doncaster for 240 days, even though there be no rain. A public banquet to celebrate the event was afterwards held.

Improvements in Colne.—The Local Board of Colne intends during the next session of Parliament to apply for powers to purchase the water works, at an estimated cost of 13,500l., and for further powers to construct sewerage

works, to make street improvements, and improve the town generally.

Miners and Railway Charges.—The miners of South Yorkshire are holding meetings in the district to protest against the excessive railway charges made by the local railway companies. They say the high rates paid to the railway companies are ruining the trade of the district, especially the coal trade, and they appear determined, through their unions, to support any measures which may break down the great monopoly. The agitation is being carried forward with vigour.

NOTES FROM THE SOUTH-WEST.

Gloucester and Birmingham Navigation.—The directors of the Sharpness New Docks and Gloucester and Birmingham Navigation Company observe in their report: "There is a slight falling off in the revenue of the past half-year, as compared with that of the corresponding period last year. This might naturally have been expected considering the extreme competition to which the port has been subjected by the ports at the mouth of the Bristol river. During the half-year the attention of the directors has been much given to the question of the shipments of Welsh coal from Sharpness. This coal would be brought over the Severn Bridge Railway, and the company would be, therefore, doubly interested in its export. The distance of the collieries from the shipping port constitutes a great difficulty, but the directors will spare no efforts to secure it. The balance of revenue on the half-year is 5183l. This has been carried to the reserve fund, which now amounts to 8466l. From this the directors recommend the payment of a dividend of 1½ per cent. for the half-year, amounting to 4557l. This will leave 3909l. in the fund."

Newport Dock Company.—The report of the directors for the half-year ending June 30, 1880, shows a balance on the revenue account of 4582l., which, added to the balance brought forward on the general revenue account of 12,224l., makes the sum of 16,826l. standing to the credit of that account. The directors recommend the payment of 1500l. on the first preference shares (being a half-year's dividend), and that the balance remaining, viz., 15,326l., be transferred as a loan to capital. The alterations and improvements in the working accommodation have been effected, and two additional movable hydraulic cranes for the convenience of the import trade have been ordered from Sir W. Armstrong and Co.

The Tredegar Works.—A new blast furnace—the fourth of its kind—has been blown in at these works, and is now in full operation. The furnaces are producing a large quantity of Tredegar pig. Attached to the furnaces are two of Cooper's stoves, the first of similar construction introduced into the district. The old furnaces look like so many dwarfs when compared with the last new furnaces, which is one of the largest in South Wales. The new coke ovens are doing good work, and the coke is of the best quality. The automatic arrangements for filling the ovens and drawing the coke comprise many recent improvements, no manual labour being required from the time the coal reaches the bank until it is emptied into the trucks in the form of coke; and the coal is screened, washed, taken to the ovens, and withdrawn entirely by machinery. In the colliery department unusual activity prevails.

Swansea.—The coal trade generally for the past week has been exceptionally dull. The exports show a falling off of nearly 4000 tons, as compared with the previous week. This must not be attributed to want of orders; on the contrary, these are plentiful, but to a dearth of tonnage, owing to a long continuance of easterly winds and bad weather. Iron is a little firmer, but tin plates are weaker.

Cardiff.—Orders for steam coals keep fairly plentiful, and some of the foreign markets exhibit a healthy activity. Prices show no change, nor is it to be expected they will do so. With regard to iron ore no change is to be reported; the ideas of buyers, whether for cargoes or for contracts, continue very low, and their stocks being good, they are able to maintain an independent tone. The uncertain condition of the iron trade certainly does not tend to encourage heavy speculations. Last week's shipments comprised 92,976 tons of coal, 1688 tons of iron, 1860 tons of patent fuel, and 1871 tons of coke. The imports comprised 6402 tons of iron ore from Bilbao, while other sources supplied 4671 tons.

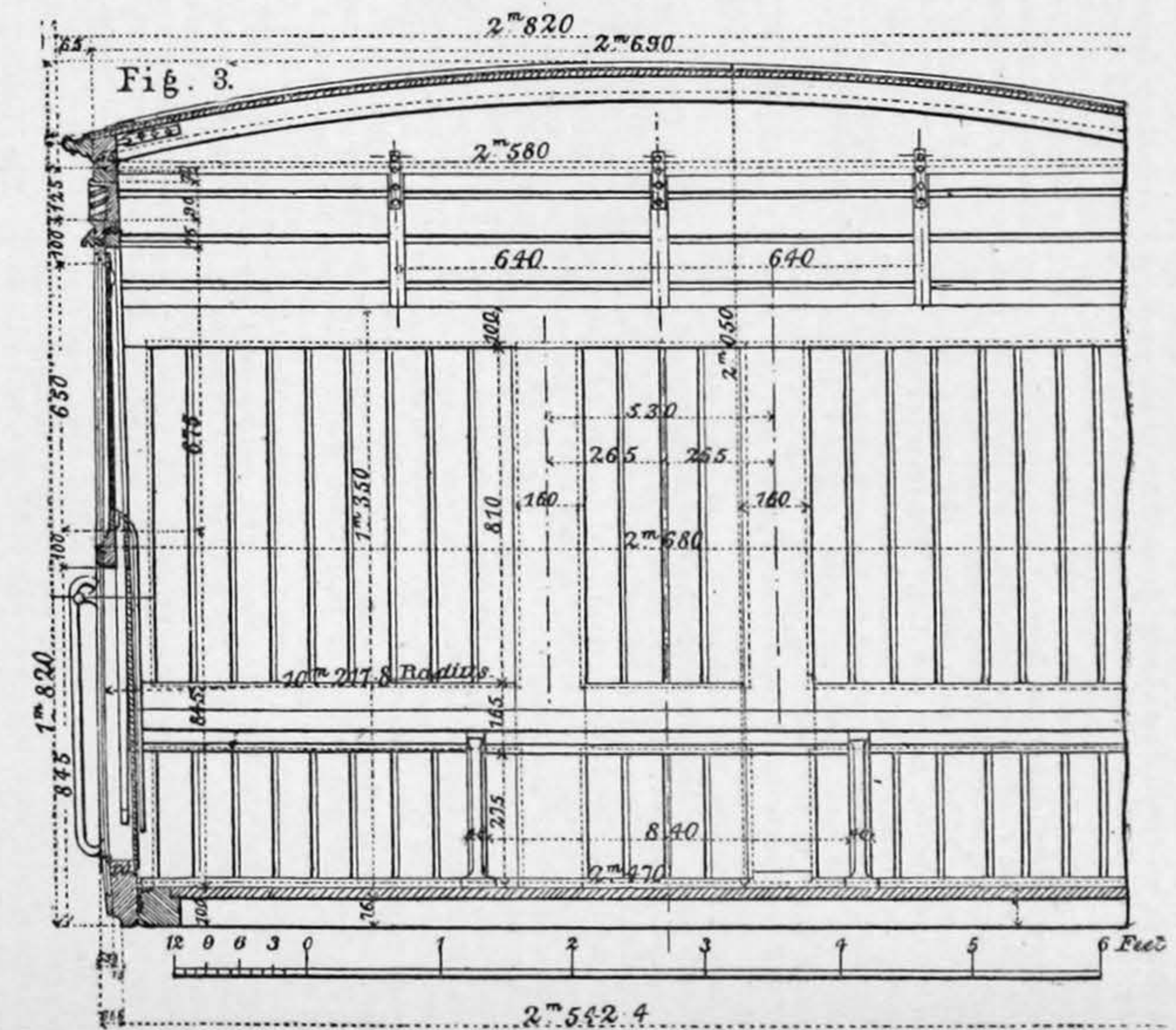
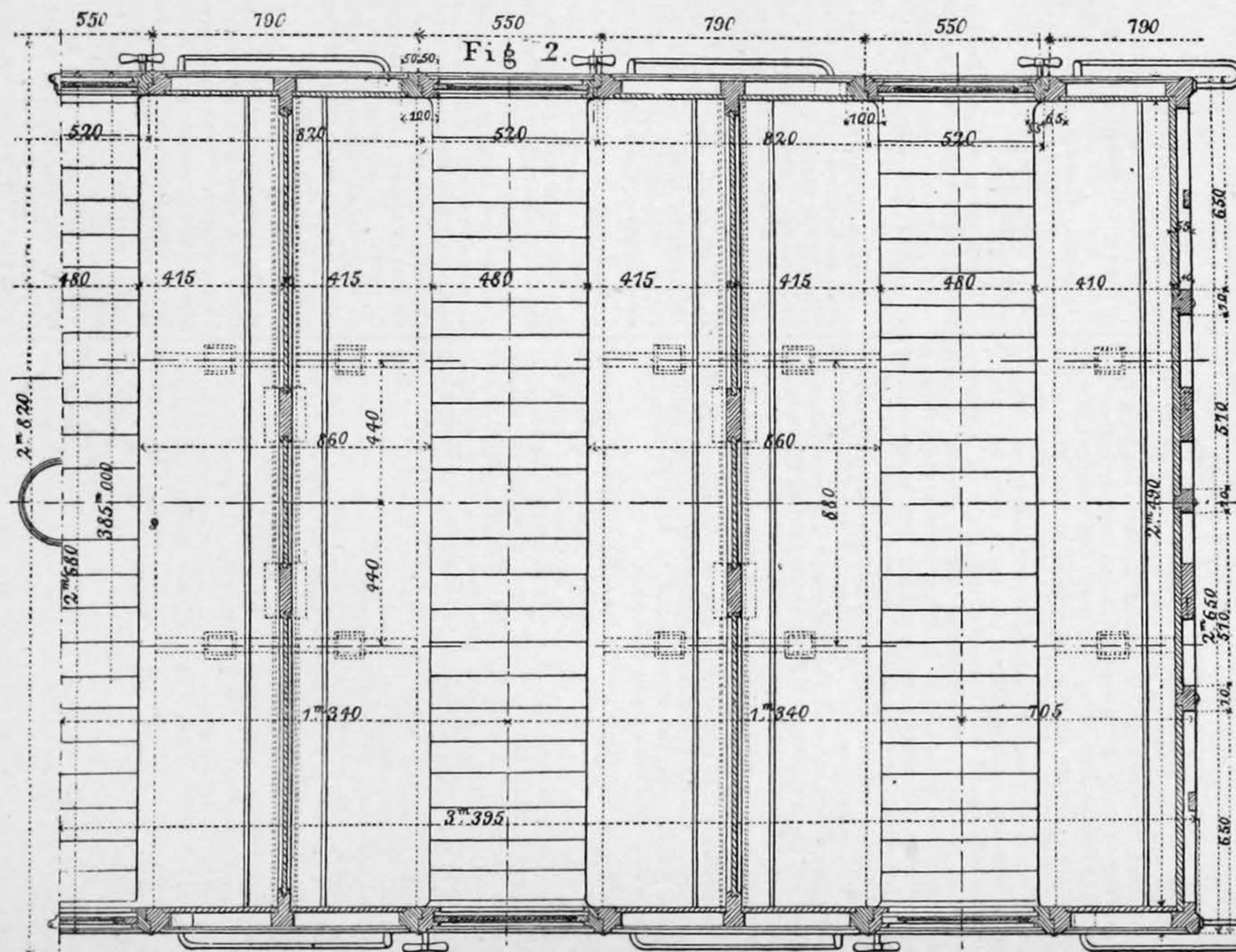
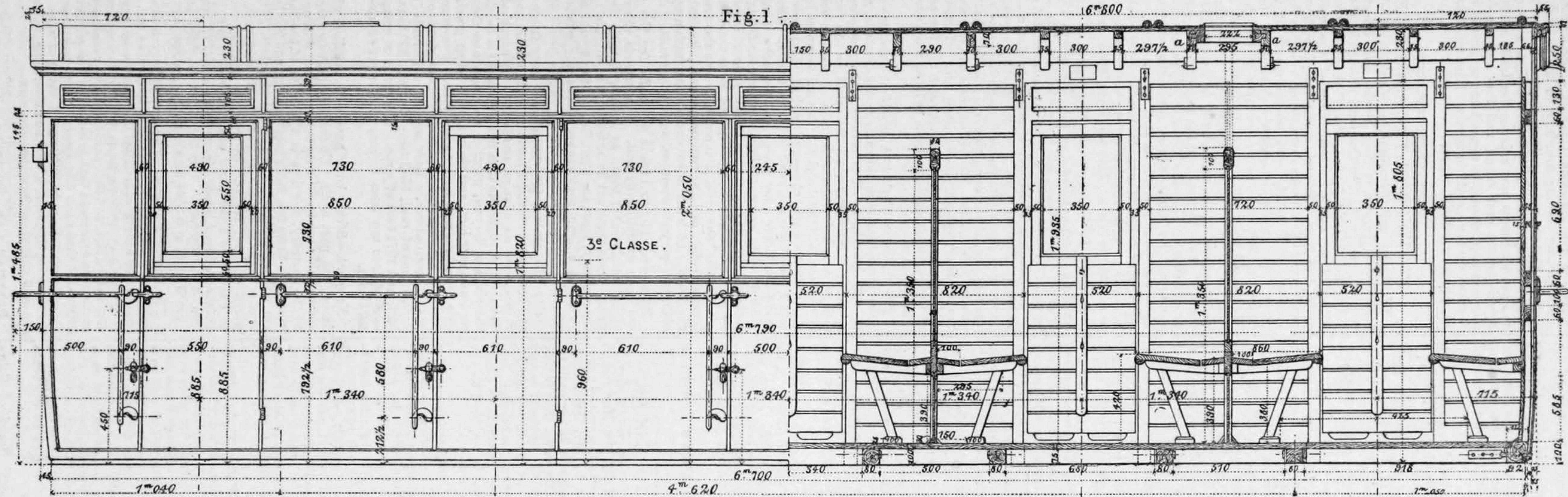
Newport.—Stems have been well supplied with orders during the past week. Under these circumstances it need not be said that there is no tendency to a decline in prices; on the contrary, firmness is the order of the day. In the iron trade there is a fair amount doing, and the local works are well occupied with iron and steel orders. It is reported that a large order for 35,000 tons of iron rails has been placed in South Wales. In iron ore transactions there is no change to report, and prices are still low. The total quantity of coal shipped last week was 17,568 tons, and of iron, &c., 1570 tons. The imports were 5305 tons of ore from Bilbao, and 3094 tons from other directions.

The Aberdare Valley.—The new colliery near Mountain Ash is now doing good work, and is turning out from 600 tons to 700 tons of coal daily. From this colliery, and that of Harris's Deep Navigation, fully 1000 tons per day are now turned out, and this fact should be remembered when surprise is expressed that prices have not advanced. It is calculated that since the improvement has taken place in the iron trade fully 10,000 tons of coal per week have been thrown into the market over and above the full average of the best outputs on previous occasions.

PULLMAN CAR BUILDING.—The new Pullman Car Works at Pullman, near Chicago, are being pushed forward with great activity, and the place already looks like a large manufacturing town.

THIRD-CLASS CARRIAGE; WESTERN RAILWAY OF FRANCE.

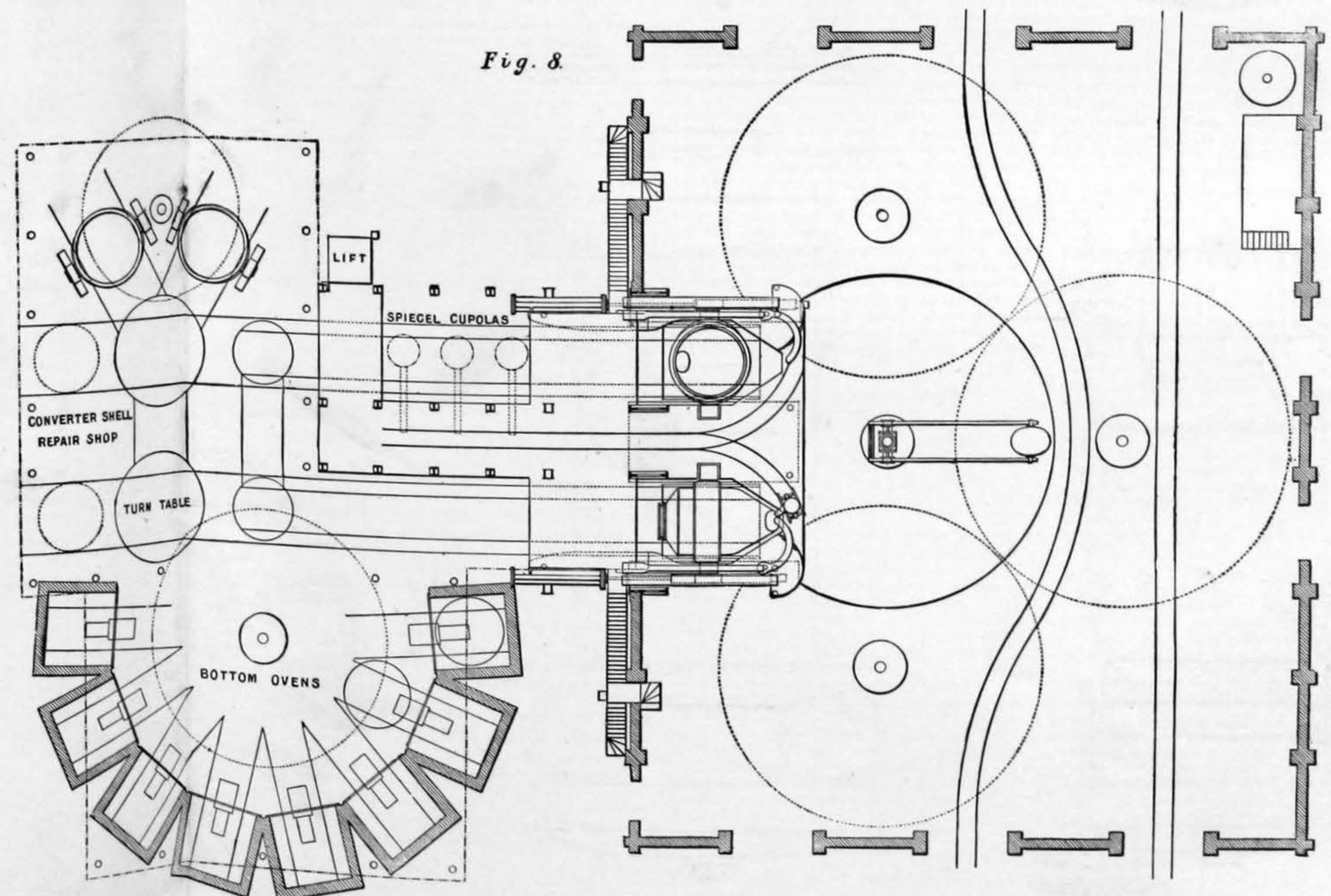
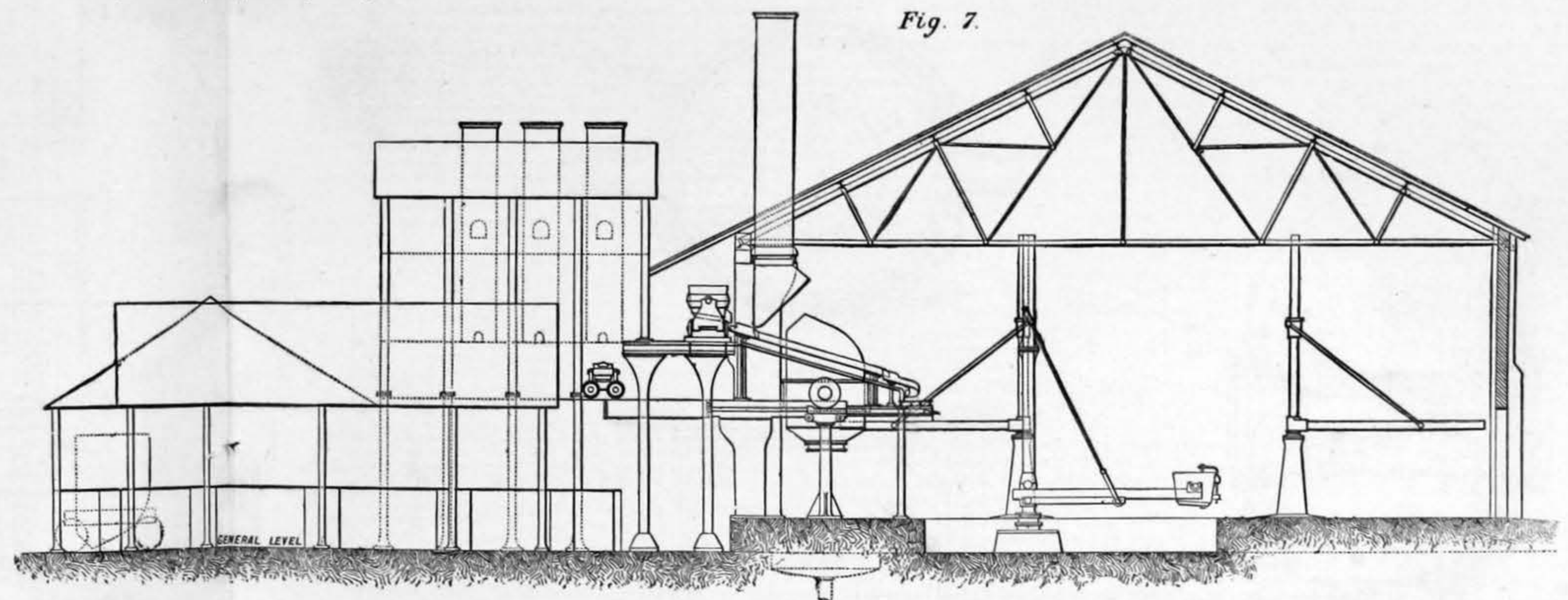
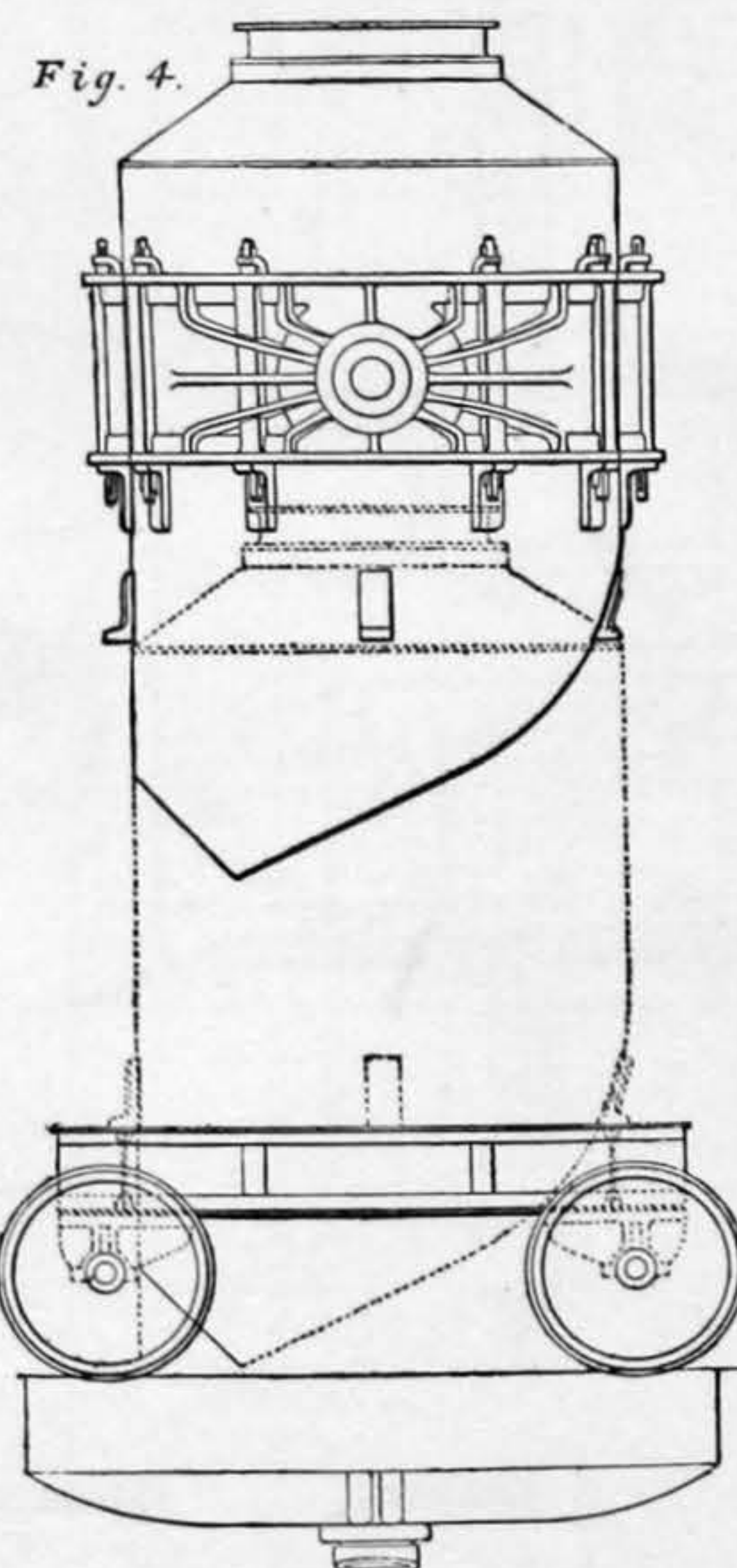
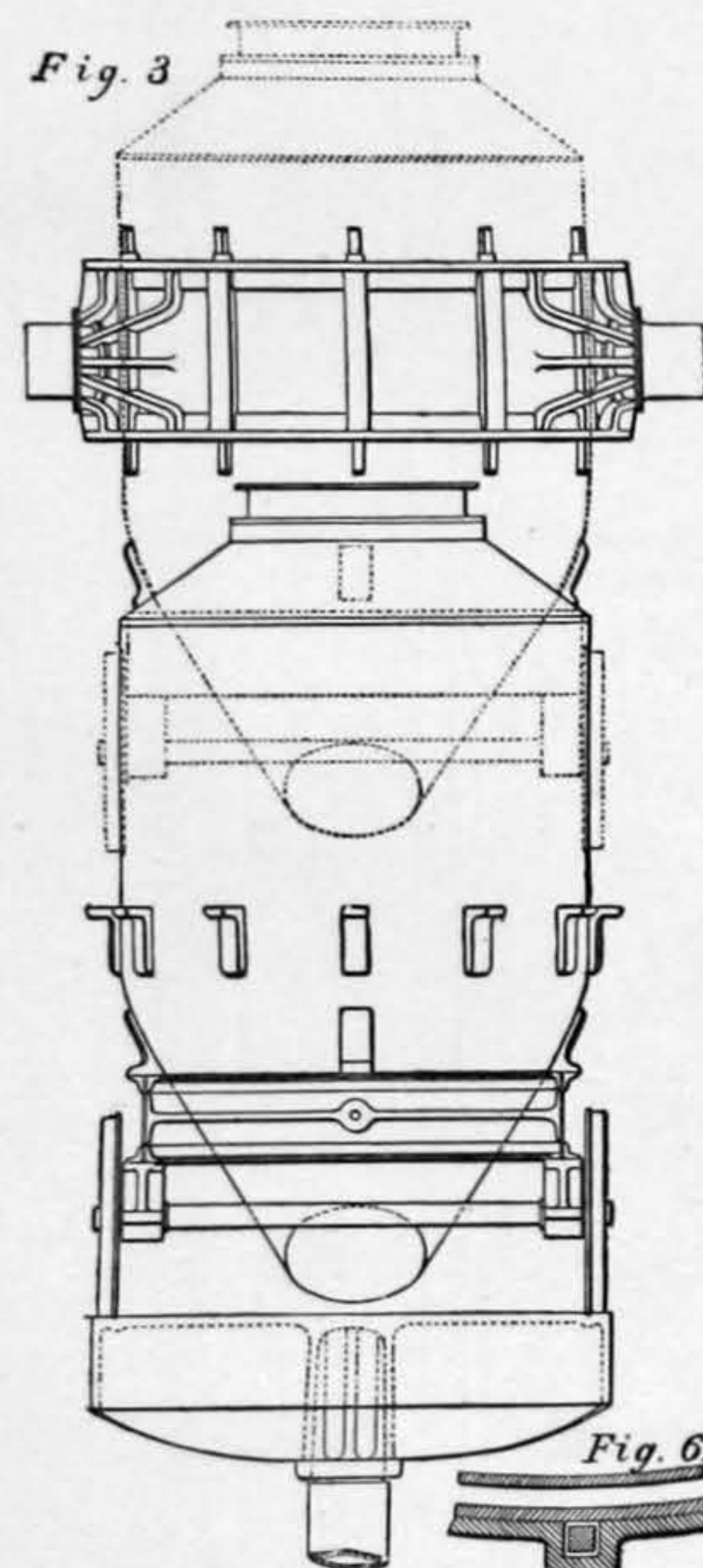
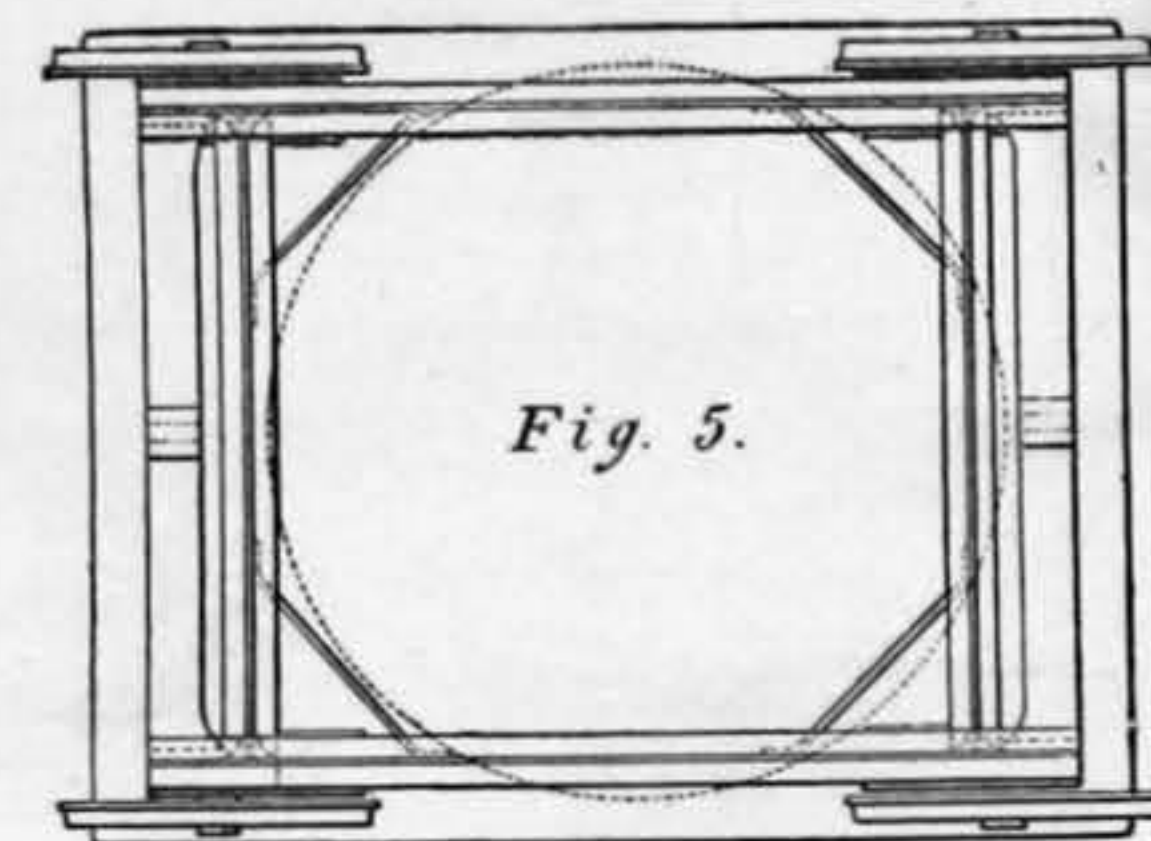
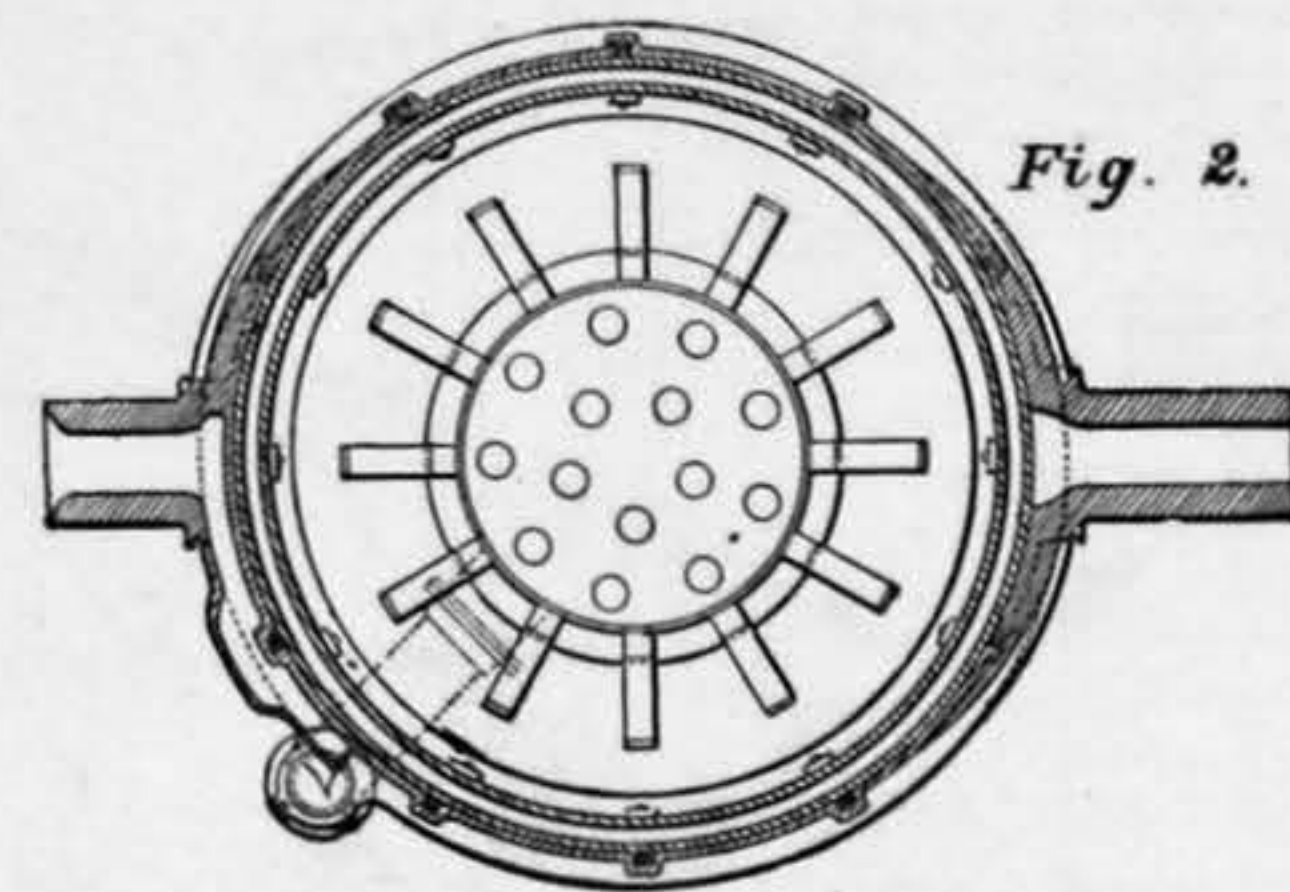
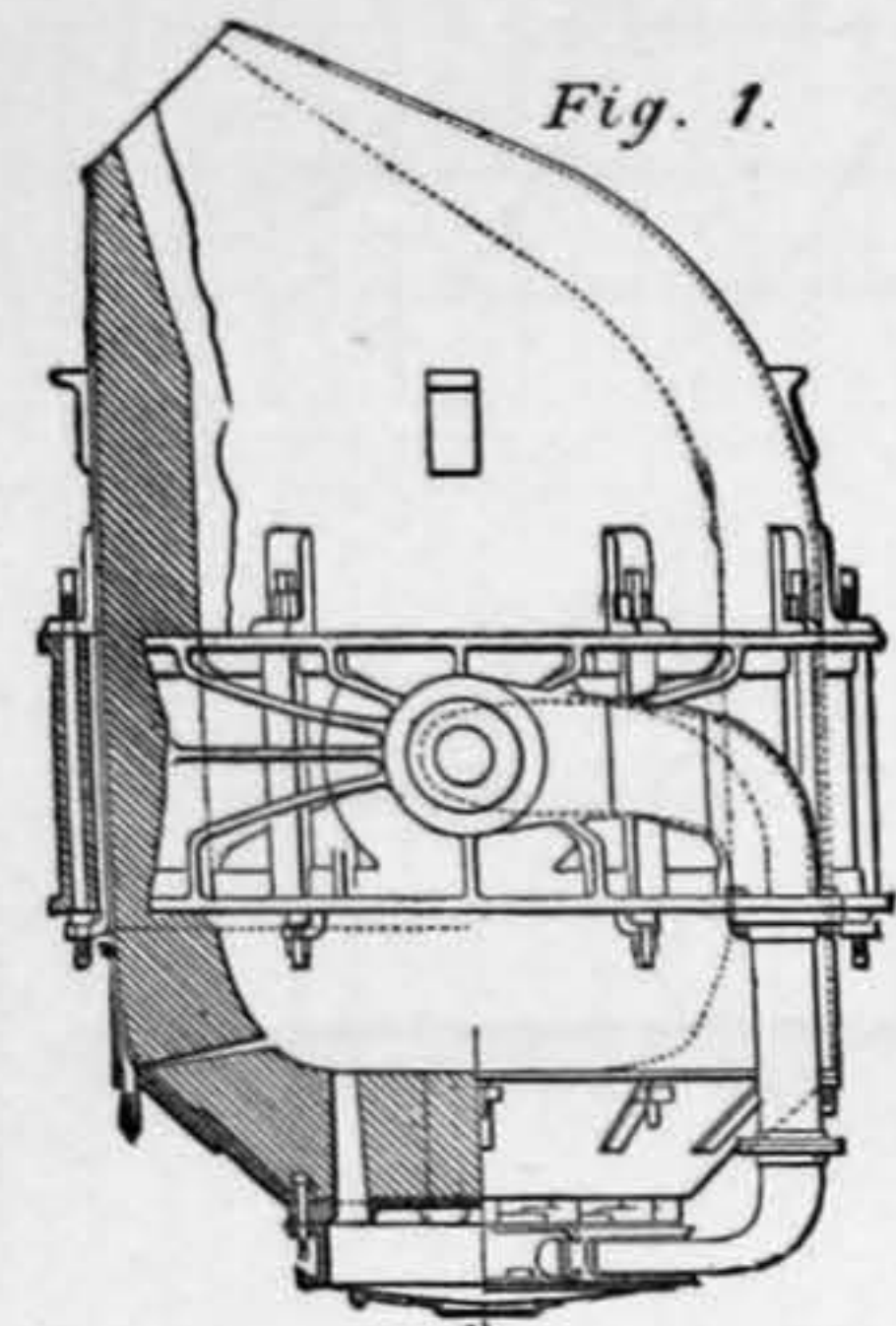
(For Description, see Page 403.)



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NOTICES OF MEETING.

INSTITUTION OF CIVIL ENGINEERS.—Tuesday, November 9th, at 8 p.m., on "Machinery for Steel Making by the Bessemer and the Siemens Processes," by Benjamin Walker, M. Inst. C.E.

THE SOCIETY OF TELEGRAPH ENGINEERS.—On Wednesday, November 10th, at 9 p.m., the first meeting of the winter session will take place at 4, Broad Sanctuary, Westminster, when the Ronalds Library will be opened, and the President will receive the members.

PHYSICAL SOCIETY.—Saturday, November 13th, at 3 p.m., the following communications will be made: "On the Beats of Mistuned Consonances of the form $h:1$," by R. H. M. Bosanquet. "Note on Professor Exner's paper on Contact Electricity," by Professors Ayrton and Perry. "On Action at a Distance," by Walter R. Browne.

The Publisher desires to draw the attention of Manufacturers and Purchasers to the advantages offered by the INFORMATION AND INQUIRY ROOM now established at the new offices of this Journal. In this room are kept for the benefit of visitors, files of the principal English and foreign technical journals, and the circulars and catalogues of the leading manufacturers in the Engineering Trades, either for reference or distribution. A classified arrangement of the various advertisements which appear either continuously or from time to time in ENGINEERING will also be available for reference. Manufacturers are invited to contribute their catalogues and circulars, which will be indexed and placed under the care of an attendant.

ENGINEERING.

FRIDAY, NOVEMBER 5, 1880.

PHOTOPHONIC RESEARCHES.

IN our issue of September 24th* we commented upon the beautiful experimental researches of Professor Graham Bell and Mr. Sumner Tainter by which those gentlemen were led to the discovery of the transmission of articulate speech by means of an

* See ENGINEERING, page 253 ante.

undulatory beam of light projected from one station to the other, and this week we are enabled, through the courtesy of Professor Bell, to place before our readers illustrations of some of the apparatus employed in that most interesting investigation.

Those of our readers who are familiar with the history of the telephone will remember that the discovery of the transmission of musical notes by means of electricity preceded by many years that of the transmission of articulate speech, and telephonic telephony was in use some considerable time before telephony was known, for it was not until the year 1876 that Professor Graham Bell announced the latter, while the former was exhibited by Reis some sixteen years before. Similarly in the case of the Photophone, the earlier experiments of Professor Bell were directed to the transmission by means of light, of musical notes with the obvious intention of advancing one very important step in the direction of the transmission of articulate speech. We need not here repeat the train of reasoning by which Professor Bell was led to avail himself of the peculiar property of the substance selenium of altering its electrical resistance under variations in the intensity of illumination falling upon it, the object of this article being rather to illustrate the apparatus employed than to follow the progress of the research, referring those of our readers who wish to recall the latter to Professor Bell's paper, which we published in our issue of September 17,* and to our remarks upon it in the following number.†

In order to obtain a beam of light whose illuminating intensity at a distance could be directly controlled by, and bear a relation to, the sonorous vibrations constituting musical notes or articulate speech, Professor Bell interposed in the path of a beam of sunlight a screen consisting of two thin plates of metal, perforated with a number of fine slits, one of these plates being fixed while the other was attached to the centre of a diaphragm which could be thrown into vibration by the human voice, so that the motion of the diaphragm would cause the movable screen to slide backwards and forwards over the fixed plate, and, in so doing, alternately enlarge and contract the orifices through which the luminous beam was transmitted. The diagram, Fig. 1, will explain the principle, but it must be observed that the distance between the plates is purposely exaggerated in order to show their construction and general arrangement. Upon sounding a note into the mouthpiece C the diaphragm in front of it is thrown into vibration, carrying with it the perforated screen A which is seen at the back of the other which is marked B. It must be observed that the width of the slits as well as their distance apart are so determined with respect to the rigidity of the diaphragm, that at no position of its amplitude is the passage of the beam entirely closed, a certain amount of light being allowed to shine continuously upon the receiver, and the opening and contracting of the orifices of the screen merely vary its intensity, for, although a rapidly intermittent beam of light would by this means transmit musical notes, it would be powerless to convey even an approximation to the complications of articulate speech. Fig. 2 is a diagram

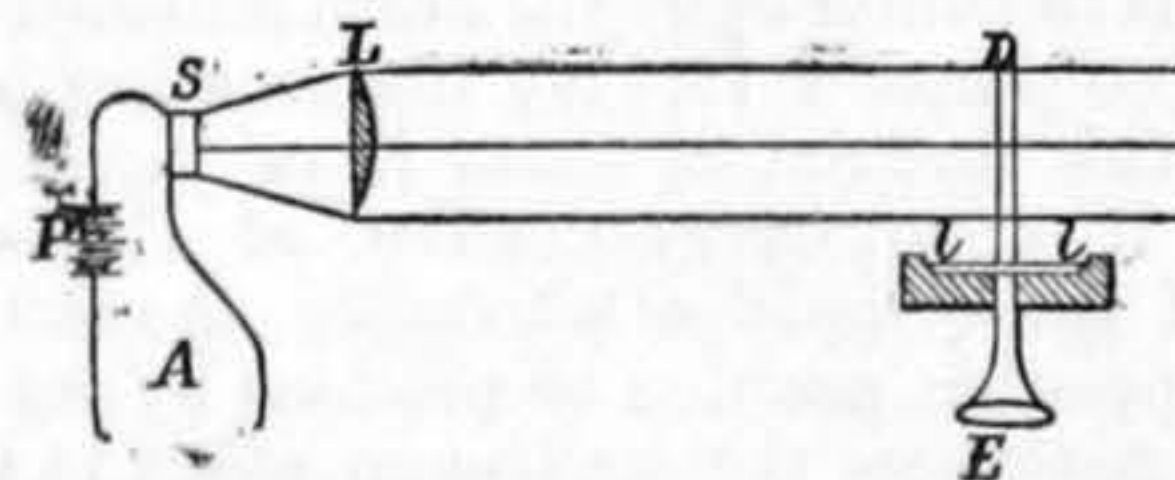


FIG. 2.

of the whole arrangement by which this vibrating screen is employed to transmit an undulatory beam of light to the receiving instrument. In this diagram, *ll* is the vibrating diaphragm set into motion by sounds uttered into the mouthpiece, E, D is the compound grating screen, and S is the selenium receiver; at L is placed a lens for the purpose of concentrating the undulatory beam upon the face of the receiving instrument which is in circuit with a battery P, and a pair of telephones at A.

One of the most interesting collateral discoveries in connexion with the researches of Professor Bell and Mr. Tainter, is the discovery or rather invention of a method of construction of selenium cells, whereby the electrical resistance of the combination is reduced to a degree, which, in the absence of a description of the apparatus might have

* See ENGINEERING, page 240 ante.
† Ibid., page 253 ante.

been regarded as incredible, as will be appreciated when we state that previous to Professor Bell's experiments the lowest resistance of a selenium cell in the dark which had ever been recorded was 250,000 ohms—an amount which placed it altogether out of the range of practical application—and that Professor Bell and Mr. Tainter have succeeded in constructing selenium cells whose electrical resistance, measured in the dark, was only 300 ohms. This highly valuable discovery has been brought about partly by employing exceedingly thin thicknesses of selenium with large surfaces of contact for the electric current to traverse, and partly by the employment of brass instead of platinum or iron for the metallic conductors. These latter metals have hitherto been employed on account of their want of affinity for the substance selenium in a state of fusion; but this very absence of affinity destroys the perfection of contact between the metallic conductors and the selenium, which, as Professor Bell has remarked, appears to behave towards them much in the same way as water to a greasy surface, and this, by diminishing the electrical surface-contacts, largely increases the total resistance of the combination. Fig. 3 represents a cross section of one form of

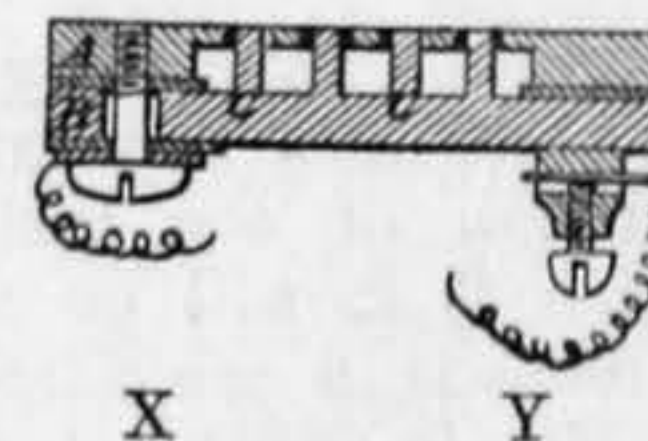


FIG. 3.

selenium receiver devised by Professor Bell and his colleague, in which the front face is the sensitive portion. This instrument consists of two circular flat plates of brass A and B, the lower of which is furnished with a number of projecting brass pins *c c*. The upper plate, which is recessed below, as shown in the figure, is drilled with a number of countersunk holes corresponding to the pins of the lower plate, but of slightly larger diameter, so that when the plates are screwed together the tops of the pins are flush with the upper surface of the top plate, there being an annular conical space between each pin and the corresponding hole in the upper plate. All these annular spaces are then filled up with melted selenium, shown black in the figure, by making the plates hot and inverting them upon a sheet of glass upon which is spread a thin layer of selenium maintained in a state of fusion; the surface of the upper plate, as well as the ends of the pins, together with the selenium in the annular spaces is then faced off in a lathe, so as to present a flat continuous surface. At X and Y are two connecting screws, the former of which is connected with the upper plate, but insulated from the lower while the latter is in connexion with the upper plate alone; and, with the exception of the filling of selenium, the two plates are insulated from one another. From the construction which we have described it is clear that the only electrical connexion between X and Y is through the small rings of selenium which surround the ends of the pins. The object of countersinking the holes from the inside is to give to the selenium the form of a truncated cone, so that the minimum thickness of the selenium, and, therefore, the course of least electrical resistance, is close to the face of the upper plate. In this way Professor Bell has produced a flat selenium cell which can be placed in the direct path of a beam of light, its sensitive surface being perpendicular to the direction of the beam in a manner precisely analogous to the position of the sensitive surface of a thermopile with regard to the direction of a beam of radiant heat. It is this form of selenium indicator which is employed in the experiment of which Fig. 2 is an illustration, its position being shown in the diagram at S.

Fig. 4 is a diagrammatic sketch of the cylindrical form of selenium cell employed by Professor Bell (and to which we would suggest that the name *Photopile* might appropriately be given), in which the cylindrical surface is the portion which is sensitive to light. This is the form of instrument adopted in the Photophone, the rays of undulatory light being thrown upon its cylindrical face by a paraboloidal reflector, in whose focus it is placed. This beautiful little instrument consists of a number of circular discs of brass about two inches in diameter strung upon a rod passing through their common centre, and separated from one another by a similar series of discs of mica whose diameter is slightly smaller than that of the brass discs, so as to form with the latter (when the whole is built together as a cylinder) a number of grooves around its cylin-

drical surface. The discs are held firmly together by nuts and bolts passing through them, two of which are shown in the diagram, and which form the connecting screws for placing the instrument in circuit with a pair of telephones and a battery. Upon reference to Fig. 4 (which we would point

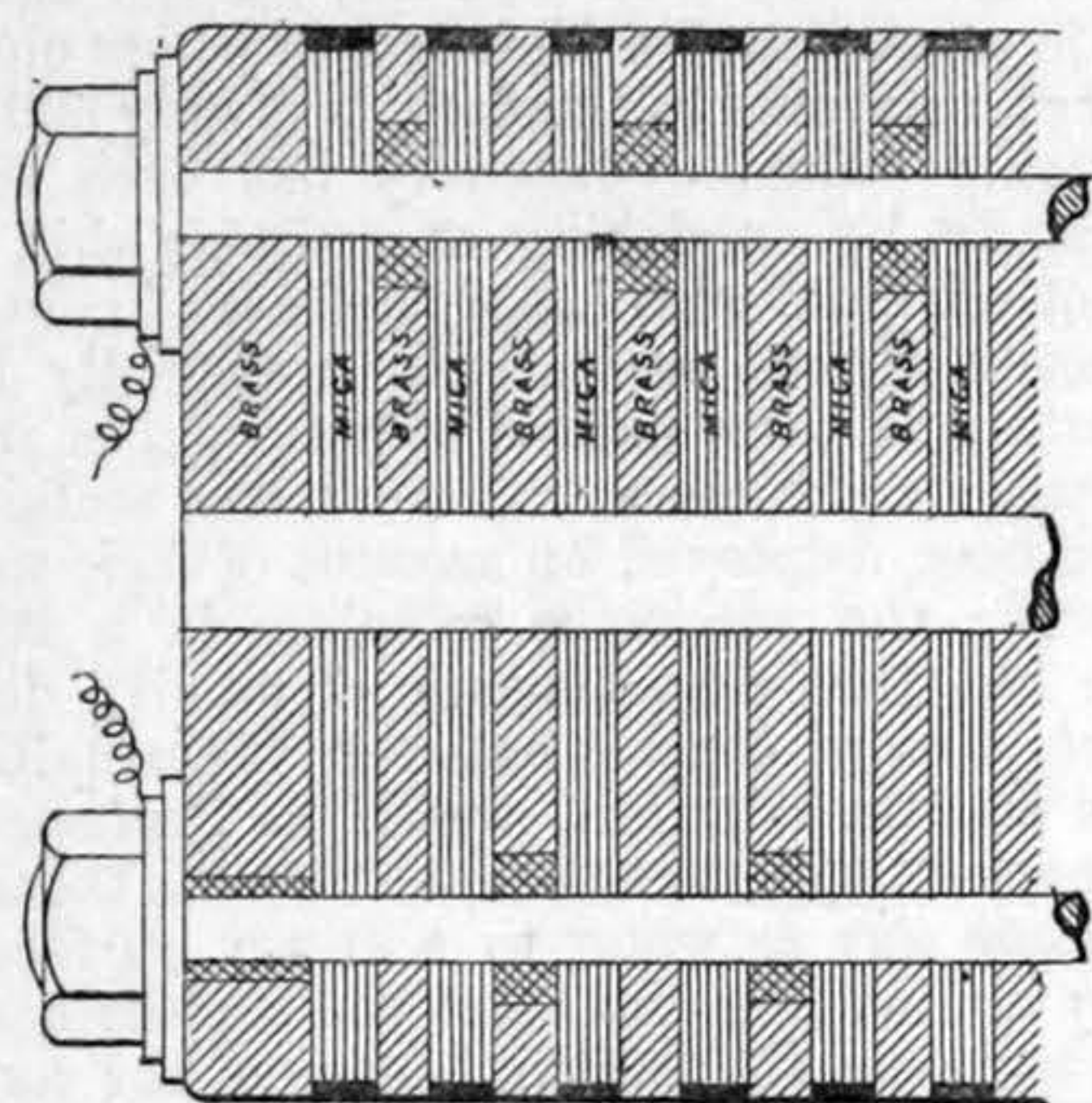


FIG. 4.

out is only a diagram explanatory of the arrangement of circuits, and does not pretend to represent the construction of the instrument or the proportion of its parts) it will be seen that every alternate disc of brass is in metallic connexion with the upper bolt, but is insulated from the lower bolt, and *vice versa*. In other words, if all the brass discs were numbered consecutively from one end of the series to the other, all the discs marked with *even* numbers are connected to the lower bolt, and insulated from the upper, and all the *uneven* numbered discs are in contact with the upper bolt, but insulated from the lower. The grooves formed around the cylindrical surface are filled in with selenium by the following simple process: the cylinder is first heated to a temperature somewhat above that of the fusing point of selenium, and, while hot, a stick of selenium is rubbed over its surface, filling up the grooves and covering the edges of the brass discs. The cylinder is then put in a lathe and the selenium is turned off until the edges of the brass discs are bared. Before being sensitive to light, however, the selenium has to be annealed by first heating it until signs of fusion begin to show themselves; when the heat is removed, the fused portions recrystallise and the selenium is thereby rendered both sensitive to light and a conductor of electricity. Professor Bell states in his paper that the whole process of annealing occupies only a few

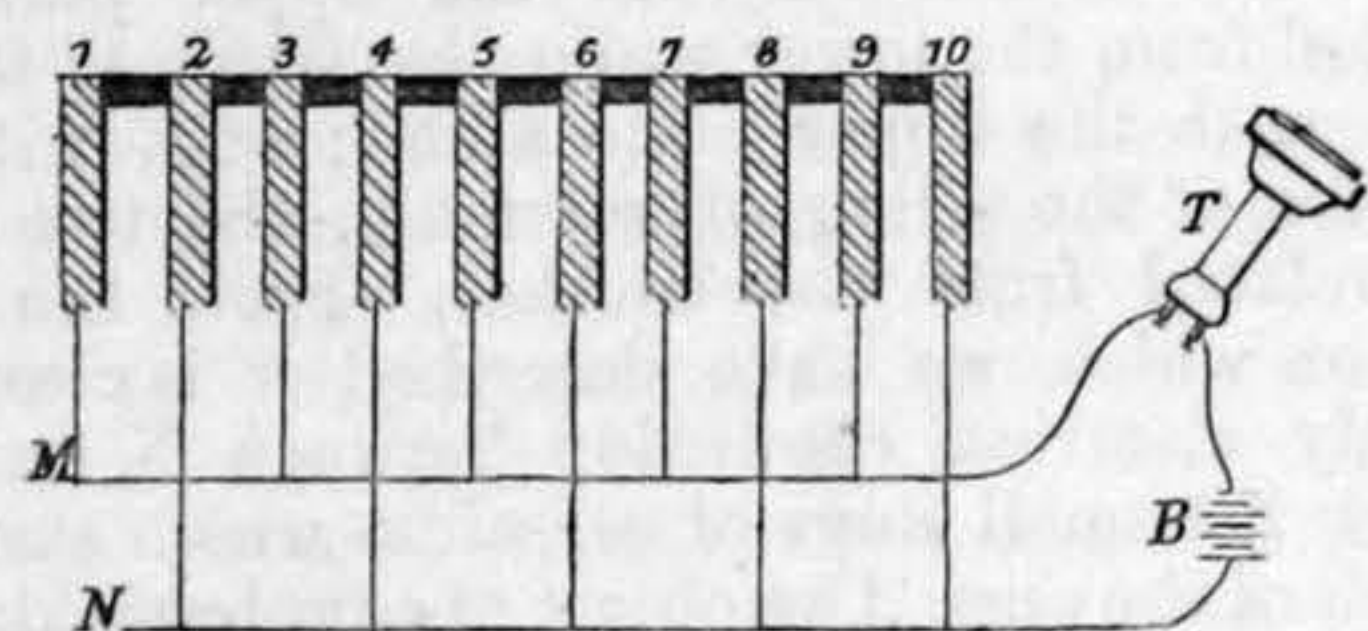


FIG. 5.

minutes. Fig. 5 is a diagram in which the connexion of the brass discs with the external or telephonic current is more clearly shown. Here it will be seen that the discs numbered 1, 3, 5, 7, and so on, are connected to one terminal of the telephone T by the wire M, while the even discs 2, 4, 6, 8, &c., are in connexion with the other terminal through the wire N and battery B. Upon examination of the diagrams 4 and 5, it will be seen that while the surfaces of contact between the selenium rings and the brass discs are increased to a maximum by reason of their large diameter, which also insures a maximum of sensitive surface, the resistance of the whole photopile is reduced to a minimum, not only by the method of making the circuits as shown in Fig. 5, but by the large sectional area of conducting material presented by the annular form of the selenium. Professor Bell informs us that he has experimented with an instrument in which the selenium filled only the spaces 1-2, 3-4, 5-6, &c. (Fig. 5), the intermediate spaces 2-3, 4-5, &c., being filled up by the mica discs having the same diameter as the brass, but it was found that moisture was apt to penetrate into the laminated mica, thus diminishing its insulating property and thereby reducing the efficiency of the instrument.

The cylindrical instrument which we have just described is the form of photopile adopted by Professor Bell in the receiving portion of the Photo-

phone, which instrument we illustrate in Figs. 6 and 7 on page 410, and which we have already described in a previous article,* the cylindrical sensitive surface lending itself more readily to receive the convergent rays of light reflected from the paraboloidal reflector.

The transmitting instrument of the photophone is shown in Fig. 6, and consists of a long board mounted upon a firm support (with suitable adjustments for directing it, within certain limits, in both altitude and azimuth), to which are attached the various parts of the apparatus, O is the mouthpiece with its reflecting diaphragm D of silvered glass or mica, and M is the mirror by which a ray of light from the sun or any other powerful source of light may be projected on to the diaphragm D by the condensing lens L, below which is fixed another lens for the purpose of parallelising the beam after reflection from the silvered diaphragm, and projecting it to the distant station, where it is received by the paraboloidal reflector of the receiving instrument shown in Fig. 7, in the focus of which is placed one of the cylindrical photopiles such as we have described, and in circuit with the latter is placed a pair of telephones and a voltaic battery, which in Professor Bell's experiments consisted of nine Leclanché cells.

The general arrangement and disposition of the whole installation is clearly shown in the diagram

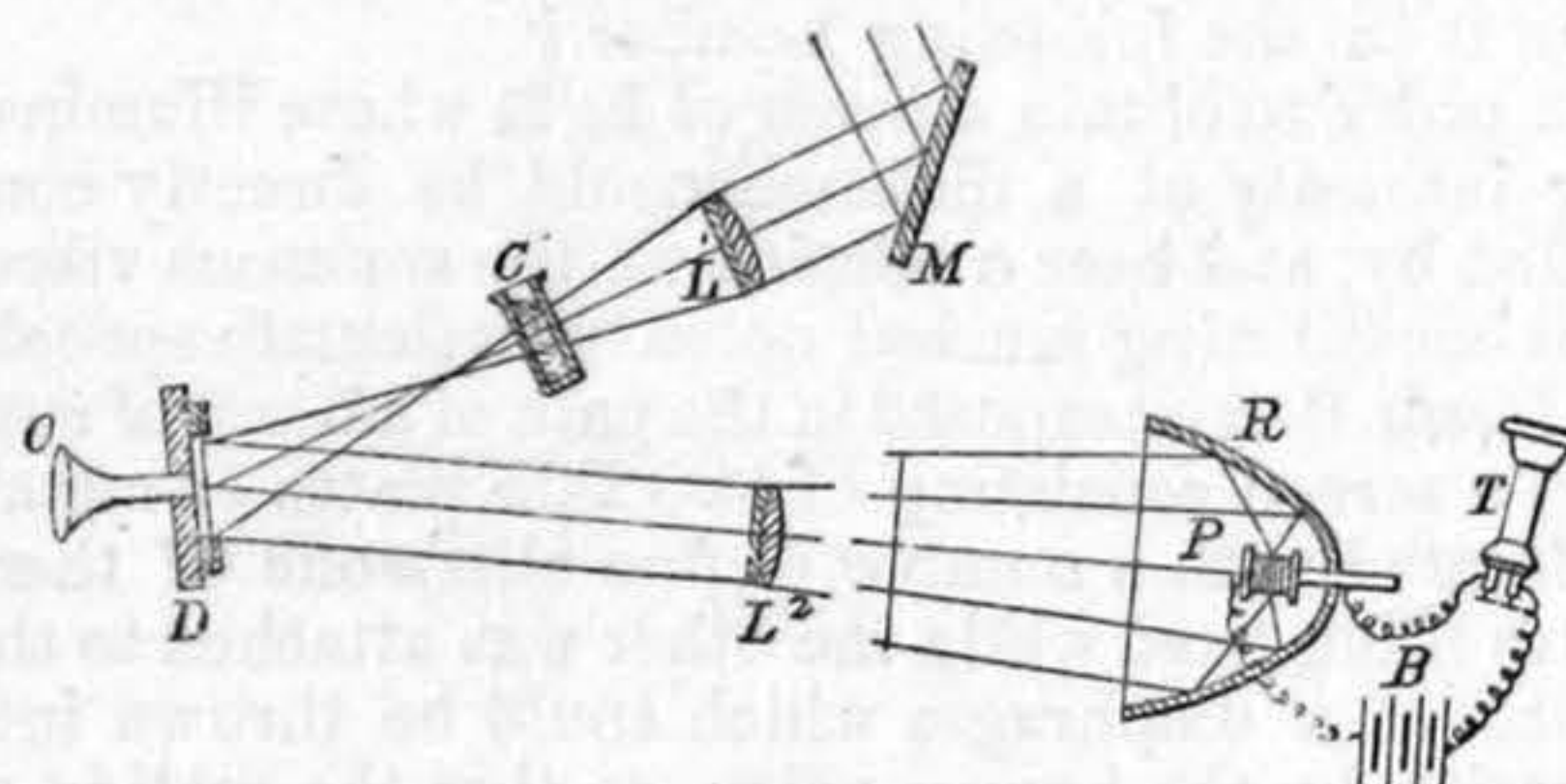


FIG. 8.

Fig. 8, in which the portion to the left of the figure is the transmitting apparatus, and that to the right the receiving instrument. The rays from the sun, or from whatever source of light is employed, after being reflected by the plane mirror M, are concentrated upon the face of the reflecting diaphragm D by means of the lens L, and a small glass trough C containing a solution of alum is interposed in their path for the purpose of absorbing the heat rays which, by altering the figure of the diaphragm mirror and introducing other irregularities, might produce disturbing influences which are better eliminated. At L₂ is placed a second lens for the purpose of either parallelising the rays and projecting them to the receiving apparatus, or of rendering them divergent according to the particular circumstances of the experiment. R is the paraboloidal reflector, in the focus of which and co-axial with it is placed the cylindrical photopile P, which is included in the circuit of a battery B and telephone T. When words are spoken into the mouthpiece O, the diaphragm D is thrown into vibration, becoming thereby alternately more or less convex and concave with continually varying amplitudes of vibration, the effect of which is to confer upon the beam reflected from its surface a continually varying illuminating intensity and, as this undulatory beam is projected by the reflector R upon every portion of the sensitive surface of the cylindrical photopile, the latter is in the best possible position to produce by its varying electrical resistance the maximum effect in the telephone.

Professor Bell has during the last few weeks been making a series of photophonic experiments in Paris, using the electric light as his source of illumination, and it is an interesting fact—although one which might have been expected from the results obtained in his earlier experiments—that the irregularities and vibrations, which are well-nigh inseparable from the light emitted by the electric arc, produce their effect in the telephone as an unceasing murmur, while at the same time articulate speech is heard superposed, as it were, upon the “voice” of the arc.

We do not know whether Professor Bell has made any experiments with any electric lamps using a rapidly alternating current, such as the Jablochkoff candle and several others; we would expect that such a source of illumination would produce a musical note in the photophonic telephone, without the aid of any interrupting apparatus, the pitch of which would depend upon the rapidity of the reversals of

the current producing the light, and that such an arrangement might be employed for signalling purposes. It would also be highly interesting if future research should lead to the discovery of a means of varying the luminous intensity of the electric arc proportionately to the sonorous vibrations constituting articulate speech, so that a telephone in circuit with a photopile exposed to its rays, would reproduce the sound by which the light was in the first instance thrown into vibration. We should be inclined to think also that some very interesting results might be obtained by observing the effects produced in a photophonic receiver when illuminated by a sensitive gas flame under the influence of sonorous vibration.

Fig. 9, page 410, is a diagram illustrating the arrangement of apparatus with which Professor Bell has been lately working in Paris. L is the electric lamp the arc of which is in the focus of a paraboloidal silvered reflector M by which the divergent rays emanating from the arc are condensed and projected as a parallel beam to the reflecting diaphragm D by which a certain small proportion of them is reflected to the receiving instrument through a distance of nearly fifty feet as shown in the figure. From this diagram it will be seen that a very large proportion of the light projected by the lamp reflector does not fall upon the diaphragm at all, but, notwithstanding this loss, most highly satisfactory results were obtained in the transmission of articulate speech, and Professor Bell is of opinion that effects equal to those obtained with sunlight would be produced by means of an electric lamp suitably arranged so as to utilise the whole of the light radiating from the arc.

As we pointed out in our last article* one of the most extraordinary discoveries made by Professor Bell and Mr. Tainter in the course of their experiments is that sounds may be transmitted by means of light from one station to another without the employment of the selenium photopile, or indeed of any electrical arrangement whatever; and that nearly all substances emit a sound when placed in the path of a beam of soniferous light, such, for instance, as is reflected from the vibrating diaphragm of the photophone in action, or as is produced by giving to the beam of light a rapidly intermittent character.

Fig. 10, on page 410, shows the instrument employed by Professor Bell and Mr. Sumner Tainter in investigating this most interesting phenomenon, as well as for projecting to a distance a rapidly intermittent beam of light. In this instrument rays of solar light are by the lens L condensed, after reflection from the surface of the mirror M, to a focus on the D disc in which is perforated an annular series of some forty holes, and which can be set into very rapid rotation by arrangements not shown in the figure. By this means a beam of light projected by the lens L on to the tube T can be interrupted from a hundred to six hundred times in a second, which corresponds to the rapidity of vibration of a musical note of high pitch. When such an intermittent beam is allowed to fall upon diaphragms of different substances placed at the end of the tube T, they, with doubtful exceptions, are thrown into vibration, and the corresponding note is heard in the hearing-tube. Professor Bell has, we understand, since found that it is not necessary to form the substance experimented upon into diaphragms, but that even when placed in a glass vessel to which a hearing-tube is attached, the sounds are emitted when the substances under investigation are placed in the path of a beam of intermittent light.

When the hearing tube I is removed, the apparatus shown in Fig. 10 may be used as a transmitting instrument for the sending of photophonic signals on the Morse or any other prearranged system to a distant station. In this case, while the disc is in rapid rotation, a shutter operated by a key (shown in the figure) is made either to obstruct the light or to allow it to pass for longer and shorter periods of time corresponding to the dashes or dots in the Morse code. When the instrument is employed for this purpose a plano-convex lens is placed at C for parallelising the beam of intermittent light.

In the course of a research, such as Professor Bell and Mr. Tainter have been prosecuting, a great many suggestions for varying the phenomena or for producing the same phenomena by various means would naturally present themselves to the minds of the investigators, and Professor Bell states in his Boston lecture, that he, in conjunction with Mr. Tainter, had devised some fifty forms of apparatus for varying the intensity of a beam of light by

* See ENGINEERING, page 253 ante.

* See ENGINEERING, page 253 ante.

the indirect action of sound. It would, however, be obviously impossible in an article dealing as this does with the general subject even to deal in detail with these various devices, but we cannot omit from notice the very ingenious arrangements, of which Fig. 11 is a diagram, for bringing about the variation of the intensity of a luminous beam by the application of Faraday's discovery of the rotation of the plane of polarisation in a beam of light in its passage through a magnetised field. Referring to the diagram the rays of light emanating from a source of light *F* are parallelised by the lens *L* and projected to the receiving photophone (not shown in the diagram), passing in their passage successively through a polarising Nicol's prism *R*, a hollow coil of insu-

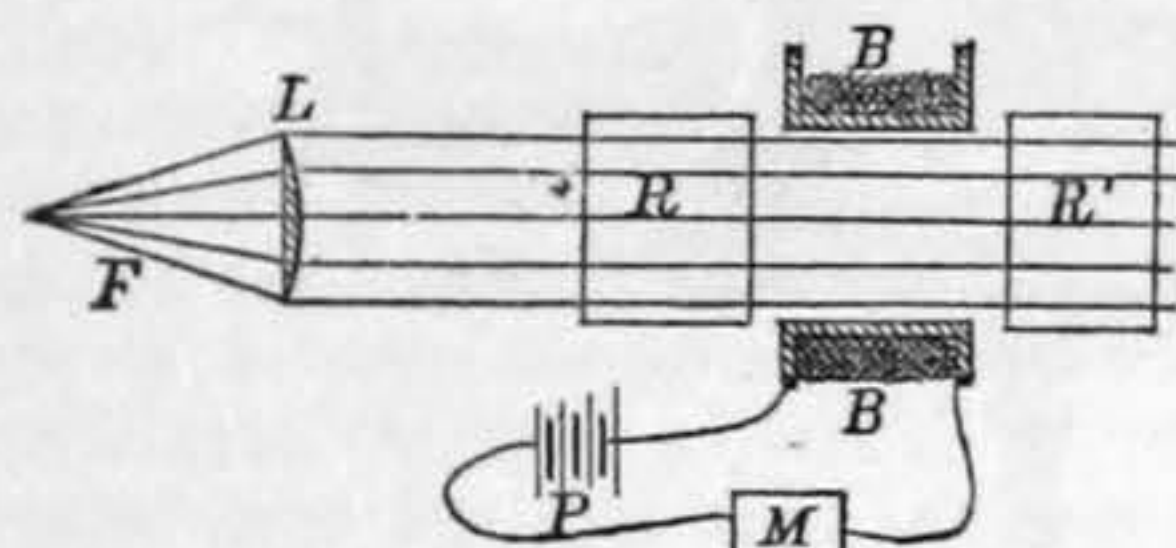


FIG. 11.

lated wire *BB*, and an analysing Nicol's prism *R'*. The coil *BB* is placed in circuit with a battery *P* and microphone *M*. The idea of this arrangement is that under the influence of sonorous vibrations the microphone, by varying the strength of the current transmitted through the coil *BB*, will so far vary the intensity of the magnetic field as to vary proportionately the illuminating intensity of the polarised beam in its passage through it, and thus to affect the Photophone at the distant station. There can be little doubt of the correctness of the theory of this most ingenious arrangement, but as the phenomenon discovered by Faraday requires for its optical demonstration a magnetic field the intensity of which is far greater than could be sufficiently varied by the action of a microphone, we are inclined to fear that the variation of the illuminating power of the beam would be too slight to have any audible effect in the Photophone.

Want of space prevents us on this occasion from describing in detail many of Professor Bell's most interesting experiments, but we have said enough to show that the investigation which was inaugurated by Professor Graham Bell and Mr. Sumner Tainter, and which is now by them being carried on, is of the most interesting character, and opens up a field of physical and perhaps cosmical research more important and far-reaching than was thrown open to the world of science by Professor Bell's earlier researches, which culminated in the production and perfecting of the electrical articulating telephone, and we have no hesitation in saying that the results accruing from the researches which form the subject of this article will make a conspicuous era in the history of physical science.

ELECTRIC LIGHT COMPETITION AT GLASGOW.

IN two former articles we have given some general information and details as to the nature of the Exhibition of Lighting and Heating Appliances, &c., held at Glasgow during the five weeks commencing on the 28th of September, and now brought to a close; and we have said something in regard to the trials of the various electric light systems that were already on the ground or about to put in an appearance. As the Franklin Institute Report upon electric lighting has become practically obsolete, in consequence of the development of so many new systems, the want of any reliable guide in the shape of fresh data bearing upon the subject has now been long felt, and will be greatly appreciated by all physicists, as well as by the commercial world.

Under these circumstances much interest has been excited in many circles by the prospect of having a series of exhaustive and reliable tests carried out in Glasgow in connexion with the Exhibition already referred to. The Executive Committee of the Philosophical Society of Glasgow, under whose auspices the Exhibition was held, had a task of no mean difficulty in bringing together a number of persons to act as jurors whose scientific attainments and position were of such an order as to render their award final, and their fiat unassailable. It is questionable if they could have selected a number of scientific men better fitted to fulfil the conditions of the case than those whose names we now give: Sir William Thomson, Dr. J. Hopkinson, Pro-

fessor James Thomson, Mr. James T. Bottomley, Dr. Wallace, gas examiner for the city of Glasgow, Mr. St. John Vincent Day, and Mr. Mortimer Evans.

There were four systems of electric lighting displayed in the Exhibition—the Mackenzie or Strode light, the Lontin system, machine and lamps; the Crompton system, and the Brush system, or that of the Anglo-American Electric Light Company. The first-named, although on the ground at the opening of the Exhibition, and remaining till its close, was so very unsatisfactory in its performances that it would have been most difficult to keep it alight sufficiently long for the necessary tests to be made by the jurors. The Lontin dynamo machine and its accompanying four lights were also very early on the scene, and great expectations were entertained of it, by its representatives in England, Messrs. Latimer Clark, Muirhead, and Co. Those expectations, however, failed to be realised in actual practice during the four weeks or so that the machine was at work, and it will not be tested in competition with the others. It is somewhat surprising that a firm of engineers of such standing should have allowed their names to be connected with a system which had to be withdrawn from open competition; and it is also much to be regretted that Dr. Siemens should not have had his appliances put to the test in this competition, which is really the only complete one of its class that has yet been attempted in this country. Messrs. R. E. Crompton and Co. were also early in attendance at the Exhibition, but with only a portion of their appliances; and the Brush Company were not present till about the middle of last month, soon after which, however, under the energetic and skilful superintendence of Mr. Montgomery, the managing director, the whole of the sixteen lights forming the speciality of their system were in full operation; and the Exhibition Hall was eventually lighted up on such a scale as has perhaps never previously been seen in this country, no fewer than twenty-three lights being occasionally in a state of activity at one and the same time. Towards the close of the Exhibition, Messrs. Crompton and Co. submitted their exhibit to the test in a very exhaustive manner; but it was then found necessary to suspend the trials for some days. By the time that this issue of our journal comes under the notice of our readers these trials will doubtless have been resumed if not actually completed, so far as the simple testing operations are concerned. We hope to be able to give in our next issue some definite information as to what the tests were, how they were carried out, and the comparative results so far as they may then be available.

THE LATE SIR THOMAS BOUCH, C.E.

It is with sincere regret that we have to announce the death of Sir Thomas Bouch, C.E., a gentleman who played a prominent part in railway engineering in the northern part of the island during the better part of thirty years or so. Sir Thomas died last Saturday at Moffatt, where he had been staying for some time, along with his wife and daughter, for the benefit of his health. He had been ailing more or less for fully two years, and the excitement and great mental strain which he had to undergo in connexion with the Tay Bridge disaster of last December, and the subsequent inquiry instituted by the Board of Trade in regard to that dire catastrophe, coupled with the worry involved in passing the Edinburgh Suburban Railway Bill last session, doubtless greatly added to the infirmity of body from which he had suffered so long. Considering the long time during which the deceased occupied a prominent position as a railway engineer, it will doubtless surprise many of our readers to learn that Sir Thomas Bouch at the time of his death was only in the fifty-eighth year of his age. He certainly looked very much older, even before he was overtaken in his professional career by the great calamity which throws such a dark shadow over his honoured name.

Born at Thursby, near Carlisle, on the 22nd of February, 1822, the deceased was the son of a captain in the merchant service. His first connexion with the profession of railway engineering began on the Lancaster and Carlisle Railway, which was constructed by the eminent firm of Messrs. Lock and Errington, of London and Carlisle, and with whom young Bouch served his apprenticeship. He subsequently occupied several appointments in the North of England, one of them being that of resident

engineer over the Wear Valley Railway during its construction. Early in the year 1849 Mr. Bouch transferred his services to the northern side of the Tweed, where he almost ever afterwards prosecuted his labours. In that year he became the manager and engineer to the Edinburgh and Northern Railway, which afterwards became the Edinburgh, Perth, and Dundee Railway, and now forms an important portion of the North British Company's system. Having entered the service of the company, his mind was almost wholly occupied with schemes for connecting the "Kingdom of Fife" with the railway system of the "outer world," and affording a direct communication through that country for the traffic between Edinburgh, Glasgow, and the south, with the northern parts of Scotland, *via* Dundee, Aberdeen, &c. The "floating railway" which he designed and carried into operation for the traffic across the Firths of Forth and Tay, was regarded with great favour for many years by his professional brethren, as also by the travelling public. The arrangements which he devised for the landing-places on the two firths likewise gave great satisfaction, and contributed in the course of years to develop the traffic of the North British system to an enormous extent.

Mr. Bouch retired from the direct service of the Edinburgh and Northern Railway Company in the course of two years or so, and started in Edinburgh on his own account as a civil engineer. He was not long settled in his well-known chambers before his skill and energy as a railway engineer were in much request, chiefly on account of the fact that the modes of carrying out railway works which he adopted were much less expensive, though not less efficient than those with which other engineers had identified their names. He resorted to steeper gradients than those generally in vogue at that time, and hence reduced the expenses of cutting and tunnelling. The result was that a great impetus was given to the construction of railways in Scotland, and no person played a more prominent part in the development of the railway system than the deceased. One of his early works was the construction of the Peebles Railway, a line of 20 miles in length, and opened in the year 1855; and in rapid succession there followed from his busy mind a number of schemes which were carried out to a successful issue, such as the Kinross-shire Railway, 10½ miles; the Leven Railway, 6 miles; the Leslie Railway, 5 miles; the Leadburn, Linton, and Dolphinton Railway, 10 miles. During the same and following decades he also carried out a number of other more or less important schemes in railway engineering in Scotland. Amongst them we may mention the Kirriemuir and Blairgowrie line, the Crieff Junction Railway, the Edinburgh, Loanhead, and Roslin Railway, the Penicuik Railway, the Crieff and Methven line, the St. Andrews line, the Glasgow and Coatbridge Railway, the Leith and Granton new connexions, and the Arbroath and Montrose Railway, 17 miles long, and now almost completed. There were also several important undertakings embraced in the Tay Bridge system. But it was not in Scotland alone that Mr. Bouch carried out bold railway undertakings. He likewise executed several most important works in the North of England, more especially the Cockermouth, Keswick, and Penrith Railway, 31 miles; the Eden Valley line, 22 miles; the South Durham and Lancashire Union Railway, 50 miles; the Darlington and Barnard Castle Railway, 20 miles; the Lancashire Union Railway, 25 miles; and he executed works of such first-class importance as the famous Deepdale Viaduct and the Bexley Viaduct. Mr. Bouch also ventured as far south as the county of Kent, where he constructed the Sevenoaks and Maidstone Railway, 20 miles in length; and some eleven or twelve years ago he brought forth a series of schemes for effecting a grand union of the Metropolitan Railways, but Mr. Fowler's projects, rather than his, were eventually accepted.

The great projects of Mr. Bouch's professional life, were his bridges for crossing the Tay and Forth, but in consequence of the great disaster which overtook the former about ten months ago, both of those great engineering works have already had such an amount of publicity given to them that it is unnecessary to dwell upon either of them here. Some time after the completion of the Tay Bridge, Mr. Bouch had the honour of knighthood conferred upon him. Sir Thomas Bouch was married in the year 1853, and he has left a widow and a family of one son and two daughters, the former being now the resident engineer on the Montrose and Arbroath Railway.

THE PHOTOPHONE.

(For Description, see Page 407.)

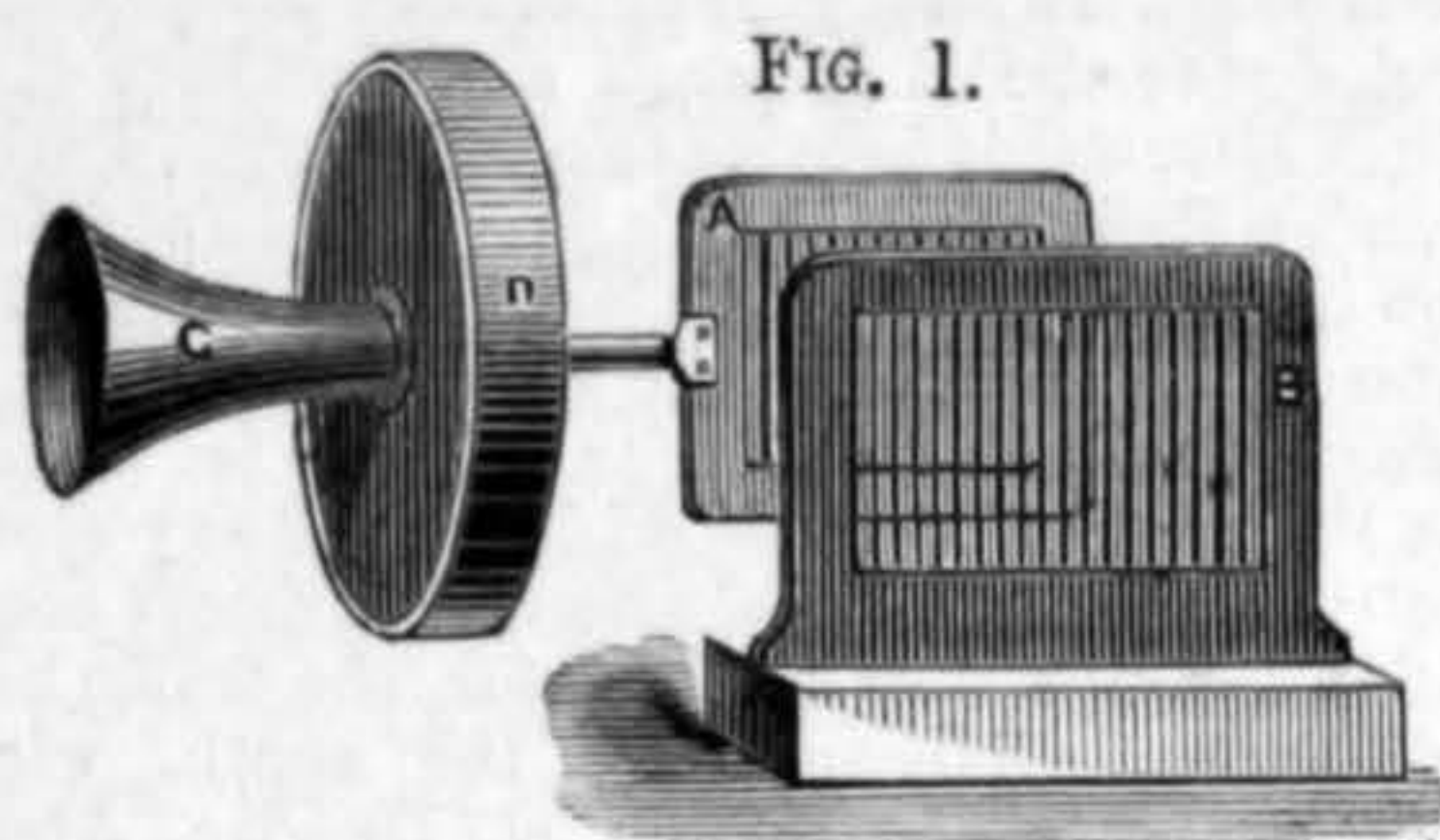


FIG. 1.



FIG. 7.

NOTES.

PARAFFINE AS A WOOD PRESERVER.

A GERMAN chemist, Dr. Schal, has established the useful fact that wood impregnated with paraffine is preserved from rot, especially when employed in alizarine manufactures, where it is exposed to the decaying action of damp, acids, and alkaline lyes. Wooden vessels which become totally rotten in two months, last for two years when impregnated with paraffine. The preparation of the wood is effected by drying it in warm air for three weeks, then steeping it in melted paraffine to which has been added some petroleum, ether, or sulphuret of carbon. In preparing this bath great care must, however, be exercised owing to the inflammability of its ingredients. To prevent the paraffine from escaping from the pores, the wood should be coated with oil varnish or soluble glass, washed after drying with diluted hydrochloric acid. The silicic acid thus formed clogs up the pores from the outside, and protects the paraffine from the action of water. Paraffine, melted with equal parts of linseed or rapeseed oil, is also, according to Dr. Schal, useful for coating iron vessels, which in chemical manufactures are otherwise very liable to rust.

EFFECTS OF MAGNETISING IRON.

The changes in the length of iron bars produced by magnetisation have often been the subject of investigation by experimenters, the latest results of note in this country being those of Sir William Thomson. An Italian physicist, Professor Righi, has recently studied the matter, and he has found that the act of magnetisation produces an increase of length in bars of iron or steel in the direction of magnetisation, but when the magnetising force ceases only a part of this elongation remains, and the part is greater or less in proportion to the coercitive force of the bars. The elongation is proportional to the square of the intensity of the current when it is not very great. A weaker magnetising force following a stronger one produces a shortening of the bar, but even total demagnetisation does not restore the bar to its original length. During reversal of the polarity of the bar its length grows momentarily less and it oscillates in length. A bar or wire of iron contracts at the moment of closing the circuit and elongates again on opening the circuit, but not to the same extent as it contracted, a fact which indicates that transverse magnetism partly remains. Further, some iron bars show a tendency to take a spiral magnetisation, that is a magnetisation giving spiral lines of force around the bar.

COMBINING HARMONIC VIBRATIONS.

Lissajou's method of combining two harmonic vibrations by means of vibrating tuning-forks

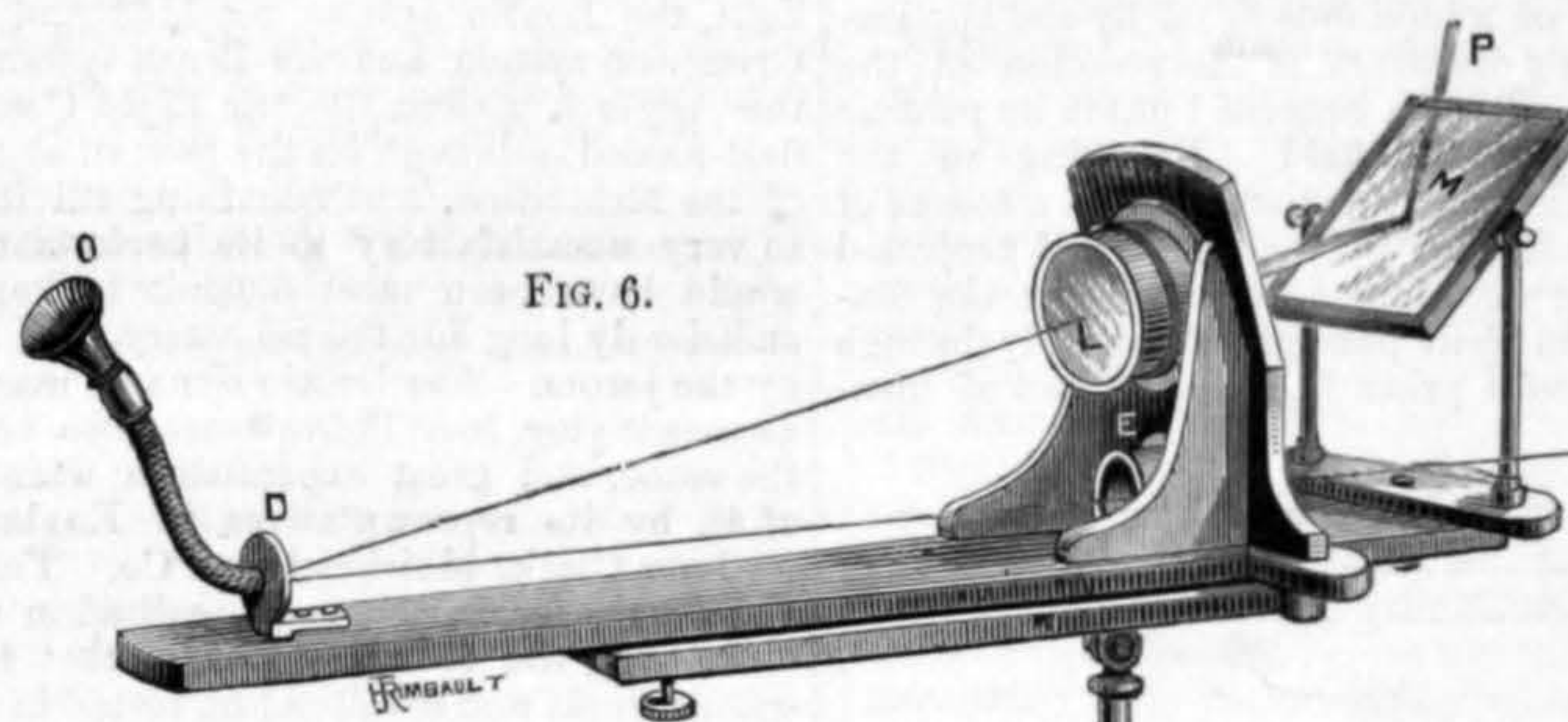


FIG. 6.

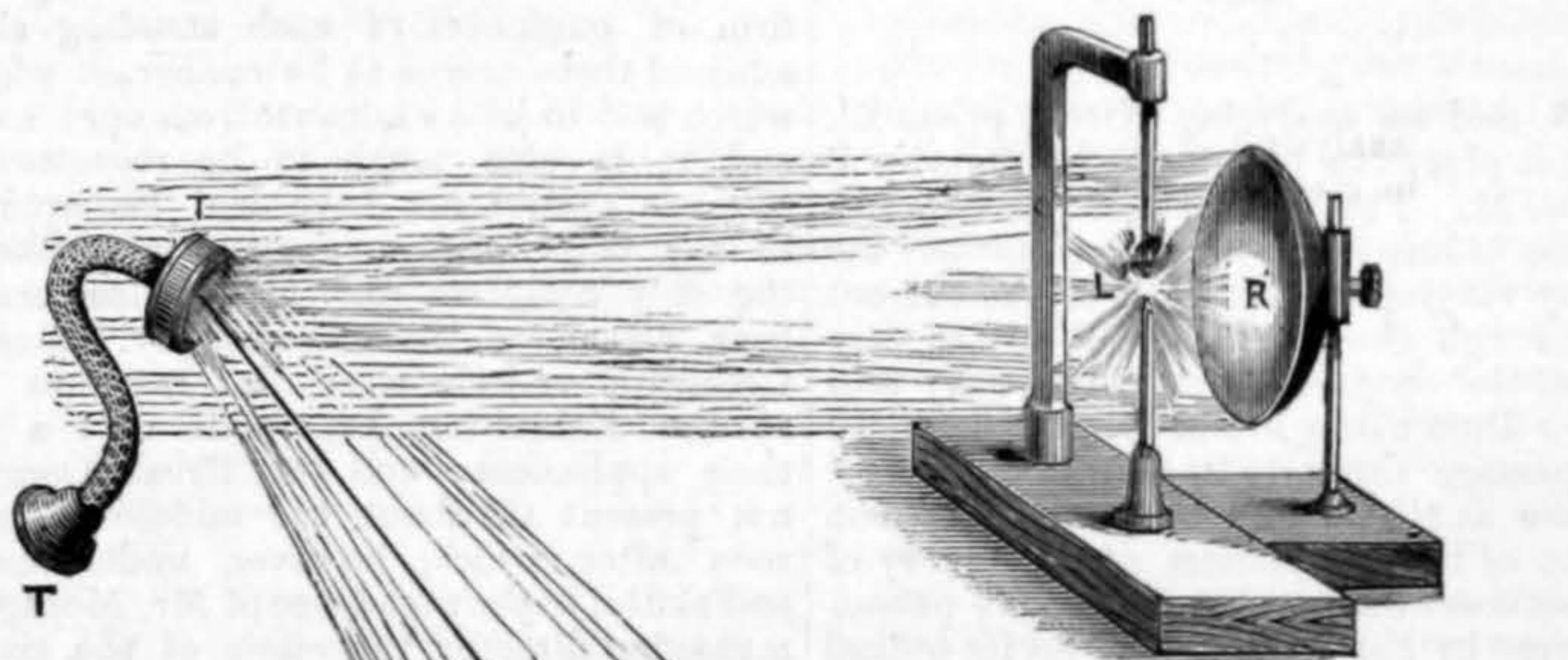


FIG. 9.

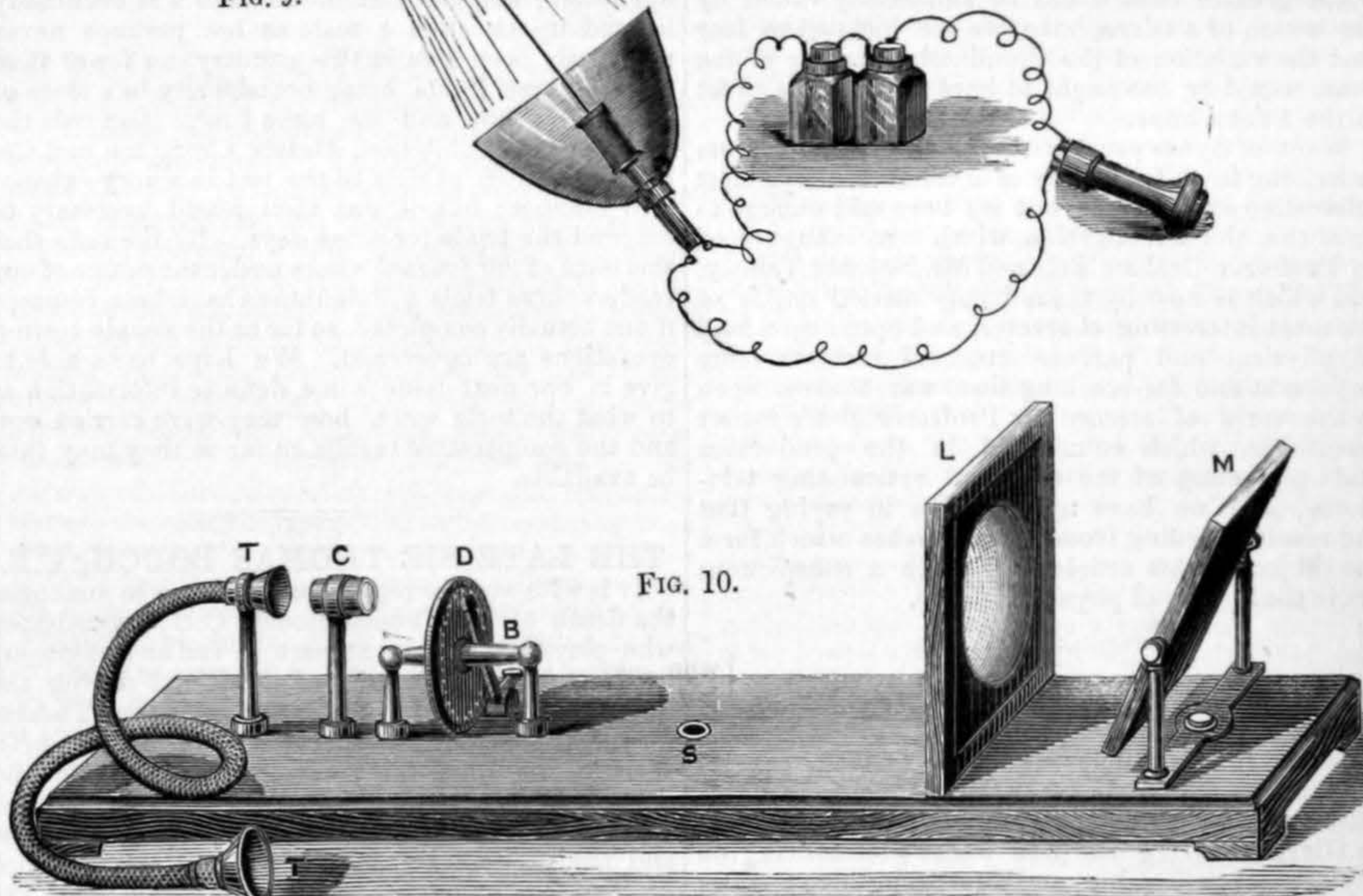


FIG. 10.

mounted with reflectors, is well known to physicists, but a simpler mode has been devised by Mr. G. M. Hopkins, of America. All the materials needed for it are a box 24 in. square and two flat metal springs $\frac{1}{16}$ in. thick, 1 in. wide, and 24 in. long. The springs are secured along the sides of the box at diagonal corners by stout screws, a block of wood 1 in. thick and 4 in. long being put between the end of the spring and box, to allow space for the vibration of the screw. "Upon the free end of each spring," says the inventor, "and in the plane of its vibration, is cemented a piece of thin cardboard, having a longitudinal slit $\frac{1}{8}$ in. wide, parallel with the spring to which the card is attached. The slits in the two cards intersect each other at right angles, forming at their intersection a clear aperture $\frac{1}{8}$ in. square. The two cards are placed as near each other as possible without touching. One of the springs carries an adjustable weight, the use of which is to change the period of vibration of the spring by placing it in different positions." Now when the springs are put in vibration the square aperture formed by the intersection of the slits moves so rapidly as to appear a band of light, and by the changing the periods of one spring the band will execute a variety of figures. To project these figures on a screen it is

only necessary to place a lamp in front of the slitted cards, and a lens between them and the screen behind.

THE MARINE EXHIBITION AT GLASGOW.

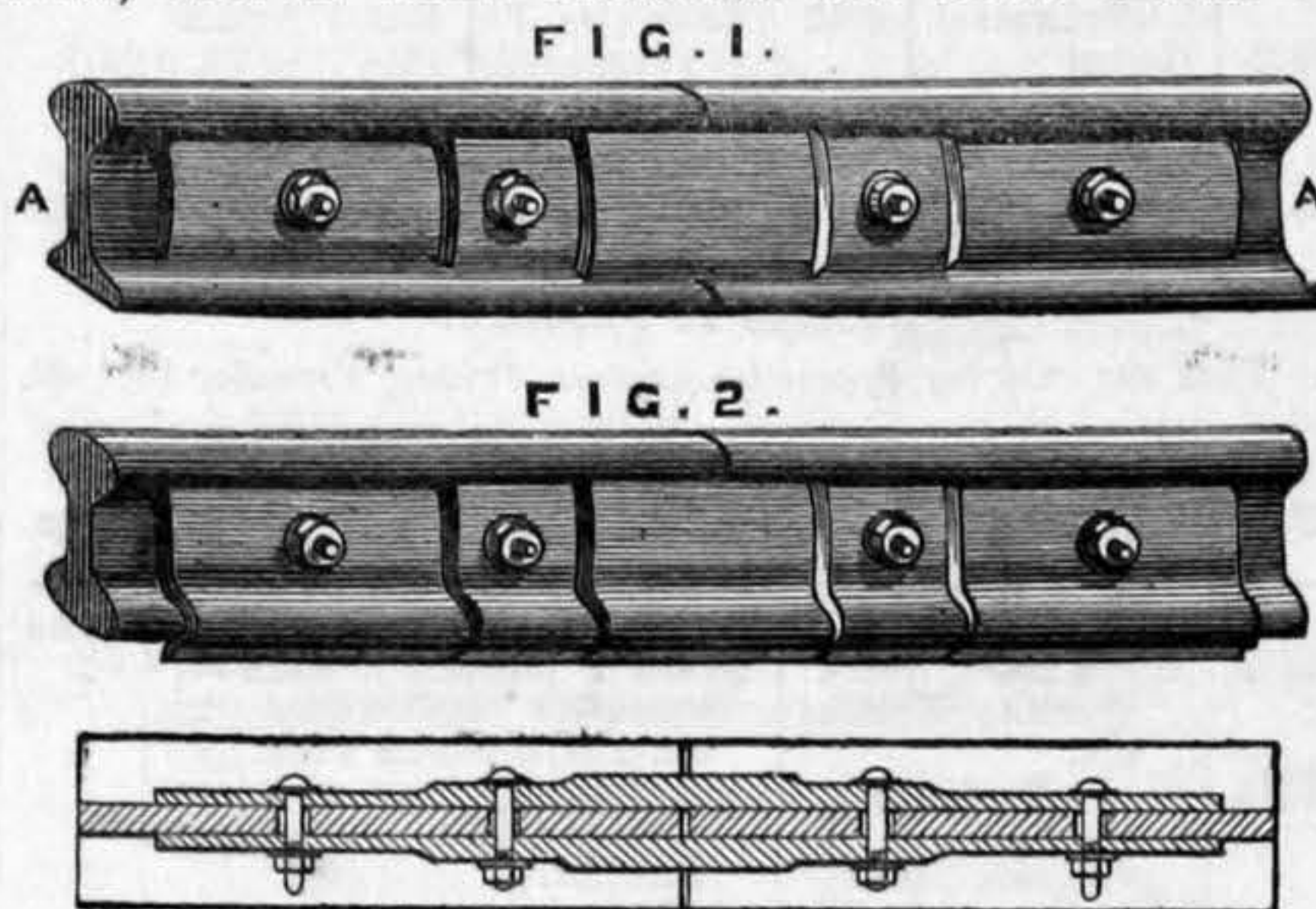
A most interesting naval and marine engineering exhibition was inaugurated on Monday last at Glasgow, by a fashionable conversazione. Probably there never was a fuller and more varied display of models and appliances connected with naval architecture and marine engineering than this which has been got together on the banks of the Clyde. The Lords of the Admiralty, the Science and Art Department, the Commissioners of Northern Lighthouses, the Board of Trade, Lloyd's Register, and various other public bodies, besides numerous private firms of engineers and shipbuilders throughout the country, have combined to make the exposition a success. Three of the large rooms of the Corporation Galleries are fully occupied with models connected with the navigation and the great shipbuilding industry. The first room is devoted to models of life-saving apparatus, lighthouses, and prismatic lights; the second to shipbuilding proper, and is replete with model ships dating from the present time back to the days of England's wooden

walls. Among these are to be seen the Admiralty models of the Monarch, the Defence, the Glatton, and Devastation, as well as a transverse section of the Vanguard, a modern torpedo boat, and a miniature of the famous Royal George, which was built in 1756 and sunk at Spithead in 1782, when the brave Admiral Kempenfelt went down with "twice three hundred men." Other interesting models, in a historical sense, are a full-rigged specimen of the Winchelsea, presented by the Admiralty in 1830 to William IV., and a model of the Great Harry built in the reign of Henry VIII., 1514. There is also a finely-finished pattern of the Popoffka Novgorod, a Russian coast defence vessel designed by Admiral Popoff, the chief constructor of the Russian Navy. The latest ocean mail steamers, and such novelties in the way of marine construction as the Livadia and the Obelisk ship Cleopatra, are all represented by handsome models. In the third room there is a large assortment of marine engineering products, including works in cast and malleable steel sent by the Steel Company of Scotland; anchors, cables, and windlasses exhibited by Messrs. Parke and Ross, Tipton, and a working model of Arrol's hydraulic rivetting machine.

FLEXIBLE RAIL JOINTS.

The earlier forms of fishplates used on our railways afforded, as is well known, joints having a strength far below that of the solid rail, and as rolling stock became heavier and speeds higher, the trouble experienced with such joints led to multifarious attempts to improve them. The result has been the employment during recent years of deeper and heavier fishplates, some clipping the lower flange of the rails, some extending a considerable distance below it, and others furnished with flanges projecting laterally, the object in all cases

being to obtain a joint which—taking the reduced distance apart of the joint chairs into account—should have the same strength as other parts of the line. That this object has been fairly attained in many cases is undeniable, but with its attainment another fault has crept in, namely, excessive rigidity on each side of the point of actual junction of the rails, and in some instances this local excess of



rigidity has been found to produce shocks under passing traffic closely resembling those due to bad joints. Very little reflection is needed to show why this should be so. Approaching a joint, the line has first the stiffness due to the rail alone, then that due to the rail and fishplates combined, and then—at the actual junction—the stiffness due to the fishplates alone, these sudden changes of stiffness next following in reverse order. It was with a view of graduating these changes and approximating to a uniformity of stiffness as well as of strength, that Colonel Richard Long, of Chicago, designed a form of fish-joint which has

lately been brought under our notice, and which has led us to these remarks. In this joint, two forms of which are illustrated in the annexed engraving, the essential feature is that the thickness of the fishplates is varied as shown in Fig. 3, the ends of the plates being considerably thinner, and the centres as much thicker than the ordinary fishplates. The new fishplates are in some cases made plain as in Fig. 1, and in others formed to clip the rail as in Fig. 2, according to circumstances, the essential feature in such case, however, being as we have said, the graduated variation in thickness, which avoids the sudden accession of stiffness at the point where the fishplates and rail act together and a corresponding sudden loss of stiffness where the plates have to act alone. As the strength of a chain is measured by that of its weakest link, so that of a fish-joint is measured by that at the actual point of junction of the rails; and thus with the graduations of thickness adopted by Colonel Long a considerable reduction in the weight of fishplates can be effected for a given strength at the point of actual junction. The variation in thickness of Colonel Long's fishplates is not so great as to necessitate two lengths of bolts, and altogether we regard the joint as a most important improvement in permanent way construction. In the United States, where the joint is known as the "Samson," Colonel Long's fishplates are being rolled by Messrs. Sellers, Fowler, and Co., of Chicago, who put up special works for their production in 1878, and who last year turned out about one million of these plates. In this country the joint is being introduced by Mr. Alfred A. Dixon, of 24, Queen Victoria-street, E.C., and as the plates are easily rolled and the use of the joints involves no disturbance of existing arrangements, we expect that they will meet with much favour.

"ENGINEERING" ILLUSTRATED PATENT RECORD.

COMPILED BY W. LLOYD WISE.

APPLICATIONS FOR PATENTS DURING THE WEEK ENDING NOVEMBER 1, 1880.
In the Cases of Inventions communicated from Abroad the Names, &c., of the Communicators are given in Italics after the Abbreviated Titles.

Nos. and Dates.	NAMES, &c., OF APPLICANTS.	ABBREVIATED TITLES, &c.
Oct. 26 4357	J. Moore, Halifax, Yorks.	Manufacture of bags, sacks, bed ticking, and other like receptacles.
4358	W. Hewitt, Trenton, N.J., U.S.A.	Apparatus and process for annealing iron and steel wire. (Complete Specification deposited.)
4359	W. Hewitt, Trenton, N.J., U.S.A.	Apparatus for cleaning iron wire, and collecting waste hydrogen gas incident to said process. (Complete Specification deposited.)
4360	N. Schnorrenberg, London.	Process or method of printing and colouring photographs on glass. <i>W. Grüne, Berlin.</i>
4361	J. C. Johnson, Wexnesbury.	Machinery for welding gas, steam, and water-pipe fittings.
4362	J. Wallace, Glasgow.	Potato diggers.
4363	H. J. Haddan, Westminster.	Suspenders and braces. <i>T. O. Potter, Boston, Mass., U.S.A.</i>
4364	A. W. L. Reddie, London.	Machine for cutting paper, cardboard, cloth, &c. <i>J. A. H. Meyer, Dresden, Saxony.</i>
4365	W. T. Sugg, Westminster.	Construction of domestic baths.
4366	J. Amson, Birmingham.	Draught preventers and regulators, and water bars.
4367	F. Ryland, West Bromwich, Staffordshire.	Wrought-iron tubular handles and method of fastening same on to culinary and other hollow ware vessels.
4368	H. H. Lake, London.	Apparatus for holding cartridges, and for supplying same to machine guns and other firearms. <i>E. G. Parkhurst, Hartford, Conn., U.S.A.</i> (Complete specification deposited.)
4369	W. R. Lake, London.	Manufacture of horseshoes. <i>J. D. Billings, New York, U.S.A.</i>
4370	J. W. Holland, London.	Water-closets, lavatories, and urinals, partly applicable generally for trapping inlets to drains and sewers.
4371	G. D. Bishopp, London.	Locomotive and traction engines worked by compressed air or other elastic fluid under high pressure.
4372	R. Punshon, Brighton.	Permanent way of railways.
4373	J. N. Holliday, Sunderland.	Steering apparatus.
4374	S. Ogden, Manchester, and J. Western, Lancaster.	Manufacture of table-cloths or covers, also applicable to toilet covers, &c.
Oct. 27 4375	P. Balmer, Scarisbrick, Lancashire.	Continuous kilns for burning bricks, &c.
4376	D. Macnee, Westminster.	Permanent way of railways.
4377	J. T. Parlour, London.	Facilitating repairs of dock walls, ships, &c., boring and carrying on other operations under water, such as lifting submerged bodies, and apparatus therefor.

Nos. and Dates.	NAMES, &c., OF APPLICANTS.	ABBREVIATED TITLES, &c.
Oct. 26 4378	G. Pace, Valetta, Malta.	Construction and working of multi-tubular firearms.
4379	G. and J. Weir, Glasgow.	Detecting and preventing corrosion in steam boilers and parts connected therewith and apparatus therefor.
4380	J. C. Mewburn, London.	Moulding, working, and uniting amber. <i>F. J. Kaldenberg, New York, U.S.A.</i>
4381	W. Forsyth, Worcester.	Composition or cement for filling in letters or other recessed work in marble, stone, &c., also applicable for cementing materials together.
4382	M. Travers, London.	Obtaining and applying motive power.
4383	P. W. G. Nunn, Bourne-mouth, Hants.	Abdominal belts for prevention or alleviation of sea-sickness.
4384	B. J. B. Mills, London.	Self-levelling tables, cattle pens, &c., for use on shipboard. <i>J. F. Dobson, Boston, Mass., U.S.A.</i>
4385	C. Dickenson and J. W. Robson, Surrey.	Filter press.
4386	J. R. Dry, London.	Cowl.
4387	J. Hinks, T. Hooper, and F. R. Baker, Birmingham.	Fastenings for cravats and neckties.
4388	P. M. Justice, London.	Combined adjustable seats and school-desks. <i>A. E. J. Damman and A. Cassard, Brussels.</i>
4389	A. M. Clark, London.	Dredger or castor for table and other use. <i>A. C. Dominique, Poche, St. Amand les Eaux (Nord), France.</i>
4390	A. M. Clark, London.	Envelope letter paper. <i>E. Clément, Paris.</i>
4391	P. Jensen, London.	Means for measuring the amount of electrical current flowing through a circuit. <i>T. A. Edison, Menlo Park, N.J., U.S.A.</i>
4392	W. Mather, Salford.	Friction coupling or clutch for driving shafts, wheels, pulleys, &c.
4393	W. R. Lake, London.	Electric lighting apparatus. <i>H. S. Maxim, Brooklyn, New York, U.S.A.</i>
4394	W. Ambler, Bradford, Yorks.	Machinery employed in the manufacture of spool tubes.
4395	C. A. Brodribb, Hastings.	Gas stoves.
Oct. 28 4396	A. C. Herts, London.	Carpet sweepers.
4397	W. Dawes, Leeds, & A. H. Dawes, Staveley, Westmoreland.	Packing cases for the conveyance of pictures, frames, &c.
4398	J. C. Rhodes, Blackpool, Lanc., W. Goodbrand, and T. E. Holland, Manchester.	Gas motor engines.
4399	F. Jackson, and E. R. Austin, Manchester.	Instruments for use in packing permanent way of railways.
4400	T. Holliday, Huddersfield.	Obtaining various colours on cotton and other textile fibre.
4401	A. C. Uljee, the Hague, temporarily of Westminster, and J. Cleminson, Westminster.	Manufacture of wheels for use on railways and tramways.
4402	C. Morfit, London.	Consolidating extract of malt.

Nos. and Dates.	NAMES, &c., OF APPLICANTS.	ABBREVIATED TITLES, &c.
Oct. 28 4403	G. G. Cave, Dowlais, Glamorgan.	Apparatus for mashing malt or other grain or ingredients for heating & cooling liquids, &c.
4404	G. Browning and S. Mort, Glasgow.	Sewing machine partly applicable to other sewing machines.
4405	T. Holliday, Huddersfield.	Utilising residuary products obtained when producing colours on cotton and other textile fibre.
4406	F. and A. Craven, Bradford, Yorks.	Apparatus for spinning or twisting fibrous substances.
4407	J. Humphrys, Barrow-in-Furness.	Boilers for generating steam.
4408	G. W. von Nawrocki, Berlin.	Photometers. <i>W. S. Limbeck Langendroer, Germany.</i>
4409	T. Davids and C. Weiss, Hanover.	Screens for indoor and outdoor use.
4410	J. A. Bennett, Stalybridge, Lanc.	Construction of yarn winding frames.
4411	U. Bromley, G. Crowe, and W. James, Chester.	Cisterns or flushing apparatus for water-closets, urinals, &c.
4412	A. J. Boulton, London.	Breechloading firearms. <i>H. R. Houghton, New York, U.S.A.</i> (Complete Specification deposited.)
4413	E. O. Day, Surrey.	Feeding bottle for infants and invalids.
4414	C. D. Saunders, J. F. H. Shepherd, and L. Saunders, London.	Stud fastenings for garments.
4415	H. J. West, Brixton, Surrey.	Stoppers for glass or other bottles or vessels for containing aerated water, &c., and method of attaching same.
Oct. 29 4416	E. Whalley, Manchester, and J. H. Scott, Rochdale.	Machinery for doubling, winding, and twisting yarns or threads.
4417	C. Winkler, Freiberg, Saxony.	Absorbing and utilising acid gases and fumes, more particularly sulphurous acid fumes, and means therefor.
4418	W. Balch, Greenwich.	Saving life at sea, &c.
4419	M. Benson, London.	Gas engines. <i>A. K. Rider, Walden, Orange County, New York.</i>
4420	A. and C. H. Rothwell, Bury, Lanc.	Weaving reversible fabrics.
4421	G. Wilkinson, Manchester.	Prime movers.
4422	H. Rankin, London.	Bagmaking machinery.
4423	J. Brindle, Whitehaven.	Improved pipe for tobacco.
4424	J. Crichton, R. Crichton, and P. Chell, Manchester.	Construction of valve gear for steam and other engines.
4425	J. Chase, Orange, Mass. U.S.A.	Manufacture and adaptation of pulp from woody or other analogous fibres.
4426	J. A. Timmis, Westminster.	Bearingsprings.
4427	P. F. Rossini, W. Snell, and J. J. Fisher, London.	Cases, frames, or books for exhibition of photographs.
4428	J. H. Johnson, London.	Electric lamps. <i>A. Beriot, Paris.</i>
4429	B. Talbot, Wellington, Salop.	Machinery for coiling and brindling iron, steel, and other metallic rods and wires.

Nos.	NAMES, &c., OF APPLICANTS.	ABBREVIATED TITLES, &c.	Dates.	Nos.	NAMES, &c., OF APPLICANTS.	ABBREVIATED TITLES, &c.	Dates.	Nos.	NAMES, &c., OF APPLICANTS.	ABBREVIATED TITLES, &c.	Dates.
4009	J. G. Lorrain, Edinburgh.	Obtaining and applying motive power partly applicable to the transformation of power into electricity. <i>G. Trouvé, Paris.</i>	Oct. 2	3284	H. H. Lake, London.	Carding machines - <i>J. Wood Cohoes, N.Y., U.S.A.</i>	Aug. 11	2778	F. H. Holmes, Fulham, Middlesex.	Effecting propulsion in water, and apparatus employed therefor, partly applicable to the transmission of power.	July 7
4021	H. Eaton, Portsea, Hants.	Engine cylinders and mode of using motive power in same.	4	3330	J. H. Johnson, London.	Preparation of cinnamic acid and of its substitution products. <i>H. Caro, Mannheim, Germany.</i>	17	2920	H. J. Haddan, Westminster.	Garments. <i>A. N. Horner, Baltimore, Maryland, U.S.A.</i>	15
4039	J. G. Lorrain, Edinburgh.	Telephones for signalling. <i>G. Trouvé, Paris.</i>	5	3354	F. G. Vedova, Smyrna, Asia Minor, at present residing in London.	Tanning hides and skins.	18	2958	J. R. Neill, Glasgow.	Log or speed indicator for ships.	17
4119	H. J. Haddan, Westminster.	Brims and bands of hats. <i>J. Peters and L. Wiegand, Philadelphia, U.S.A.</i>	11	3450	W. R. Lake, London.	Apparatus for facilitating gymnastic exercise, and convertible into a table, bed, chair, &c. <i>C. H. and J. B. Gifford, New York, U.S.A.</i>	26	3111	J. Donovan, West Hartlepool.	Supporting, raising, lowering, disengaging ships' boats, and apparatus therefor.	29
4320	H. J. Haddan, Westminster.	Skate attachments. <i>C. Brewster, Montreal, Canada.</i>	23	3484	J. A. and J. Hopkinson, Huddersfield.	Steam boilers.	27	3221	W. Hawarth, Burnley, Lanc.	Liquid composition or compound for washing, bleaching, and disinfecting purposes.	Aug. 6
4345	W. W. Vaughn and A. Clark, Stockton, San Joaquin, California.	Spirit levels.	25					3243	E. Hird, Bolton-le-Moors, Lanc.	Construction of apparatus for spinning and doubling cotton and other fibrous materials.	9

PATENTS SEALED.
I.—Sealed October 29, 1880.

Nos.	NAMES, &c., OF APPLICANTS.	ABBREVIATED TITLES, &c.	Dates.
1488	K. W. Jurisch & J. H. Lewis, Widnes, Lanc.	Steam engines. <i>Partly communicated by Proell and Scharowsky, Dresden, Germany.</i>	April 12
1538	C. D. Douglas, London.	Baths.	15
1543	B. J. Edwards, Hackney.	Packing photographic plates, and appliances therefor.	30
1772	W. Smith, Barnard Castle, Durham.	Street sweeper.	May 1
1784	B. and D. Wright, Leeds.	Stocks used in the manufacture of leather, also applicable to other purposes.	May 1
1794	J. Broad, London.	Treating and manufacturing oils and wax from shale, peat, and canal coal, and apparatus therefor.	3
1799	P. O'Halloran, London.	Caloric engine. <i>J. Jenkins, Philadelphia, America.</i>	3
1807	F. H. F. Engel, Hamburg, Germany.	Venetian blinds. <i>G. Weckmann, Hamburg.</i>	3
1814	W. C. Locke, New York, U.S.A., now of London.	Amylaceous compound.	4
1821	A. West, Birstall, Yorks.	Apparatus for suspending and preventing overwinding of cages.	4
1830	O. Sweeney, Philadelphia, Penn., U.S.A., at present of Liverpool.	Reservoir lamps.	5
1840	W. R. Lake, London.	Apparatus for the production of electric light. <i>T. L. Clingman, Asheville, North Carolina, U.S.A.</i>	6
1850	W. R. Lake, London.	Ventilated case or bin for storage and preservation of grain or seed. <i>E. J. W. Geelen, Rotterdam.</i>	6
1852	J. Lefranc, Paris.	Manufacture of Chemical or artificial coal.	7
1874	A. McCaw, J. Stevenson, and J. P. Orr, Belfast.	Manufacture of transparent or other paper or cloth, labels, tablets, or sheets for advertising, decorative, and other purposes, and machinery therefor.	7
1885	K. Knott, London.	Coal-producing and ice-making machinery.	8
1904	W. Holland and R. Budd, Birmingham.	Manufacture of certain parts of the furniture of umbrellas and parasols, and apparatus therefor.	10
1978	E. I. H. E. Whitehouse, and J. T. Whitehouse, Coseley, Staffordshire.	Manufacture of ears for buckets and other articles having bail handles, and tools or apparatus employed in said manufacture.	13
2008	B. Fowler, R. Burton, and R. H. Shaw, Leeds.	Steam-cultivating engines and machinery used therewith.	15
2019	W. R. Lake, London.	Water-closets. <i>E. Frandsen, Vienna.</i>	18
2078	F. Hoyer, Liverpool.	Registering apparatus for checking work done by printing presses, applicable also for recording the score of games, such as golf, lawn-tennis, and other purposes.	22
2092	W. Clark, London.	Mechanism for operating and regulating the motion of sewing machines. <i>D. S. Van Wyck, Fishkill Plains, New York.</i>	June 18
2193	W. Southall and A. Southall and T. Barclay, Birmingham.	Anti-septic and absorbent pads for absorbing discharges in childbed and other discharges.	29
2479	J. Reilly, Manchester.	Manufacturing, upholstering, and gimping chairs, seats, sofas, couches, &c., made of mahogany, or other woods, or of iron or other metals, or of wood & metal combined, and apparatus connected therewith.	June 18
2654	L. S. Chichester, of Jersey City, N.J., U.S.A.	Pulverising grain, ores, minerals, and other frangible substances and apparatus therefor, and method of preparing the grain for pulverisation.	29
2664	W. R. Lake, London.	Locomotive engines. <i>E. Fontaine, Detroit, Mich., U.S.A.</i>	July 8
2804	J. Aird, Lambeth, Surrey.	Valves of gas mains or pipes for maintaining a tight joint.	10
2857	J. Lloyd, Birmingham.	Perambulators.	10
3086	L. Sterne, Westminster.	Air engines. <i>J. Ericsson, New York, U.S.A.</i>	27

II.—Sealed November 2, 1880.

Nos.	NAMES, &c., OF APPLICANTS.	ABBREVIATED TITLES, &c.	Dates.
1804	A. McGregor, Leigh, Lanc.	Construction of chaffcutters.	May 3
1815	D. Jones, Birmingham.	Furnaces of steam boilers.	4
1818	J. Skinner, Dundee.	Sliver conductors for rotatory gill and other apparatus used in preparing jute and other fibrous materials.	5
1837	S. Hargreaves, Watterside, Lanc.	Looms for weaving.	5
1841	S. Tweedale, Accrington.	Machinery for spinning and twisting fibres.	7
1868	E. Newbold, New Wandsworth, Surrey.	Furnace bars.	7
1877	H. Aspin, Manchester.	Construction of machinery or apparatus for shaking carpets.	8
1892	W. Lloyd Wise, Westminster.	Air compressors. <i>C. W. Burton, Paris.</i>	8
1894	H. Sharp, Bolton-le-Moors, Lanc.	Rails for tramways.	10
1898	H. H. Lake, London.	Heddles for looms. <i>S. Sewell, Tewkesbury, Mass., U.S.A.</i>	10
1905	H. J. Allison, London.	Fireplaces. <i>A. E. Lefevre-Bergeot, Paris.</i>	11
1915	C. Beckmann, London.	Machinery for the manufacture and printing of paper bags. <i>E. and C. Schurmann, Elberfeld, Prussia.</i>	11
1922	S. Staigh, London.	Manufacture of handles for table and other knives, also applicable to handles of umbrellas, whips, &c.	12
1929	L. Howell, Taibach, Glamorgan.	Pickling and swilling metal plates, and apparatus therefor.	12
1934	H. J. Thatcher, Cardiff.	Instruments or appliances for adjusting and correcting deviations in the mariner's compass.	14
1941	E. G. Lakeman, Modbury.	Ploughs.	14
1949	G. Hibbert, Richmond, York, and L. Cook, Horwich, Lanc.	Grate bars for furnaces or fireplaces and blasts.	19
1995	J. T. and F. S. Liley, London.	Umbrellas and sunshades.	19
2029	R. C. Menzies and E. J. Bevan, Edinburgh.	Manufacture of paper for cheques and like documents.	20
2034	W. Powles, Birmingham.	Perambulators.	20
2053	H. J. Haddan, Westminster.	Vehicles and portable steaming apparatus. <i>A. H. Crawford, Liverpool, New York, U.S.A.</i>	21
2055	H. J. Haddan, Westminster.	Stables. <i>A. H. Crawford, Liverpool, New York, U.S.A.</i>	21
2057	H. Doulton, Lambeth.	Joints or connexions of earthenware pipes.	21
2066	W. R. Lake, London.	Manufacture of paper pulp. <i>C. Dengg and Co., Vienna.</i>	21
2073	J. Dutton, Bermondsey, Surrey.	Driving mechanism for bicycles, tricycles, and like vehicles.	21
2075	W. Clark, London.	Apparatus for use in making chocolate creams and other sweetmeats, applicable also for other purposes. <i>J. B. Gauvin and L. Broulin, Paris.</i>	24
2098	W. Weldon, Burston, Surrey.	Manufacture of bicarbonate of soda and apparatus therefor. <i>A. R. Pechiney, Salindres, France.</i>	24
2099	W. Weldon, Burston, Surrey.	Calcining bicarbonate of soda, produced by the ammonia process, and apparatus therefor. <i>A. R. Pechiney, Salindres, France.</i>	24
2100	W. Weldon, Burston, Surrey.	Apparatus for expressing liquids from precipitates or other bodies. <i>A. R. Pechiney, Salindres, France.</i>	24
2160	F. Walton, Twickenham, Middlesex.	Manufacturing, embossing, and colouring of panels, and mouldings, and composition, and other fabrics, and apparatus employed in such manufactures.	27
2195	W. Morgan Brown, London.	Looms for weaving. <i>G. Crompton, Worcester, Mass., U.S.A.</i>	29
2201	W. R. Lake, London.	Boats and apparatus for the cultivation, preservation, & conveyance of oysters and other shell fish. <i>V. A. L. De Blandiniere, Tarn, France.</i>	June 15
2414	G. H. Corliss, Providence, Co. Providence, Rhode Island, U.S.A.	Steam pumping machinery, partly applicable to steam engines and pumping mechanism generally.	16
2442	D. and T. Robertson, Glasgow.	Cooking ranges.	16
2472	G. W. Dawson, Indianapolis, U.S.A.	Apparatus for filtering water.	18

FINAL SPECIFICATIONS FILED.

Oct. 23, 1880.	Nos. 1673, 1676, 1686, 1687, 1690, 1691, 1693, 1695, all of the year 1880.
" 25, "	1700, 1746, 2930, 2963, 2964, all of the year 1880.
" 26, "	1697, 1699, 1704, 1706, 1707, 1708, 1710, 1711, 1719, 1769, all of the year 1880.
" 27, "	1319, 1714, 1722, 1723, 1732, 1738, 1788, 1930, all of the year 1880.
" 28, "	1729, 1730, 1733, 1735, 1739, 1740, 1741, 1745, 1749, 1750, 1753, 1755, 1758, 1777, all of the year 1880.
" 29, "	1483, 1756, 1762, 1765, 1771, 1780, 1904, 1977, all of year 1880.

PATENTS IN RESPECT OF WHICH THE THIRD YEAR'S STAMP DUTY OF 50% HAS BEEN PAID AND REGISTERED.

No.	Name.	No.	Name.	No.	Name.
1877	Napier.	1877	Conradi	1877	Greenwood & Horsfall.
3976	Mills (Tralls).	4021	(Priew).	4330	Culmer.
3978	Potter.	4078	Reade.	4017	Smith.
3999	Scott.	4083	Banner.	4026	Wirth (Klotz).
3977	Cates and Howard.	4087	Wilkes.	4061	Morfit.
3979	Haward.	4091	G. & E. Ashworth.	4062	Tilson.
4003	Apsey.	4060	Vaughan (Cooley, Oliver, and Sherwood).	4183	
4032	Pendleton.				
4127	Westinghouse.				
4144	Parnell.				

PATENTS IN RESPECT OF WHICH THE SEVENTH YEAR'S STAMP DUTY OF 100% HAS BEEN PAID AND REGISTERED.

No.	Name.	No.	Name.	No.	Name.
1873.	Lake (Rhode Island Horseshoe Co.)	1873.	Brin.	1873.	Bullough.
4210		3477	Alexander.	3648	Lake (McKay).
		3576	Chatwood.	3665	
		3550			

PATENTS WHICH HAVE BECOME VOID.

I.—Through Non-Payment of the Third Year's Stamp Duty of 50%.

No.	Name.	No.	Name.	No.	Name.
1877.	B. and A. B. Blackburn.	1877.	Johnson	1877.	McKie.
3838	Rogers.	3865	(Manoury).	3892	Hall.
3482	Foley.	3867	Wirth (R. & C. Steinau).	3896	Carr and Waring.
3443	Brooks and Gradwell.	3868	Hadfield.	3899	Thompson and Maw.
3845	Parkinson.	3872	Hudson.	3900	Nordmünster.
3846	Brookes (Herlin).	3873	Turnbull.	3901	Jensen (Ahlborg).
3849	Brookes (Herlin).	3881	Battye, W. & J. Atkinson.	3904	Parsons.
3853	Bartlett.	3882	Stubbs	3905	Meredith.
3854	Pickersgill.		(Grover).	3907	Beaumont.
3855	Chapman.	3884	Sauvée	3912	Williamson.
3858	Walton.		(Baboin).	3914	Pennycook.
3859	Pitt (Paret).	3885	Hadfield.	3915	Wrigley.
3860	Eavestaff.	3888	Holgate.	3916	Lake (Harding).
3862	Stevenson.	3889	Brook and Jobstake.	3917	

II.—Through Non-Payment of the Seventh Year's Stamp Duty of 100%.

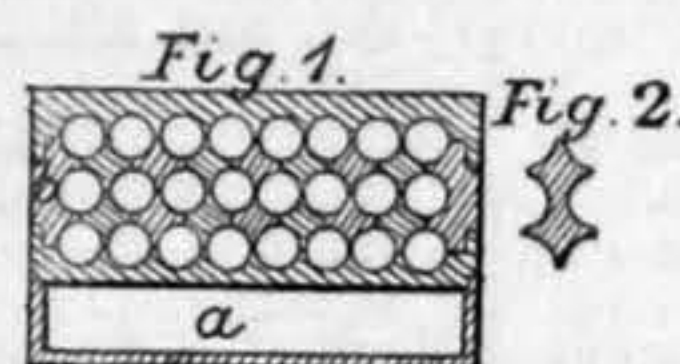
No.	Name.	No.	Name.	No.	Name.
1873.	Galloway.	1873.	Hyatt.	1873.	Robertson.
3369	Browne.	3381	H. E. and G. A. Ermen.	3427	Orchar, Muir, and McIlwham.
3376	E. A. and J. A. Jones.	3386	Maas & Flos.	3435	Adams.
3378	Osborne and Alley.	3389	Trossin.	3445	Robertson.
		3401	Raworth.		
		3411	Clark		
		3419	(Loiseau).		

ABRIDGMENTS OF SPECIFICATIONS PUBLISHED DURING THE WEEK ENDING OCT. 30, 1880.

Abridgments marked with a * relate to applications not proceeded with. The number of Views given in the Specification Drawings is stated in each case after the price; where none are mentioned the Specification is not illustrated.

Where Inventions are communicated from abroad, the Names, &c., of the Communicators are given in italics.

347. Kerbways: W. G. White, Paris, and J. U. Sears, London. [4d. 4 Figs.]—The invention has for its object to obviate the difficulty attending the laying down, inspecting, and repairing of telegraphic and other electric wires under kerbways, by substituting for the ordinary stone kerb, a metal kerb consisting of a series of plates dovetailed and recessed into each other, the under

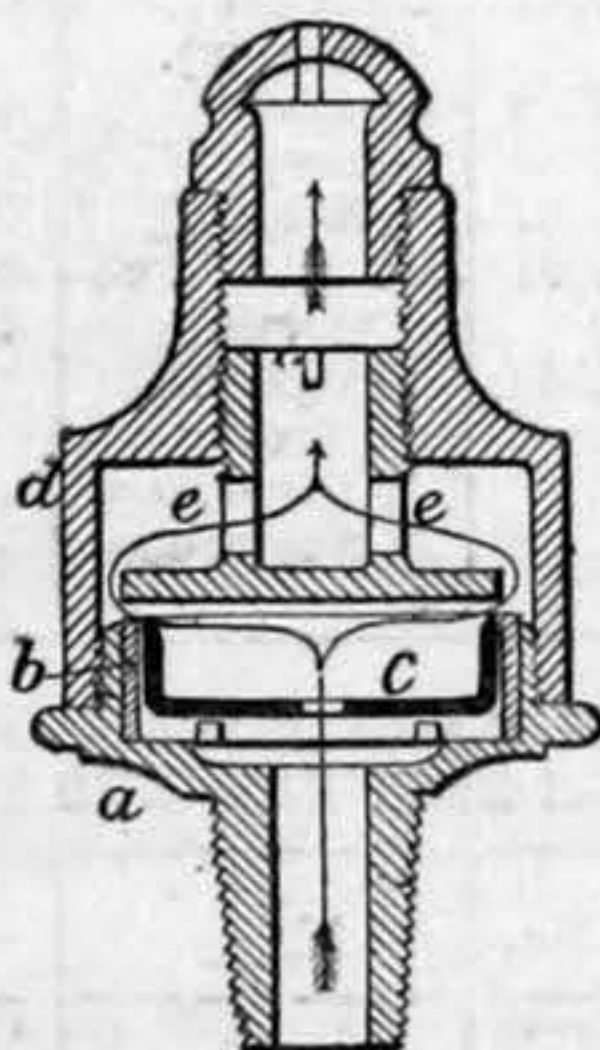


plates being merely frames, while the top ones are solid. In the diagram, *a* is a metal tank placed below the level of the road, and forming a receptacle for cables used for street lighting and other purposes. Above is a series of plates *b* containing circular holes for telegraph or telephone wires. One of these plates is also shown in section. When the top plate is removed, the inner plates can be easily withdrawn. (January 27, 1880).

829.* Swivels: T. A. Vaughton, Aston, Birmingham. [2d.]—The swivel is especially applicable to watches. The body consists of an open elastic hook, and to the back is fixed a cross band with the ends formed into tubes, into which two parallel wires doubled in the middle are inserted, and slide. The lower part, containing the band, is turned at right angles to the other part. One of the tubes is open at its inner side, so that when the branches are pressed together the end in the open tube can pass out, and the folded wire can turn upon the other end within the closed tube. (February 25, 1880).

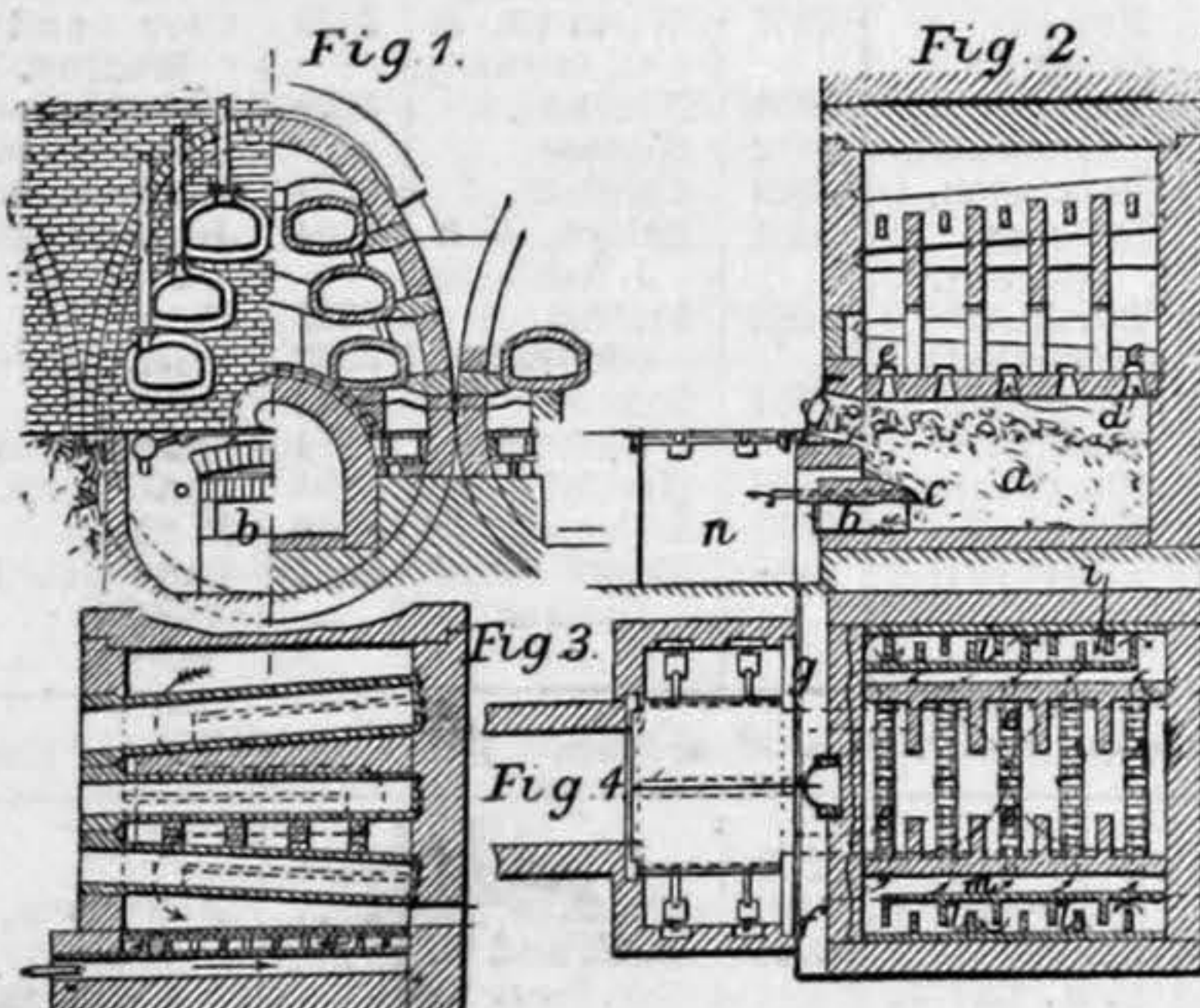
905.* Covering Wire with Insulating Material, &c.: J. C. L. Loeffler, London. [2d.]—The object of the invention is to apply several layers of insulating plastic material to electric conductors at one operation. The wire is drawn through a succession of dies of gradually increasing size, and receives a covering in each. The dies may be all in connexion with one forcing cylinder, or each may have a separate supply; the apparatus may be used to complete the coverings at one operation, or at several. (March 1, 1880. Void by reason of the patentee having neglected to file a specification).

1092. Gas Regulators: F. Wright, London. [6d. 4 Figs.]—Refers to regulating the quantity of gas passing to a gas burner, by the use of a movable cup in conjunction with an adjustable plane surface; in the illustration *a* is a cylindrical chamber formed with a tubular stem screwed for attachment to the supply pipe. This chamber *a* is lined with a cylindrical bushing *b* of non-corrosive material, up and down which the regulating cup *c* moves, *d* is a cover fitted with a suitable burner and made with a screwed socket for the reception of the screwed stem of the adjustable button *e*, which has a plane surface on its underside. The gas enters the chamber *a* and passing under the cup *c*, through the small hole *f*, flows between the edge of the cup *c* and the plane surface of the button *e* to the burner. Should the pressure of the



gas be sufficient to lift the cup, the rim of the latter will approach the plane surface and check the flow of the gas. The pressure within the cup will then accumulate until it is sufficient, together with the weight of the cup, to balance the pressure beneath. In this way a constant bulk of gas is supplied to the burner. The consumption of gas is varied either by altering the weight of the cup *c*, or by increasing or diminishing the size of the hole *f* by an adjustable conical plug. Other means of combining the different parts to obtain the same effect are shown. (March 13, 1880).

1220. Gas Generators, &c.: C. Pieper, Berlin. (A. Kloeene, Dortmund.) [6d. 14 Figs.]—Relates to gas generators placed below a steam boiler or retort furnace, and constructed so that the air required for the conversion of the solid fuel into



carbonic oxide enters by an opening in the front or lateral wall of the gas generator while the points of combustion of the carbonic oxide are immediately above the arch of the same. For the purpose of cooling the edge of the opening and preventing its destruction by the slag, a metal channel is formed along it, in

which water or air is made to circulate. Figs. 1, 2, 3, and 4 illustrate the application of the invention to a retort furnace containing six retorts: *a* is the gas generator constructed as low as possible, and made to project upwards as far as the retorts will allow, by being formed with a parabolic arched roof. The air enters through the opening *b*, and under the channel *c*. The generator gas passes through the openings *dd* into the retort furnace, and meets with the air supplied by the channels *ee*. This air enters from the outside into the channels *f* and *g*, and circulates on one side in the channels *i*, and on the other side in the channels *l, m*, and is finally conducted by the branch channels *cc* to the points where the combustion takes place. The air is heated to a certain extent in the above-mentioned channels, but principally in the channels *ee*, which are built of especially thin moulded firebricks. The pit *n* is provided with flap doors and counterweights to form a flooring when the attendant does not require to have them open to remove the slag. The generator may be built with an inverted arch at the bottom for the purpose of keeping off any underground water, or with a grate and a recessed ash-pit at the bottom to contain water. The specification further describes how the apparatus may be applied to steam boilers, or to a furnace containing a less or a greater number of retorts, any number of which may be worked at the same time, and also relates to an arrangement by which a series of pipes laid in a flue which conducts the combustion gases to the chimney, serve to heat the air before it enters the generator or furnace. (March 22, 1880).

1277.* Composition for Wall Panelling &c.: G. Brown, London. [2d.]—Consists of whitening, flock, brown paper, glue, oil, and resin, compressed into suitable moulds to produce impressions for the internal decoration of houses. It is stated that the novel introduction of flock with a decrease in the quantity of glue employed in this mixture gives it a great superiority over the article known as "composition." (March 27, 1880).

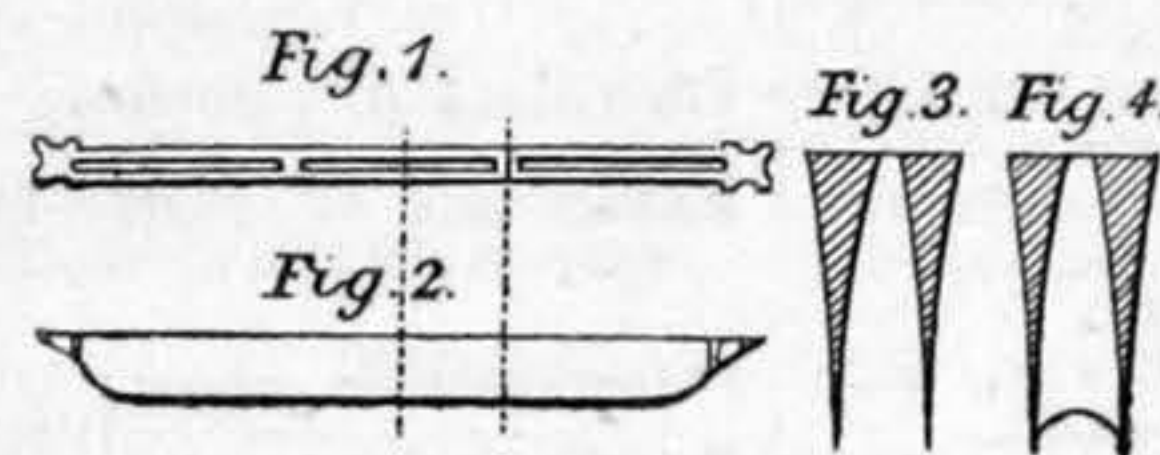
1279.* Automatic Apparatus for Cricket Playing: J. Jeffery, Epsom. [2d.]—The action of the apparatus, which is for facilitating the practice of cricket, is as follows: The ball, having passed the wicket, runs up an inclined sheet, strikes a net, and falls therefrom into a channel or shoot which leads it back to the bowler. (March 27, 1880).

1280.* Mincing Food: J. Kennedy, Strabane, Co. Tyrone. [2d.]—A circular frame carries on its inner edge a bevel toothed wheel, and below a receiver. The toothed wheel gears with a bevel pinion upon an upright shaft. To the shaft is attached one or more knives, curved to the radius of the receiver. On turning the shaft the knives revolve and cut the food in the receiver, which revolves at a slower speed, and a reciprocating lid presses down and consolidates the food before it is presented to the knives. (March 27, 1880).

1281.* Velocipedes: A. and M. Weight, Reading. [2d.]—The novelty consists in the device for connecting the treadle lever to the crank. One end of the treadle lever is pivoted to the frame and the other carries the pedal plate. Between these two points is a pin which engages the shorter arm of a bellcrank lever, whose longer arm is joined by a connecting rod to the crank-pin. The bellcrank rocks on a pin which enters an elongated hole in it. (March 27, 1880).

1283.* Stays and Corsets: E. Langdon, London. [2d.]—The object is to reduce the size without interfering with the comfort, and to render them adaptable to the figures, of the wearers. Longitudinal or horizontal strips of elastic material are introduced in each section of the front of the corset. The strips are inserted between casings of whalebone, and are stitched to the material of the corset. (March 27, 1880).

1290. Firebars, &c.: C. Mace and J. Brewster, Sunderland. [6d. 9 Figs.]—The firebars are made with large air channels at the ends and with deep and thin webs with concave sides. At the bottom they are brought to a knife edge to gain the utmost air space. Figs. 1 and 2 are respectively a plan and a side



elevation of the improved bar, and Figs. 3 and 4 are cross sections of bars, the latter showing the method of connecting them by webs. The invention further relates to casting the bars with their faces on a metal plate in order to chill them. (March 27, 1880).

1291. Refractory Bricks, &c.: W. R. Lake, London. (A. Braconier, Nancy, France.) [2d.]—This invention consists in obtaining magnesia as a direct undissolved residuum, by a single operation, in which the lime is eliminated from the calcined dolomite by means of a solution of hydrochlorate of ammonia or metallic chlorides. Also the application of the magnesia so obtained in the manufacture of bricks. The calcined natural dolomite is treated with such liquid residues as contain hydrochlorate of ammonia and metallic chlorides, with or without hydrochloric acid in a free state. Only the quantity of dolomite strictly necessary to dissolve the lime alone is employed, the magnesia from the dolomite then remains undissolved and mixed with these foreign matters which the dolomite contained in its natural state. The lime refuse now thrown away by soda makers can be utilised. In the manufacture of bricks the magnesia obtained as above is dried and slightly calcined in a kiln; it is pulverised and moistened with water to consistency of stiff paste, when it is moulded into bricks and subjected to the highest pressure. The bricks are desiccated and then burnt or baked for at least twelve hours in regenerative furnaces constructed of magnesium bricks. (March 27, 1880).

1292.* Respirators: T. McCulloch, Devonport, and D. Morrison, Stonehouse, Devon. [2d.]—A helmet passes over the head of the wearer, rests upon the shoulders, and is secured by straps. There is an aperture for the escape of expired air, and to the inner side is connected a flexible tube provided with a mouthpiece, which can be held between the lips of the wearer, the other end of the tube has a trumpet-shaped mouth. The tube enables fresh air to be admitted and the wearer to use it as a speaking tube for communicating with persons outside the building. (March 29, 1880).

1293.* Beating and Stretching Skins: A. C. Henderson, London. (E. Masurel, Tourcoing, J. and P. Masurel, Roubaix, France.) [2d.]—The apparatus consists of two cylinders turning in the same direction at the same circumferential speed. One is of cast iron and grooved, and the other by preference of cast iron covered with india-rubber. In operation they can be separated by the workmen to admit the skin folded lengthways with the hair inside and then replaced. The upper cylinder draws in the skin and the lower one expels it, and the process is continued as long as necessary. One of the cylinders may be replaced by a sliding table. (March 29, 1880).

1294.* Obtaining Transfers from Photographs on Enamel, &c.: J. W. Bailey, London. [2d.]—A transparency of the object to be copied is obtained in the usual

manner by photography. Another glass covered with a film composed of bichromate of potash, borax, honey, sugar, and gum is then submitted in connexion with the transparency to the action of light, which reproduces the object in the form of an intaglio. The required colour is then worked into the intaglio thus produced, and the film withdrawn from the glass and placed on the article it is required to ornament, after being previously coated with collodion and ether, and fixed with hyposulphite of soda. It is now submitted to heat "to entirely remove all chemical substance," and the colour is fixed by being burnt in or varnished as may be required. (March 30, 1880).

1295. Improvements in Insulating Electrical Conductors: E. M. Allen, London. (A. Knudson and F. L. Kane, Brooklyn, New York.) [6d. 2 Figs.]—Consists in coating electrical conductors, more especially such as are designed for telegraphic purposes, with an insulating fibrous material coated or saturated, or both, with a waterproof flexible adhesive compound composed of Trinidad or other natural asphaltum, mixed with non-drying and softening material, such as paraffine oil, petroleum



residuum, &c. The proportion of native bitumen and non-drying material depends upon the nature and character of the bitumen and the place in which the conductor is to be used, but a suitable compound for ordinary purposes may be made of 65 parts of Trinidad asphaltum mixed with 14 parts of petroleum residuum. Fig. 1 represents a conductor coated with a continuous covering of fibrous material applied in any convenient manner. The wire is then saturated or coated with the compound by passing it through a quantity of the material kept by heat in a liquid condition. In covering a joint between two conductors, the ends are stripped and the joint is then wrapped with narrow strips of loosely woven cloth, or tape, previously saturated with the compound, as shown in Fig. 2. (March 30, 1880).

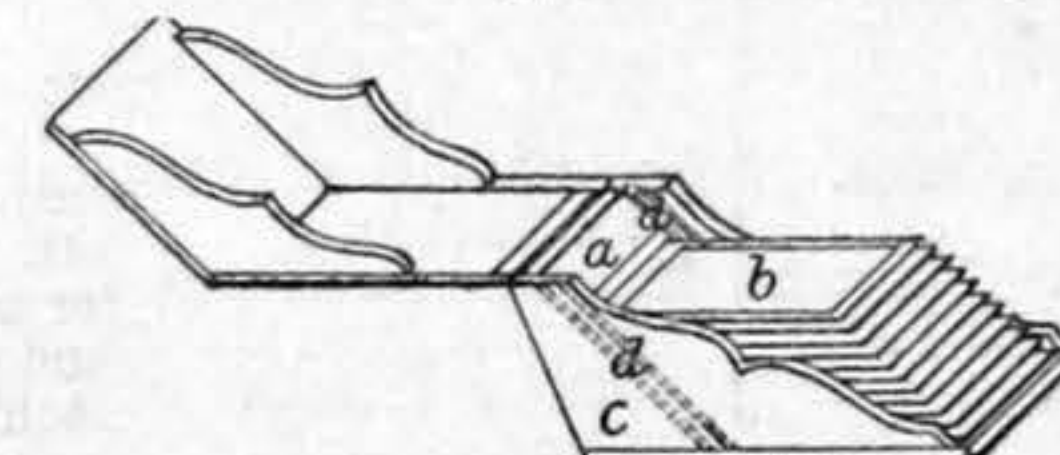
1296.* Fans: O. Thaege, London. [2d.]—Each blade of a fan, having a rigid tubular handle, has a cord attached to it, and passing through eyelet holes in the handle of the fan. To open the fan the cords are drawn downwards, and secured by a bead retained in a slot in a metal plate. The fan may be closed on the release of the bead by a spring. (March 30, 1880).

1297. Waterproof Overcoats: B. Birnbaum, London. [4d. 6 Figs.]—The ventilation of such garments is secured by piercing them in suitable places with holes, and protecting the holes by small crescent-shaped hoods. (March 30, 1880).

1299. Cruet Frames, &c.: G. C. Wildman, Wolverhampton. [4d. 3 Figs.]—Consists chiefly in making the ring frame that contains the bottles, in one piece, instead of screwing or soldering the various parts together. The baseplate is also formed from one piece of metal, and is secured to the central pillar or handle by a winged nut. (March 30, 1880).

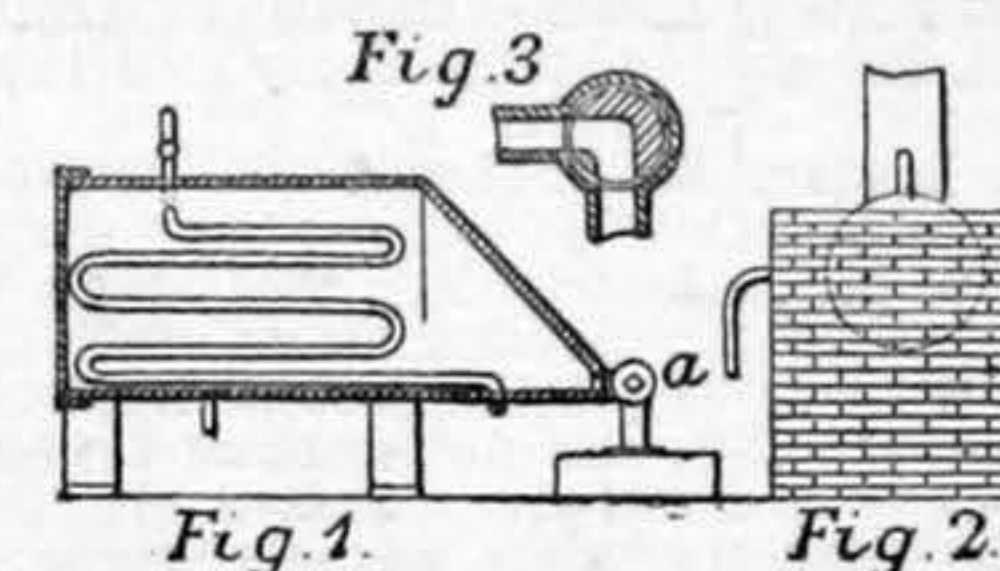
1301. Corsets: W. H. Symington, Market Harborough. [6d. 4 Figs.]—The bosom is formed by horizontal strips, shaped like the gores of a balloon, or by pieces resembling spherical triangles united with their apices at the centre of the bosom. (March 30, 1880).

1303. Apparatus for Holding Photographic Pictures, &c.: W. R. Lake, London. (Theodor Muench, Vienna.) [6d. 9 Figs.]—For holding and exhibiting photos, &c., and similar flat objects, an open holder has a series of pivoted bearings on two of its opposite sides. The frames containing the photos, &c., have pivots at or near their lower edge to suit the bearings. A case for containing the frames has an inclined groove



for the reception of the holder. The illustration shows the apparatus opened. The holder *a* consists of an open frame of wood or metal having holes in its sides for the reception of the pivots on the frames *b*. The casing *c* has grooves *d*, into which the holder *a* slides, so that the frames or other photos, &c., may be inserted or replaced. (March 30, 1880).

1304. Utilisation of Bamboo Reed for Manufacture of Fibrous Materials: W. R. Lake, London. (W. O. Giles, New York, U.S.A.) [6d. 3 Figs.]—The knots of the bamboos are cut out, and the portions between the knots are treated for several hours in a vessel into which steam generated from caustic alkali, or passed through caustic liquor, is alternately



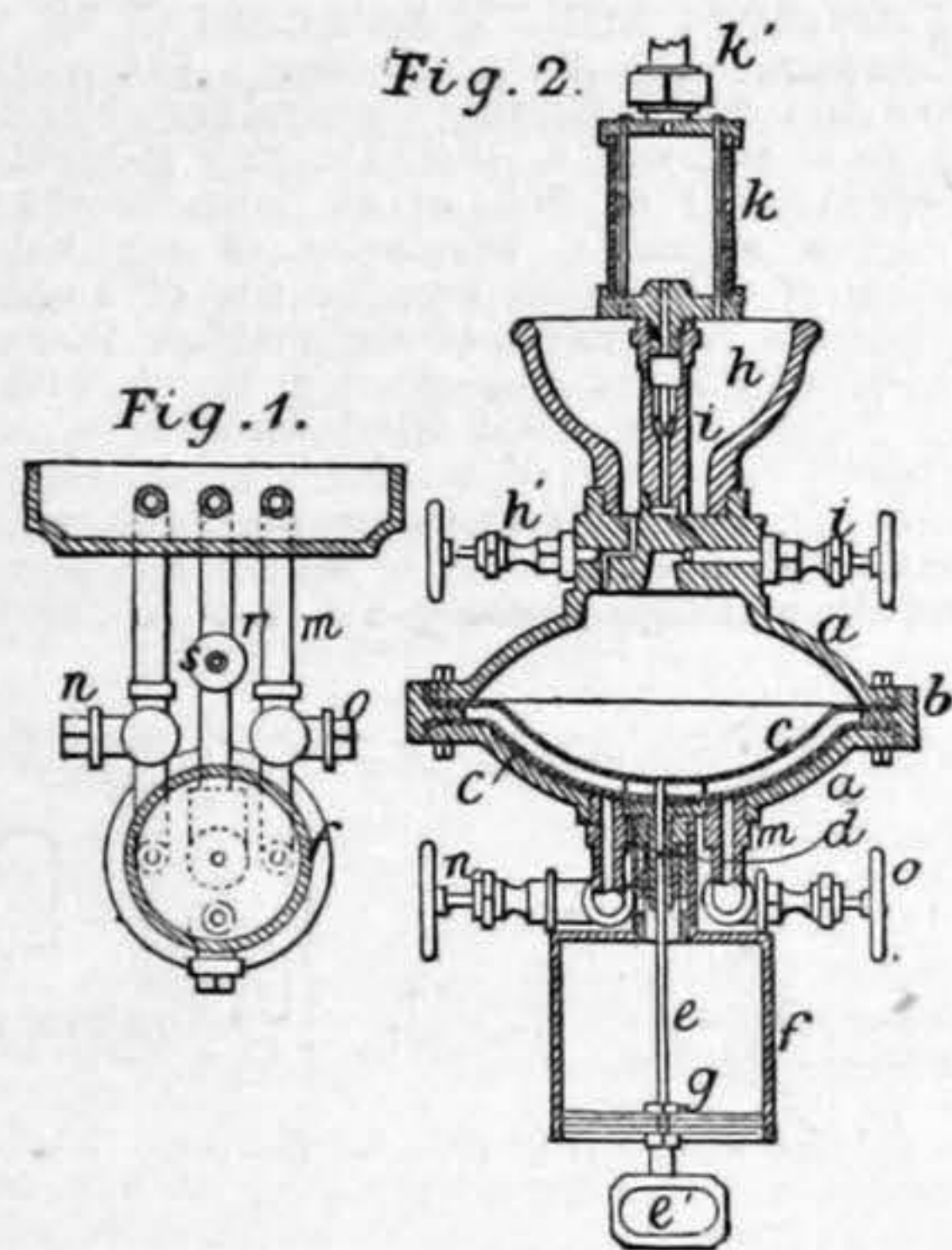
fed and discharged to dissolve the silicious, resinous, and glutinous portions of the wood. After the steaming and boiling are completed, the plant is passed between rollers and further disintegrated, and then mixed with wool for the purpose of being spun into yarn. Figs. 1 and 2 represent the boiler, and Fig. 3 a cock, shown also at *a* for exhausting the steam periodically. (March 30, 1880).

1306. Stoppers for Bottles and Jars: W. R. Lake, London. (F. Knoeller, Neulengbach, Austria.) [4d. 3 Figs.]—The stopper consists of a shaving of wood rolled into a conical form, and inserted into a metal capsule. The material of the capsule varies according to the liquid with which it will come into contact. (March 30, 1880).

1307.* Incubator: W. R. Lake. (H. W. Oxford, Chicago, U.S.A.) [4d.]—The incubator is formed with double walls of straw board packed with a non-conducting substance. The bottom is made of a coarse fabric to allow of free ventilation, and above it is placed a revolving table fitted with trays to hold the eggs, which can be removed through a doorway protected by a curtain. The heater consists of a treble-walled case, the inner wall forming a cylinder, in which are placed a series of vertical pipes communicating with a bottom plate and an upper plate. Within this cylinder is arranged a central pipe, which, like the vertical pipes, opens into a flame chamber. The hot air passes into the oven by means of a suitable pipe, and the products of combustion pass down between the cylinder and the casing, and out by another pipe. The lamp is fed from a fountain, which delivers the oil as required, being formed on the same principle as bird fountains. In the hot-air pipe is a valve controlled by an electro-

magnet, which shuts it when a circuit is completed by the expansion of a column of mercury in the oven above the point corresponding to the temperature required. (March 30, 1880).

1308. Lubricating the Cylinders and Valves of Steam Engines: A. M. Clark, London. (A. L. Harrison, Bristol, Conn., U.S.A.) [6d. 3 Figs.]—The lubricator consists of an oil reservoir divided by a single or double flexible diaphragm, and has an outlet at its upper side to the parts to be lubricated, and is fitted at its underside with connexions for a steam or water pipe; a rod is connected to the diaphragm, and provided at its outer end with a hand loop; a transparent chamber containing glycerine, and a vacuum chamber, whereby atmospheric pressure is obtained upon the diaphragm to feed the oil. Fig. 2 is a vertical section, and Fig. 1 a sectional plan. The oil chamber is formed of

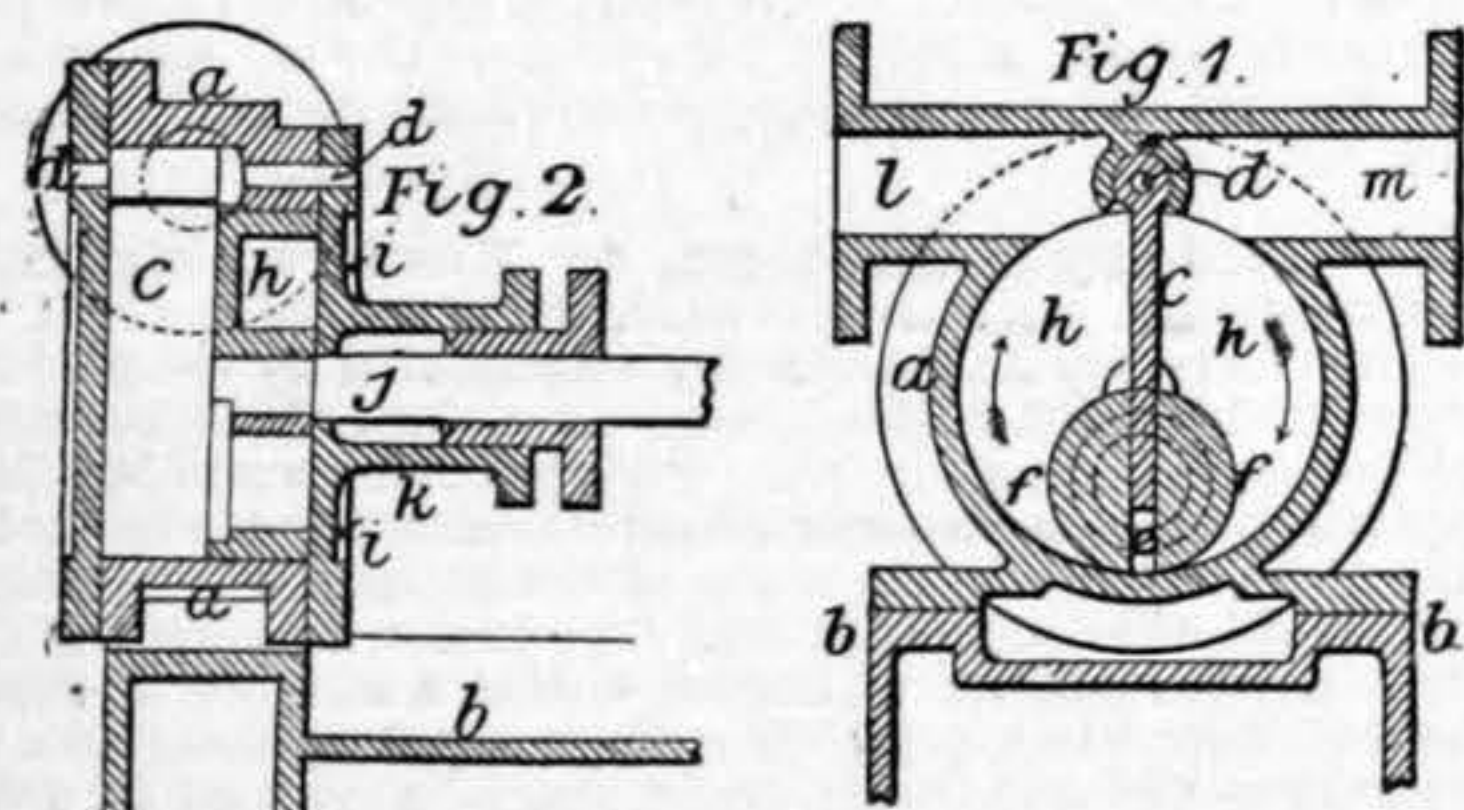


two discs *a a*, which are bolted together by a flange ring *b*. The flexible diaphragms *c c* are separated by the ring *b*, and clamped between the flanges of the discs *a*. The space between the diaphragms is filled with glycerine to prevent unequal stretching, and to equalise the pressure. A rod *e* is connected to the diaphragms, and passes through a packing nut and a cylinder *f*, terminating in a hand loop *e'*. The oil is first poured into a cup *h*, and the cock *h'* opened to allow it to enter the oil chamber, the diaphragm *c* being drawn down as shown. The reservoir being filled, the cocks *h'* *n* are closed, and *s* turned to connect the exhaust pipe *r*, see Fig. 1, with the cylinder *f*, and a cock *o* opened to admit steam by a pipe *m*. The diaphragms are balanced by the steam pressure, and the cylinder being exhausted above the head *g*, the atmospheric pressure beneath *g* forces the rod *e* and diaphragms *c* upwards, when the oil is forced through pipe *i* into a glycerine chamber *k* in drops at more or less frequent intervals, the flow being regulated by cock *v*. The oil passes up through the glycerine to tube *k'*, whence it flows to the cylinder, &c., to be lubricated. (March 30, 1880).

1309. Safety Pin Fastener: I. L. Pulvermacher, London. [2d.]—The appliance is designed to protect the wearer from injury from the points of pins. Its "essential features are hollow bolts." The specification contains no drawings, and is too intricate to be understood without such aid. (March 30, 1880).

1310. Manufacture of Sulphate of Ammonia: W. C. Young, London. [4d.]—Liquids containing ammonia in combination with sulphur are distilled, and the products passed through a furnace together with a current of air, whereby the sulphide of ammonia is converted into sulphate, and partly into sulphate. These are condensed, and heated air is forced through the solution, from which sulphate of ammonia is obtained by crystallisation. When the liquid under treatment does not contain sufficient sulphur, sulphurous or sulphuric acid is added at some part of the process, and the fixed ammonia is liberated by the presence of lime if necessary. (March 30, 1880).

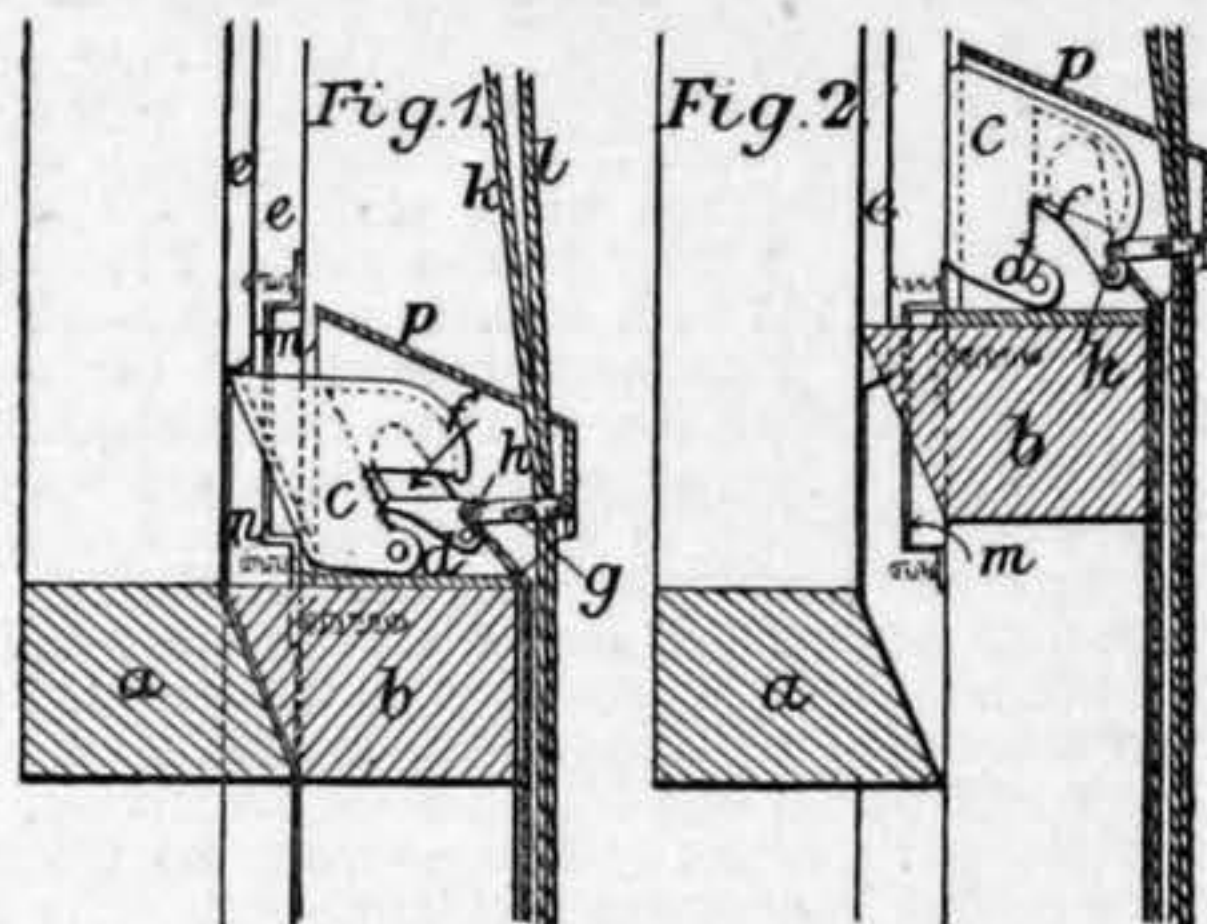
1311. Rotary Engine: S. Mellor, London. [6d. 2 Figs.]—The essential feature of novelty in this invention is the combination of a pendulous tongue, a circular block or piston, and a rotary disc, which revolves within a cylindrical chamber. Fig. 1 is a cross section and Fig. 2 a longitudinal section; the cylinder *a* is bolted to a bedplate *b*, and is closed by covers *i*, one of which has a stuffing-box *k*, through which passes the rotary driving shaft *j*. A pendulous tongue *c* is centred above the cylinder at *d*; the end of the tongue passes through a slot *e* in the piston block *f*. The piston block has a circular stem which takes into a recess in the rotary disc *h*. Steam is admitted through the passage *m* and presses on the piston block *f* and tongue *c*; the disc *h*, and with it the shaft *j*,



is thereby caused to revolve; the piston block in its revolution round the cylinder, slides up and down on the tongue *c*, which vibrates to and fro within the cylinder. When the piston block has passed the mouth of the passage *l* the exhaust steam escapes. Instead of using the apparatus as a rotary engine it may be imparting rotary motion to the shaft *j* be arranged as a pump, in which case the passages *m* and *l* become the suction and delivery pipes, valves being placed in suitable positions to prevent the return of the water. (March 30, 1880).

1312. Apparatus for Securing Window Sashes, &c.: W. P. Bonwick, London. [6d. 15 Figs.]—Fig. 1 shows the meeting rails of the window with the apparatus in the locked position and the window shut. Fig. 2 is a similar view with the apparatus unlocked and the lower sash open; *a* and *b* are respectively the meeting rails, of the upper and lower sash, *c* is a fastener mounted and turning on the pin *d*, *e* is a rack fixed to the stile of the upper sash in which the fastener *c* engages by its own weight, and wherein it is locked by the prop *f*; *g* is a slotted pull, forked at one end so as to embrace the prop *f* to which it is attached by a pin *h*. The pull is supported in its proper position by a pin passing through its slot, and which is fixed in the case. Through a

hole in this slotted pull pass the cords *k* and *l* for closing and opening the upper sash. On pulling outwards either of these cords at a point below the fastener the slotted pull *g* is drawn back, and so disengages the prop *f* from the serrated portion of the fastener *c*. By continuing to pull the cord until the prop has disengaged the fastener from the sash, and also pulling its fellow cord on the opposite side of the window, the upper sash is opened or closed; a recess *m* is made in the parting bead between the two sashes; the guide *n* of the fastener may enter this recess

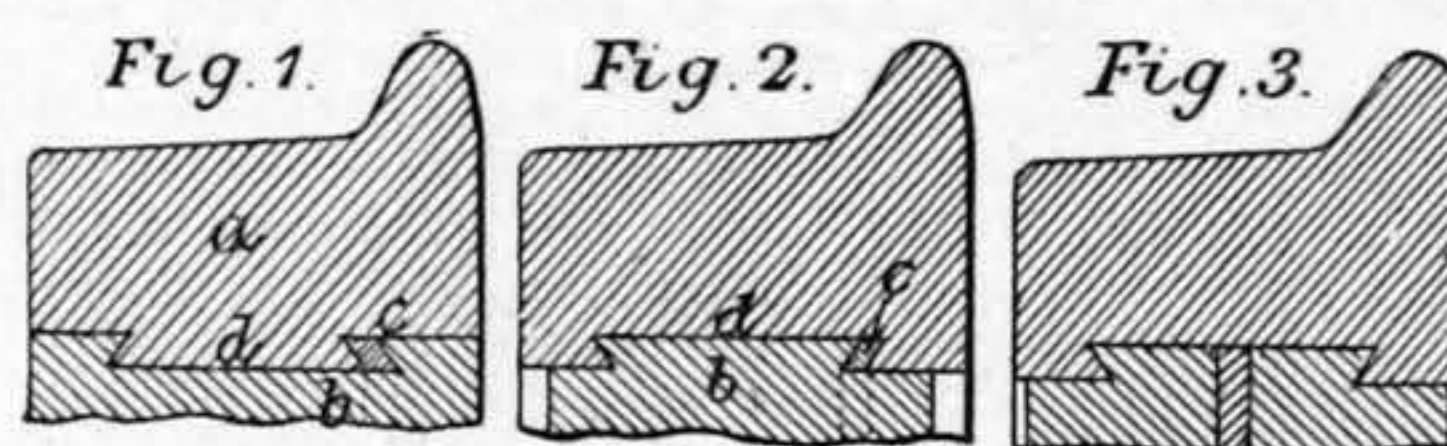


when the fastener itself projects into the grooves *e* of the upper sash. In this position the lower sash is locked down closely independently of the upper sash by the guide of the fastener being arranged to catch against the top of the recess *m*; *p* is a cover or case to the apparatus in order to prevent its being tampered with. The specification contains detailed views of the various parts of the appliance. (March 30, 1880).

1313. Hot-Water Heating Apparatus: J. McIntyre and S. Saunders, Manchester. [2d.]—Refers to hot-water apparatus for heating rooms, &c., where the boiler cannot be conveniently placed at a sufficiently low level in the building to be heated. The pipe through which the hot water passes from the boiler ascends to some distance above its level, and then descends to the lowest position of the circulating pipes which are placed below the level of the boiler and pass back to the boiler. With the ascending pipe is jointed another called the "escape pipe," having its outlet higher than the highest part of the ascending pipe and discharging into the atmosphere or into a cistern. The circulation is obtained by the expansion of the water in the ascending pipe. (2) In apparatus for heating water for baths, &c., two boilers (or one with a division) are heated by one fire. The water-heating boiler has hot and cold water cisterns arranged in the ordinary manner. (3) Combines the arrangements described under (1) and (2), the escape pipe passing into the hot-water cistern. Taps or cocks may be used with the combinations (1) and (2), so that both boilers, or both divisions of one boiler, will act as water heaters, or they may be arranged to regulate the warming temperature. (March 31, 1880).

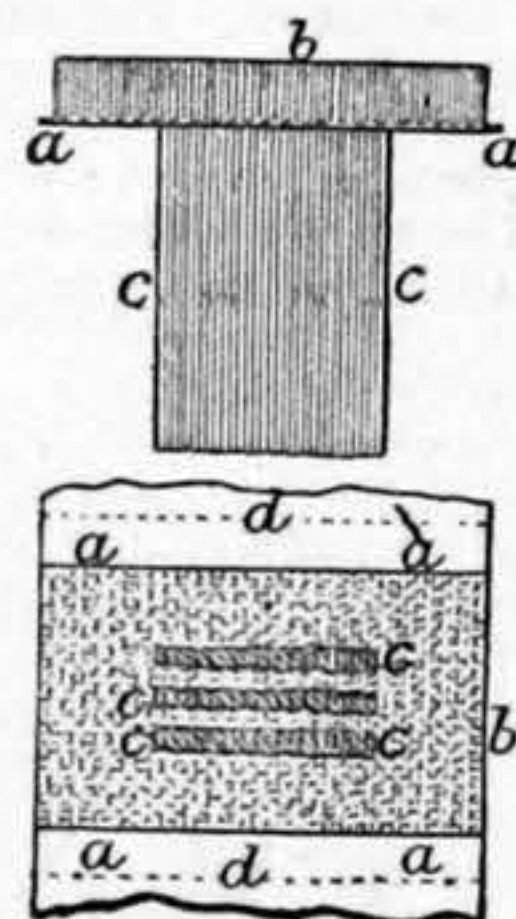
1314. Adjustable and Convertible Chairs: A. Bonnemaison, Paris. [2d.]—This invention relates to chairs in which eight different degrees of inclination may be given by pressing upon a stud and by a fixed stop arresting the moving parts either at the beginning of the movement, or in any of the various positions which the parts may assume. (March 31, 1880).

1315. Wheels for Railway Carriages, &c.: F. C. Glaser, Berlin. (G. Dronen, Utrecht.) [6d. 3 Figs.]—Relates to the method of forming and attaching wheel tyres to wheels. The tyre is formed of straight bars, having a recess or groove *d* throughout its length. The wheel centres have a corresponding projection *b* around their peripheries, but of less width than the



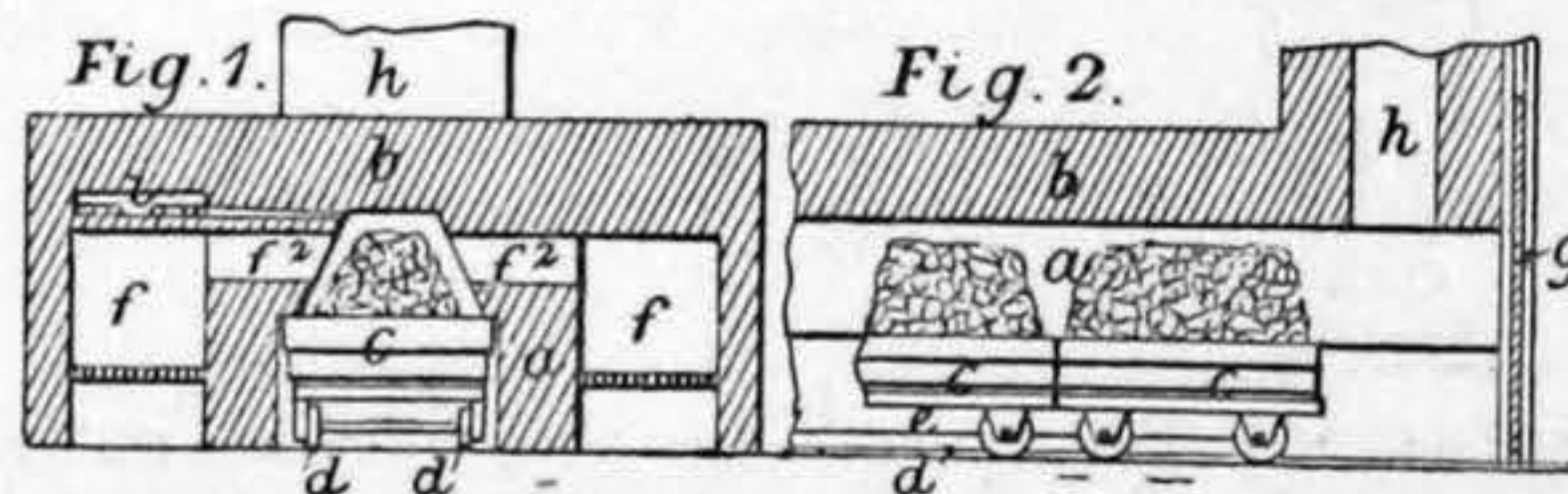
recess. The tyres are bent round the centres and the ends butt against each other. The intervening space between the recess and the dovetail is filled in with molten metal *c*, by which means the tyre is firmly attached to the wheel. In some cases the recess is formed in the periphery of the wheel and the dovetail on the tyre. (March 31, 1880).

1316. Lubricating Pads or Axle-Box Floats: B. J. B. Mills, London. (Edward Fraulob, Chemnitz.) [6d. 5 Figs.]—The pad is formed from lengths of fabric provided with the required pile surfaces on both sides, and cut into the desired



lengths. The drawing shows a side view and a plan. A length of fabric *a* is manufactured with the required pile surfaces *b* and *c*, and is afterwards cut across the lines *d d*, thereby forming so many distinct lubricating pads. (March 31, 1880).

1317. Burning Limestone, &c.: A. McAra, Glasgow. [6d. 5 Figs.]—The improvements consist in conveying the limestone through the kiln or chamber wherein it is burned,



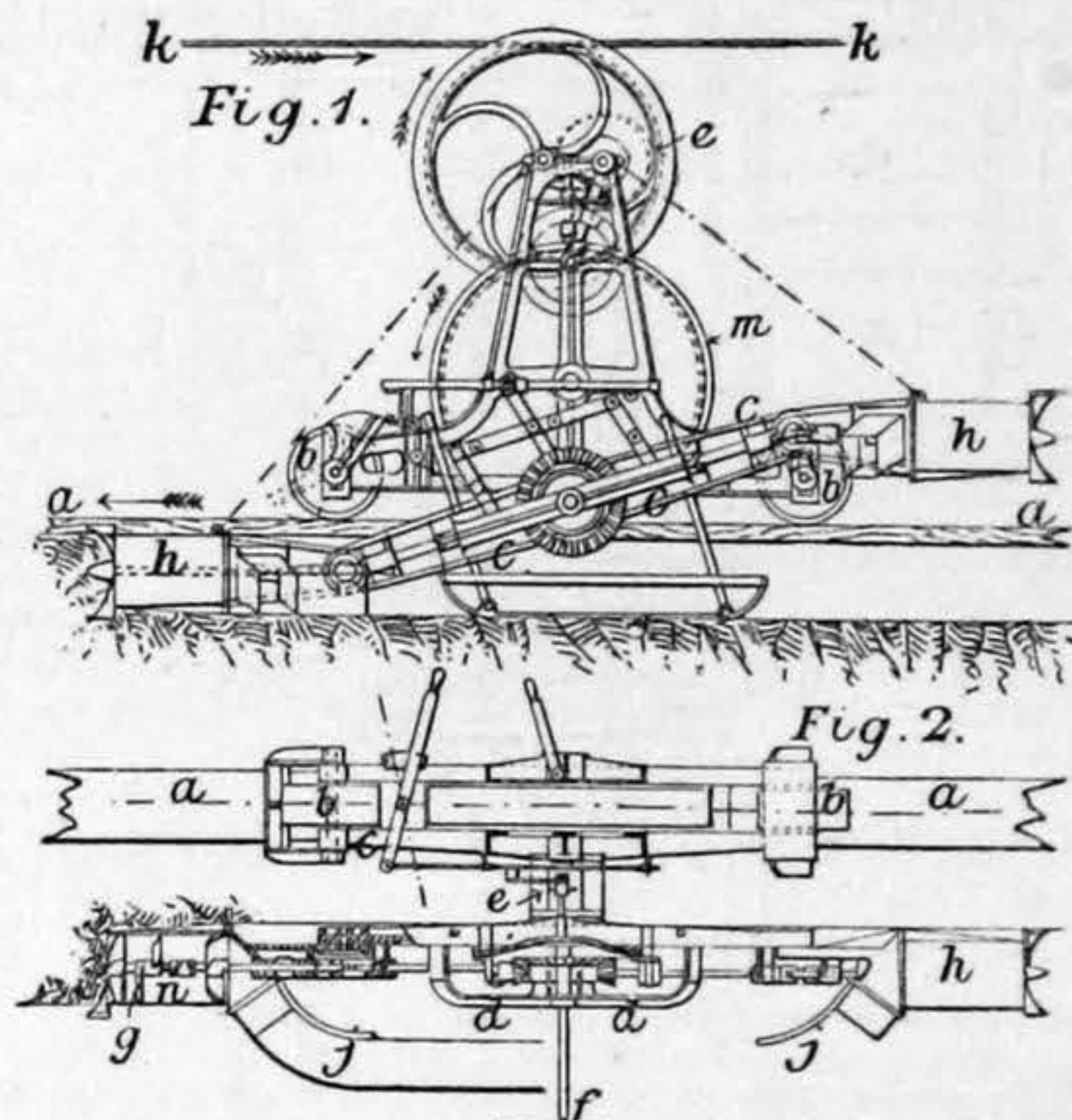
towards the fire by which the burning is effected, upon a travelling bottom in the kiln or chamber. The apparatus consists of a kiln formed to receive a train of wagons, the upper surfaces of which form the movable floor of the kiln. Fig. 1 is a sectional elevation of the kiln, showing an end view of one of the wagons, Fig. 2 is a

side elevation. The kiln consists of side walls *a* and a roof *b*, the lower part is recessed for the wagons *c*, the top of which are formed of fireclay set in iron trays mounted upon wheels, and running on rails *d* at the bottom of the kiln. The kiln is, preferably, about 60 ft. in length, and the surfaces of the series of wagons *c* form the travelling kiln bottom. The wagons are drawn through the kiln by a chain *e*, operated by hauling apparatus. The limestone is loaded on the wagons and passes slowly towards the furnaces *f f*. The products of combustion pass by the passages or flues *f'* into the kiln, and over, and amongst the limestone, and (the doors *g* at either end being closed) the said products escape by a flue *h*. Superheated steam may be introduced into the kiln by a steam pipe into a coil of piping *i* contained in the roof of the furnace, and furnished with a nozzle as shown. As the wagons are withdrawn they are unloaded, and run back to the entrance of the kiln to receive a fresh supply. (March 31, 1880).

1318. Treating Materials for the Manufacture of Paint: J. C. Martin, London. [2d.]—Various pigments are treated previous to their being ground with oil for increasing the body of the resulting paint, by mixing or grinding them with hydrated silica or hydrated silicate of magnesia, mixed with water or in a dry condition, either alone or combined with other substances, such as form stearite or soapstone, talc, asbestos, or similar material containing fixed water or water of hydration. The hydrated silica is prepared by precipitating it from a solution of an alkaline silicate by means of an acid and afterwards slowly drying it. (March 31, 1880).

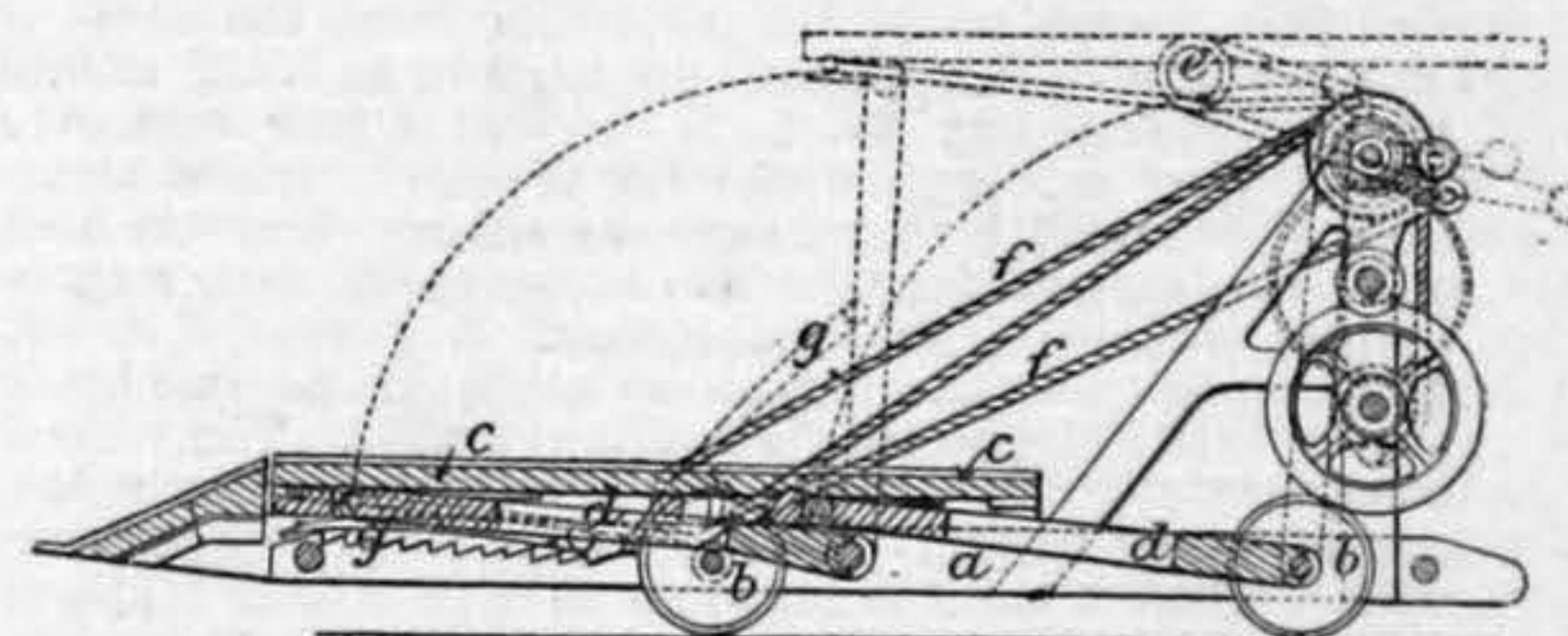
1320. Metallic Pistons, &c.: W. Potter, Woolwich. [2d.]—A coil of steel or other suitable metal is fitted within the expanding rings of the piston, forming when compressed a cylinder with straight ends and bevelled off on the parts which come in contact. Inside this coil is a metal ring fitted on the inside with springs, and prevented from turning by studs passing into recesses in the ring. Another smaller and concentric ring is fitted to the piston, the space between the two rings being occupied by the aforesaid springs, and another set of springs is fitted to the inner ring. The inner surface of this ring is formed with a circle of teeth, gearing with a pinion or pinions by which the ring is turned, thereby causing the springs on this ring to act on the springs of the outer ring, forcing it outwards and causing the packing rings to expand. The pinions are prevented from turning by a detent catch applied thereto. (March 31, 1880).

1321. Digging and Shaping Peat, &c.: H. Simon, Manchester. (C. Schlickeysen, Berlin.) [8d. 13 Figs.]—The apparatus is arranged to travel along the ground, and is operated by the action of a rope driven by an engine from a distance. A furrow is made by means of revolving cutters, which lay the excavated material in a continuous column by the side of the furrow. The cutters are mounted at the end of an arm, and are driven by gearing so arranged that the depth of the furrow can be varied. Two sets of cutters are mounted at opposite ends of the lever, so that the apparatus can be made to operate in either direction. On the ground are laid planks *a*, on which the apparatus travels in the direction shown by arrow; *b b* are steadying wheels. A double lever *c c* has a projecting bracket *d*, through which, and through sleeve *e*, passes spindle *f*, which operates the gearing for revolving the cutters *g*. The gearing is provided with clutches and levers for altering or stopping the motions. As the apparatus is drawn forward by the action of the rope the cutters revolve and throw up the material at the side of the furrow which they form. The cutters are enclosed in a casing *h*, which terminates in guide *j* so that the material cut passes through the casing, and is guided to the side of the furrow. The rope passes around a wheel, and by means of pinions and gearing gives motion to the main wheel *m*



of the apparatus. If the machine is only required for excavating, the cutters may be removed and a disc or drum on which are projecting knives substituted, which will deposit the material loosely on the ground. (March 31, 1880).

1322. Raising and Lowering Loads or Weights: H. E. Newton, London. (J. P. Poirot, Paris.) [6d. 5 Figs.]—The invention is chiefly suitable for raising weights in places where it is not convenient to employ ordinary winding tackle. The illustration shows the apparatus in its lowest position, the dotted lines show it raised. The main framework *a* is mounted on runner wheels *b*, so that the entire apparatus may be moved to any required position. The weight is placed on a platform *c*, which is jointed to levers *d d*. At each side of the platform are pulleys around which pass the hauling ropes *f f*, which are operated by the winding gear at the end of the apparatus. When the ropes are wound up the levers *d* cause the platform to rise parallel with



the main frame. Jointed to the front levers *d* are pawls *g* connected together by a tie-rod. When therefore the load is being lifted the pawls engage with the teeth of a fixed ratchet, and the

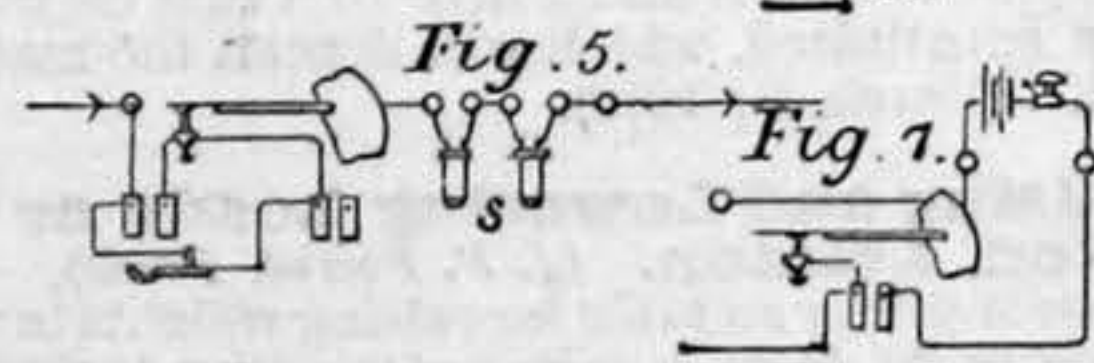
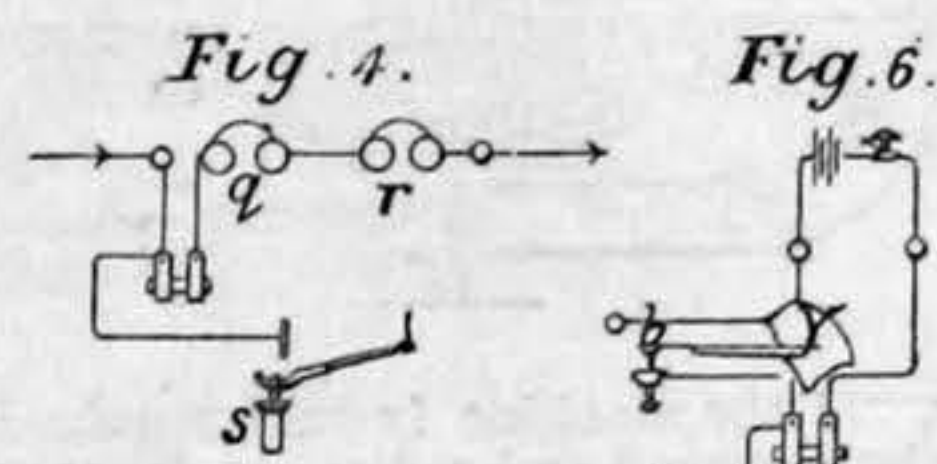
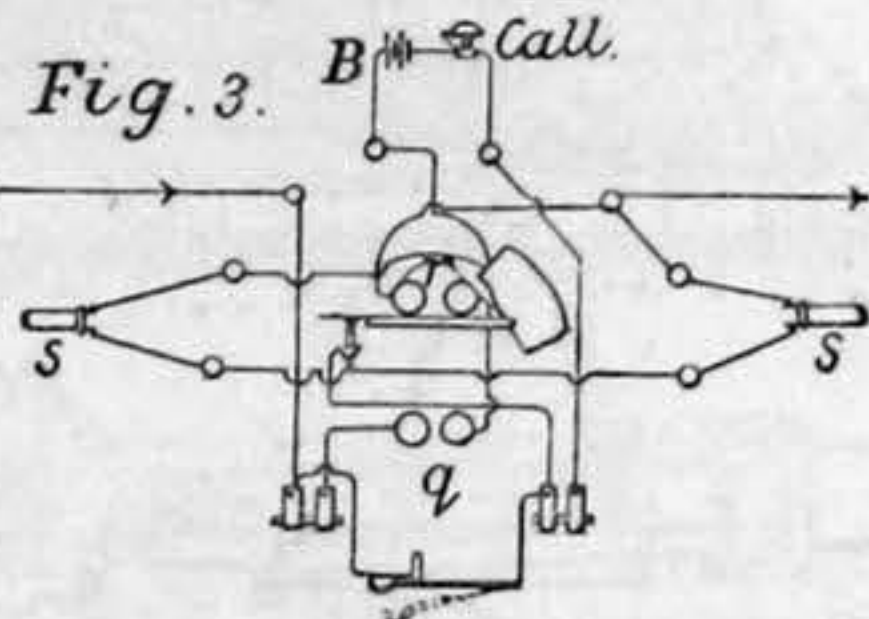
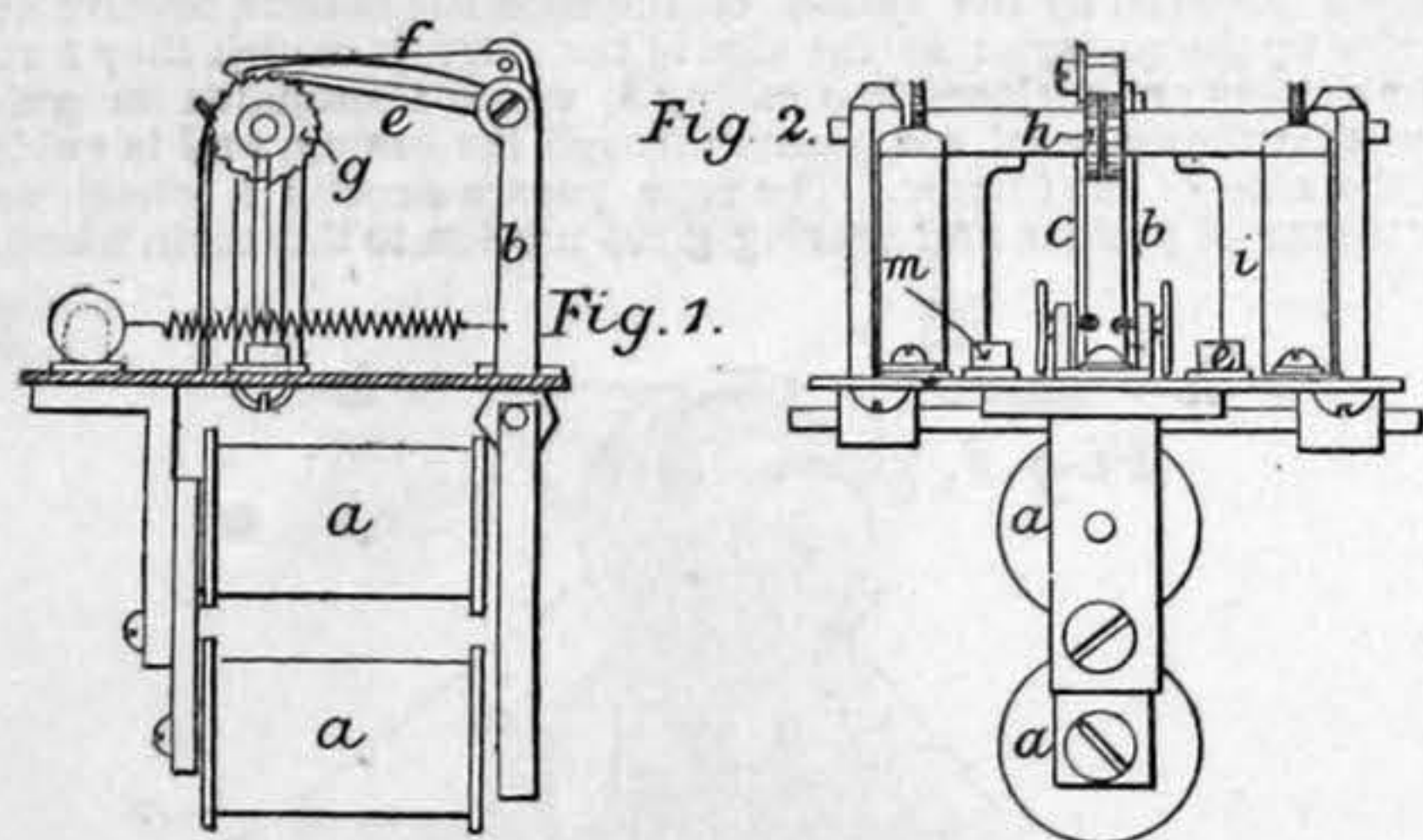
load is retained in any position, and assured against falling should the hoisting ropes or chains break. (March 31, 1880).

1323.* Apparatus for Saving Life at Sea: A. Graf, London. [2d.]—Travelling bags are formed of two parts buckled to the breast and back when required, by straps, and constructed with separate air-tight chambers. The apparatus may be made of sheet metal or gutta-percha, and provided with handles for carrying about. Openings in the upper ends of each half are closed by covers with lock-up handles for enclosing air. (March 31, 1880).

1324. Artificial Manure: T. Croysdale, Whitley Bridge, York. [4d.]—This relates to obtaining a dry pulverulent manure from shoddy, woollen, or silk waste, and sulphuric or other mineral acid mixed in a steam-heated vessel such as described in Specification 5061 of 1876. The material to be operated upon, becomes heated and mixed by the revolving motion of scrapers and stirrers radiating from the hollow spindle of the cylinder. The contents of the cylinder are discharged through manholes. A proper temperature is readily insured by the use of steam as a heating medium, and every portion of the contents is equally exposed to this regulated temperature. The material is dried and reduced to powder, and may be used either alone or mixed with other substances. Phosphoric acid may be substituted for the sulphuric acid for producing a phosphatic manure. (March 31, 1880).

1327.* Blinkers for Horses, &c.: W. R. Lake. (C. F. Eissbrückner, Geestemünde, Germany). [2d.]—This specification describes a peculiar arrangement of horse blinkers, each of which is provided with a cavity larger than the animal's eye, and an elastic rim surrounding the eye to prevent pressure thereon. By pulling a cord communicating with a lever acting on the blinkers they are forced into such a position as to exclude the power of vision, and are so retained by a spiral spring. (March 31, 1880).

1328. Telegraphic and Telephonic Apparatus: W. R. Lake, London. (E. Davis, Cambridge, and P. A. Doud Boston, Mass., U.S.A.). [1s. 39 Figs.]—Relates to the giving of visible and audible signals by means of an electric current by the combination of two or more instruments in one circuit, each instrument consisting of an electro-magnet with two or more armatures, and mechanism actuated by the movement of the said armatures, or by clockwork controlled by one of the armatures, the said mechanism being so contrived that any one of the instruments can be so set as to sound a local alarm on any one of a number of instruments on a circuit without causing the other instruments to signal. In one form of instrument one "heavy" current, one light current, and one heavy current sent in succession will so move the parts of one of the instruments as to sound the alarm, but will not move any other instrument in the series, each instrument requiring a particular arrangement of strong and weak currents to affect it. The instrument consists of an electro-magnet with two armatures, one held up by a weak spring and one by a strong one, so that one responds only to a light current while both are moved by a strong one. The motion of each armature will move a ratchet wheel one step by a pawl, and an insulated leaf spring is so arranged with reference to each wheel that metallic contact is made with each wheel at a certain point in its revolution, these springs being the terminals of a local circuit. The instrument at station



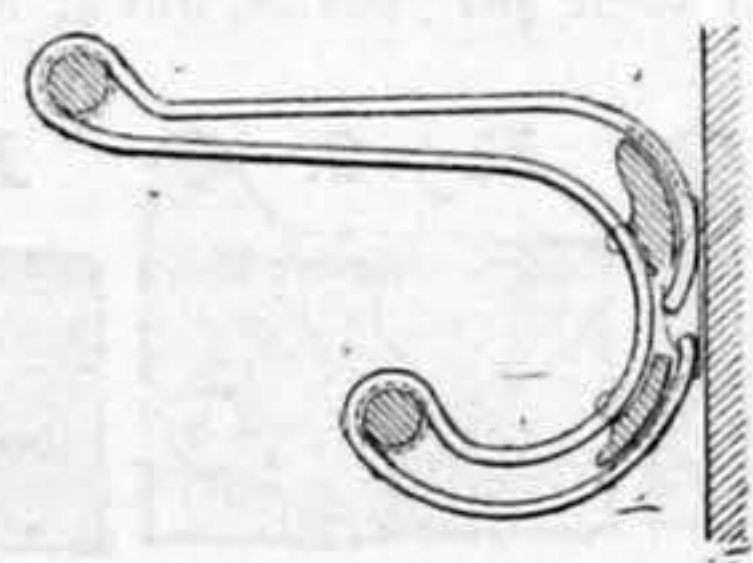
No. 1 of circuit No. 1 has its wheels so formed that when it is "at unison" the leaf springs are both out of metallic contact with the wheels; if station No. 1 of circuit No. 1 is to be called from the central office one heavy current is sent over circuit No. 1, and both armatures are moved and both wheels revolve one step. The wheels are so shaped that a metal projection from the wheel of the heavy current armature is brought so close to its leaf spring that another motion of the armature will bring it into contact with that spring, while the projection from the wheel of the light current armature requires two motions to bring it into contact with its leaf spring. A light current is now sent over circuit No. 1, thereby moving the wheel of the light current armature, and this is followed by one heavy current which moves both wheels, and brings both projections into contact with their respective leaf springs to establish the local circuit. Stations 2, 3, 4, &c., have similar instruments, but differently adjusted, no two being alike, so that only one station is ever called at a time. The wheels may be brought into unison, that is, to the zero or starting-point, in a variety of ways, among which the following is preferred: In each ratchet wheel a tooth is cut away to form a blank space. The pawl of the strong current armature works upon both wheels, but the pawl of the light current armature has two hooks upon it at different levels, one of which works one wheel only, but when it rests in the blank space of that wheel, the pawl falls low enough owing to the shape of that blank space to bring the other hook into gear with the teeth of the heavy current wheel, and this heavy cur-

rent wheel is revolved by the light current pawl until the hook rests in the blank space of that wheel also, the heavy current pawl, extending across both wheels, being in readiness to move them. After a station has been called a number of light currents are sent along the line to put all the instruments to zero. Fig. 1 is a side view of the instrument and Fig. 2 is a front elevation. From these two figures the general arrangement will be understood; *a* is the magnet *b* the armature, *c* the pawls, *d* the wheels. Each wheel is shown with an arm *i* projecting from its shaft which comes in contact with one of the blocks *l* *m* of insulating material, in which are the metal pieces *n* *o* included in the local circuit *p*, so that when the arm *i* is in contact with the piece *n* and the arm *k* with the piece *o*, the local circuit is complete. Another form of the said instrument consists of a notched wheel worked by a step-by-step motion or by clockwork. A third form consists of two armatures, each controlling a wheel, but both wheels on the same shaft. These armatures may be both permanent magnets, so arranged that a positive current will attract one of them and a negative current the other. Secondly, the invention relates to a system of circuits in which the novelty consists in the arrangement of a series of calling instruments and a series of telephones in a single circuit so that the telephones are all cut out of the circuit when on their holders, and each telephone is brought into the circuit by cutting out its calling instrument by means of a suitable switch operated by putting the telephone on and taking it off its holder. Thirdly, the invention relates to a secret system whereby no telephone can be used until its calling instrument is properly set. The wire from the telephone to the main line is connected to an insulated spring on the instrument, and a wheel comes into contact with it when the instrument is set for calling, and this contact completes the connexion to the main line. The diagrams 3 to 7 illustrate this secret system, and also the signalling by a local circuit, and the electrical connexions of one of the instruments alluded to above. In them *q* *r* are the coils of the magnet, *s* is the telephone, but the various courses possible to currents under different circumstances are too intricate for description. Fourthly, the invention relates to a central switch for connecting any two or more of a large number of circuits by a combination of a switch board and movable pieces described and illustrated at great length. (March 31, 1880).

1329.* Eliminating Phosphorus from Iron in Bessemer Converters: W. R. Lake, London. (Emil and Eduard Pirath, Frankfurt-on-the-Main, Germany). [4d.]—Instead of lining the converter with basic bricks to dephosphorise the iron, the inventor introduces finely-divided magnesian salt or soda, either through the ordinary blast pipe or through special ones at each side, or by a separate arrangement. The powder is fed into the blast pipe by a hopper and shaker, or by a creeper. (March 31, 1880).

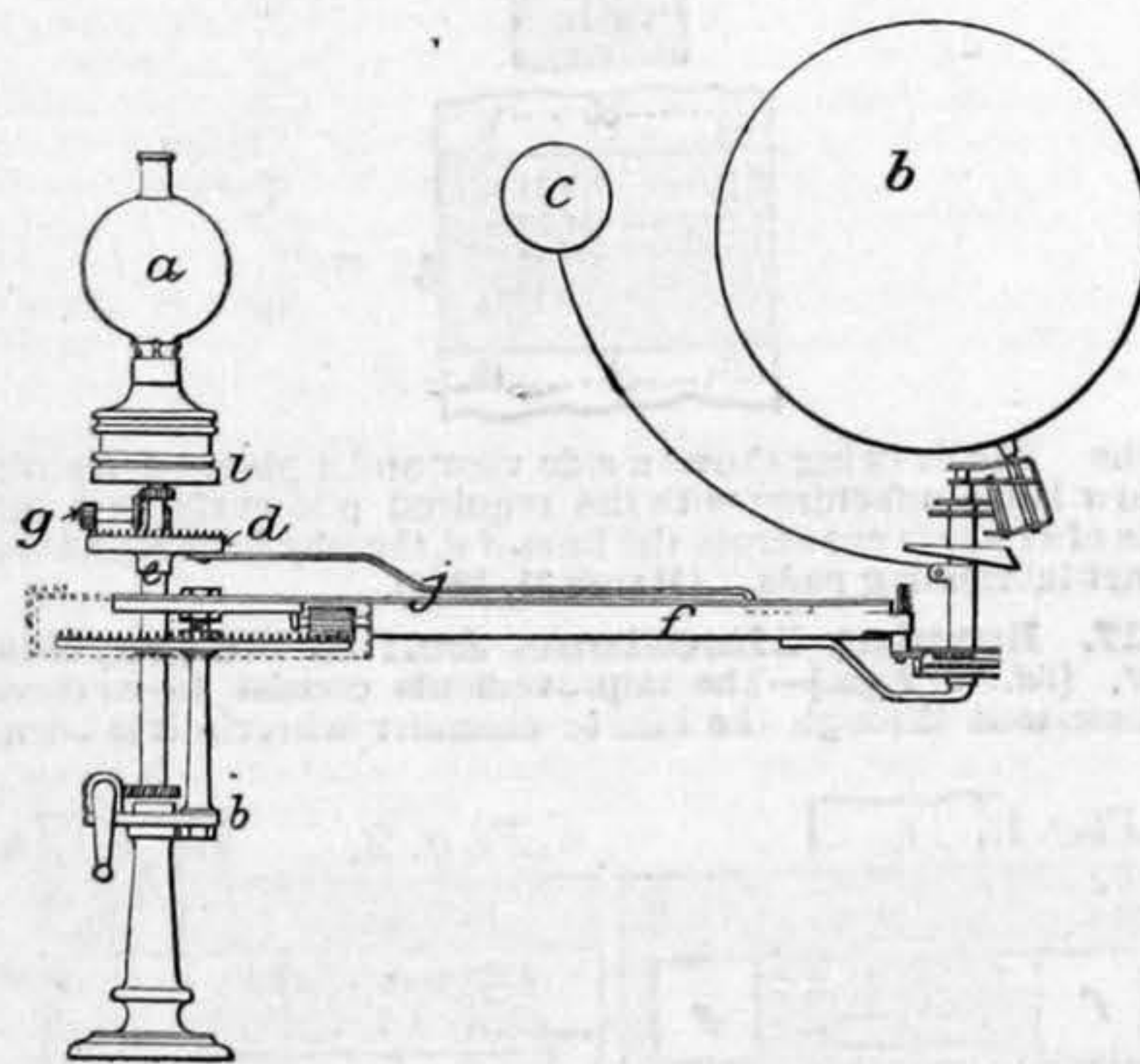
1330.* Blast or Exhaust Apparatus for Locomotives: W. R. Lake, London. (J. E. Martin, Concepcion, Chili). [2d.]—Two blast pipes are employed, that is to say, a double pipe combined with a single pipe of larger diameter, so that the double pipe discharges within the single pipe; the lower end of the double pipe is connected to the exhaust pipes as usual. The upper end is secured to, and discharges within, the base of the single pipe. The following advantages are claimed: (1) The steam will not "blow over" from one cylinder to the other; (2) the effect on the fire is very mild, so that the gases are not drawn away unconsumed, and sparks and cinders are not thrown from the chimney. (March 31, 1880).

1331. Improvements in Clothes Hooks: W. A. Barlow, London. (P. Miles, Brooklyn, New York). [6d. 11 Figs.]—The body of the hook consists of a wire bent into suitable shape, and with or without grooved balls as terminations. The hook is attached to horned brackets provided with grooves for the reception of the wire, the horns of the bracket being of such a form as



to materially strengthen the hook. The diagram represents a side view of this improved hook, the bracket being made to screw against a wall. Other forms are described in which the free end of one of the wires is turned back and screwed, and in which the bracket is provided with a screw projecting in its rear for attachment. (March 31, 1880).

1332. Orreries or Planetary Machines: J. H. Morley, Nottingham, and R. C. Hopper, Birmingham. [6d. 3 Figs.]—This is an apparatus to be employed for educational or illustrative purposes for showing the motion of the earth, and of heavenly bodies around the sun: *a* represents the sun, *b* the earth, and *c* the moon. For the purpose of showing the revolution of the sun on its own axis once in every twenty-six days, a crown wheel *d* having eighty-four cogs is attached to a hollow spindle, upon which it revolves whilst the radial arm *f* makes one revolution. The crown wheel *d* drives a twelve-toothed pinion *g*, on the spindle of which is a pinion, which gears with a

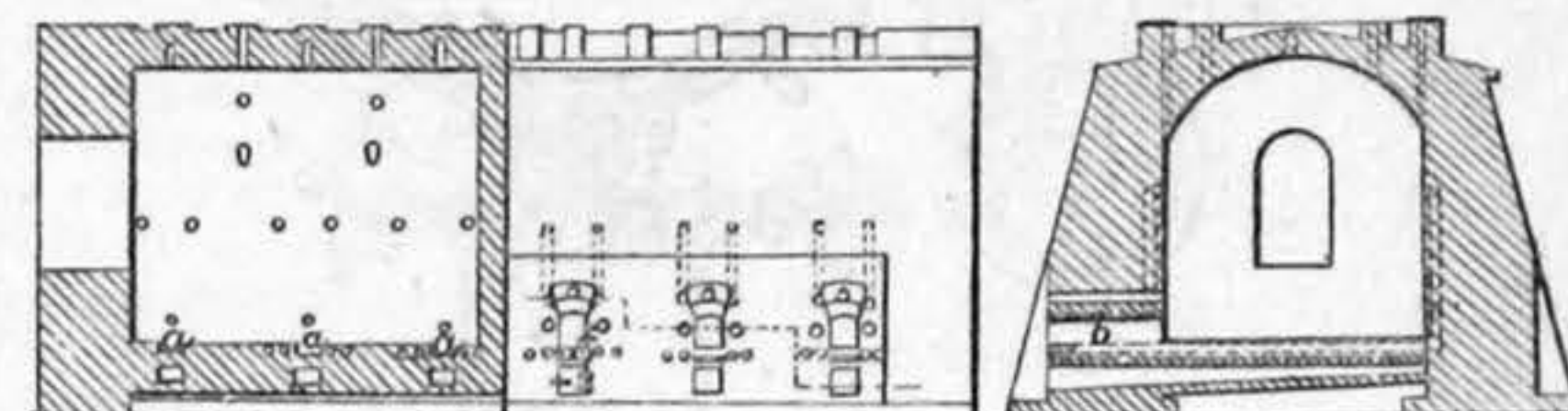


toothed wheel on the underside of plate *i* which serves as the lamp stand representing the sun. The sun *a* thus has fourteen revolutions to one complete revolution of the arm *f*. The link piece *j* actuates the arm *f*, which receives the same number of revolutions as the wheel *d*. The earth *b* can be revolved on its own axis, and the moon *c* around the earth by the bevel gearing spindles and pinions shown. The earth globe *b* is hollow, and is provided inside with magnets for the purpose of attracting and holding at any

required point of the earth's surface a model image or object to illustrate the change of position of bodies upon the earth's surface and the law of gravitation. This latter is claimed as a novelty, as is also the arrangement of the apparatus. (March 31, 1880).

1334.* Cocks or Valves: J. C. Etchells, Newton Heath, Lanc. [2d.]—An annular or hollow tapered socket rises up inside the cock or valve body nearly to the top, and on its outside the corresponding tapered plug or valve is mounted for opening and closing the necessary orifices by spindles. Around the socket is a jacket or passage through which fluid passes from the inlet side, thence through openings formed in the socket and plug or valve to inside of the socket, and then through a passage "communicating with the open bottom of the socket with the outlet side of the cock or valve body or vice versa." (March 31, 1880).

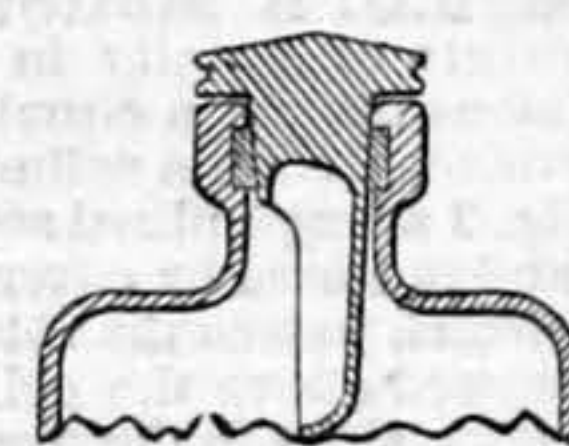
1335. Furnaces and Fireplaces: G. W. von Nawrocki, Berlin. (R. Müller, Berlin). [8d. 18 Figs.]—Has reference to a method of effecting the production and combustion of gaseous fuel without a separate gas generator, whereby an incandescent layer of fuel, or an incandescent porous grate is caused by a regulated admission of air to effect, first, the distillation of the volatile constituents of a charge of solid fuel, and then the conversion of the residue thereof into combustible gases, which are immediately burnt with heated air admitted a certain distance from the layer of solid fuel. Fig. 1 is a side view partly in section of a brick kiln constructed according to this invention, and Fig. 2 a cross section of the same. The oven is divided in two chambers, each of which contains three firing places *a*, and three charging passages *b*, in which, close to the fire-



door *d*, is a horizontal partition *f*, by which the charging opening is divided into two parts. The lower opening is closed by a double slide *g*, and the upper one by the fire door *d*. The slide *g* admits air to the fuel on the grate after the conversion of the volatile constituents. In the proximity of each fire is a group of openings to lead the necessary air into the combustion chamber, the four lower ones passing along the fireplace to the back wall of the kiln, and thence into the combustion chamber. After the preliminary firing of the bricks, which takes from 24 to 48 hours, is completed, the combustion of the gaseous fuel is commenced, the volatile portions being burnt first, and afterwards the carbonaceous constituents. This system of firing may be employed in brick kilns, lime kilns, porcelain ovens, bakers' ovens, and steam boilers. (April 1, 1880).

1337. Emery Wheels and other Grinders: J. Pearson, J. Whitestone, and R. R. Gubbins, London. [4d.]—Hot melted glue or gelatine mixed with a strong solution of tannic acid in methylated spirit or water is poured upon and thoroughly incorporated with emery powder or sand which has been previously heated to about 212 deg. Fahr. This mixture is placed in an iron mould (which may be lined with non-adhesive substance) wherein it is first subjected to pressure and afterwards baked in an oven at a temperature of between 212 deg. and 300 deg. Fahr. until it is hard, when it is removed from the mould and again baked. The skin of cementing material is then removed from its surface by a diamond tool or otherwise. The proportions of the different materials are preferably as follows: by weight, 27 parts of glue or gelatine, 23 parts of tannic acid, and 600 parts of emery powder. The quantities of water and methylated spirit used to reduce the glue and tannic acid should be, as small as possible. (April 1, 1880).

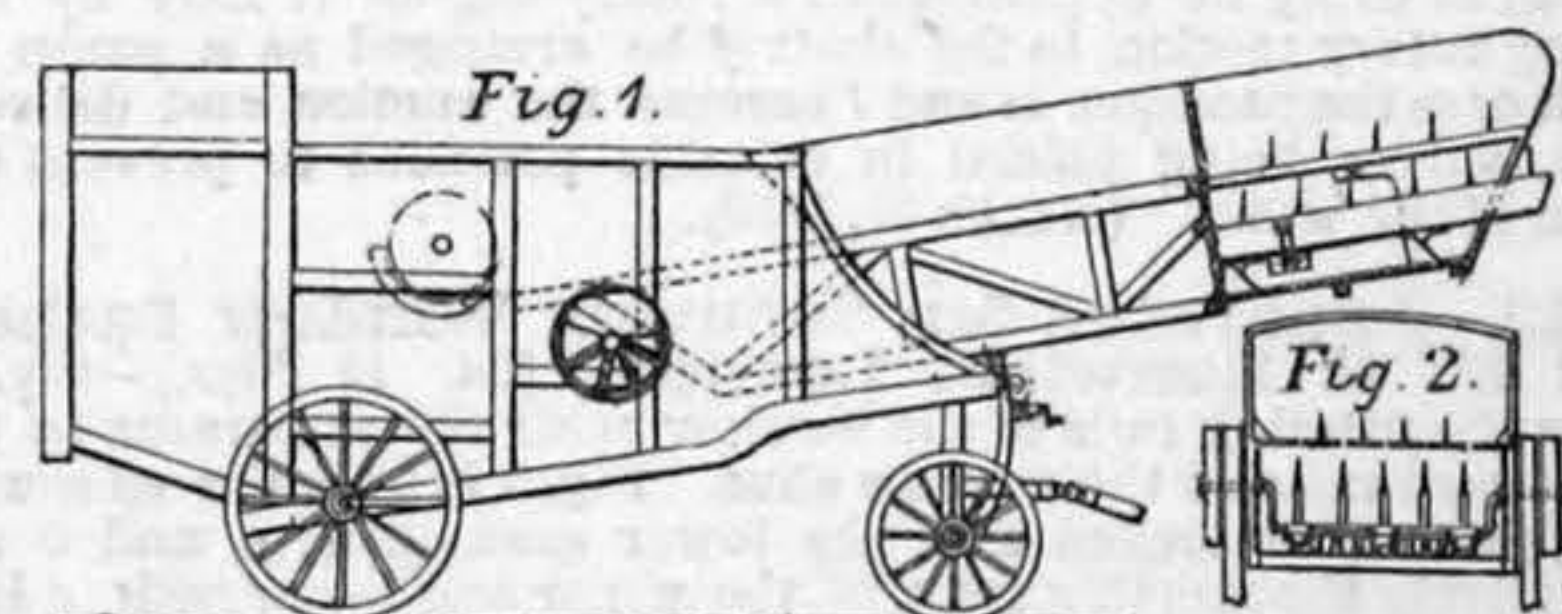
1338. Stoppers for Bottles, &c.: F. W. Durham, New Barnet. [6d. 6 Figs.]—The improved stopper is essentially designed to serve for measuring out definite quantities of the contents of a vessel, such as doses of medicine. The stopper is made to extend some distance down the throat of a bottle and is furnished



with a cavity of such capacity as to hold the required measure. For powder the cavity is made in the form of a scoop, as shown in the illustration. For measuring liquids the lower part of the stopper is hollow, a hole in the side near the top admitting the liquid. Several forms of this stopper are described and illustrated. (April 1, 1880).

1339.* Rotary Induction, or Electric Motor: J. C. Mewburn. (W. de Fonvielle, Paris). [2d.]—Consists in employing the rotary action directly engendered by the passage of an interrupted current in the pressure of a piece of magnetic metal capable of moving round an axis. The applications of this principle are applied either as a motor or scientific instrument. In the latter case the motive part may be enclosed in a glass or other vessel full of air or liquid or exhausted of air. The motor is composed (1) of a galvanometric frame on which are wound a number of turns of insulated electric wire, (2) of the motor proper mounted on a pivot in proximity to the said frame, (3) of magnets grouped in position around the motor. (April 1, 1880).

1340. Thrashing Machines, &c.: C. Middleton, East Dereham, and P. Everitt, Great Ryburgh. [6d. 3 Figs.]—Consists substantially in constructing thrashing



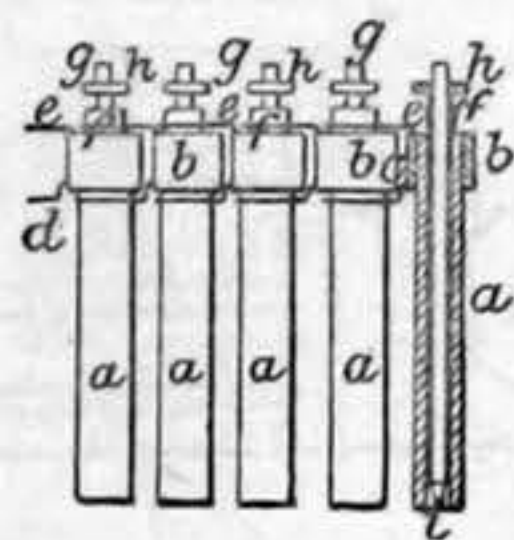
machines with combined straw elevators and shaking apparatus whereby the shakers hitherto employed are dispensed with and the straw delivered directly on to the stack, and also in the construction and arrangement of the straw elevator. Fig. 1 is a side

elevation of a thrashing machine with the elevator adapted. Fig. 2 is a cross section of the elevator. The elevator consists of a closed frame in which is fixed a grid composed of parallel bars *a* with tines *a'*. The elevator is pivoted at its foot to the thrashing machine and supported at any required elevation by means of segmental racks *b* and pinion *c*. A worm *e* and wheel operate the pinion *c* for raising the elevator. The frame is closed on underside by planking *f* and upper side by sheet iron *g*. Tine bars *iii* are attached to cranks *h h'* below the grid *a*. These tine bars work between the bars of the grid, and carry upwards the straw received into the elevator. The crankshaft *h* also forms the centre upon which the elevator turns. Brushes *l* are connected to the crossbars *k k'* for the purpose of sweeping down any corn that may lie upon the planking *f*. On the return motion the brushes sweep over the planking *f*, and carry down any corn that may be thereon. (April 1, 1880).

1341.* Forming, Salt, &c., into Balls: R. J. T., A. F., and H. L. Hawksley, Oldham. [2d.]—The salt supplied to a table is caused to fill a number of cups or recesses formed therein. An upper table then descends and inverted cups or plungers formed in it enter those in the lower table and compress the salt in them. The upper table, which works in guides and may be suitably balanced, is then raised. A tray is placed over the lower table, which is then inverted and deposits the balls in recesses in the tray, in which they are then placed in a stove and dried and hardened. The upper table may be actuated by hand or power. Modifications are mentioned. (April 1, 1880).

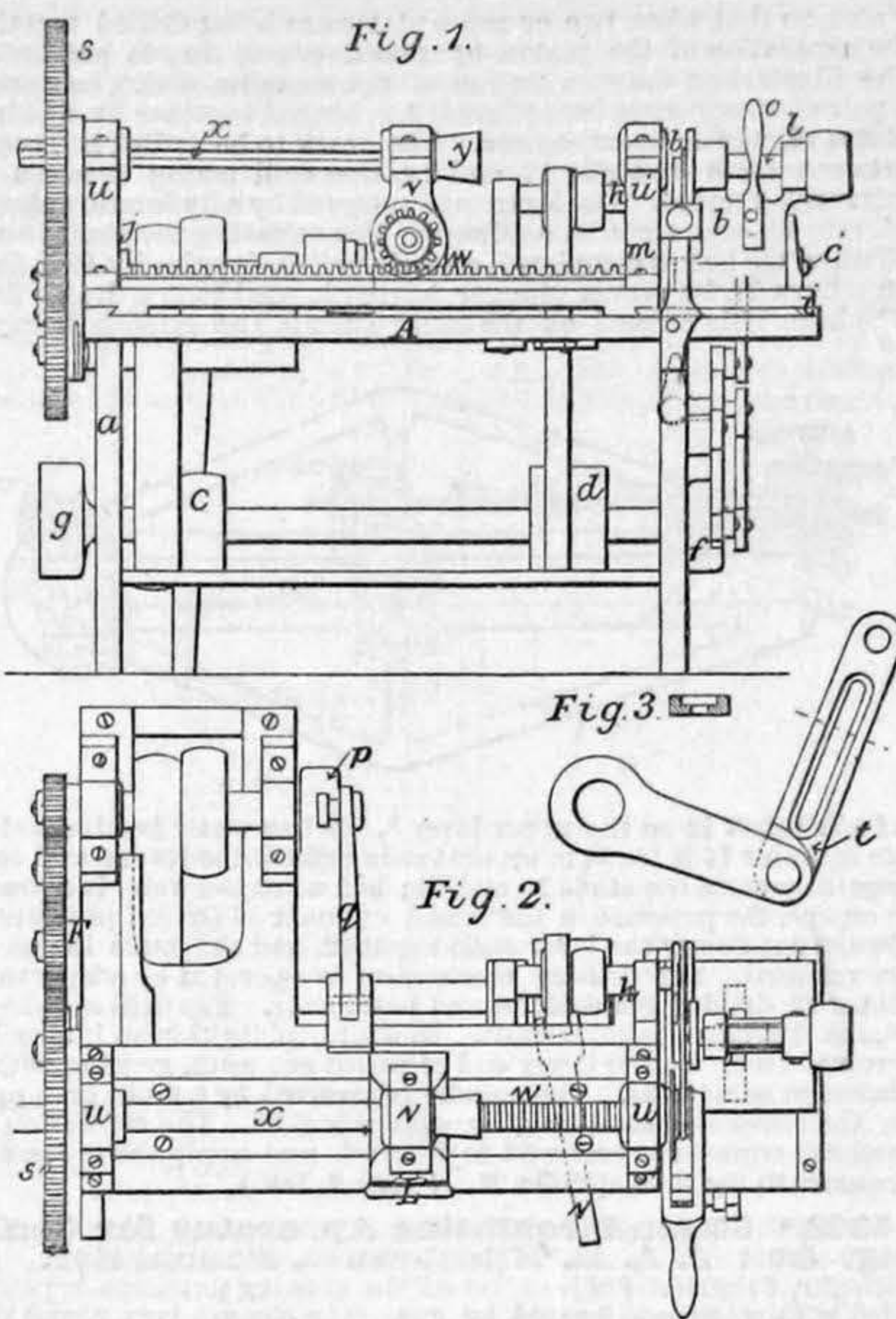
1342.* Looms: J. Holding, Manchester. [2d.]—(1) Relates to the connecting rods or crank arms of looms. Dispenses with the usual cotter or gib and substitutes a bolt, whose shank passes through the slots in the straps and head or butt of the arm or rod, the ends of the straps being confined between the bolt head and nut. To prevent slipping the butt is curved or recessed, so that when screwed up the tails are sprung into it and present an inclined face, in resistance to thrust or pull. The springing up also locks the binding nut. Prefers a nut with long head formed to the curve of the straps when bound down. Instead of being recessed the butt may have a projection on each side of which the straps may be sprung by bolts. (2) To the "sley" board of looms, before or behind the reed, a smooth rod or strip of metal is applied upon which the warp bears, thus reducing friction and preventing or lessening wear of the "sley." (April 1, 1880).

1343. Improvements in Apparatus for the Production and Application of Electricity and Magnetism: I. L. Pulvermacher, London. [8d. 33 Figs.]—Relates to chain batteries comprising a number of elements connected and capable of acting when straightened out or when rolled up together. It further relates to portable batteries capable of being put in contact with the body to localise a current, and to voltaic bands, electric and magnetic or magnetic only, for wearing upon the body. The illustration shows an arrangement of chain battery, of which four elements are seen in elevation and one in section. Each element is composed of a hollow cylinder *a*, of artificial carbon, or other electro-negative material, externally covered with an insulating envelope with the exception of the upper end, which is forced into the interior of an insulating ring *b*, which is lined with a thin metal ferrule carrying a strip *c*, whose ends are bent round and connected with the annular rings *d* and *e*. These rings are connected respectively with the cylinder *a* and the tube *f*, which is fixed by insulating cement to it, and serve not only to articulate one element with the next but to connect the zinc and carbon electrodes of two neighbouring elements; a zinc rod is



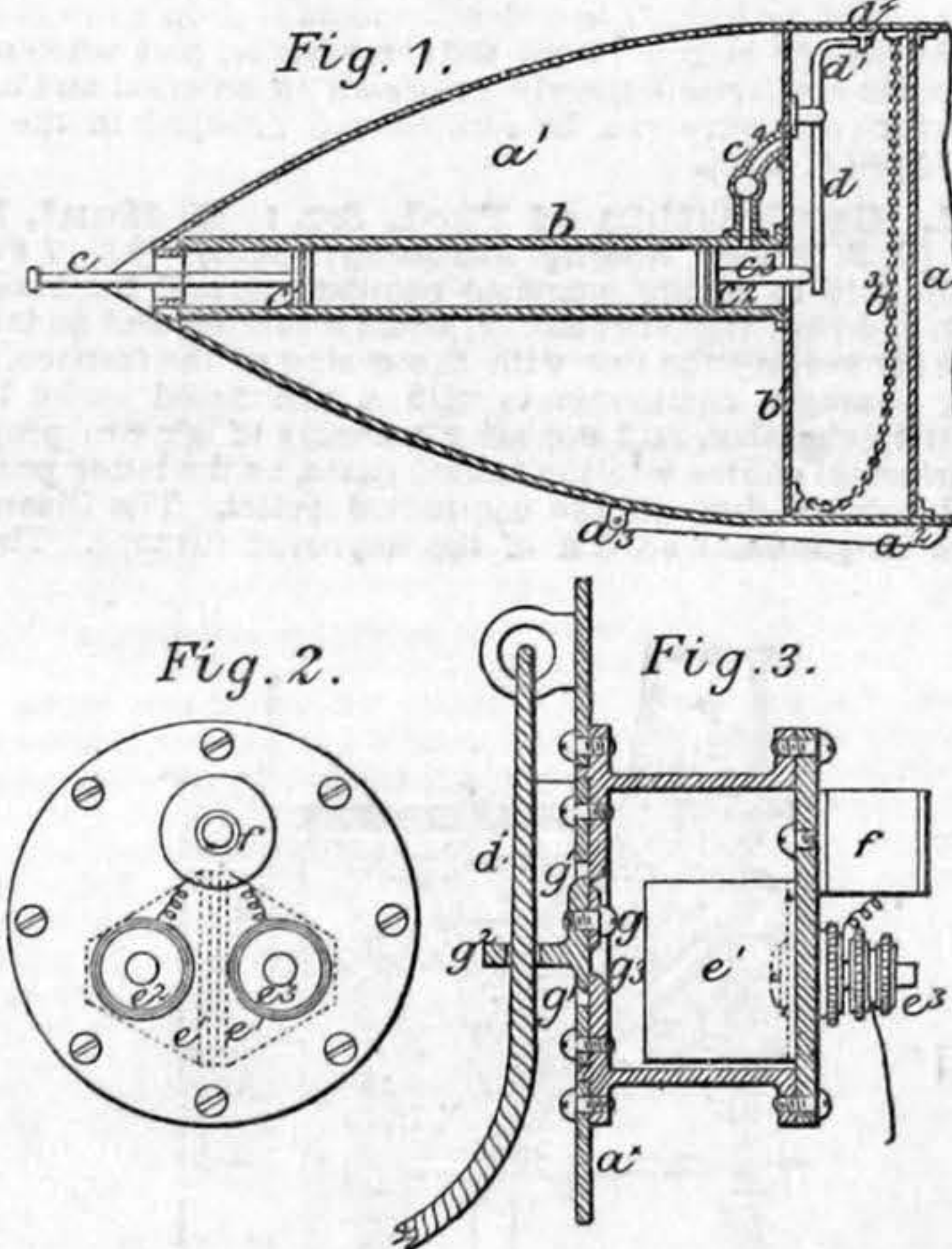
kept in position by the tube *h*, the lower end serving to stop the central hole *i* of a ring of insulating material occupying the base of the cylinder *a*. The exciting liquid occupies the space between *a* and the rod. A further modification of chain battery is described in which the elements are placed in reception links which are hinged to one another. The copper element is a plate rolled edge to edge, provided with holes for entrance of exciting liquid and air for depolarisation. The electro-positive element is a bar of tinned metal surrounded by and soldered to a zinc wire coated with thread or thin cord, preventing the copper and zinc from touching each other. The specification describes means of easily setting up the elements in the reception links, and of effecting the articulation of the links. In one form of battery the iron rod, carrying the electro-positive metal, supports also the electro-negative element wound in spirals between the zinc wire, and separated from it and from the rod by spirals of thread and string. Other forms of apparatus are described together with accessory appliances for ascertaining the intensity of the current and for modifying it, as required. (April 1, 1880).

1345. Machinery for Turning Wood, &c.: W. R. Lake, London. (F. Hanson, Hollis, Maine, U.S.A.) [8d. 9 Figs.]—Relates to machines for cutting wood into forms with irregular surfaces or outlines, and with any desired number of irregular shaped holes or indentations. To accomplish this, means are provided for giving motion to a revolving tool-holder (1) parallel or (2) transversely to the bed of the machine, and also (3) a rocking motion around a horizontal axis a few inches below its own axis of rotation. The chuck that carries the wood has likewise an independent set of appliances for imparting to it (1) a continuous rotary motion at any speed, (2) an intermittent rotary motion occurring at any desired periods, and through any required angles, (3) a reciprocating motion at right-angles to its length, either in a vertical or a horizontal plane, and (4) an endwise feed motion. Fig. 1 is a side elevation and Fig. 2 a plan of the machine. Commencing at the right-hand side the rotating tool-holder *l* is carried in the headstock *b* which slides in guides. It can also slide at right angles to these guides by means not shown. The sliding motion is conveyed to the headstock by an arrangement of levers at the end of the bed actuated by a crank-pin, adjustable in a T slot in the face of the disc *f*. The upper part of the headstock is pivoted to two uprights so that it can be rocked by the handle *o* if required after a steadying pin has been withdrawn. The timber to be shaped is held between the toothed chuck on the shaft *x* and a bearing on the upright *u* and can be fed forwards by a pinion and rack; the shaft *x* is rotated by a train of change wheels arranged on an elbow bracket (Fig. 3) to allow it to be reciprocated by the connecting rod *q* attached to the crank disc *p*. The means for the vertical reciprocation of the shaft *x* are not described in the specification. When the article is to be rotated regularly the crank disc shaft is driven by a belt and connected to the shaft *x* by a train of wheels, but when its motion is to be intermittent, another set of wheels is introduced and driven by a connecting rod and ratchet wheel actuated by the crank disc *p*. A circular saw, driven by a belt from the back shaft, is shown in Fig. 2, carried in a handle frame for cutting off the finished work from the end of the timber as completed. By the combination of some or all of these motions, and by the use of various cutting tools, a great variety of forms can be produced, many of which are



specified, and the requisite adjustments of the change wheels and crank-pins, &c., described. (April 1, 1880).

1346. Torpedo Boats, &c.: W. R. Lake, London. (J. L. Lay, Paris.) [6d. 4 Figs.]—Relates to torpedo boats such as described in former Specification 747, 1878. The invention refers also to improvements on Patent 4878, 1879, and comprises a detachable magazine, and a cushioning arrangement for receiving the shock or concussion, and detaching the magazine when the boat strikes a ship or other object. Also a circuit-closing apparatus for firing the torpedo, and providing torpedo boats with electrical or electro-magnetic engines connected by a cable to a dynamo-electric machine at the shore or other station for effecting the propulsion of the boat. Fig. 1 shows part of the bow of a torpedo with the cushioning apparatus, Fig. 2 a front view of the circuit closer, and Fig. 3 a section of the same secured to the bulkhead of the magazine: *a* represents the hull of the boat, *a'* the detachable magazine in which is a tube *b* extending longitudinally through the magazine, and secured to a diaphragm or plate *b'* at the rear end. The tube has two pistons *c* and *c'*. The former has a rod *c* extending through the stem, and provided with a striking knob—the latter a rod *c'*. The tube between the pistons is filled with liquid, a part of which escapes through the outlet *c'*, when the piston *c'* is forced past the opening. When the rod *c* strikes a ship or other object it is forced inward, and the rod *c'* engages with the lever *d* and releases its hook or catch *d'* from the bracket *d''*. The magazine then drops, its fall being controlled by chain *b''*, and also by a guide-bar *a''*, one end of which is connected to the magazine at *a''*, and the other end hinged to the hull of the boat *a*. The liquid

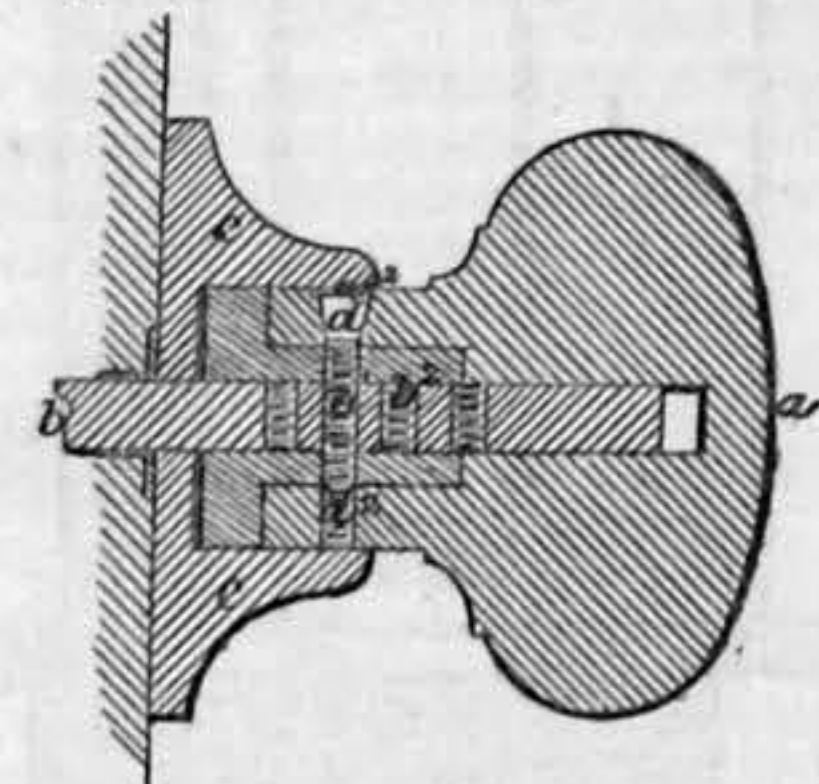


between the pistons offers the necessary yielding or cushioning resistance. The circuit closer (Figs. 2 and 3) is for firing a cartridge within the magazine after it has struck the ship and fallen. It is attached to the bulkhead *a''* of the magazine, two copper plates *e e'* are connected to binding screws *e'' e'''*, from which wires are connected to the cartridge; *f* is a resistance coil arranged in connexion with a keyboard on the shore, as described in former patent, and is connected to the circuit closer. An opening *g* is covered and kept water-tight by a thin diaphragm *g'*, to which is attached a lug *g''*, and a wire rope passes through the lug, and is attached to the circuit closer, as shown. When the magazine drops, as above described, this rope tightens, and tears away the lug and diaphragm, the water then enters through the opening *g*, and coming in contact with plates *e e'* closes the circuit between the same, and causes the magazine to be fired by cutting out the resistance coil *f*. For driving the propeller an electrical engine is carried by the boat, and connected to the shore by a cable conductor. (April 1, 1880).

1347.* Machinery for Purifying Middlings, &c. E. Davies, Liverpool. [2d.]—The machine consists of horizontal reciprocating sieves, slightly inclined, covered with silk, and capable of adjustment, set within a suitable box carried by framework. The middlings are fed through a hopper with a feeding roller on to the sieves, which receive their motion from a

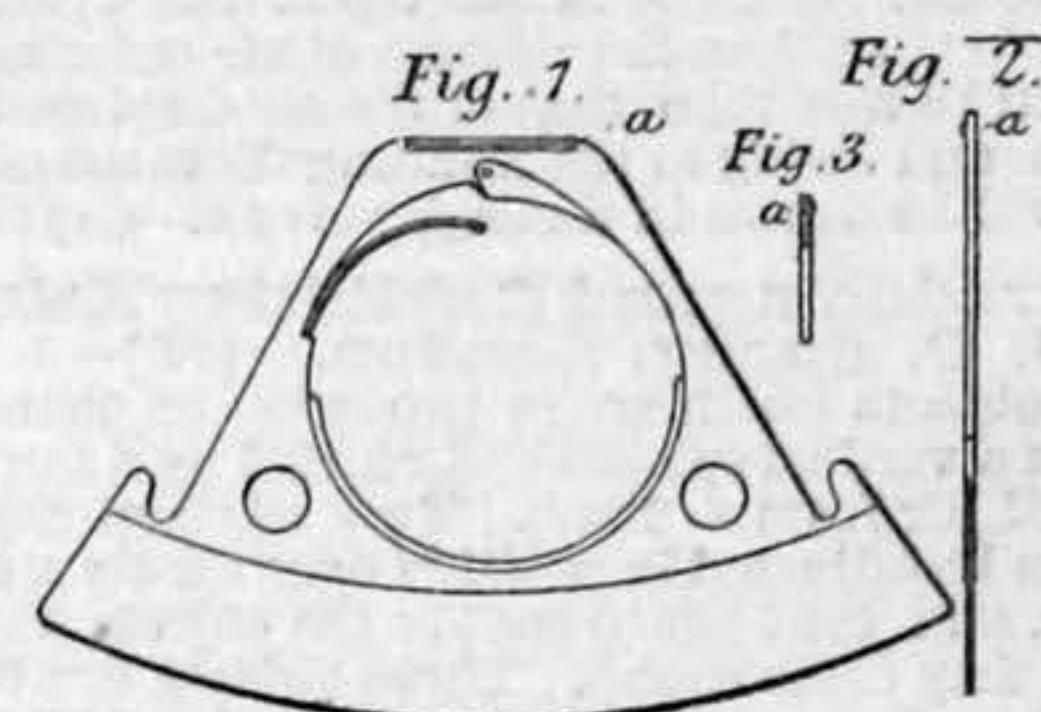
crank or similar appliance. Under the sieves are placed travelling brushes carried by endless bands, which keep the silk clear, and brush the stuff that passes through it down discharge spouts. A blast of air under the silk lifts the light impurities, which are passed through an outlet at the bottom by another current of air. Another blower may also be fixed on the top for creating an exhaust for taking away the impurities. Air chambers are formed across the top and down each side. The air passes through perforations in the chambers under the sieves. Wire gauze, &c., may be substituted for silk for sifting ores, &c., and beaters may be put at the bottom of the machine to cause a slight knock on the end of the sieve frame. (April 1, 1880).

1349. Door Knobs, &c.: A. Bell, Edinburgh. [6d. 5 Figs.]—The handle is fixed to the spindle by a screw or pin that passes through them both. The pin is prevented from jarring out by a fixed collar that surrounds the shank of the door knob. By detaching the collar from the door, and turning it round until a slot in it is over the pin, the latter may be removed; *a* is the knob,



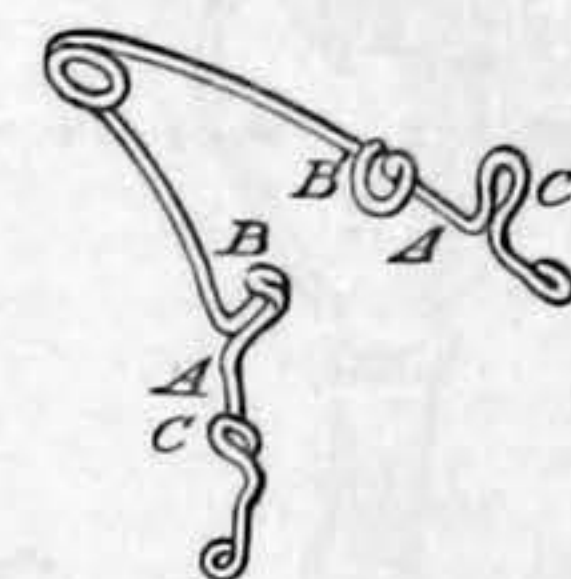
b the spindle, *c* the collar or rose, *d* the pin. The slot in the collar is not shown. (April 2, 1880).

1350. Carriages for Lace Machinery: J. Cropper, Nottingham. [6d. 3 Figs.]—The top of the carriage is thickened by forming a hollow or depression thereon, a short distance from the upper edge, such depression causing a corresponding rise on the opposite side. This hollow may conveniently be struck in a fly press, and can be filled with solder if a flat surface is required on one side. In the illustrations *a* is the recess. The



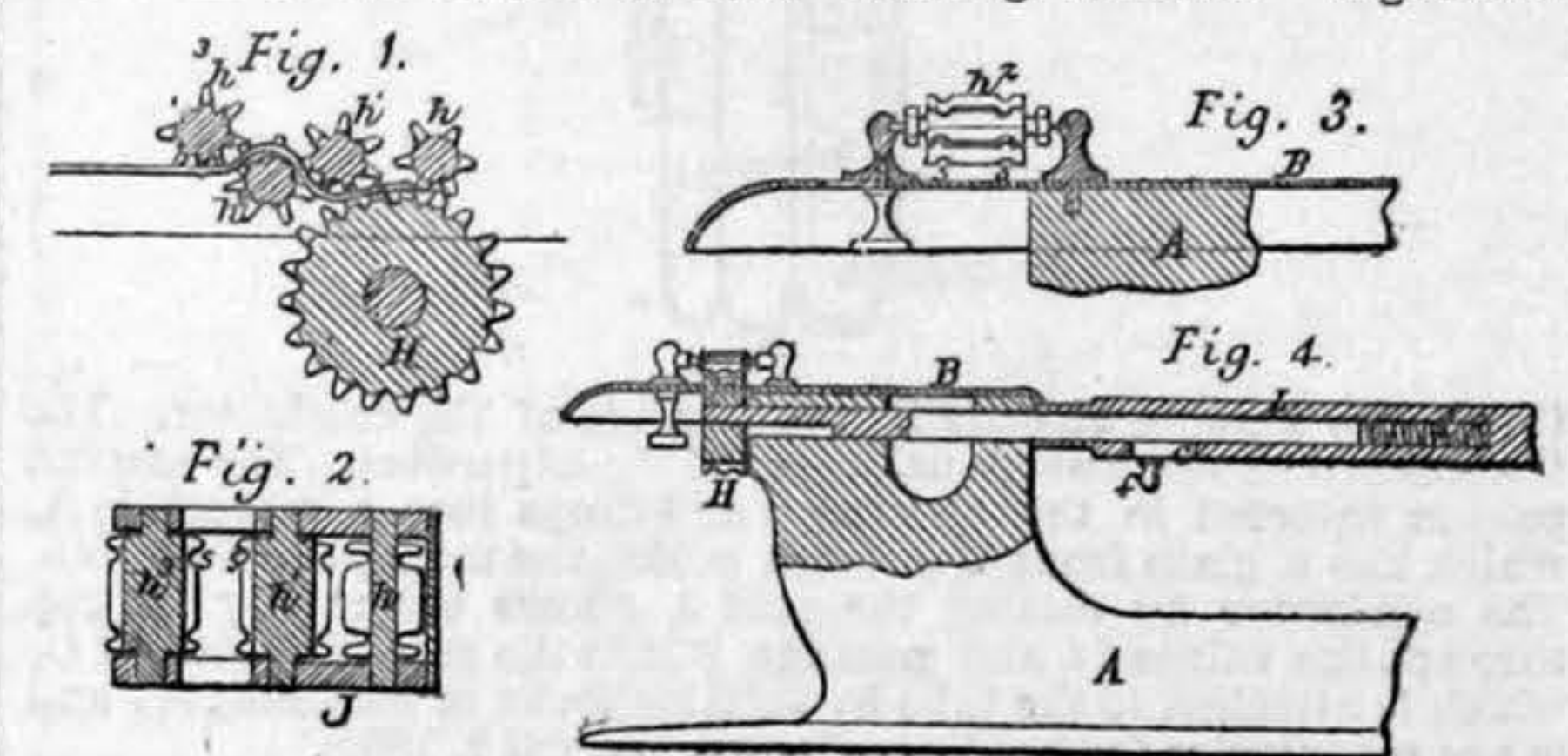
object is to enable the carriage to hold the warp threads in a lace machine straight up, and thereby form a good division of the warp threads for the points to enter safely. (April 2, 1880).

1352. Glove Fastenings: H. J. Haddan, London. (W. H. Story, Acton, Ontario, Canada.) [6d. 13 Figs.]—Consists of a spring with diverging legs in combination with devices for fastening or coupling the legs together when the glove is to be



secured. These devices may be hooks and eyes turned on the wire, or various forms of studs and coupling links. The former arrangement is shown in the illustration at A, B, C. (April 2, 1880).

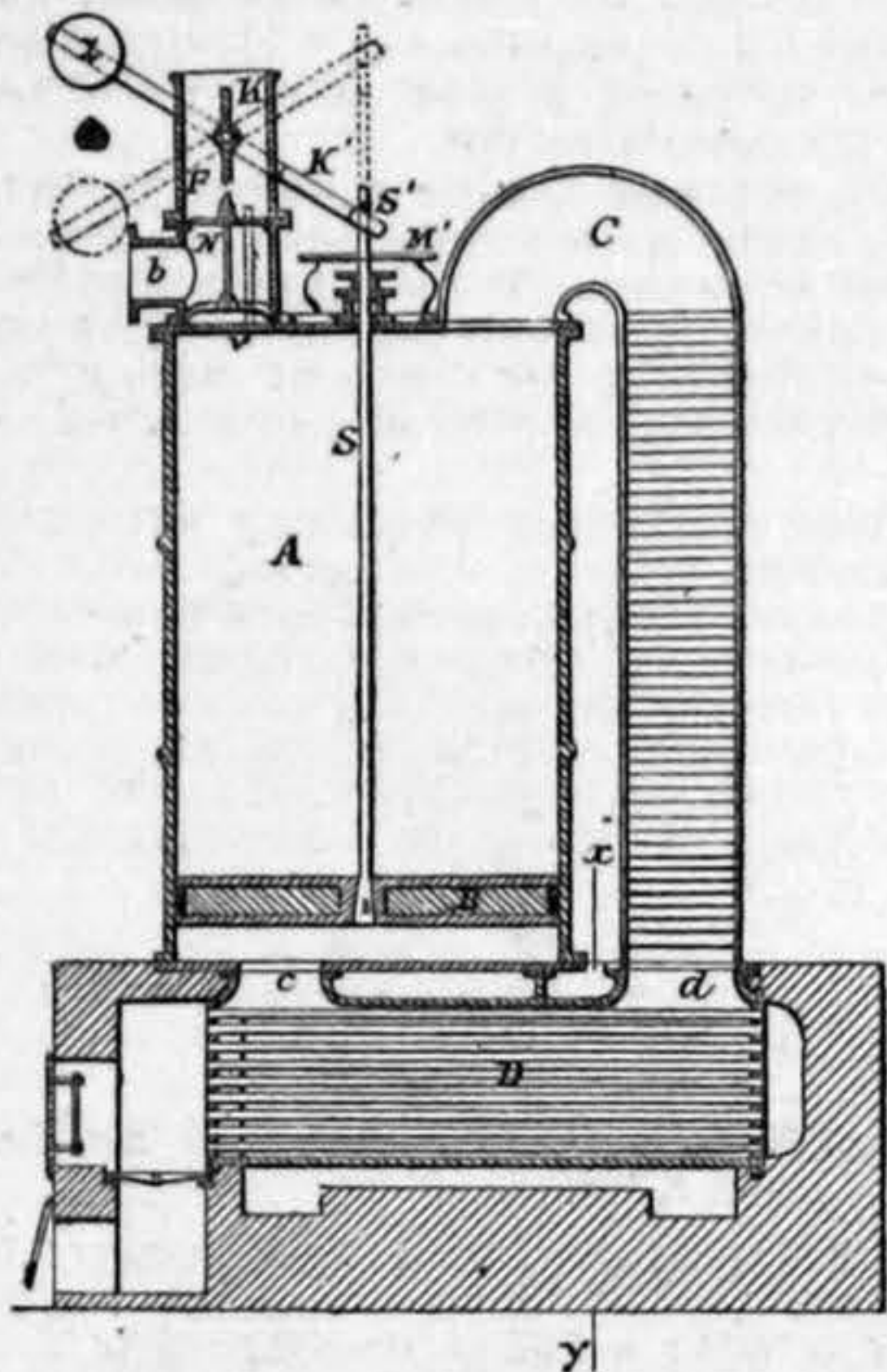
1353. Sewing Machines: H. J. Haddan, London. (J. Heberling, Mount Pleasant, Ohio, U.S.A.) [6d. 8 Figs.]—Relates to that class of machines in which the needle is held stationary and the fabric is crimped or folded and then pushed or forced along the needle on to the thread to form "running stitches." Fig. 1 is a



section of the feed rollers, and shows the bent needle or needles lying in grooves turned in the rollers, as shown in plan in Fig. 2. The three rollers *h, h', h''* are carried on a slide affixed to the head of the machine, and can be raised to admit the work; *h''* is fixed on the table (Fig. 3), and *h* is connected to the main shaft (Fig. 4) by the square-ended spindle *i*, which slides in a central recess, and is rotated by the stud *j* projecting through the slot *e*. The spindle *i* can be forced further up the recess against the pressure of a spring when it is desired to detach the wheel *H*. The teeth of the pinions *h', h'', h'''* are made of gradually reducing pitch, to avoid injury to the material, *h'* being the coarsest and *h'''* the finest. The cloth is straightened before it reaches the crimping rolls by being passed through an adjustable yielding smoother, one form of which is somewhat similar to the peg plate used for straightening wire. (April 2, 1880).

1354. Caloric Apparatus: C. D. Abel, London. (N. Yagn, St. Petersburg.) [6d. 6 Figs.]—This invention consists substantially in producing air blast by alternately heating and cooling confined air, and thus causing its alternate expansion and contraction as it travels from one enclosed space into another. A portion of the air escapes as blast, during the time of expansion, and a fresh quantity of air is drawn in during the time of contraction. A piston travelling to and fro in a cylinder alternately causes the air to flow from one end of the cylinder through a regenerator and a heater to the other end, so as to take up heat during its transit, and then flow back through the regenerator, so as to give up the greater part of its heat to the latter before re-entering the cylinder. Suitable valves allow the inlet and outlet of air. In combination with the apparatus a motor engine may be worked by the suction or the blast produced. The drawing shows a vertical section of the caloric apparatus; *A* is the blowing cylinder *B* a piston made hollow and filled with a non-conductor of heat. The piston rod *S* passes through a stuffing-box and operates a valve *K*, a suction valve *v* and a delivery valve are placed in the cylinder cover. On

the piston taking its upstroke the air above will pass through the regenerator and heater D into the lower end of the cylinder. The air becomes heated in its passage and expands, and the increased pressure in going back through C and D to the upper part of the cylinder, will open a delivery valve, so that on the continued upward motion of the piston only a portion of the air above will pass to the lower end, the other portion being discharged through the valve into a conduit pipe, thus creating an air blast. On the down-



ward motion the air below will pass back through C and D into the upper part of the cylinder. In passing through D it becomes still further heated, but in its passage through the regenerator it gives off some of its heat, and enters the top of the cylinder in a comparatively cool state; thus the volume of air entering the cylinder at the top will be less than that of the air displaced by the piston at the bottom, and owing to the resulting decrease of pressure cold external air will be drawn in through valve E. (April 2, 1880.)

1355.* Producing and Exhibiting Kaleidoscopic Effects: J. O. Spong, London. [2d.]—A circular tray carrying the objects which are to produce the changeable effects, is mounted on a vertical spindle and rotated by a fan put in motion by a current of air from a flame. Two mirrors, supported independently, can be adjusted in position over the tray, and in relation to each other, and the light to enable the objects to be viewed in succession as they come round. These objects can be turned over from time to time by a pendent arm. (April 2, 1880.)

1356. Apparatus for Collecting Fares: A. E. Adlard, London. [6d. 3 Figs.]—The payer deposits the amount to be paid in a receptacle where it can be seen both by the payer and the conductor, and when both are satisfied as to correctness of amount it is transferred into a general receptacle, without



the money passing directly into the hands of the conductor. The illustration shows a sectional view of the apparatus. The amount paid is inserted in the opening e and drops into a receptacle A, which has a glass front d through which the money may be seen. The conductor by raising the part A allows the money to drop through the valves i i and passage B into the general receiver C, which is attached to the tube by suitable locks or fastenings; l and m are receptacles for holding change. (April 2, 1880.)

1357.* Tilt for Wagon Coverings: J. Tilley, North Shields. [2d.]—To the sides of the wagon are secured by "bolt and eye" attachments four bars, whose other ends meet, and are fitted together so as to form, when covered by a sheet, a dome-like structure. When not required, the bars can be laid down on the wagon sides, and secured by clips. (April 2, 1880.)

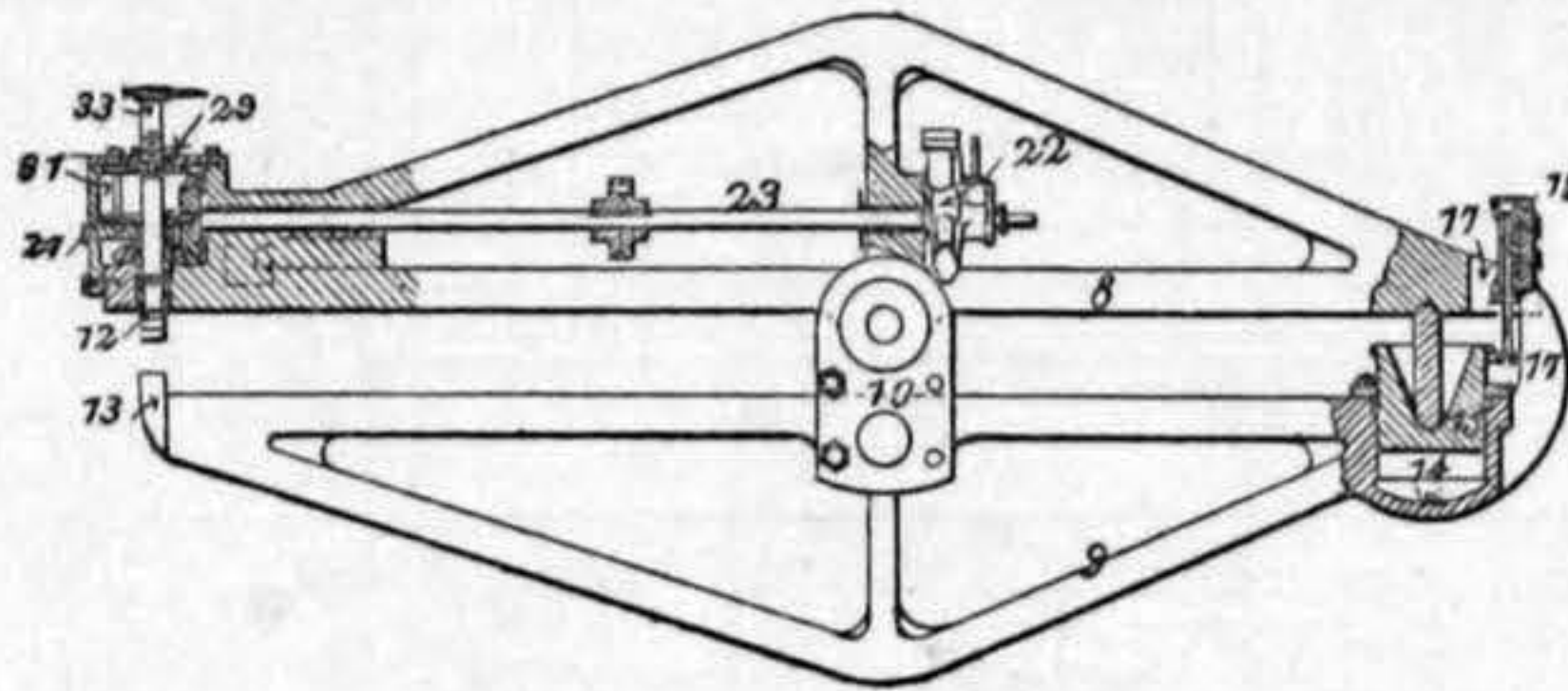
1358.* Copying Apparatus: H. B. Binks, London. [2d.]—The object is to provide a means of producing copies of written matter in black instead of coloured inks as heretofore. The apparatus consists of a pad, copying ink, and an inking roller. The writing is executed on paper with copying ink of an aluminous solution, and left to dry without blotting; it is then placed face downwards on the pad, and evenly rubbed for about three minutes. The paper being removed, a negative is left on the pad, printing ink is then applied by a roller to the negative, and the superfluous ink washed carefully off. Copies can be taken from the negative in a similar manner to that adopted in lithography, but without any mechanical pressure. (April 2, 1880.)

1359.* Pens and Styles: H. B. Binko, London. [2d.]—To retain ink, fine shavings, or wires of metal, glass, or asbestos are attached to the pen or style. (April 2, 1880.)

1360.* Composition for Treating Harness, &c.: J. J. Taylor, Harpurhey, Lanc. [2d.]—Consists of alcoholic spirit one pint, turpentine spirit one pint, red lavender spirit half an ounce, soap 4 lb., wax 4 lb., isinglass or gelatinous matter, one ounce. Other proportions may be used, but those stated are preferred. (April 2, 1880.)

1361. Drilling Machines: A. C. Kirk, Glasgow. [6d. 7 Figs.]—Relates chiefly to portable drilling machines, but a part of the improvements are applicable to fixed machines. An important feature is the means for firmly grasping the plate or

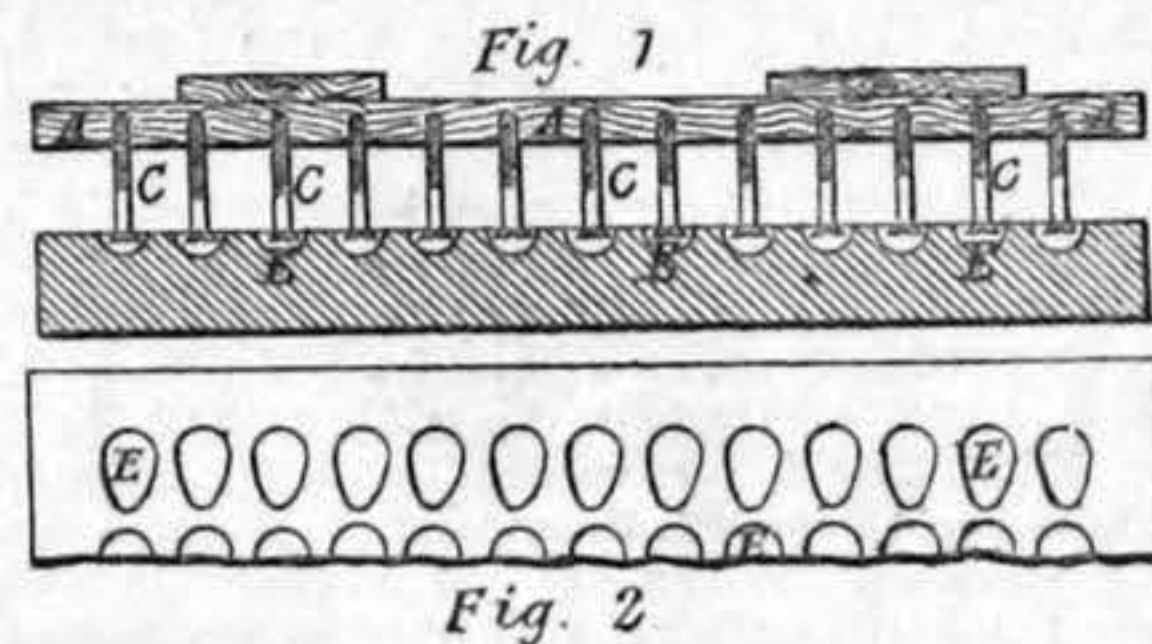
Plates, so that when two or more plates are being drilled together, the separation of the plates, by raised edges, &c., is prevented. The illustration shows a section of the machine, which comprises a pair of strong open frame levers 8, 9, hinged together by a pair of plates 10, which fit on bosses. The work to be drilled is grasped between teeth or studs 12 and 13, the drill acting between an intervening space. The levers are actuated by a hydraulic cylinder 14, ram 15, and strut 16, as shown. For releasing the studs 12 and 13 when the hole is completed, a small hydraulic cylinder 19 is fixed on a horn 17, its ram or plunger having jointed to it a double link. The horn 17 is formed on the lower lever 9, and extends between



a forked part 18 on the upper lever 8. When water is admitted to the cylinder 14 it tends to separate the ends of the levers, and consequently close the studs 13 and 14; but when the water is allowed to escape, the pressure in the small cylinder 19 (which pressure is always on) draws the lever ends together, and the studs 13 and 14 are released. The drilling mechanism is operated by a hydraulic motor 22, driving the shaft 23 and bevel gear. The drill spindle 27 passes through a tubular shaft. In the top plate 29 is an internally screwed bush, on the lower end of which are teeth, gearing with a pinion on spindle 31. The spindle is revolved by a tooth or tappet on the tubular shaft engaging with wheel 32. The revolution of the bush causes the screw 33 to descend, and apply the necessary pressure to the drill spindle 27. (April 2, 1880.)

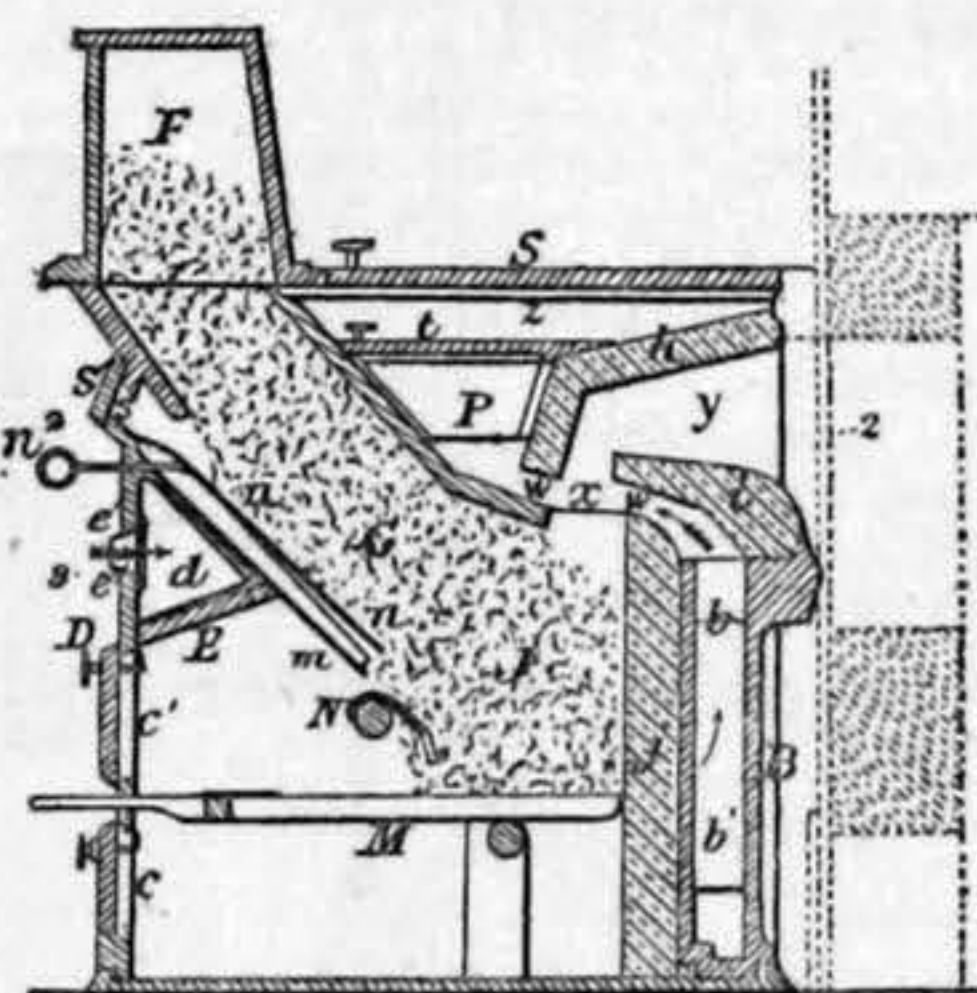
1362.* Steam Circulating Apparatus for Cooking, &c.: J. A. R. Hildebrandt, Manchester. (J. Fleischer, Cologne). [4d.]—A vessel for cooking purposes is partly filled with water and heated by gas. The steam plays round the bottoms of saucepans fitted in openings in a plate through perforations in which it passes, playing round, and, if required, entering the upper parts of said pans. It also enters the open bottom of another pan fitted in an opening in the cover of the vessel, the edges of said cover being steam-tight. Several arrangements are referred to, to suit application to cooking, bathing, and other purposes. (April 2, 1880.)

1363. Moulds for Sugar, &c.: E. A. H. Loze, Liverpool. [6d. 2 Figs.]—Consists in an improved mode of making moulds for hollow or solid forms of sugar or other viscous material, of plaster or other material lined with a waterproof



varnish that is not affected by sugar or moderate heat. The illustrations show a method of making multiple moulds. A board A has a number of long screws C with their heads projecting about an inch; these screws are placed so as to dip into the hollows E of a series of hollow moulds in which the moulds proper are cast. In these the plaster is run round the screwheads, and when set the half moulds are formed, merely requiring to be dried and coated. Moulds for solid ware can be formed and grouped in the same way. (April 2, 1880.)

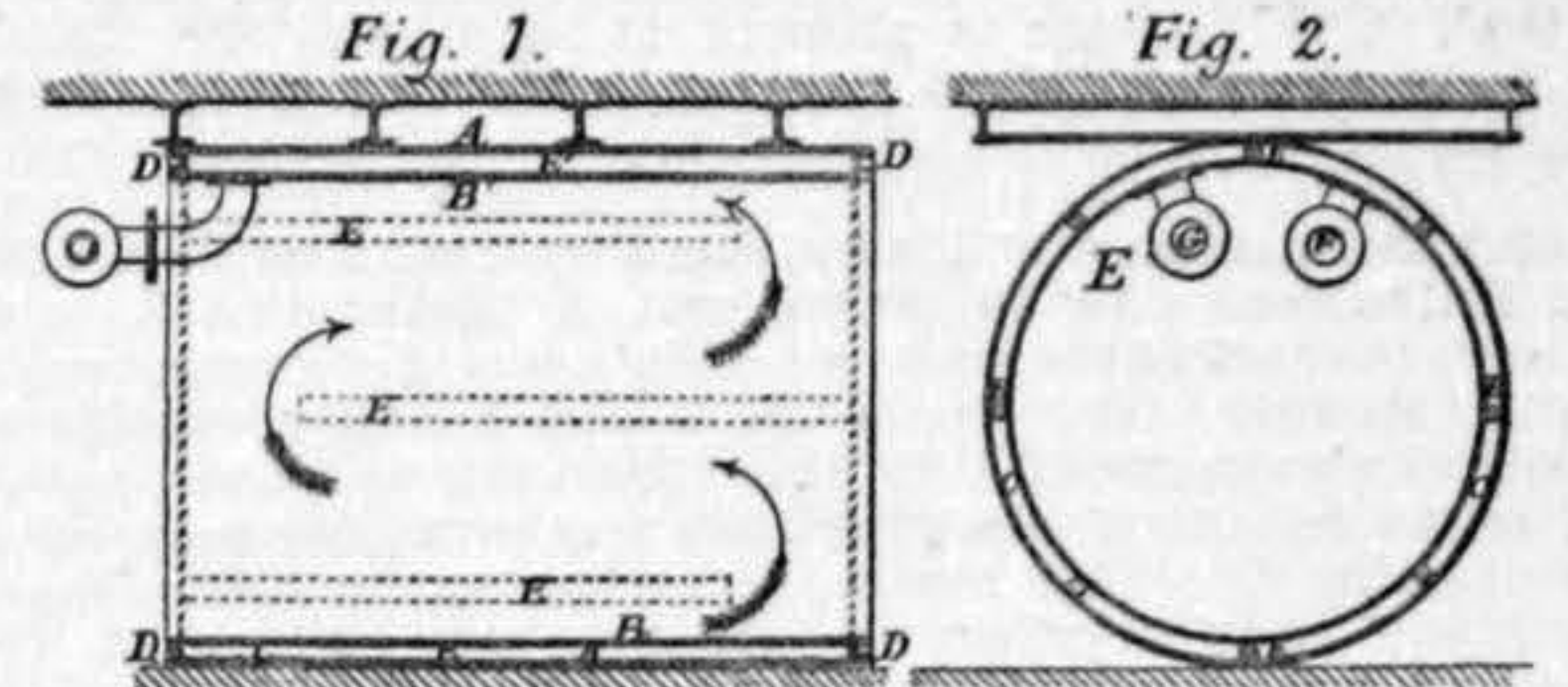
1364. Combustion of Fuel, &c.: B. Hunt, London. (C. B. Gregory, Beverley, New Jersey, U.S.A.). [6d. 7 Figs.]—The object is to secure complete combustion, and the invention consists of a combustion chamber, a fuel reservoir, and an inclined passage connecting the two with the casing of the furnace. Air-heating passages communicate with a contracted outlet in the combustion chamber, and opposing volumes of air are projected in a horizontal course into the heated gases, as the latter pass in a vertical column through the contracted outlet. The illustration shows a longitudinal section of the improved furnace. The side



and back walls are hollow, and enclose chambers b, which communicate with similar chambers at the sides of the walls by the openings b'. The front plate D has the usual ash-pit opening c, and an opening e; M is the grate, N a transverse grate bar, E a box enclosing chamber d which communicates with the chambers b in the side walls. Fuel is introduced into reservoir F until chamber J and passage G are filled. The products of combustion pass through the contracted passage x, and escape at y. Cold air enters the chambers a, and a portion enters chamber P, and the remainder through w. In passing through the chambers the air becomes heated before mingling with the products, and all the inflammable gases are ignited before escaping at y. (April 2, 1880.)

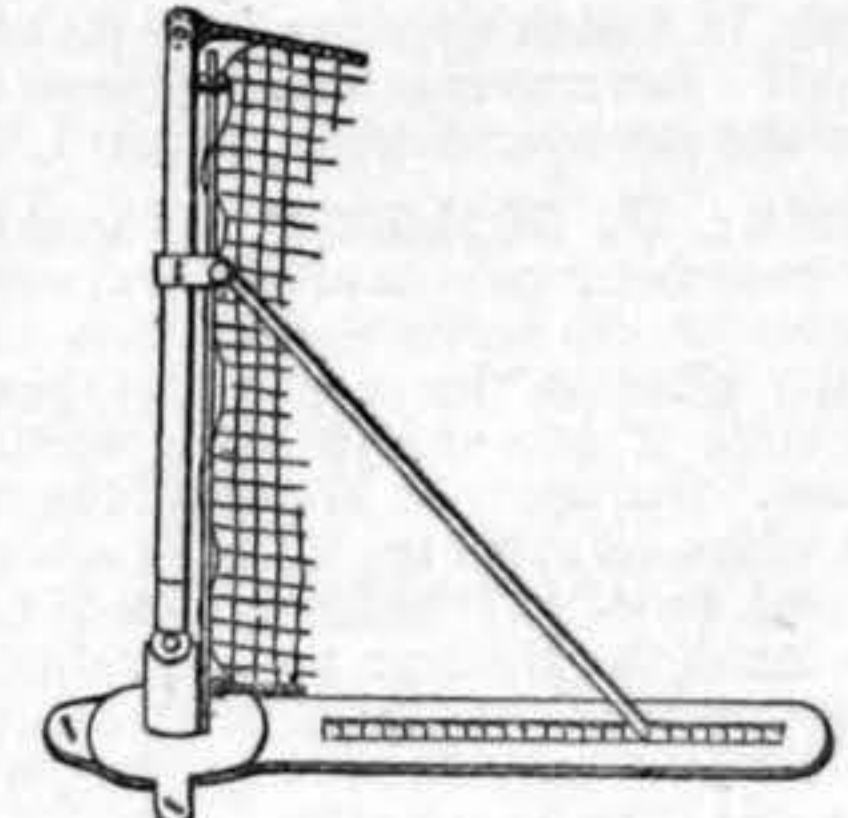
1365. Preserving Alimentary Substances by Cold: S. Pitt, Sutton. (L. Ribourt, Paris). [6d. 2 Figs.]—Relates chiefly to the preservation of fresh food on board ship. The space allotted for the purpose between decks is partly filled by open-ended jacketed cylinders, about 10 ft. by 6 ft. over all, and within and around these cylinders the substances to be preserved are packed. A constant circulation of a solution of chloride of magnesium is maintained through the whole of the jacketed spaces around these cylinders, and through a freezing machine, for the purpose of maintaining a sufficiently low temperature to

prevent any decomposing action to be set up. In the drawing A is the external and B the internal wall of one of the cylinders; E E



are wooden divisions to cause the circulating liquid to take a zig-zag passage; G and F are the inlet and outlet pipes. (April 2, 1880.)

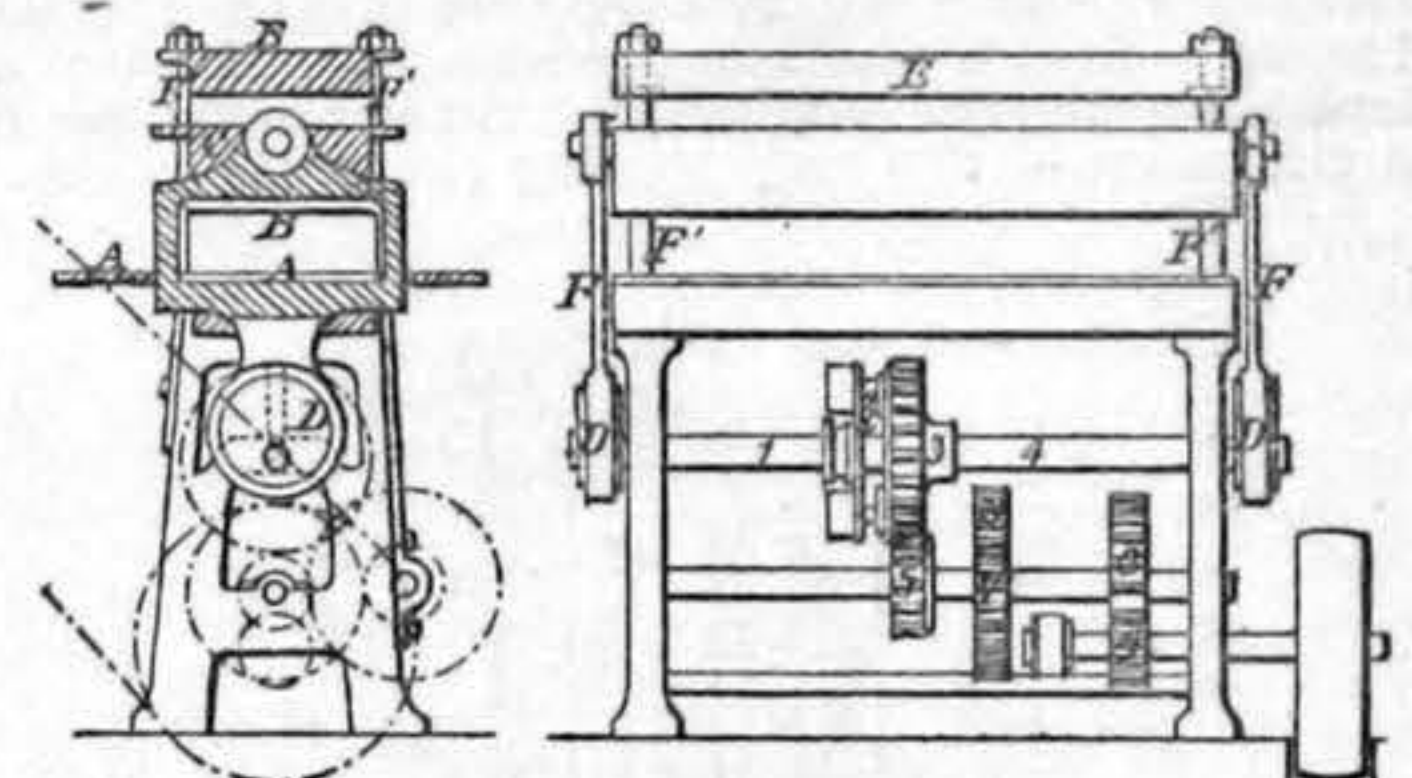
1367. Lawn Tennis Poles: F. A. Ayres, London. [6d. 3 Figs.]—Instead of driving the poles into the lawn they are hinged to a stand or base that can be lightly pinned or weighted down. The net is strained by turning the post on the hinge and



fixing it by a strut, or if the pole is attached to the base by a permanent connexion, as is sometimes the case, a small winch is supplied to tighten the rope that carries the net. The illustration shows the former method. (April 2, 1880.)

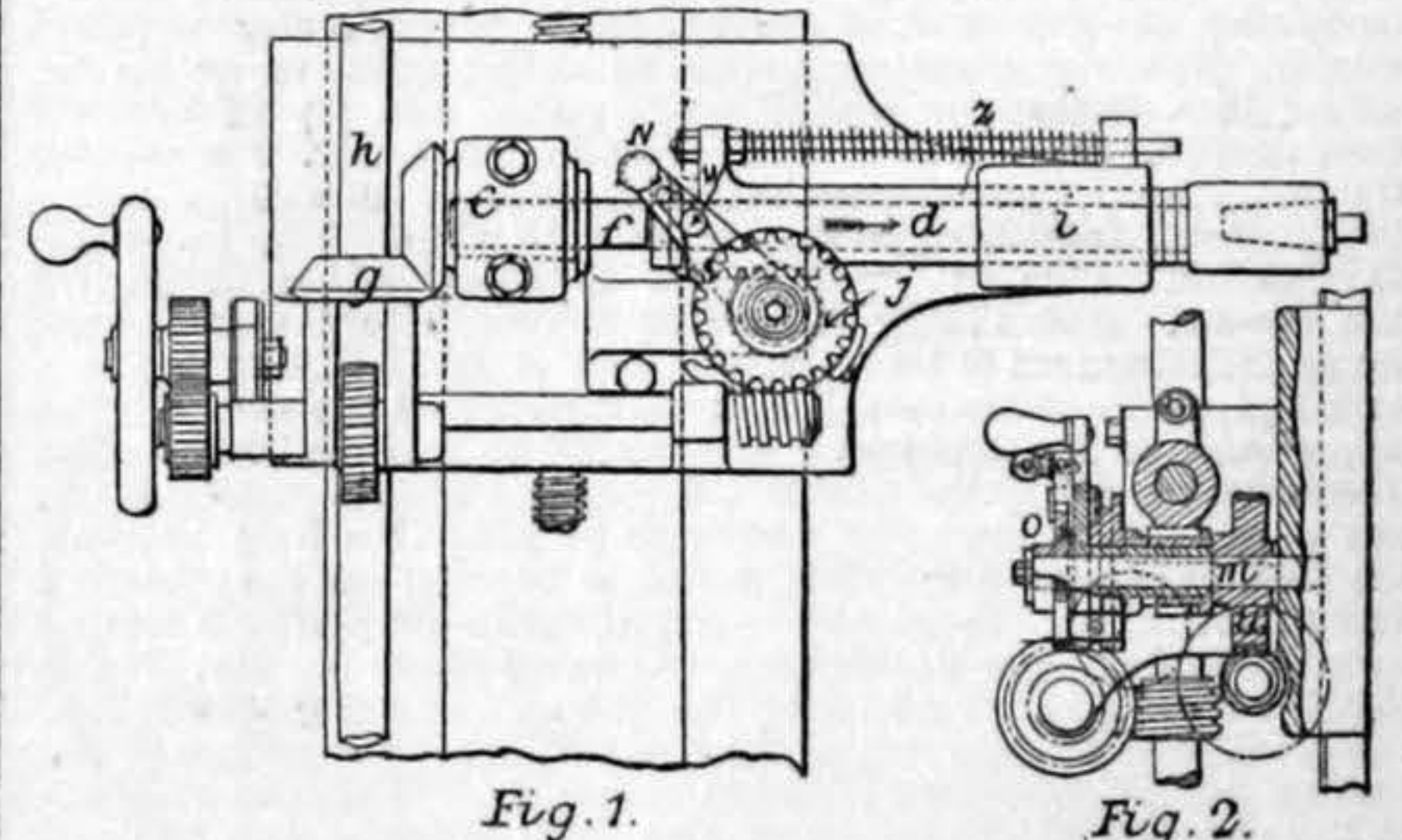
1368.* Securing the Parts of Scaffolding, &c.: R. Robinson, Gateshead-on-Tyne. [2d.]—To fasten a cross-pole to an upright one, a spiked curved plate is placed against the latter, having two chains attached, one of which after passing round said upright (resting against a pin in the convex side of the plate) passes round the cross-pole, and takes into a slip hook on the other chain. To fasten upright poles one to another the device is suitably modified. (April 3, 1880.)

1369. Apparatus for the Manufacture of Oil Cakes, &c.: C. Eskrett and W. H. Searle, Kingston-upon-Hull. [6d. 3 Figs.]—Is an improved machine for consolidating the seed or composition before it is placed in the finishing press. The press plate slides on the pillars F' F', and is reciprocated by the eccentrics D D and the links F F'. The eccentric shaft is driven by a clutch 2, arranged by means "well understood," but not shown, to come out of gear periodically to afford time for the removal and introduction of the material operated on. A charge is first placed on the platform A, and compressed by the down stroke of the press plate C, and then another charge is introduced on to the top of the press plate C and consolidated by the upward stroke of the machine. (April 3, 1880.)



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1370. Apparatus for Drilling Boiler Rings, &c.: S. Dixon, Marple. [6d. 4 Figs.]—This has reference to machines where a number of drill frames are arranged radially, the rings to be drilled being attached to a turntable. The improvements consist (1) in a quick return movement for the drill spindles, (2) a notch wheel and pawl for feeding the drills to the work, and adjustable stops for releasing and re-engaging the pawl, (3) connecting the horizontal shafts in the radial beds of drilling machines with a central wheel having a common axis with the table, in order to actuate the drills, or to raise and lower the headstocks simultaneously, as the case may be. Fig. 1 is a front elevation and Fig. 2 a vertical section of the drill headstock. The drill spindle c revolves in sleeve d and bearing f, motion being given by the bevel gearing g and shaft h. The sleeve d can slide in bearing i, motion being given by rack and pinion j, which is fixed on a hollow shaft. A spindle m carries at one end a wormwheel n and at the other a notch wheel o. A lever v attached to the hollow shaft carries a hinged pawl w, which is shown engaged with one of the teeth of wheel o. The shaft m revolving will consequently turn the hollow shaft, and with it pinion j, so that the sleeve d will be moved forward for forcing the drill spindle. When the hole is drilled the required depth an adjustable stop is in such a position that the

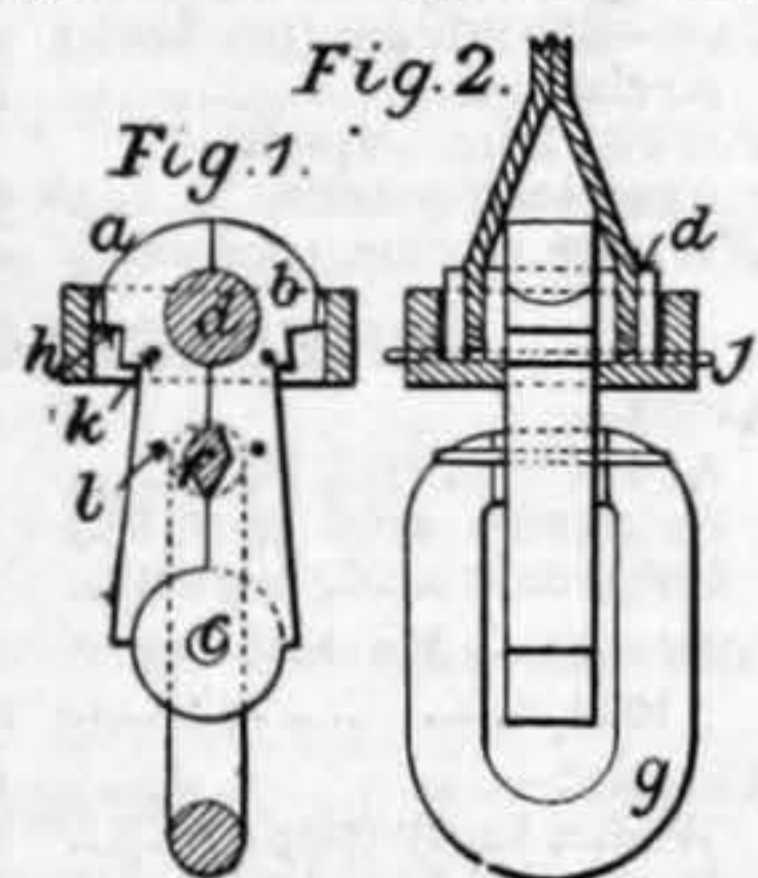


heel of pawl w strikes it and the pawl is released. The wheel o being free, a spiral spring z forces the sleeve d back, and so withdraws the drill from the work. Another stop is placed so that when the sleeve d is moved back the required distance the pawl strikes against it, and the pawl is again put into gear with the wheel o. Describes and illustrates the arrangement of drilling machines in connexion with a central wheel. (April 3, 1880.)

1371. Buttons or Fasteners for Boots, &c.: F. H. F. Engel, Hamburg. (J. Steffen and H. Winterboer, Elmshorn, Germany). [6d. 14 Figs.]—Two plates are hinged one to another, and these when closed are secured together by a spring catch. The illustrations show them as applied to shoes. (April 3, 1880).

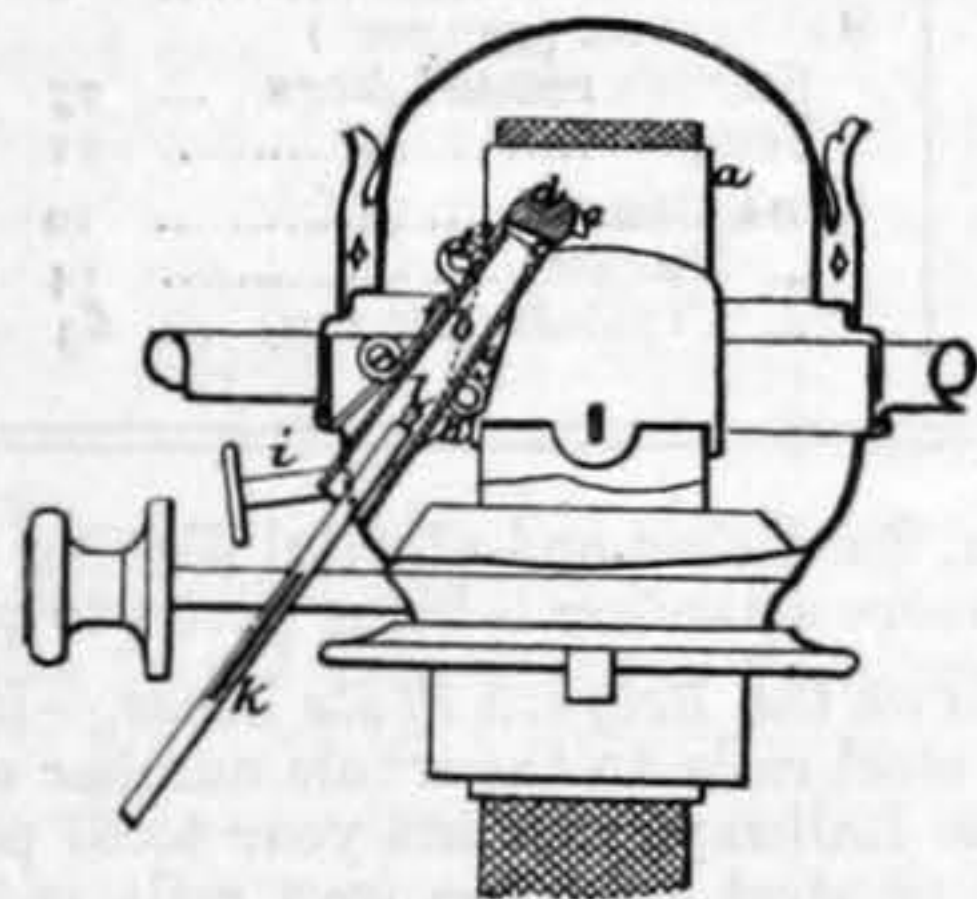
1372.* Bending and Twisting the Arms of Pulleys, &c.: T. James and J. Jackson, Reading. [2d.]—The machine is constructed to make wrought-iron arms for wheels and pulleys by bending bars of flat or half-round or other section into a V shape with a segmental piece across the opening. Each side of the V forms half of an arm, while the segmental piece serves to attach it to the rim. The bending is performed by rolls, two or more being fitted to a frame which has a motion round a fixed centre. The corners of the arms are bent in these rolls, and the circular parts between three rolls capable of adjustment. The arms are twisted by two vices, one of which is capable of being revolved. (April 3, 1880).

1383. Safety Detaching Hooks for Mine Cages, &c.: F. Leonardt, Handsworth. [6d. 7 Figs.]—Fig. 1 is a section and Fig. 2 a side elevation of the improved hook. The pit rope is spliced to the grooved cylinder *d*, which is grasped between the jaws *a b* centred at *c*; *g* is a link attached to the cage chain at its lower end, and passes through a hole between the jaws at its upper end, where it is of the shape shown in section; *k* is a collar which holds the jaws in position, being secured to them by copper wires or rods *jj*. When the apparatus is overwound the collar



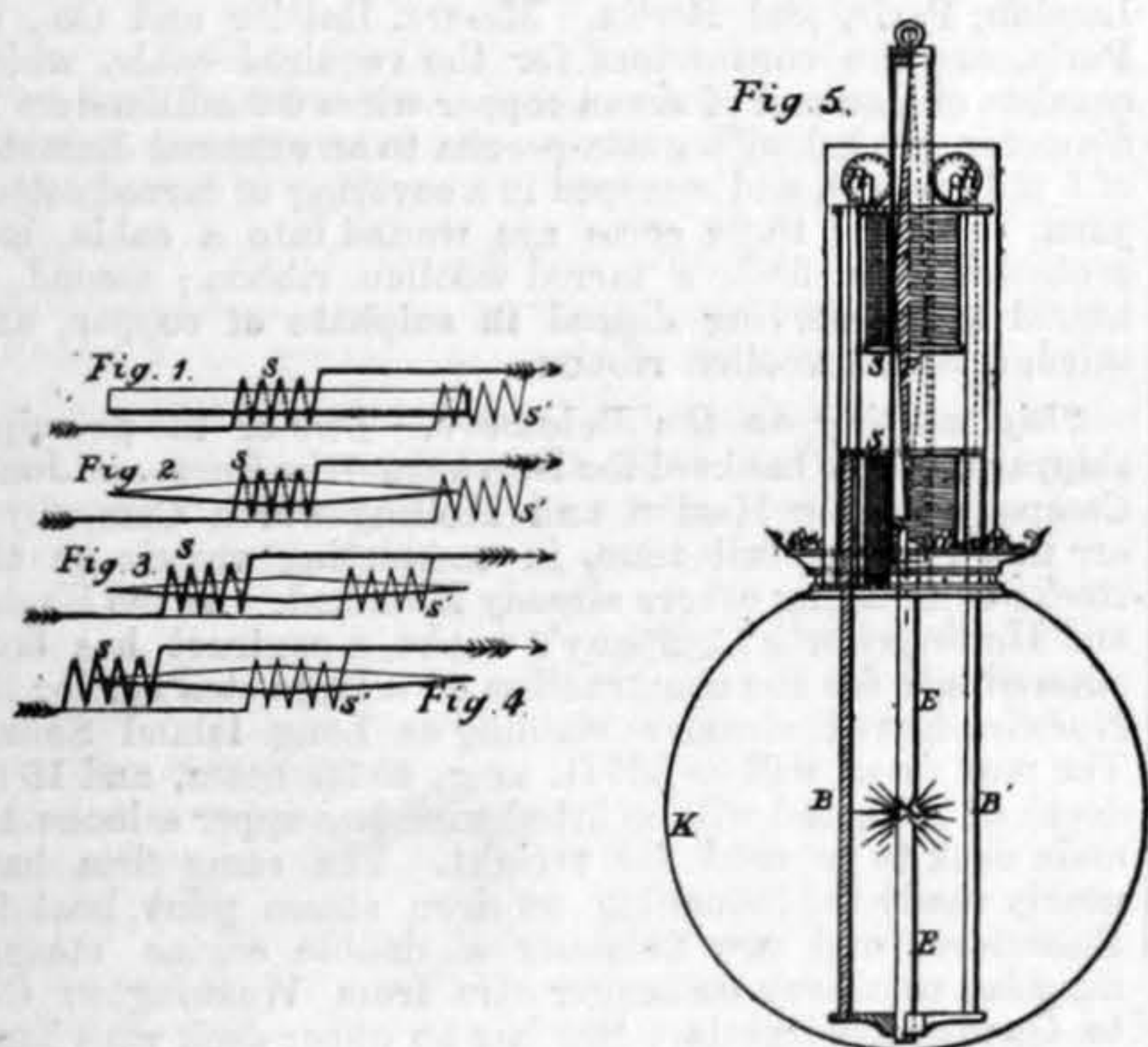
k comes against a fixed plate (not shown), and is forced down, after the copper wires have been sheared, so as to partly release the cylinder *d*. In its descent *k* severs the second set of wires *ll* and forces the knife edge *f* down the opening between the two jaws so to fully expand them for the passage of the cylinder *d*. The ears *h h* catch on the sides of the stop plate and support the cage from falling. Another modification is shown in which a chain link takes the place of the cylinder *d*. (April 5, 1880).

1396. Mechanism for Lighting Lamps: J. and J. Hinks, Birmingham. [6d. 12 Figs.]—Applicable to hydro-carbon and other lamps having one or more wicks, and also to gas lamps. When used with hydro-carbon lamps, the mechanism consists of an inclined tube fixed by, or between, the wick cases, and covered at its upper end by a cap with a sharp or roughened under surface. When a match is pushed up the tube it is ignited as it forces open the cap, and is held in the required position in



contact with the wick by a spring at the back of the cap. When this spring is released, by a handle provided for the purpose, the match falls out. The illustration is a view partly in section of a duplex burner: *a* is the wick case, *b* the match tube, *d* the hinged cover jointed at *d*, and closed by the spring *f*; *i* is a pusher to open the cover by means of the levers *g* and *h*. When a wax match is used it is enclosed in a holder *k*, but a wooden match is usually long enough without a holder. Another modification of the invention is shown, slightly differing in its details. (April 6, 1880).

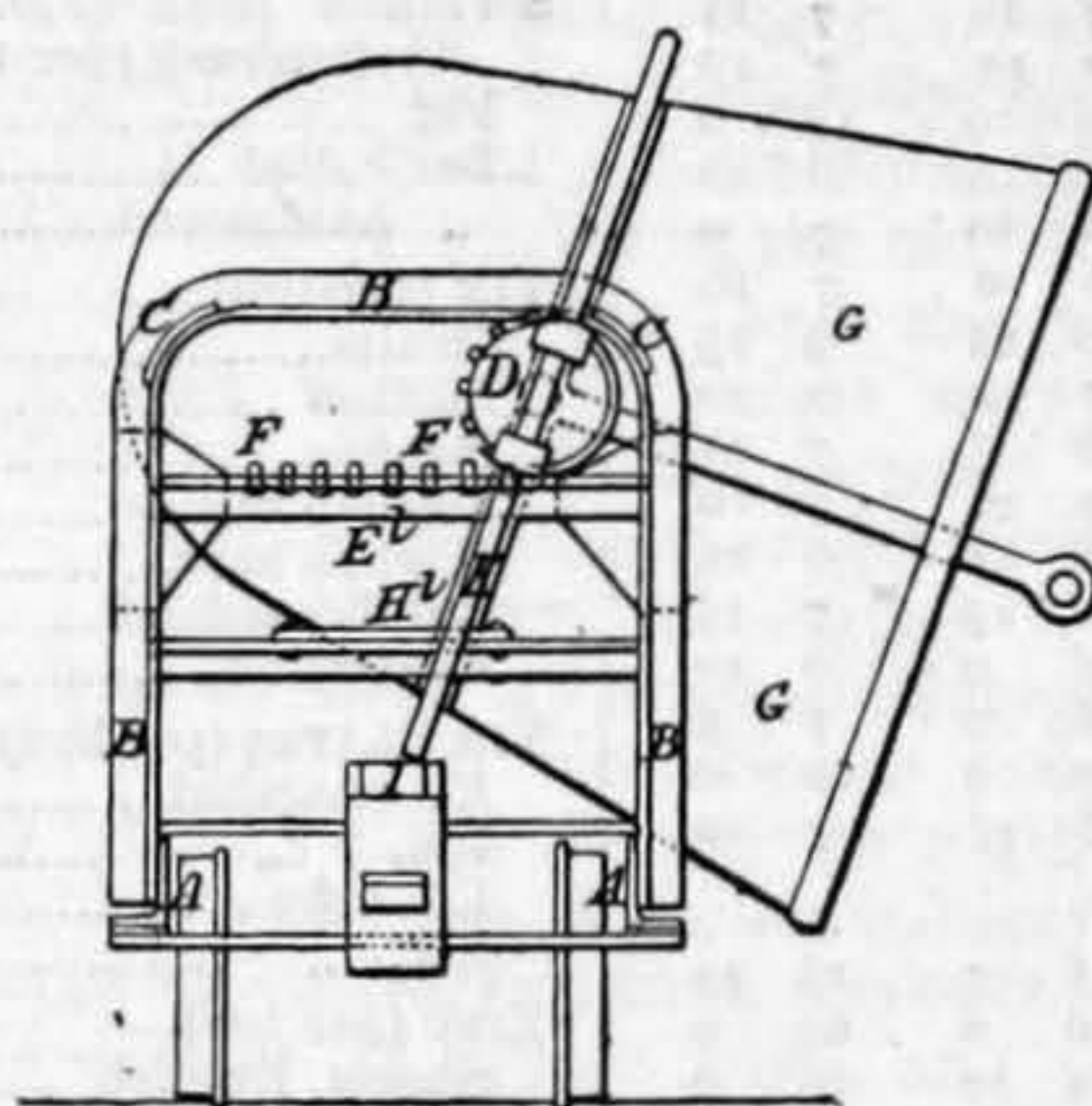
1397. Electric Lamps: C. D. Abel, London. (F. Krizik and L. Piette, both of Pilsen, Austria). [6d. 11 Figs.]—The essential feature of novelty in this invention consists in the use of solenoid cores, having the mass of the metal, of which they consist, lessened towards each end; and combining with them two differential solenoid coils, one being in the main circuit and one in a short circuit, for the regulation of the electric lamp. Figs. 1, 2,



3, and 4 show the principle on which the invention is founded. In a core of uniform section (Fig. 1) placed within solenoid coils *S S'* of equal magnetic force, the attraction on the core will depend on its position relatively to the coils, hence when in the position shown it will be more strongly attracted by *S'* than *S*. By making the core as shown, Figs. 2, 3, 4, notwithstanding the different positions occupied by the core, it remains equally attracted by the two coils

S S'. Fig. 5 shows the core *F* attached to socket of upper carbon the whole balanced by a weight attached to a cord passing over pulley *R*. When the carbons are too near, the attractive power of *S* being increased while *S'* is diminished, the core *F* is attracted upwards. When the carbons are too far apart, *S* loses force, and *S'* gains force, so that the core *F* is attracted downwards, and causes the carbons to approach. (April 6, 1880).

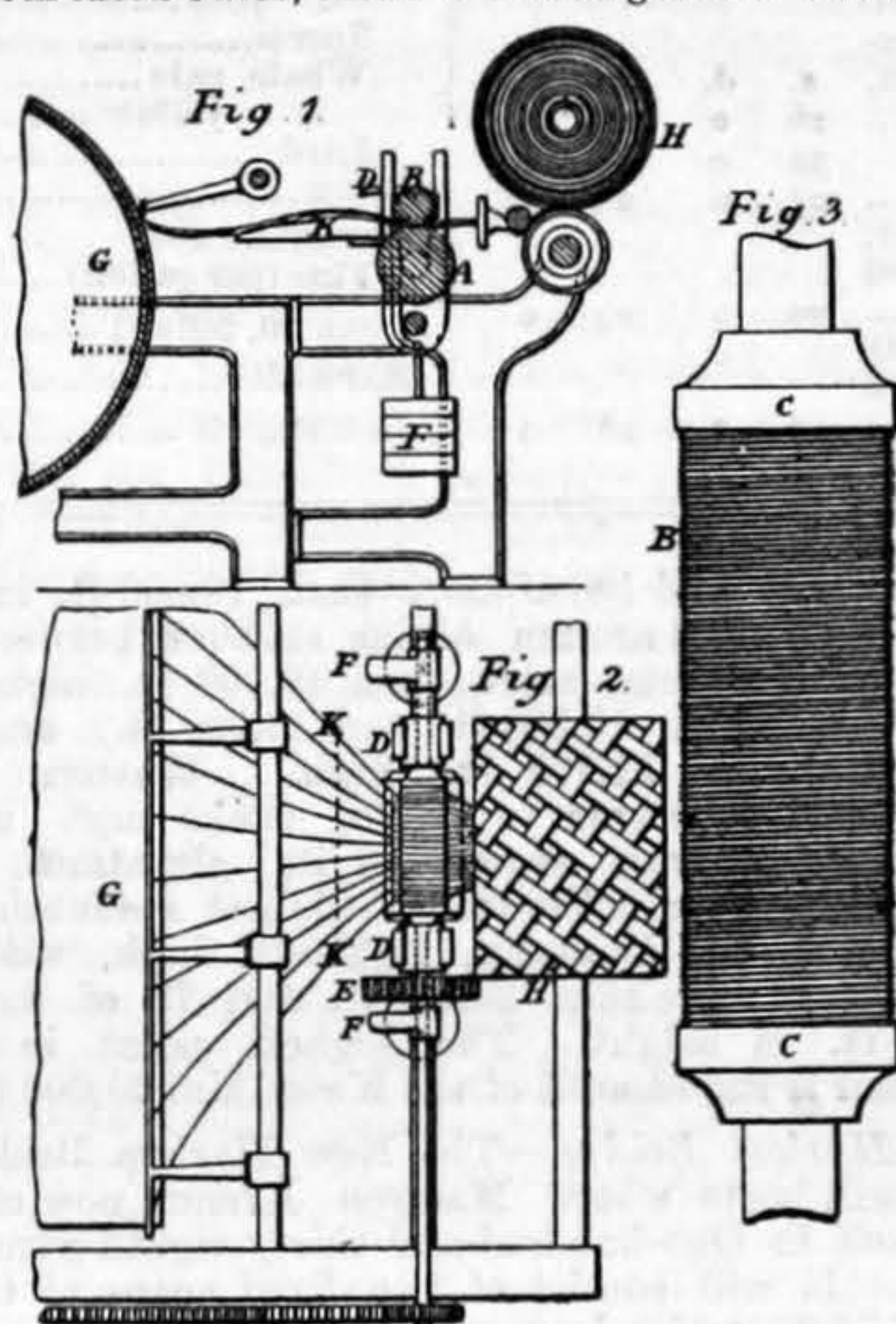
1405. Tip Trucks, &c.: S. Geoghegan, Dublin. [6d. 3 Figs.]—The illustration shows a truck in the position for discharging its contents. The body is carried at each end by a toothed roller resting on a toothed bar *F*, and capable of rolling thereon, so as to carry the body outward at the same time that it



is tipped, in order that it may be inclined at a greater angle than would be the case if it were rotated on a fixed centre. *K* is a locking bar that engages with catches, and *I* is a stop to steady the truck when being shunted. (April 6, 1880).

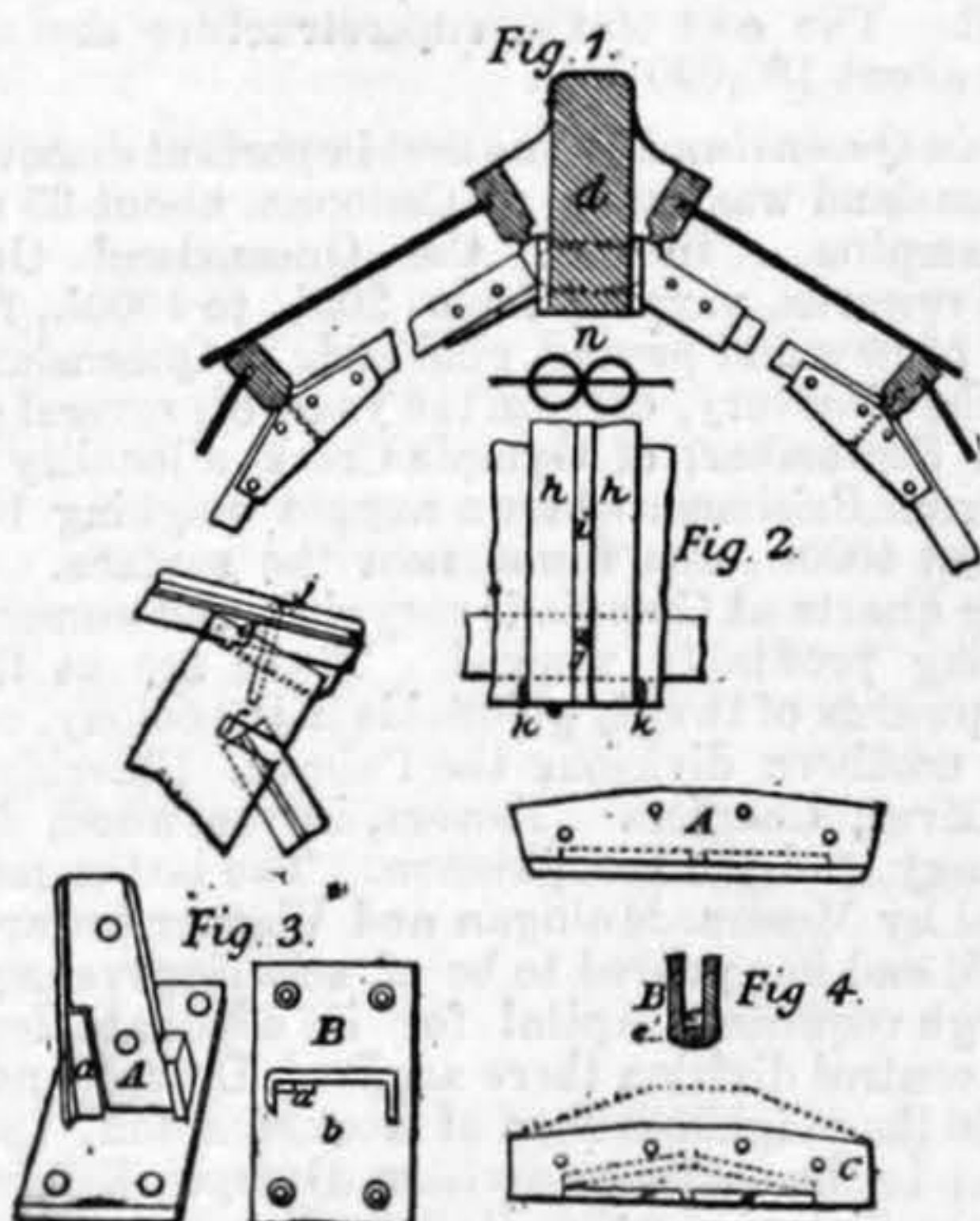
1421. Spoons and Forks: W. R. Lake, London. (W. Conraetz and E. Zwierzina, Vienna). [2d.]—These articles are made of iron, and are cast in moulds. After being converted into malleable iron, they are polished, stamped in dies, and coated with silver, tin, &c. (April 7, 1880).

1430. Breaking up Wool Burs: H. Simon, Manchester. (L. Offermann, Leipzig). [6d. 3 Figs.]—The object of the improvements is to break up or cut the longer bur fibres of wool, so that they cannot be seized by the drawing rollers of the combing machine. The invention essentially consists in the use, for this purpose, of a pair of rollers, between which the wool sliver is passed, one of the rollers having blunt cutting edges in close proximity to, but not touching, the surface of the other roller. Figs. 1 and 2 are respectively a part vertical section and a part plan of a carding machine with the invention applied. Fig. 3 shows an enlarged view of the roller having the blunt cutting edges: *A* is a smooth-faced roller, and *B* the cutting roller. The ends *CC*



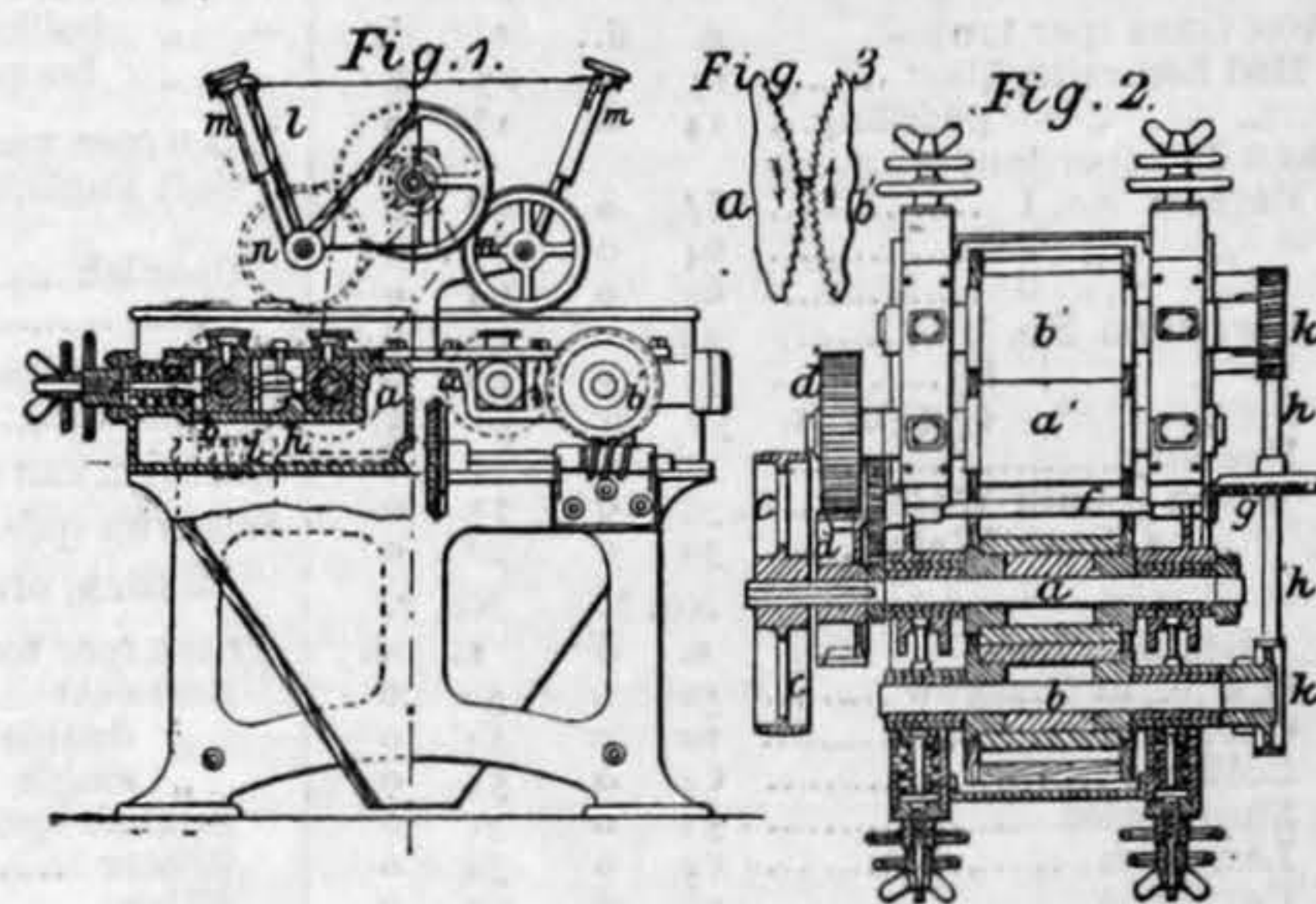
of the latter rest upon the roller *A*, and are slightly larger in diameter than the cutting edges, to prevent absolute contact of the edges with the surface of roller *A*. Both rollers rest in bearings *D*; *A* is driven from the doffer *G*, and communicates motion to *B* by toothed wheels *E*. Weights *F* maintain the pressure on the top roller. *G* is the doffer, and *H* the winding apparatus, between which the rollers are placed. The wool sliver is led over guide-bars *K*, and delivered to the rollers in a broad band of uniform thickness. The apparatus may be applied to the gill boxes following on the carding engine. (April 8, 1880).

2141. Glass Roofing: E. Tracey, Forest Gate, Essex. (W. Howitt, Ilford). [6d. 11 Figs.]—The invention is



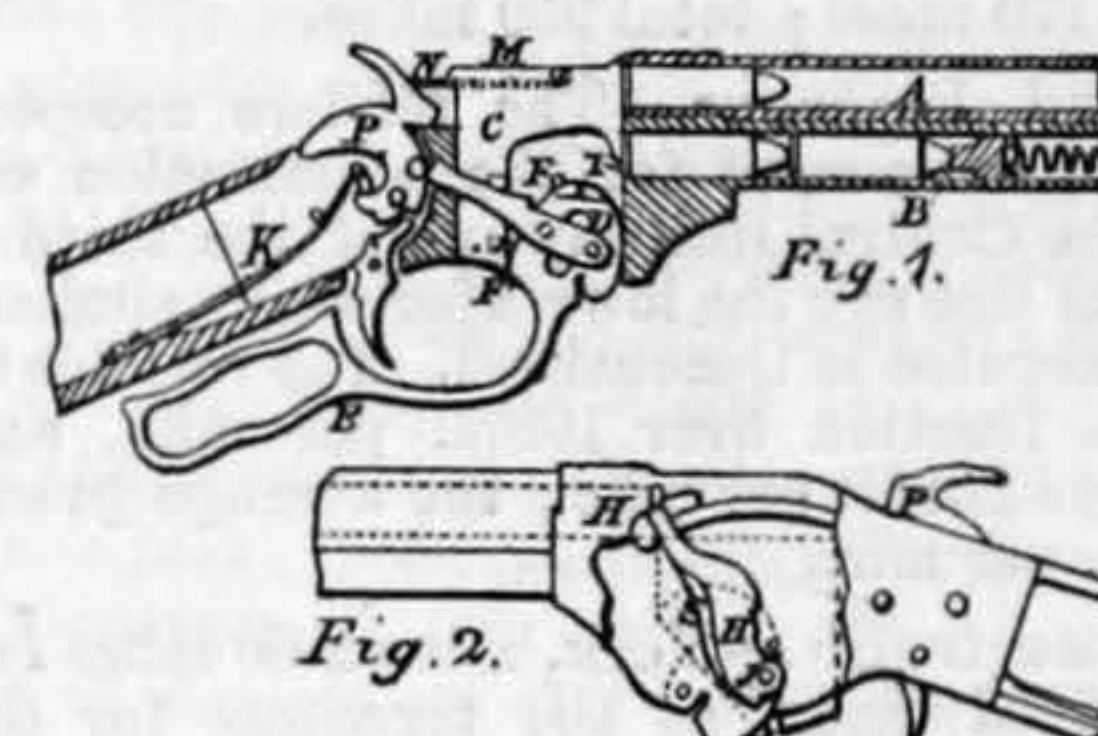
particularly adapted for railway stations, conservatories, &c. The illustration shows parts of a curved roof suitable for a hothouse. Fig. 3, *A* and *B*, shows in perspective and in plan a cast-iron step for attaching the ends of a rafter or principal to the wall plate and the ridge piece, the latter application being shown. Fig. 4, *A*, *B*, and *C*, shows in elevation and section a "rib," or junction piece for uniting portions of a rafter at a knee, as seen in Fig. 1. A hole is bored through the rib for the insertion of a screw to secure the purlins. Fig. 2 shows in section and elevation an improved metal sash bar composed of two hollow slit tubes, soldered together, and forming guides, into which the glass is inserted. The method of attaching the sash frames to the purlins is shown in Fig. 1, and also to a larger scale in the details. The upper ends of the panes are inserted in a groove in the side of the purlin, and the ends of the sash-bars in holes mortised out for their reception; the lower ends project over the next purlin so as to drip on the glass below. The inventors state they "abandon in toto everything like cement or putty." (May 26, 1880).

2186. Roller Mills for Treating Wheat, &c.: M. Benson, London. (C. Oexle, Augsburg, Germany). [8d. 3 Figs.]—Relates to roller mills, and describes "a new mode of rotation" by which a pair of crushing, grinding, or cutting rollers are worked or moved in the same direction. Figs. 1 and 2 are respectively an elevation and a plan both partly in section of the improved mill which is constructed in duplicate; a section of the rollers is also shown, the nature of their action on the grain, and their direc-



tion of rotation. The rollers *a a'* make from 80 to 300 revolutions per minute, while the roller *b'* revolves in the same direction at a very slow rate. The grooves on the rollers may be either straight or spiral. The following advantages among others are stated to be secured by revolving both the rollers in one direction: (1) The grain is granulated without producing flour; (2) it is cut and not crushed; (3) it is divided along its longitudinal axis so that any dirt contained in the crease can be subsequently removed; (4) the grooves last longer; (5) better bran is produced. (May 29, 1880).

2192. Magazine Firearms: A. Schneider and T. G. Elliott, San Francisco, U.S.A. [6d. 9 Figs.]—The improvements are especially adapted to be used in cases where the magazine for holding the ammunition extends beneath the barrel of the arm. Fig. 1 is a longitudinal section, and Fig. 2 a section showing the opposite side of the breech-block and shell extractor. A vertically sliding block *C* has the lower front cut away to receive the head of the guard lever *E*, while the rear or vertical portion is perforated to receive actuating pins *F F*, which project from the convex head of the lever *E*, and which draw the block down when the lever is moved. The shell extractor *H* is operated from the head of the lever *E*, and an arm *I* from the opposite side of the head connects with the hammer *P*, and cocks the gun. A spring arm or plate *M* upon the top of the breech-block *C* takes an inclined position when the block begins to move downward, and acts as a



guide to the ejected shell, and also prevents the fresh cartridge from being thrown out after it leaves the magazine *B*, and before it enters the barrel *A*. The hammer *P* is caused to rebound after striking and firing the cartridge. The hammer is actuated by a spring *V*, and secured by a link to make what is known as a rebounding lock. It strikes the firing pin by its momentum, and the recoil brings it back to its safety notch. The gun may be used as a single breechloader, and the barrel charged without using the magazine *B*; this is done by throwing the breech-block *C* half-way down; this ejects the empty shell, throws the extractor *H* back, but does not uncover the magazine. The cartridges contained in the magazine are pressed forward by a spiral ring, as shown. (May 29, 1880).

UNITED STATES PATENTS AND PATENT PRACTICE.

Descriptions with illustrations of inventions patented in the United States of America from 1847 to the present time, and reports of trials of patent law cases in the United States, may be consulted, gratis, at the offices of ENGINEERING, 35 and 36, Bedford-street, Strand.

FOREIGN AND COLONIAL NOTES.

American Union Telegraph Company.—This company, after a year and a half of hard fighting, now owns and controls 60,000 miles of lines and by the end of the year will control 75,000 miles. It reaches every important city in the United States, controls the Dominion Telegraph Company, of Canada, and employs 1500 officers and 5000 operators.

Chicago and North-Western Railroad.—The Chicago and North-Western Railroad Company announce that by November 1 it will have the track laid on its Deadwood extensions to Pierre, on the east bank of the Missouri river, opposite Fort Pierre. From the same date the company will have in operation a through route to Deadwood, viz., by railway to Pierre, and a stage thence to Deadwood.

PRICE LIST OF MATERIALS.

THURSDAY, NOV. 4, 1886.

METALS.				IRON, WROUGHT—				STEEL CASTINGS—continued				PITCH (per cwt.)—				
	£	s.	£		£	s.	£		£	s.	£		s.	d.	s.	d.
ANTIMONY ORE (per ton)—	0	0	0	Cleveland angles.....	5	10	5	Side cranks, cross heads,	4	0	30	British.....	6	0	7	0
Regulus (star).....	62	0	65	" bars.....	5	10	5	crank wheels, engine	4	0	30	Archangel.....	0	0	0	0
BRASS (per lb.)—	s.	d.	s.	" puddled bars...	3	12	3	slides, &c.....	20	0	26	PLUMBAGO (per cwt.)—	16	6	19	0
Sheets, 48 x 24.....	0	7	0	" boiler plates...	7	10	7	Tumbler bars and other	20	0	26	Ceylon lump.....	10	6	14	0
Yellow metal.....	0	6	0	" rails.....	5	7	6	castings for dredging	20	0	26	" chips.....	6	3	6	9
CASTINGS TYNE AND CLEVELAND	£	s.	£	" ship plates.....	6	10	6	purposes.....	20	0	26	" dust.....	6	3	6	9
(per ton).....	£	s.	£	" sheets.....	7	10	7	SWEDISH IRON (F.o.b) at	£	s.	£	RAILWAY GREASE (per	28	0	30	0
Girders.....	4	17	6	" hoops.....	6	15	7	Gottenburg (per ton)	0	0	0	cwt.)—Rose's.....	60	0	00	0
Chairs.....	3	0	3	" girders.....	11	0	15	Pig.....	9	10	12	Pritchard, Offer and Co.'s	15	0	30	0
Pipes.....	4	7	5	Scotch bars.....	6	0	6	Bar rolled.....	15	0	15	concentrated.....	5	6	5	9
COPPER (per ton)—	£	s.	£	" nail rods.....	6	10	7	" hammered.....	90	0	90	Yellow grease.....	00	0	00	0
Chili bars.....	61	0	61	Shropshire bars.....	8	15	9	TIN (per ton)	91	0	92	RESIN (per cwt.).....	35	0	35	6
Australian.....	69	10	72	" boiler plates	7	0	7	Straits.....	93	0	94	TALLOW (per cwt.)	00	0	00	0
English tough, best.....	66	0	67	" sheets.....	6	5	7	Billiton.....	92	0	93	N. American.....	35	0	35	6
" ingots.....	65	0	65	Staffordshire bars	7	10	8	Banca.....	93	0	94	S. American beef.....	00	0	00	0
Sheets, &c.....	70	5	71	" plates.....	8	15	9	English ingots.....	93	0	94	" sheep.....	33	0	35	0
Bottoms.....	74	0	75	" boiler.....	6	15	7	English bars.....	93	0	94	Australian beef.....	35	0	37	0
IRON ORES (per ton)—	s.	d.	s.	" hoops.....	6	15	7	English refined.....	90	0	90	sheep.....	37	9	39	0
Red hematite, blast.....	13	6	17	Welsh rails S.W.....	6	0	6	Australian.....	18	0	25	St. Petersburg, Y.O.....	35	6	36	0
" puddling.....	14	0	18	" bars.....	6	0	7	TIN PLATES (per box)	00	0	00	English, town.....	12	0	13	0
IRON PIG (per ton)—	£	s.	£	" boiler plates, S.W.	9	0	10	I.C. charcoal.....	15	0	19	Rough, English.....	18	0	18	6
Barrow No. 1.....	65	0	66	" hoops, S.W.....	6	15	7	I.X.....	00	0	00	TAR—Stockholm (per barl.)	12	6	13	0
" 2.....	64	0	65	LEAD (per ton)—	15	5	15	I.X.....	20	0	21	Archangel.....	33	9	34	0
" 3.....	63	0	64	Soft English pig.....	00	0	00	I.C. coke.....	11	0	14	TURPENTINE—Spirit—	20	0	35	0
Cleveland No. 1.....	44	0	44	" W.B.....	14	17	15	ZINC (per ton)—	17	0	20	American (casks).....	20	0	35	0
" 3.....	39	6	39	Spanish.....	10	0	10	Sheets, English.....	5	0	5	WIPINGS, engine, (per cwt.)	20	0	35	0
" 4 (Forge).....	38	0	38	Sheet.....	10	0	10	WIRE, fencing.....	8	d.	8	CHEMICALS, &c.				
Foundry.....	37	0	37	PHOSPHOR BRONZE—	112	0	135	" Telegraph (galvanised)	18	0	25	ACIDS—	s.	d.	s.	d.
Welsh (South Wales).....	55	0	72	(per ton).....	6	15	6	COALS AND COKE.	00	0	00	Aquaforis (per lb.).....	0	2	0	4
" (North Wales).....	50	0	70	QUICKSILVER (per bottle)	6	15	6	Barrow.....	00	0	00	Sulphuric acid (per lb.)	0	0	0	1
No. 1.....	No. 3.	No. 3.	No. 3.	SPELTER (per ton)—	16	5	16	Bristol.....	00	0	00	Sulphuric acid, brown...	0	0	0	0
Scotch Pig—	s.	d.	s.	Silesian, ordinary.....	16	5	16	Derbyshire.....	00	0	00	AMMONIA—Muriate (per	£	s.	£	s.
G.m.b., at Glasgow.....	52	6	50	STEEL (per ton)—	34	0	50	Lancashire.....	29	0	38	ton).....	29	0	38	0
Gartsherrie.....	62	0	54	Best cast.....	45	0	65	Newcastle and Durham...	23	0	24	ARSENIC—	s.	d.	s.	d.
Coltness.....	63	0	54	" double shear.....	32	0	50	Scotch.....	10	0	11	White, lump (per cwt.)...	23	0	24	6
Summerlee.....	58	0	51	" single.....	14	0	22	Staffordshire.....	5	6	5	Powdered (per cwt.).....	10	0	11	0
Langloan.....	62	0	53	English spring.....	00	0	00	Welsh.....	4	6	8	BLEACHING powder per cwt.	5	6	5	9
Carnbroe.....	56	0	52	Bilister.....	28	10	30	Yorkshire.....	6	0	8	BORAX—refined (per cwt.)	60	0	63	0
Monkland.....	52	6	50	Milan.....	6	10	7	COKE—	5	0	8	BRIMSTONE (per ton)—	£	s.	£	s.
Clyde.....	53	0	50	Bessemer rails.....	12	0	13	Cleveland.....	11	6	13	Rough.....	6	0	6	7
Govan, at Broomielaw...	59	0	51	" tyres.....	12	0	13	Durham.....	12	0	13	Flour.....	11	0	13	0
Calder, at Port Dundas...	52	6	50	" axles.....	7	5	8	Roll.....	9	0	9	Roll.....	9	0	9	10
Glengarnock, at Ardros-	56	0	53	" billets.....	13	0	13	COPPERAS—green.....	45	0	50	COPPER—Sulphate (per	s.	d.	s.	d.
san.....	56	0	53	" plates.....	12	0	13	cwt.).....	20	0	20	LEAD, SALTS, &c. (per cwt.)	£	s.	£	s.
Eglinton, ditto.....	52	6	50	" angles.....	12	0	13	Acetate, best.....	37	0	38	Acetate, best.....	37	0	38	0
Dalmellington, ditto.....	52	6	50	STEEL CASTINGS (per cwt.)—	26	0	28	Engelbert's lubricator...	44	2	00	Brown.....	28	0	30	0
Carron, at Grangemouth	52	6	50	Hydraulic cylinders in	30	0	34	Seal, brown.....	23	0	24	Red.....	16	9	17	0
Ditto, specially selected	55	0	50	the rough not to ex-	25	0	28	" pale.....	29	10	30	White.....	22	0	22	6
Shotts, at Leith.....	62	0	54	ceed 6 ft. in length,	20	0	24	Sperm.....	68	0	70	LITHARGE (per cwt.).....	25	0	29	0
(The above all deliverable alongside).	s.	d.	s.	guaranteed.....	20	0	24	Whale, pale.....	23	0	28	POTASH—Bichromate (per	0	5	0	6
Shropshire.....	50	0	85	Do. do. finished.....	30	0	34	" yellow.....	26	0	27	lb.).....	25	0	28	0
North Staffordshire.....	42	0	60	Pinions and cog-wheels...	25	0	28	Lard.....	45	0	47	SALTPETRE (per cwt.)	21	0	22	6
South.....	45	0	75	Hammer tups, faces,	20	0	24	GLUE.....	30	0	40	English refined, kegs...	10	0	11	0
Yorkshire Thornaby pig	70	0	75	swages, 5 cwt. and	25	0	26	PETROLEUM—	s.	d.	s.	Bengal.....	14	3	14	6
No. 3.....	70	0	75	above.....	25	0	26	Fine (per gallon).....	0	9	0	SODA Caustic.....	10	0	11	0
				Holders-up for rivetting	25	0	26	COAL oil, refined.....	0	8	0	" Nitrate.....	14	3	14	6
				machines, &c., 1½ to 5				RAPE oil.....	29	6	29	" Crystals (per ton)...	£3	8	£3	10
				cwt.....				LINSEED oil.....	27	3	28					

Through cars will run between Chicago and Pierre, thus necessitating but one change between Chicago and Deadwood in either direction. The distance is as follows: Chicago to Pierre, 780 miles, all rail; stage, Pierre to Deadwood, 170 miles; total 950 miles.

Queensland Railways.—The tenders accepted by the Queensland Government for the construction of the fifth section of the Central Railway and of the third section of the Northern line are the lowest for which similar work has ever been executed in Queensland. The rate for the Central line was a fraction over 1937l. per mile, and for the Northern line 2000l. per mile; the average price for both being 1953l. per mile.

Western Australia.—York, a town 60 miles from Perth, has been fixed upon as the terminus for the Eastern Railway of Western Australia. An extension from Guildford to York, 50 miles, will cost about 200,000l.

The International Bridge.—The Grand Trunk Railway Company of Canada is placing large quantities of stone round and about the several piers of the International Bridge, at Buffalo. The great amount of freight and passenger traffic, which now tests the full capacities of the bridges, necessitates these improvements. Negotiations, it is said, are proceeding for duplicating the structure, so as to secure a double track.

Cheap Belgian Railways.—The Belgian Government has taken the initial step towards establishing a system of cheap railways by appointing a commission to make a report upon the subject.

Fencing on the Canadian Pacific Railroad.—A contract for wire fencing on the Canadian Pacific Railroad, awarded to Messrs. Skead and Haycock, of Ottawa, includes 200 miles, commencing at Emerson and extending along the Pembina branch, and the first 100 miles west of Winnipeg.

The Highest Mountains.—Hermann von Schlagintweit, in the last volume of his journeys in India and high Asia, gives a table of altitudes, including statements of the heights of the most elevated mountains. The elevations are not extraordinary south of the Himalayas, the most marked ones being four mountains from 11,000 ft. to 15,300 ft. high in Assam, and the Sufedkoh Peak in the Punjab, 19,839 ft. high. The Eastern Himalayan district, embracing Bhootan, Sikkim, and Nepal, contains the highest mountain known on the earth, which is called Mount Everest by the English, and is 29,002 ft. high: and the third highest, Kinchinjunga, 28,156 ft. high. The same district has besides 32 mountains of more than 20,000 ft., and 32 of more than 10,000 ft. The Western Himalayan region, extending from Kumaon to Hazara, exhibits the Nanda Devi in Kumaon, 25,749 ft., as its highest peak, and has besides 29 mountains of more

than 20,000 ft. and 108 of more than 10,000 ft. in height. In Eastern Tibet are ten Alpine stations between Lassa and Guari Khorsum, more than 10,000 ft. high, two of them reaching to 15,500 ft. and 16,700 ft., and Lassa, the capital, is 11,700 ft. high. Western Tibet, from Guari Khorsum to Balto, ranks next after the Eastern Himalayan region in its elevations, having within its boundaries the second highest mountain known on the earth, the Dapsang, 28,278 ft. high, with twelve mountains of more than 20,000 ft. and 73 of more than 10,000 ft. in height. The highest point in Eastern Turkistan is the summit of the Kwen-hin, 20,000 ft. high.

The Harlem Bridge.—The New Harlem Bridge, New York, will begin where Madison Avenue now ends, and will reach to One-hundred-and-thirty-eighth Street, Morrisania. It will consist of two fixed spans at each end, each of 73 ft., and a draw span of two openings, each to be 150 ft. long. This will make the entire bridge about 600 ft. in length. There will be five stone piers and two abutments. The centre pier is now completed. It is 47 ft. in diameter at the base, and 36 ft. at the top. The second pier on the east side of the river is well under way. The side piers will be 16½ ft. wide at the base, 5 ft. wide at the top, and 40 ft. high. The estimated cost of the piers is 70,000 dols. The superstructure of the bridge will be a plain truss of iron. Its design has not yet been fully determined upon. The height above high water of the middle span will be 28 ft., while that of the fixed span will be 25 ft. The cost of the superstructure and approaches will be about 130,000 dols.

Gold in Queensland.—The first important discovery of gold in Queensland was made at Canoona, about 35 miles from Rockhampton. In 1867 the Queensland Government offered rewards, varying from 200l. to 1000l., for the discovery of new and paying goldfields in Queensland. This led to the discovery, early in the year, of several goldfields; and in September, of Gympie Creek, a locality about 130 miles from Brisbane, where a nugget weighing 100 lb., and valued at 4000l., was found near the surface. The gold-bearing quartz at Gympie is very rich, and numerous claims are being profitably worked. There are at the present time upwards of twenty goldfields in the colony, comprising, in the northern division, the Palmer, Etheridge, Gilbert, Cape River, Charters' Towers, Ravenswood, Normanby, Cloncurry, and the Hodgkinson. The last-named was discovered by Messrs. Mulligan and Warner towards the end of 1875, and has proved to be of superior reefing qualities, although requiring capital for its adequate development; in the central division there are Peak Downs, and numerous fields in the neighbourhood of Rockhampton, Calliope, and Boyne; in the southern division, Gympie, Kilkivan, Jimna, Pikedale, Talgai, Lucky Valley, Nanango, Tenningering,

and Leyburn. Surfacing and alluvial digging is decreasing, while much more attention is being given to quartz reefing.

Steel Rails on the Belgian State Lines.—It appears that the ratio of steel rails to the whole number of rails on the Belgian State Railways was last year 45.87 per cent. The substitution of steel rails for iron rails is thus far from being completed on the system. Even on the main lines the proportion does not exceed 54 per cent. As regards iron permanent way, the administration seems to have a preference for Vautherin sleepers modified according to the model of the Rhenish lines. In 1873, the steel rails laid down upon the system cost 18l. 16s. per ton; in 1879, the corresponding cost was 4l. 10s. per ton.

Rolling Stock on the Belgian State Lines.—The effective supply of rolling stock on the Belgian State Railways last year was as follows: Locomotives, 1149; tenders, 760; passenger carriages, 2558; vans, 491; trucks and miscellaneous vehicles, 32475.

Vienna Telegraphy.—Vienna is about to be supplied with underground telegraph lines after the manner of London, Paris, and Berlin. Messrs. Rattier and Co., of Paris, are the contractors for the required cable, which consists of a strand of seven copper wires 0.6 millimetres in diameter, coated with gutta-percha to an external diameter of 5 millimetres, and wrapped in a covering of tarred cotton yarn. Some of these cores are wound into a cable, and protected with, first, a tarred woollen ribbon; second, a tarred hemp serving dipped in sulphate of copper, and third, a tarred woollen ribbon.

Shipbuilding on the Delaware.—Two of the principal shipyards on the banks of the Delaware—the Pusey and Jones Company and the Harlan and Hollingsworth Company—are now running full time, in completing vessels on the stocks or finishing others already launched. At the Harlan and Hollingsworth Company's works, a contract has been entered into for the construction of a large steamer for the Norwich line of steamers running on Long Island Sound. The new vessel will be 335 ft. long, 46 ft. beam, and 18 ft. depth of hold, and will be fitted with two upper saloons, the main deck to be used for freight. The same firm have nearly ready for launching an iron steam pilot boat for Baltimore, and are finishing a double engine steamer intended to convey passenger cars from Washington City to Quantico, Virginia. She has an upper deck with handsome state rooms, while the main deck has tracks upon it for cars.

VENTILATION OF THE YEOVIL TOWN HALL.—Messrs. Robert Boyle and Son's system of ventilation has been selected by the directors, from the competition plans submitted, for the ventilation of the Town Hall, Yeovil.