VISITS IN THE PROVINCES.

THE BARROW FLAX AND JUTE WORKS.

THE Barrow Flax and Jute Works, was one of the principal objects of interest on the occasion of the recent visit of the Institution of Mechanical Engineers to Barrow. The history of the establishment of these works is of a very interesting character. As is well known, the town of Barrow sprang into existence owing to the very spirited development which took place years ago, and which is still going on, in the hematite iron trade of the district. The inauguration of the iron and steel works, which are gigantic industrial establishments, soon brought together a very large and yearly increasing population, but, of course, employment in these works could only be found for men and boys, and in the case of working men with large families they had either to leave the town and find employment in other places where not only they but the other members of their families could get work, or their daughters, and in many instances their wives, had to go elsewhere and secure work in factories and in other places. The consequence was that it was found difficult always to secure the services of steady men, for they naturally could not be expected to live away from their families any longer than they could possibly help. Sir James Ramsden, the managing director of these works, and a gentleman to whom all honour is due for the zeal and assiduity with which he has promoted the welfare of the town of which he is one of the foster fathers, developed a scheme for establishing a flax and jute works with the object of making Barrow much more than it had been in years gone by a "home" for those who were employed in it. Through his instrumentality the Barrow Flax and Jute Company was established in 1870. The town, it may be remarked, possesses many advantages for the successful working of this trade, for not only does it furnish employment for a large number of persons who previously had nothing to do, but by the direct shipment of jute from India to Barrow a new trade was introduced into the port, and the raw material was secured at a small cost of freightage, which has added very materially since to the increase in the tonnage of imports. The largest class of ships can find their way into the docks at Barrow, and here a series of warehouses has been built for the storage of the raw material as it is discharged from the vessels. Another important feature in connection with the trade is the fact that a great proportion of the jute goods now manufactured are for the American market, and now that large vessels are leaving Barrow almost daily to all parts of America, while on the other hand a fortnightly service of steamers has commenced plying in connection with the Anchor Line between Barrow and New York direct, the facilities for the transportation of goods to the New Continent have been greatly increased, and thus the jute trade is not only adding very materially to the tonnage of imports, but also to the tonnage of exports connected with the port of Barrow. There is, perhaps, no trade which has shown greater progress during late years than the jute trade, for jute yarns and jute fabrics are now extensively applied, as Mr. W. Fleming, the general manager of the works of which we are speaking, told the Mechanical Engineers a few weeks ago, in the production of "telegraph cables, wire ropes, oil-cloth and linoleum manufactures, ropes, twines, cords, &c., even down to artificial hair." It is interesting to know that this cheap material is now being produced in the shape of men's and women's clothing, and it is not unreasonable to suppose from the present tendency in the direction of further development that jute will play a much more important part in the future than in the past. Kalemeit is now produced by the Barrow Flax and Jute Company for carpets, rugs, window drapery, &c., and it is being more and more generally used every day. The process is a secret, but it is understood to consist chiefly of dyeing and printing, and some good and fast colours have been obtained. Patterns were shown of this cloth before the Mechanical Engineers at their late meeting, and they met with general favour. The works of the company occupy a very central part of the borough of Barrow. They have a frontage to Hindpool-road of 580ft., and they extend back a distance of 360ft. along Abbey-road. The style of architecture is attractive. The centre of the main front is occupied as general offices, and as an entrance for workpeople, while on each side of the offices are wings two storeys in height, with towers at each corner three storeys high. The buildings are of red brick, relieved with fire-brick and white freestone.

The works are within a hundred yards of the main line of the Furness Railway, and about one hundred and fifty yards from the Devonshire Dock. A special branch line has been made from the railway into the works, along which the raw material, fuel, &c., is conveyed, and the finished article finds its way back in wagons for delivery by railway or shipping. The jute bales are landed at the rear of the works. A daily supply of the raw material is brought into the "batching-room," where the bales are opened and the jute pulled into stricks, after which it passes through softening machines, consisting of heavy fluted rollers, which crush and crimp the fibres, and make them easier to work. On passing through these machines the batching process consists of the sprinkling of the stricks with oil and water. Four of these machines are at work. The jute is weighed into bundles and carried into the preparing room adjoining, which is 260ft. by 248ft. The machines here are in rows. In the first place the jute is received by breaker cards, of which there is one row, then a row of finisher cards, a row of first drawing cards, a row of second drawing cards, three rows of spinning frames, and one row of winding machinery. The process in this department is much the same as in a cotton mill, but of course the machinery is more adapted for the heavy work it has to perform. All of these machines are usually in motion, and the material on leaving one row of machines finds its way to the next in rotation, so that there is a continual progression of work from the rear to the front of this part of the building. The process carried on up to this point is all confined to the ground floor to the left of the entrance gate, and the jute in the shape of cops, bobbins, and chains, is conveyed to the right side of the entrance gate. Here is a room for preparing the beams for the looms. From this place the beams pass into the weaving-room, 210ft. square. Here 416 looms of various sizes are at work in the production of sacking, bagging, tarpauling, hessians, striped bedding, jacquard window curtains, and counterpanes. The arrangements in this room have been greatly modified since the fire, and it is observable that all the machinery is in operation. The shafting is all underground, so that all belting from the roof is obviated, and the room in consequence has a more airy aspect. The looms are employed on different qualities of jute, from the fine material made from line yarns for the Kalemeit process to the roughest bag cloth, and from counterpanes of attractive designs and colours to the common striped cloths for bedding. Leaving the weaving room, the cloth is conveyed to the preparing and cloth-receiving room, which occupies the front of the building on the right of the entrance, and receives its light from Hindpool-road, the weaving and spinning sheds receiving their light from the roof. Here the work is inspected, and the calendering and finishing process, for which there is special machinery, is conducted. The cloth leaves these machines, and by means of slits in the roof of this room it is wound into the storey above, where the goods are lapped by machinery ready for packing, and where the bagging is cut into proper lengths and then sown by machines which are of various styles, and do their work by means of various stitches. The cloth in bundles passes by means of small wagons on rails through a corridor behind the first floor of the general offices to a room over the winding and warping department at the north end of the building. Here are several printing machines for printing the names of firms, &c., on the finished bags, and at the extreme end of this room are hydraulic presses receiving pressure from a special engine. The goods are placed in these presses, and when intended for shipment they are pressed into bales of great solidity. These are covered with jute cloth and then secured with steel bands, which are specially manufactured by the Barrow Steel Wire Company. The railway siding adjoins the room where the finished goods are made ready for transmission by rail or by sea, and the bales are lowered into wagons and disposed of with much celerity. It is estimated that the average output of the Barrow Flax and Jute Works is 140 tons per week, and it is noteworthy that 1700 hands are employed in the factory, while employment is found for fully 300 people in different parts of the town in sack-sewing, depôts having been opened in some half dozen districts where the jute bags are taken ready for sewing, and distributed among the women who are disposed to earn a few shillings per week at home. When these sacks are finished the women employed on them take them back to the depôt, and they are paid at brief intervals for the result of their labour. There are three large engines in the works. The spinning mill engines are a pair of compound beam engines made by Messrs. J. Musgrave and Sons, Bolton, who also supplied the weaving and calendering engines, the high-pressure cylinders being 30in. in diameter with a stroke of 3ft. 9in., and the low-pressure cylinders 48in. diameter with 7ft. stroke. The actual power of these engines is 750-horses. The weaving engines are of the same type, the high-pressure cylinders being 32in. diameter with 3ft. stroke, and the low-pressure cylinders 42in. diameter with 6ft. stroke, the actual power being about 400-horse. The calendering engines are of the compound horizontal type, the high-pressure cylinder being 20in. diameter with 4ft. stroke, and the low-pressure 33in. diameter. The horse-power of these engines is put down at 180. These engines are supplied with steam generated by ten Galloway boilers which are at a low level, and the railway trucks are enabled to discharge their load right at the fronts of the boilers. There are in the boiler-house two force pumps used for fire-extinguishing purposes, and also for feeding the boiler, and it is worthy of remark that these pumps did very great service on the occasion of the late fire. The company always keeps up steam in its boilers, so as to be ready with the force pumps should fire arise again in their works. The company has also provided a manual fire engine with all the necessary apparatus for a speedy supply of water in the case of fire, and the reservoirs in the yard, into which the condensed steam finds its way, are also fed with a plentiful supply of town water. The whole of the arrangements of the works are of the most admirable character, and as all the modern appliances, mechanical and otherwise, have been adopted with the view of enabling the management to compete satisfactorily with the markets of the world, the works are considered as one of the most model establishments connected with this fast-growing and important trade, and it was therefore not to be wondered at that the Mechanical Engineers, on the occasion on their visit to Barrow, should have shown great interest and bestowed much attention to the manufacturing facilities possessed by the Barrow Flax and Jute Company. The excellence of the manufactures of this company won for them the gold medal at the Paris Exhibition in 1878. It should be mentioned that the disastrous fire which occurred at these works eighteen months ago destroyed the whole of the weaving shed and other departments in its neighbourhood, but care has been taken to reconstruct the building on the safest principles possible, and further, the opportunity has been taken advantage of to adopt more modern appliances for manufacture, as in the jute trade, as well as in other trades, progress of a very marked character has been made since 1870, when these works were first established. Mr. Melville is the mill manager at this establishment.

THE VIENNA INDUSTRIAL EXHIBITION.

LOCAL exhibitions, even when they embrace the collective produce of an entire country, have only, as a rule, a circumscribed interest to the world at large, unless characterised by some special improvement or progress which threatens to affect their mutual relations of commerce with other lands. In a country like Austria, which has hitherto been mainly dependent on other markets for the higher classes of manufactured goods, the progress and improvement displayed in nearly every branch of industry represented in the present collection have a powerful significance on its future relations to foreign producers.

Any one who saw the ill-fated Exhibition of 1873 cannot fail to be astonished at the rapid advance made in the last seven years, and those who have hitherto looked upon Austria as a market for their wares must be prepared in the future to meet her as a powerful competitor on their own ground. Bohemian glass is proverbially good, and the mathematical instruments of Vienna will bear comparison with any in the world; but up to the present no one ever attempted to substitute native material for imported glass in their construction, and not only lenses, but even the few lighthouse lanterns on the Adriatic, were imported from abroad, when nothing but want of enterprise prevented their being manufactured with superior material at home. Messrs. Kraft and Sons, of Vienna, one of the largest instrument makers in Austria, have at last succeeded, after an immense outlay in experiments and unheard-of difficulties in stimulating the glass manufacturers to attempt anything out of their ordinary line—one firm asked 8s. per lb. for the lighthouse lenses in their rough state—in constructing several for the Austrian marine, and as £600,000 are to be spent in the next few years on the coast of the Adriatic, have secured for their manufactory a greater part of the above sum, which must otherwise have found its way into London or Parisian workshops. A lantern of the third degree is exhibited complete, with specimens of one of the first degree already erected, side by side with English and French lenses, and it cannot be disguised that the latter suffer by comparison. The lesson to be read is that not only is the door shut on future importation, and a new branch of manufacture secured to the country, but the chance of competing with foreign producers on their own coasts is increased by the superiority of the materials and work.

The machinery department is not as well filled as one might have expected, and one or two specially interesting novelties—viz., an electrical railway, by B. Egger and Co., and an improved motor, by Julius Hock and Co.—are not sufficiently advanced to fill the space allotted to them. The contemporary Exhibition at Munich has absorbed so large a quantity of brewing and milling appliances that one can hardly expect the same firms to exhibit largely at both places at once. The well-known firms of Escher-Wyss, Pini, Nemelka, Nagel and Raemp, Wannieck, and Carl Senz and Co. make, however, a very fair show. The latter exhibit a new Non-pareille Grieser, or universal disintegrator, for wheat, rye, barley, maize, gallnuts, &c., in a very compact and powerful form. The internal arrangement consists of two cast iron discs with T-shaped projections, one of which is attached to the spindle and revolves, the other fastened to the casing. The feed is regulated by a belt from the spindle. As soon as the projections or teeth are blunted, the driving belt is reversed and the opposite edges brought into play, so that the discs are self-sharpening, require no labour, and can be easily and cheaply replaced when worn out. Specimens of the several materials treated speak well of the performance, and it promises to become a powerful auxiliary to the roller system, and a good independent disintegrator for brewers and dyers. The action is something between that of a pair of stones and that of the cutters exhibited by Pini and Bollmann, in the Paris Exhibition, described in THE ENGINEER. There are other milling machines on the stand, but the incompleteness of their arrangement prevents further notice at present. Collmann's valve gear, which has been largely adopted in Austria, is shown on a 20-H.P. engine by Schulz and Goebl, of Vienna. Langen and Wolf of course exhibit one of their gas engines—an 8-H.P.—at work, but as we shall again have occasion to refer to this in connection with the electric light as offering an excellent opportunity of comparing the expense of gas *versus* electricity, we must defer a notice of it. Messrs. the Florisdorf Engine Works, exhibit one of Brown of Winterthur's engines, but having seen the one at Paris, we cannot understand why the graceful form of the original should have been hampered with "architectural" additions, which have no bearing on its effectiveness, and say more for the ingenuity of the foundry than for the taste of the engineer. Messrs. Wannieck, of Brunn, have a very powerful horizontal engine, with a sort of Corliss expansion, and flat valves.

Some mention must be made of the marked improvement in general manufactures. The china, more especially the artificial flowers, the glass, furniture, textile fabrics, sanitary appliances, &c., are far superior to anything in Paris in 1878. The effect of art schools is beginning to bear good fruit, and the workmen of both London and Paris would do well if they could only see how far they have been surpassed in what hitherto they have considered their special productions. The general arrangement of the cases, the introduction of "collective" exhibits, and the admirable classification of the goods, reflect the greatest credit on the taste and energy of the Commission. It would be, perhaps, too much to say that the Industrial Exhibition of 1880 is perfect, but at least it is as a whole the most perfect and interesting of its kind we have seen.

DUTCH TRIALS OF COMPETITIVE PROJECTILES.

A report has recently been printed by the Dutch Government on the trial against armour of projectiles supplied by Ekman—of Finspong—Krupp, and Grüson. The experiment took place at Scheveningen, on June 16th, 1879. It has a special interest from the fact that the projectiles were all fired with a reduced velocity, calculated purposely to give bare penetration as nearly as possible. We have results obtained with the new 8in. and 6in. Armstrong guns—which we propose to notice shortly—where the same idea was carried out, beginning at about the same thickness of plate, but increasing up to a very high standard. The Dutch experiments, if they did not embrace an ambitious programme, were at all events carefully carried out, and are therefore instructive. The plate fired at is shown in Figs 1, 2, and 3. It consisted of a section of our English Bellerophon target, namely, iron plates of 6in. and 8in. above and below, as shown in Figs., on 10in. of teak, with 1½in. skin. For this, a penetrating figure of 60 foot-tons per inch circumference was found to be sufficient for the upper portion, and 93 foot-tons per inch circumference enabled the projectile shown in Fig. 2 to get its point through the inner skin of the lower portion. The guns employed were a cast iron and a steel gun, each of 24 centimetres calibre—that is, 9·45in. The range was 500 metres—547 yards.

The projectiles supplied were as follows:—From Ekman, *chilled iron—(vide* Fig. 4)—of two sizes, namely, 2·6 calibres long, weighing 147·75 kilogs. (325·73 lb.), and 2·8 calibres long, weighing 152·34 kilogs. (335·85 lb.). These were chilled nearly to the centre in the head, and the body was left unchilled—*vide* Fig. 4. From Grüson, *chilled iron—vide* Fig. 5—of two sizes, namely, 2·6 calibres long, weighing 149·65 kilogs. (329·93 lb.) and 2·8 calibres long, weighing 153·85 kilogs. (339·18 lb.). These were chilled to a certain depth over both head and body, as shown in Fig 5. From Krupp, *steel*, 2·8 calibres long, weighing 161 kilogs. (354·94 lb.).

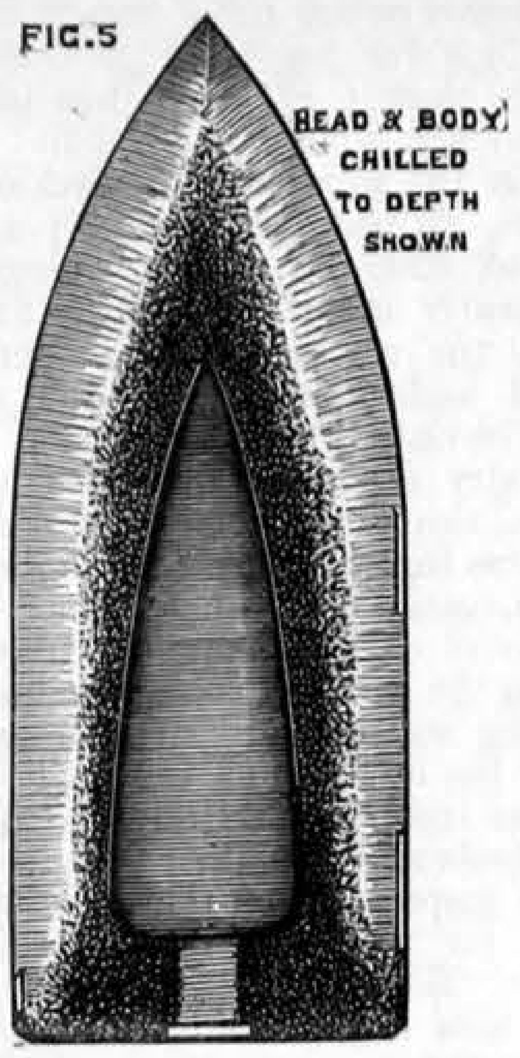
More was expected from the steel projectiles than the chilled ones. They were heavier, and were fired with a higher charge at the lower portion of the target from the steel gun, which was polygrooved, the projectiles being rifled by means of copper rings near shoulder and base, as seen in projectile in Fig. 2, whereas the chilled projectiles had studs, being fired from the cast iron gun at the upper portion of the target.

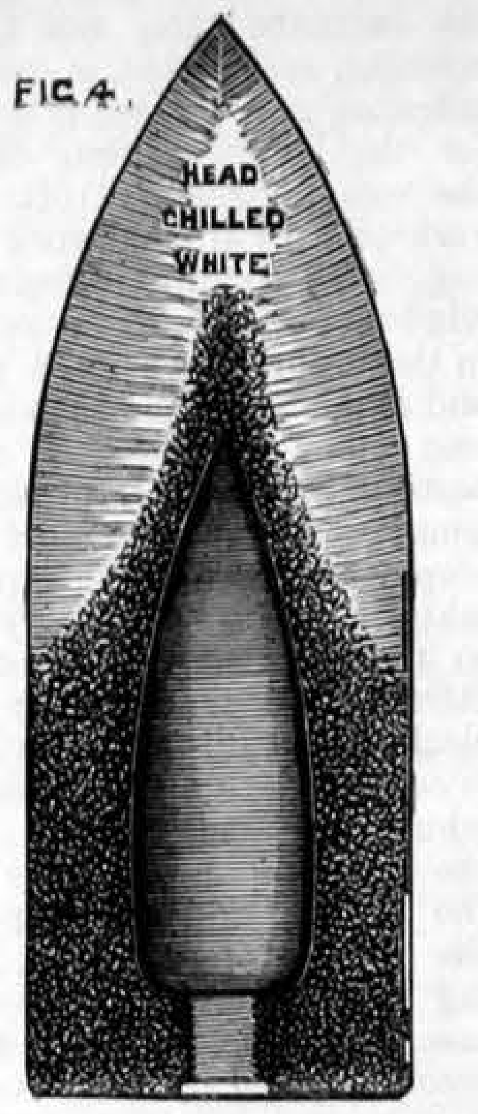
In all, seventeen rounds were fired, namely, four heavy and one light of Ekman's, five heavy and three light of Grüson's, and four of Krupp's. The following table gives the details:—

No. of round and maker.	Weight of charge. Kilogs.	Weight of projectile. Kilogs.	Striking velocity. Metres.	Stored up work in ton metres per cent. of shot's circumference.	Remarks.
1. Ekman	16	147·75	266·9	7·116	Struck near top.
2. ,,	,,	152·34	266·4	7·311	Ditto.
3. ,,	,,	,,	264·7	7·196	Struck junction of plates.
4. ,,	,,	,,	267·4	7·363	Fairly through.
5. Grüson	18	149·65	290·3	8·527	Struck close to 4.
6. ,,	,,	,,	290·3	8·527	Fairly through.
7. Ekman	,,	152·34	285·9	8·416	Struck top edge.
8. Grüson	,,	153·85	287·3	8·584	Fairly through.
9. ,,	,,	,,	288·7	8·669	Through.
10. ,,	16	,,	266·3	7·378	Struck near top.
11. ,,	,,	,,	262·3	7·159	Just through (*vide* Fig. I.)
12. ,,	,,	,,	267·1	7·420	Through.
13. ,,	,,	149·65	271·9	7·482	Through weak place.
14. Krupp	22·3	161	323·0	11·367	Through thick portion.
15. ,,	,,	,,	321·5	11·248	Barely through
16. ,,	,,	,,	322·6	11·326	Barely through.
17. ,,	—	—	—	—	Not given.

The following conclusions were arrived at as regards the calculated penetration, namely, that a projectile discharged from the cast iron gun, with a velocity of 373 metres, or 1224ft., would pierce the 6in. plate at about 1800 metres (1969 yards) range; and a heavier projectile from the steel gun, fired with a velocity of 472 metres (1549ft.), would pierce an 8in. target and backing at about 1800 metres (1969 yards).

As regards the projectiles, none of the Ekman (Finspong) chilled iron projectiles were broken up on impact, except





that the point of one was broken off to the length of 142 mm. (5·6in.). The remainder of the projectiles underwent no alteration in form beyond setting up to the extent of 6 mm. (0·236in.) in length. Of the eight Grüson chilled iron projectiles, seven broke up into a great many fragments, while one, which remained entire, showed a crack along the tapering portion about the shoulder of it, but was set up in length only 2 mm. (0·079in.). The Krupp steel projectiles all remained entire. They underwent a slight deformation, setting up longitudinally to the extent of from 22 mm. to 28 mm. (0·866in. to 1·102in.), while above the shoulder the diameter increased to the extent of from 1·5 mm. to 2·5 mm. (0·059in. to 0·098in.); also all the points for a length of from 16·5 mm. to 21·5 mm. (0·64in. to 0·84in.) were deformed. The Swedish projectiles of Ekman were considered very superior to those of Grüson. The Committee found it difficult from these experiments to say whether the steel showed a superiority sufficiently decided to justify their high price as compared with the chilled projectiles.

With regard to this report, it may be remarked that the behaviour of the Finspong projectiles to a certain extent agreed with the results obtained in our own English competitive trials—that is to say, the Grüson's projectiles were harder than the Finspong. At Shoeburyness, in 1878, one Grüson shot broke up badly, but another did remarkably well (*vide* The Engineer, April 12th, 1878.) The Finspong metal is, of course, remarkably excellent; but no observation is made in this report as to its price. The chilling of the body, still kept up by Grüson, has been abandoned long ago by most manufacturers. In the abstract, the unchilled metal having the advantage in tenacity and the chilled metal in hardness, it would seem sound to retain a little unchilled in the centre, to hold the shot together, while the entire ring of chilled metal might prevent setting up. Practically it has been found better to leave the entire body mottled. The crushing strain there must fall much less heavily than in front, and tenacity throughout the body seems the desideratum.

FIG. 1

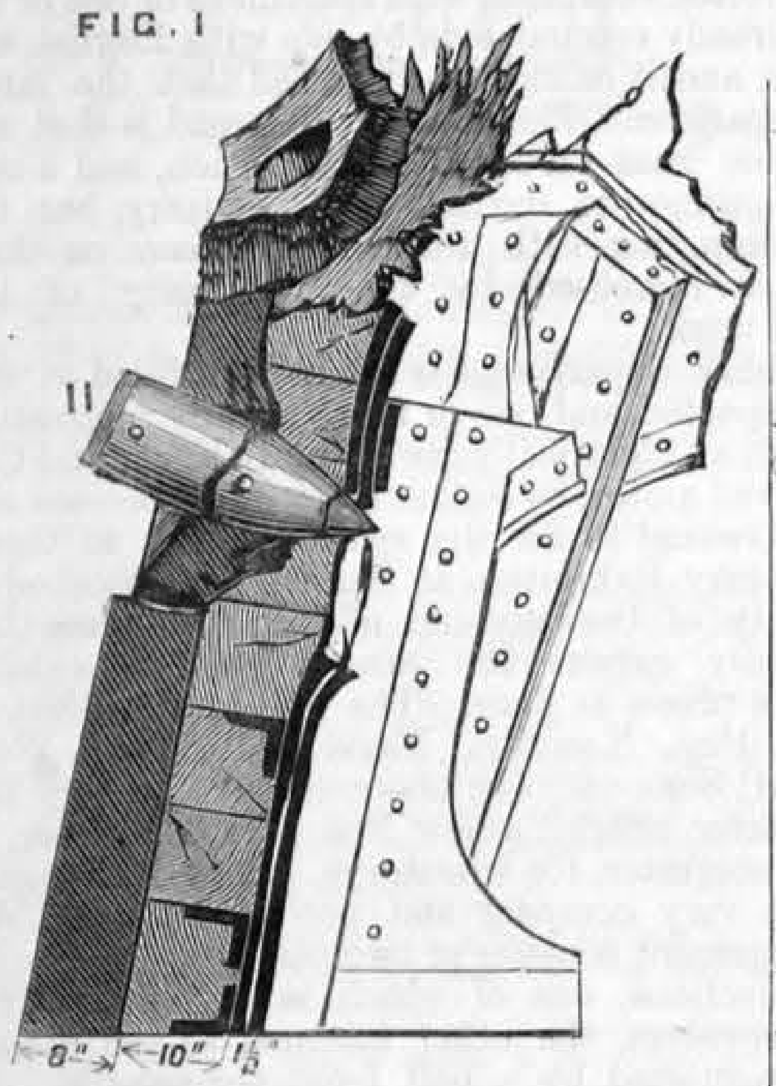


FIG. 2

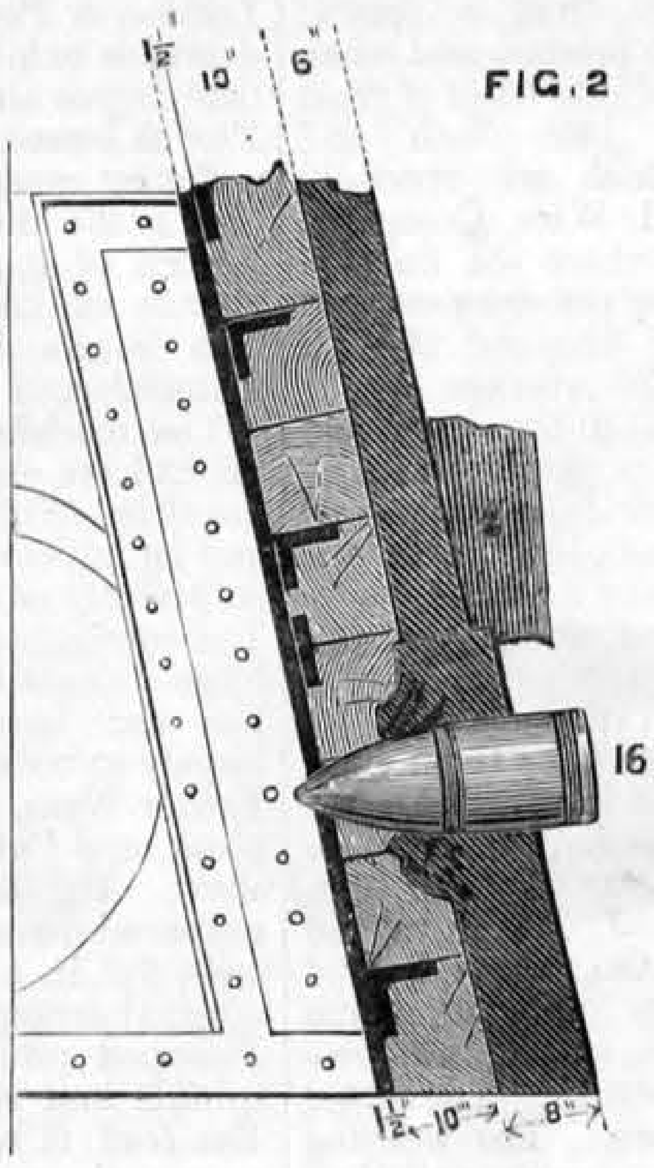
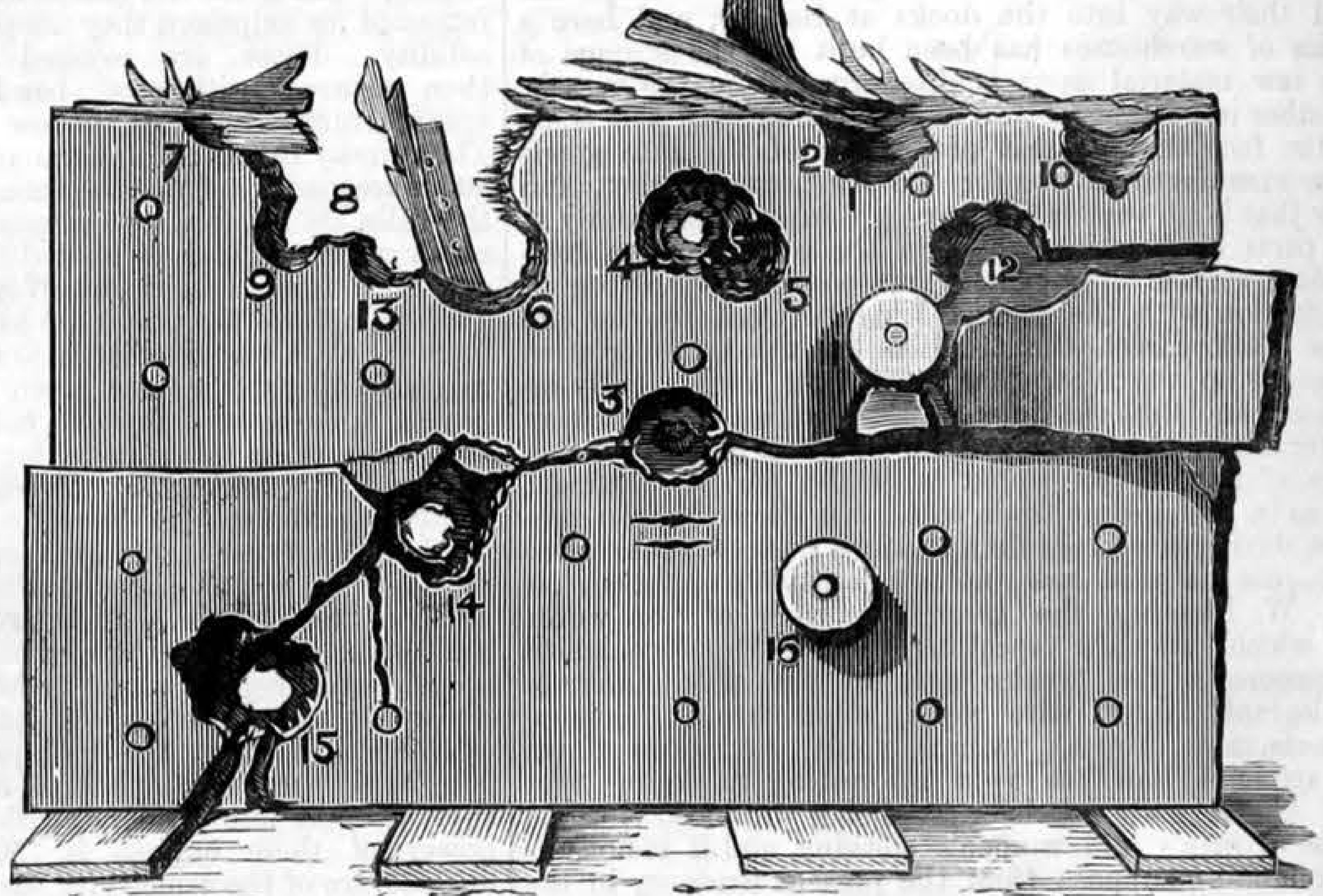


FIG 3



DUTCH TARGET.

The Jamin Electric Light.—The directors of the Compagnie Générale des Panoramas have decided upon the adoption of the Jamin system for the illumination of the panoramic exhibition which they are now arranging in Leicester-square.

INDIAN RAILWAYS.

The following statistics are given in the recent report to the Secretary of State for India in Council on Railways in India for the year 1879-80, by Mr. Juland Danvers, Government Director of the Indian Railway Companies:—

"The length of the whole railway system of India now open for traffic is 8611 miles, of which 6073 miles are in the hands of guaranteed companies, 2363 miles are State, and 175 are native State lines; 6693 miles are constructed on the 5ft. 6in. gauge, and 1918 on a narrower gauge. During the past year 395 miles—including the Candahar line—of new railway have been opened for traffic. The railway system is not now terminated by the frontier. A line has been taken from Sukkur on the Indus as far as Sibi, a distance of 133½ miles, in the direction of Candahar. Its further extension to a place about 12 miles from Quetta is now being carried on, but operations beyond this point to Candahar are confined to surveys. On the north-west frontier energetic measures have been taken to continue the Punjab Northern Railway to Peshawur across the Indus at Attock. The bridge which is in course of construction at this place will consist of five spans, two of 314ft., and three of 264ft. each. It is expected that the line will be so far advanced as to be ready for use up to the left bank of the Indus in November, and from the right bank to Peshawur in January next. Turning to Central India, the remaining link in the railway communication between Delhi and Bombay by way of Ajmere will be finished in the course of the present year. The Rajputana State line will then be opened for traffic throughout. Eighty-two miles of the lower portion between Pahlunpoor and Ahmedabad, where the narrow and the broad gauge systems meet, were opened in November last. The other part of the Rajputana and central Indian system connecting Ajmere with Indore and the Great Indian Peninsula Railway, will probably be opened in the course of 1881. With the exception of a gap of 50 miles, it is expected to be opened on the 1st of January next. The bridge over the Ganges at Benares has been undertaken as part of the system of the Oude and Rohilkund Company, and will be commenced forthwith. It will be the largest work of the kind in India, and is to consist of seven spans of 416ft., the pier foundations being formed of a solid block of masonry 65ft. long by 28ft. wide.

"The net revenue derived from all railways in India during the year 1879 amounted to £5,372,596. That from the guaranteed lines was £5,062,188, compared with £5,002,028 of the previous year. The guaranteed interest paid by the Government was covered, leaving a balance in favour of revenue of £313,955. The net receipts of the State lines amounted to £310,408, compared with £200,374 of the year 1878. The gross receipts of the guaranteed lines were £9,765,284, and the expenses £4,703,096. On the State lines the gross receipts were £1,465,824, and the expenses £1,155,416, showing an average proportion of net receipts to expenditure on the guaranteed lines of 51, and on the State lines of 22 per cent. In making these comparisons, he says, it must be observed that the State railways are for the most part either political lines recently opened, or small branches with little traffic on them and expensive to work, but serviceable as feeders to the main lines. The Rajputana line, running south from Agra and Delhi, may be regarded as an exception to this description. The total net earnings divided over the total capital outlay, both guaranteed and State, yielded are turn at the rate of £4 7s. per cent. per annum. The guaranteed lines earned at the rate of £5 4s. per cent. per annum.

"The capital expended on the Indian railways up to the end of the official year was £123,124,514. Of this £97,327,851 had been expended on guaranteed lines, £24,403,797 on State lines, and £1,392,866 on lines in native States. The capital expenditure during the period covered by this report—fourteen months in the case of the State railways, nine months in that of the East Indian Railway, and twelve months in that of the other guaranteed lines—was £5,388,772, being £883,185 on guaranteed and £4,505,587 on State lines.

"The number of passengers increased from 38,489,586 in the year 1878 to 43,144,468 last year. The proportion per cent. of first-class was ·519, of second 2·049, and of the lowest classes, 97·432.

"The aggregate quantity of goods carried on all lines amounted to 7,876,766 tons as compared with 7,296,335 of the previous year. The amount received for the conveyance of the same was £7,248,752, compared with £6,734,059 in 1878. The chief articles carried were cotton, grain, rice, piece goods, military stores, salt, seeds, tobacco, and opium.

"The expenses of working and maintenance during the year amounted to £5,774,510, compared with £5,101,335 of the previous year. The cost of maintenance was £1,463,550, and of working £4,310,960.

"The rolling stock employed in working the railways consisted of 1850 locomotives, 4294 passenger carriages, and 34,856 trucks. The total train mileage during the year was 28,915,144, compared with 26,570,395 of 1878. The passenger train mileage was 5,392,544, the goods 13,546,878, the minerals 357,561, and the mixed goods and passengers 8,964,032.

"The goods shipped to India from this country for the use of the railways amounted during the year to 207,743 tons, of the value of £1,578,404, the freight and insurance of which was £315,181. Besides this, 143,279 tons of coal, 1938 chaldrons of coke, and 8393 tons of patent fuel were sent out.

HASWELL'S IMPROVED COUPLING BETWEEN ENGINE AND TENDER.

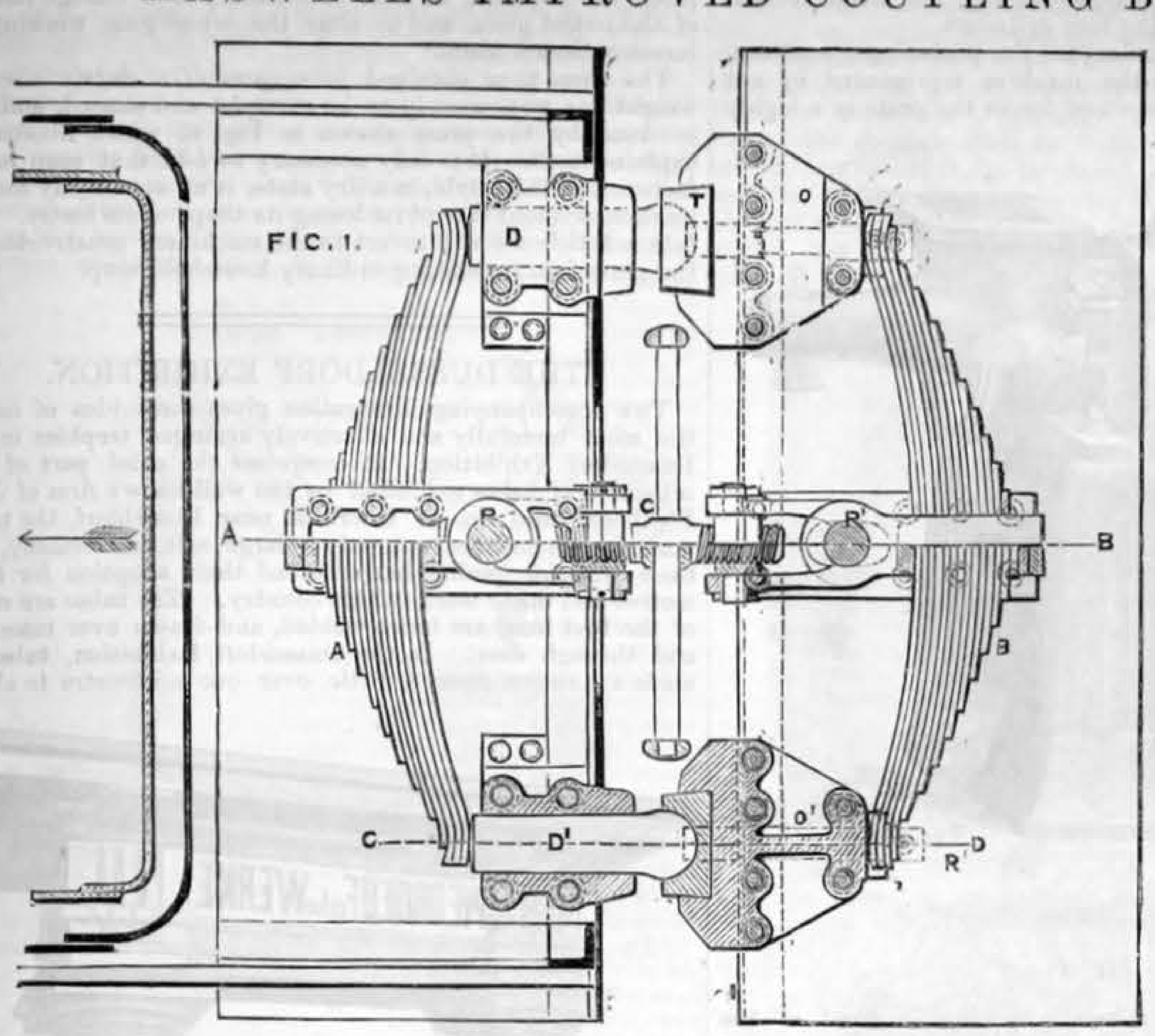


FIG. 1.

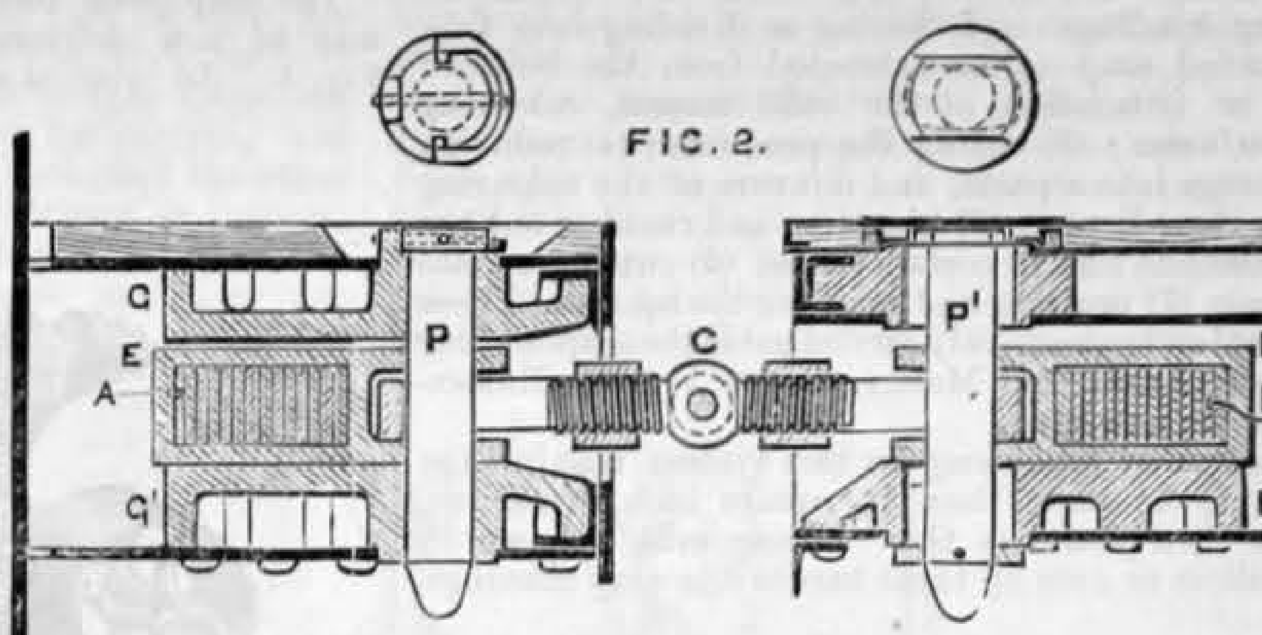


FIG. 2.

SECTION ON LINE A.B

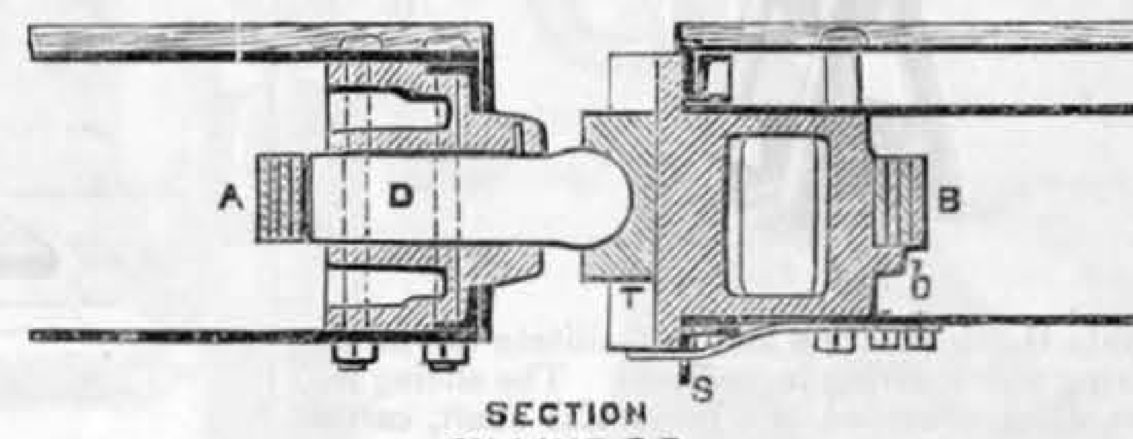


FIG. 3.

SECTION ON LINE C.D

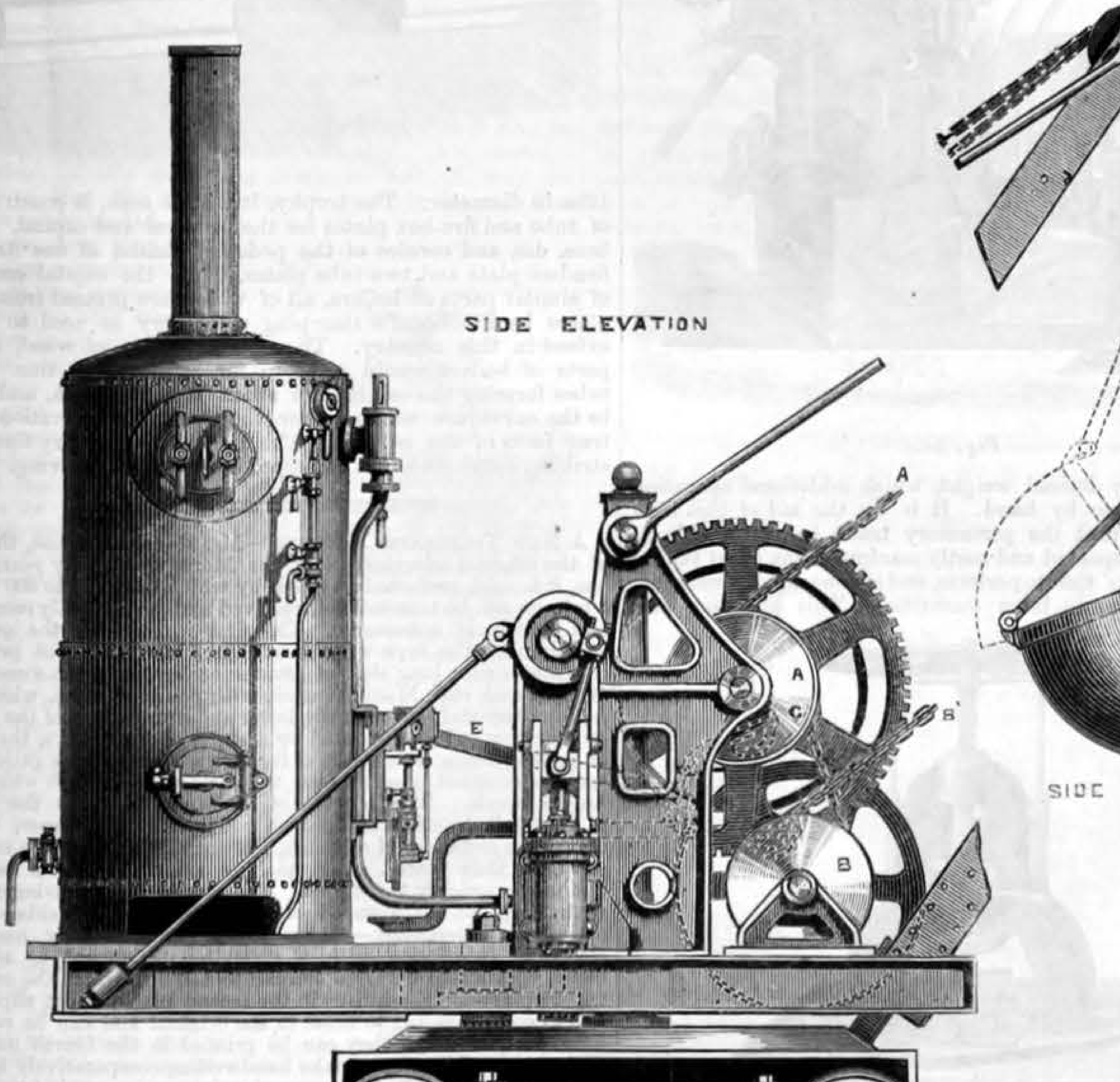
We published some time ago, drawings and description of a coupling between engine and tender constructed by the Austrian States Railway, and pretty generally adopted throughout the country. Mr. Haswell has since that time introduced further improvements, which will be readily understood from the accompanying engravings.

The sides of the sliding blocks *a a*, of tough cast iron, are bevelled and supported below by a spring *b*, as a double security against their falling away when the engine and tender are uncoupled. The front and back surfaces are planed, the buffers D D are of hardened steel, and their spherical ends carefully fitted so that the surfaces when properly oiled work smoothly. When the drawsprings A and B are tightened up there is no play on the engine and tender bolts as P P, is the case with all other kinds of coupling on descending gradients. With this system when the load pushes the tender against the engine the buffers D D press on the ends of the engine spring A, while the tender spring B, receding backwards in the oblong slit, keeps the screw coupling perfectly tight.

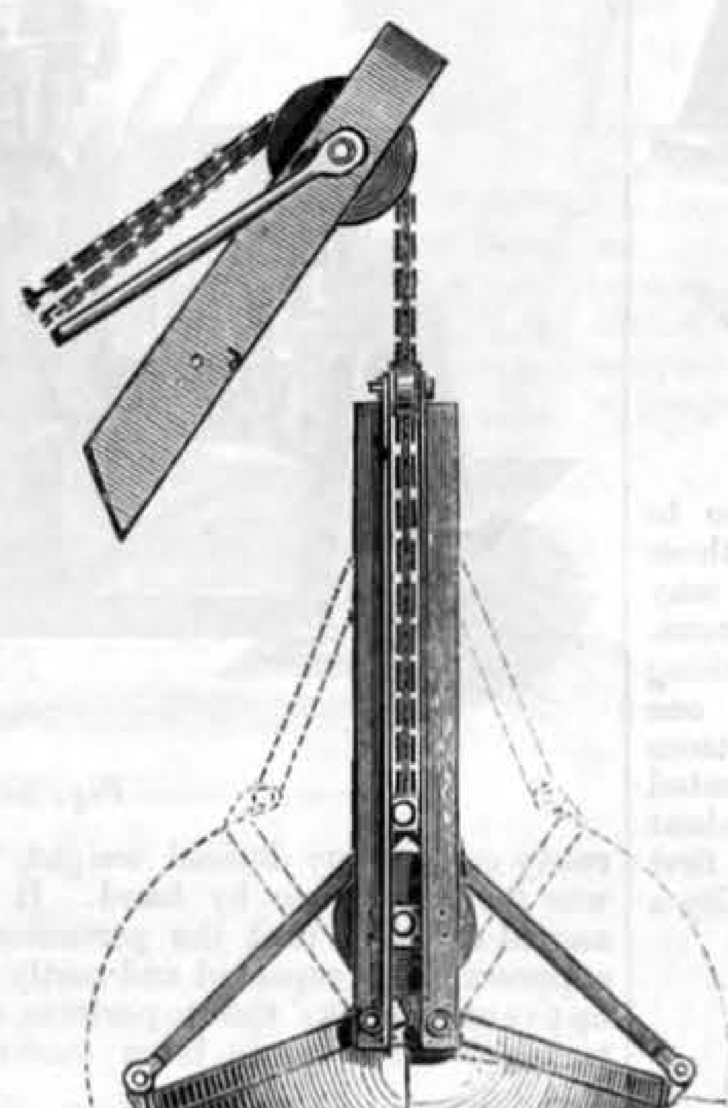
The improved system has been applied on a large scale to a number of engines for the Russian Railway, Brest Kiew, as well as to those on the Roumanian lines. Passenger engines with 5ft. coupled wheels, constructed with all the wheels between the fire and smoke-box, can travel with this coupling with perfect safety at the same speed as engines with trailing wheels. On the Raab line engines of this description, fitted with the improved coupling, have attained a speed of 100 kilometres per hour without any unpleasant oscillation. One of the great advantages it offers is that the construction of the locomotives can be improved, as the weight can be equally distributed over the wheels without the assistance of dead weights.

PATENT SELF-ACTING CRAB BUCKET CRANE.

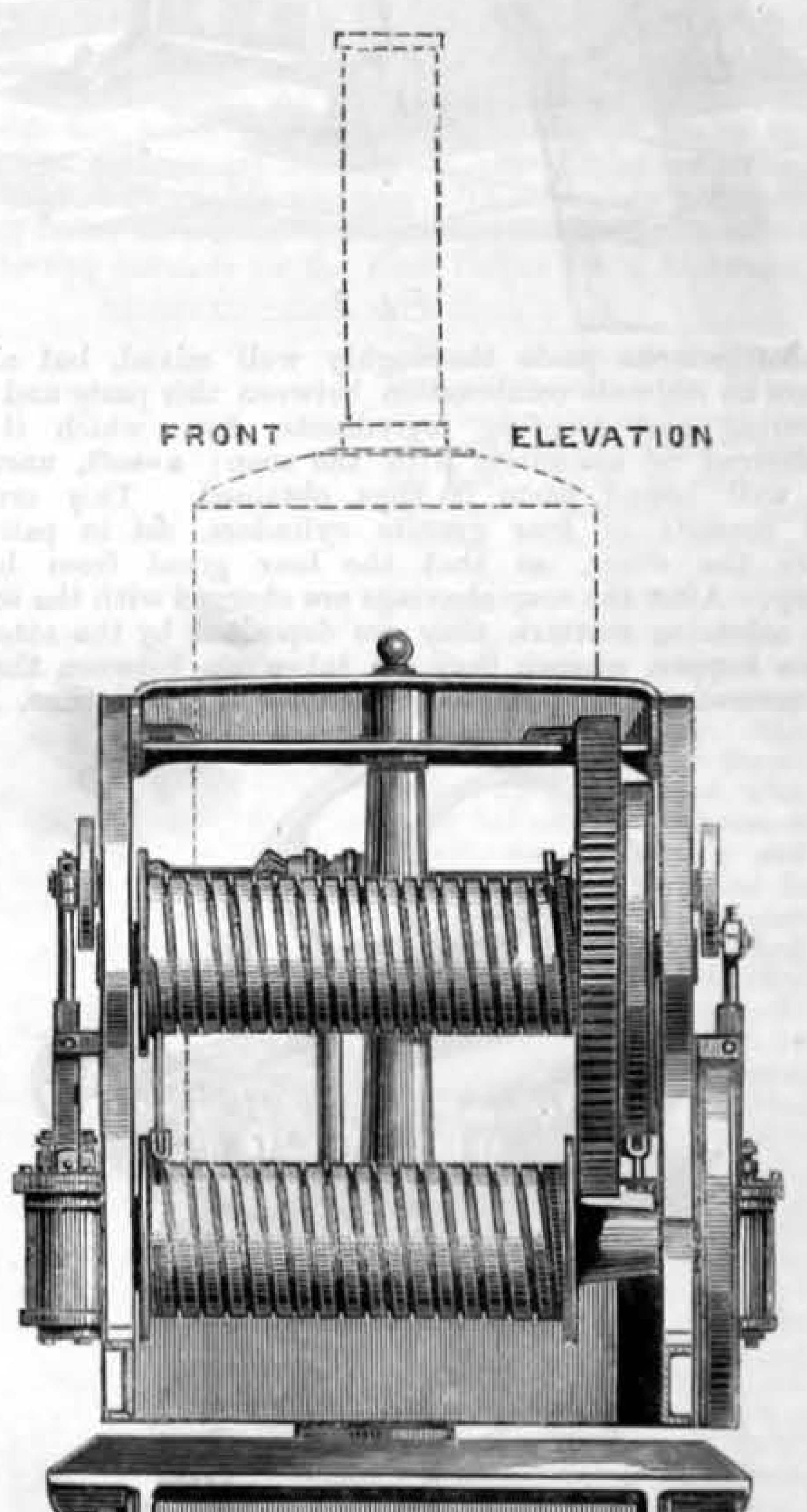
MESSRS. JOHN H. WILSON AND CO., ENGINEERS, LIVERPOOL.



SIDE ELEVATION



SIDE ELEVATION OF BUCKET



FRONT ELEVATION

This crane has been designed specially to make the bucket or grab self-acting—to open and close and to fill and empty itself automatically. The bucket may be used for discharging grain, coal, or sand, &c., as well as for dredging purposes. The grab can be used for excavating and general contractors' work, also for lifting coke and other material of a like nature. The crane as shown is fitted with two chain barrels as seen on annexed sketch, and the bucket or grab is worked in the following manner:—The top barrel marked A and chains A_1 are for lifting the load. The lower barrel marked B and chain B_1 open the bucket D for discharging its contents. The barrel B is driven from the lifting barrel A by means of a messenger chain C. When the bucket is filled and lifted to its required height and position for discharging, the barrel B is held fast by a powerful brake E; the lifting barrel A is then thrown out of gear by means of a suitable clutch and lever, whereupon the bucket opens and empties itself. The brake E is then released and the open bucket is lowered with sufficient speed to fill itself. The lifting barrel A is then thrown into gear again, and the chain A_1 closes the bucket at the commencement of the lift and holds it firmly when full. The dotted lines show the position of the bucket when open ready to be lowered. These machines can also be used as ordinary steam cranes, and when so required it is only necessary to unhook the messenger chain C from the barrel A. This patent self-acting gear can be easily and economically applied to any steam or hand cranes now in use.

SOAP-MAKING MACHINERY.

The various operations to which toilet soap is subjected, in order to bring it into the market, may be classed under the seven following headings:—(1) Slicing or dividing into thin slices the purified soap cakes extracted from the boilers; (2) pounding, or trituration of the solid masses, colouring matters and perfumes; (3) sifting the products; (4) reducing the soap strainings into a paste, and mixture of the colouring and perfumery ingredients; (5) kneading and running out the paste in a continuous film in certain forms; (6) cutting up into cakes or squares; (7) pressing and marking the squares. These operations are at least successively carried out in the soap-making machinery constructed by Messrs. Beyer Frères, illustrations of which we now give.

The manufacture of toilet soap by this system requires the soap bars not to be more than 1¼ square inch in section. These bars are then placed in the "slicing mill," shown by Fig. 1, which slices or cuts up these bars in fine soap shavings,

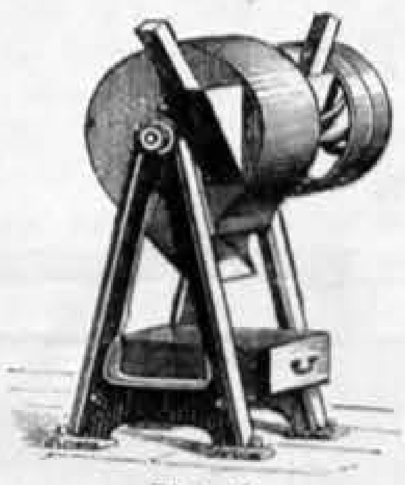


Fig. 1

so as to accelerate the desiccation and to facilitate the mixing in of the colouring and scenting ingredients. The slicing mill consists of two discs, mounted on a horizontal shaft, carried on a cast iron frame. These discs are fitted with twelve blades, which cut up the bars placed in two inclined hoppers, and allow the shavings to fall into a box placed underneath the mill.

The soap now reduced into shavings is next ground or pounded in a grinding mill worked by steam, as shown in Fig. 2. The object of this operation is not merely to obtain

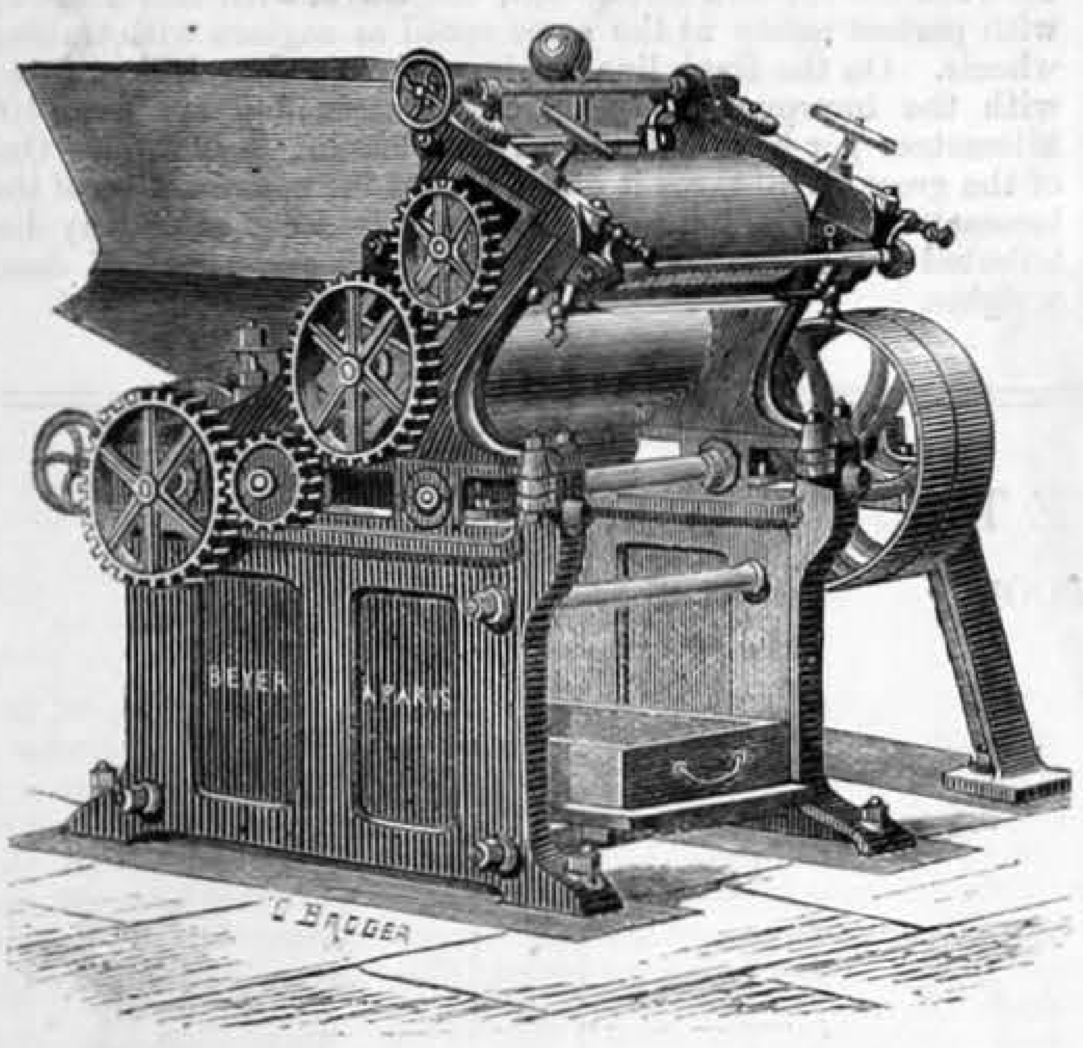


Fig. 2

a homogeneous paste thoroughly well mixed, but also to secure an intimate combination between this paste and those colouring and scenting ingredients, &c., which it may be desired to assimilate with the soap; a soft, unctuous, and well bound paste is thus obtained. This crushing mill consists of four granite cylinders, set in pairs one above the other, so that the four grind from bottom to top. After the soap shavings are charged with the scented and colouring matters, they are deposited by the attendant into a hopper, whence they are taken up between the first and second cylinder, and so ground for the first time. By a

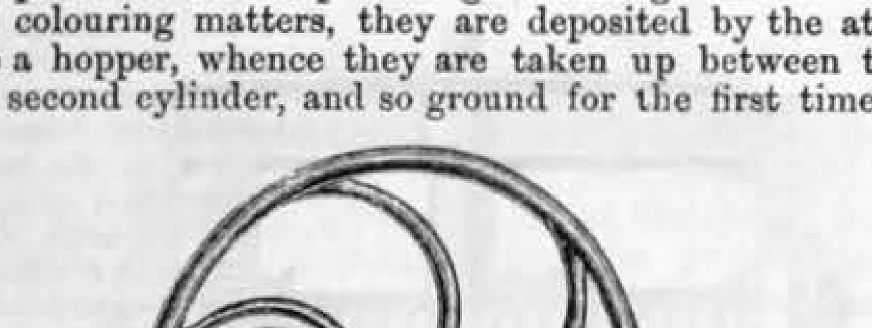


Fig. 8

differential rotary motion the soap arrives automatically between the second and third cylinders, and after being thus ground for the second time it is similarly passed between the third and fourth cylinders, and again crushed. This top roller is so constructed as to be able to deliver the soap paste it receives into the fore-mentioned hopper, so that this grinding operation is repeated over and over again till the attendant, by shutting off the passage between the top roller and the hopper, forces the soapy paste to fall off the top cylinder into a box placed underneath the machine. To insure a still more perfect mixing, a comb is inserted to divide the soapy paste as it passes through the machine. Fig. 3 shows a grinding mill working with three only instead of four crushing rollers. The capacity of the machine shown in Fig. 2 is about 7 cwt. of paste per hour through the four cylinders.

The soap paste having undergone the preceding operations, may be now delivered to the machine represented by our Fig. 4. An internal endless screw forces the paste in a highly

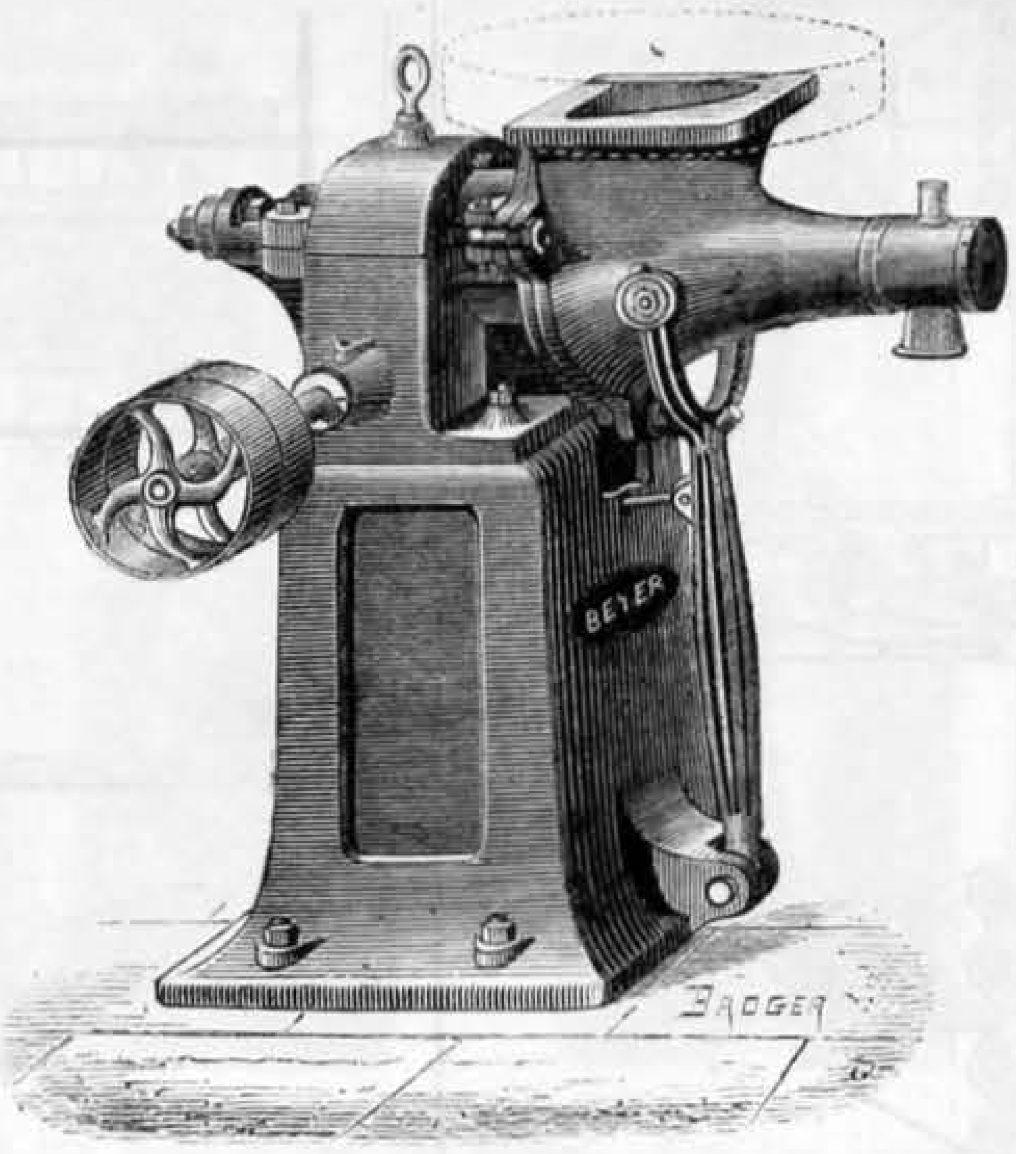


Fig 4

compressed state out of a small opening in front of the machine, and delivers the paste in a kind of endless roving or sliver, remarkable for its neat form and its lustrous polish. This machine has, however, been supplanted to some extent by the kneading mill shown in our Fig. 5. The latter, though entirely different in its construction, fulfils the same functions as the preceding machine, in addition to delivering the squares

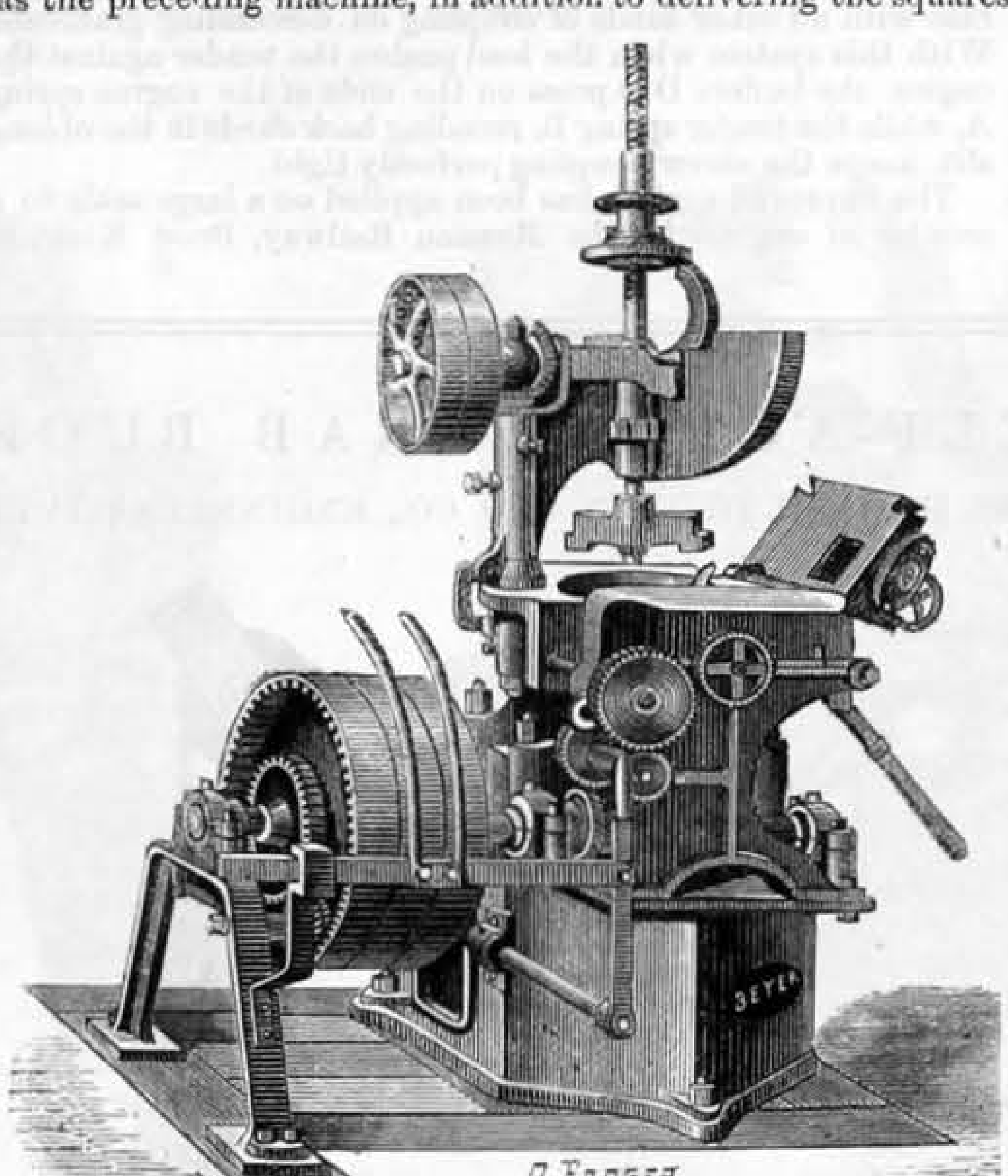


Fig. 5

ready cut to any desired weight, which additional operation was formerly done by hand. It is by the aid of this last-named machine that the perfumery trade has been able to suppress many repeated and costly manipulations often taking up five or six weeks' time to perform, and of thus rapidly manufacturing toilet soaps in large quantities. This kneading mill

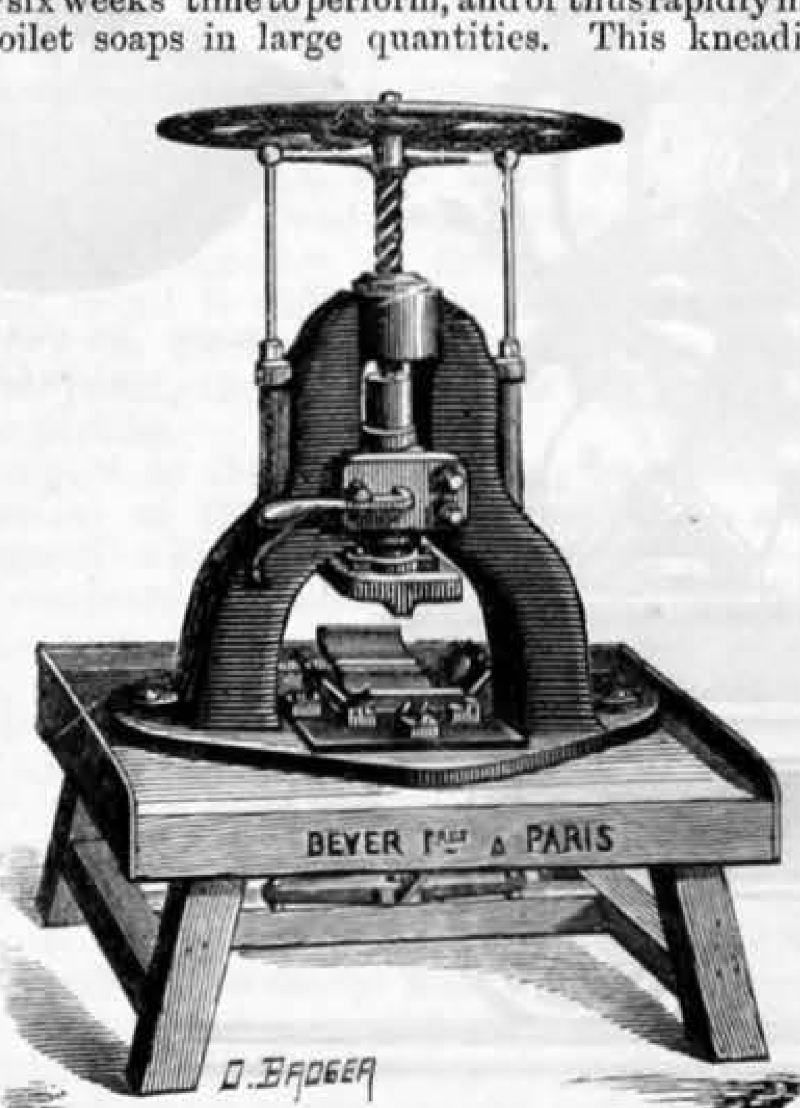


Fig. 6

consists of a mechanical pestle, which rams or beats down the soap paste into a metal cylinder. Beginning by extracting the air contained in this paste, increased pressure applied thereon forces the paste out of an opening of determined area. A knife working automatically cuts—according to the size and kind of manufacture required—the paste in such a manner that each piece is exactly cut to the same size, and consequently is also of the same weight. If larger or smaller pieces are required, all that is necessary is to change the size of the outlet piece, and to alter the wheel gear working the fore-mentioned knife.

The soap thus obtained in squares of a certain size and weight has now merely to be stamped and shaped, and this is done by the press shown in Fig. 6, which illustration explains itself. It is only necessary to add that soap manufactured in this style, in a dry state, is at once ready for the market, without fear of its losing its shape or its lustre. In a future article we will revert to the machinery constructed by the same firm for making ordinary household soap.

THE DUSSELDORF EXHIBITION.

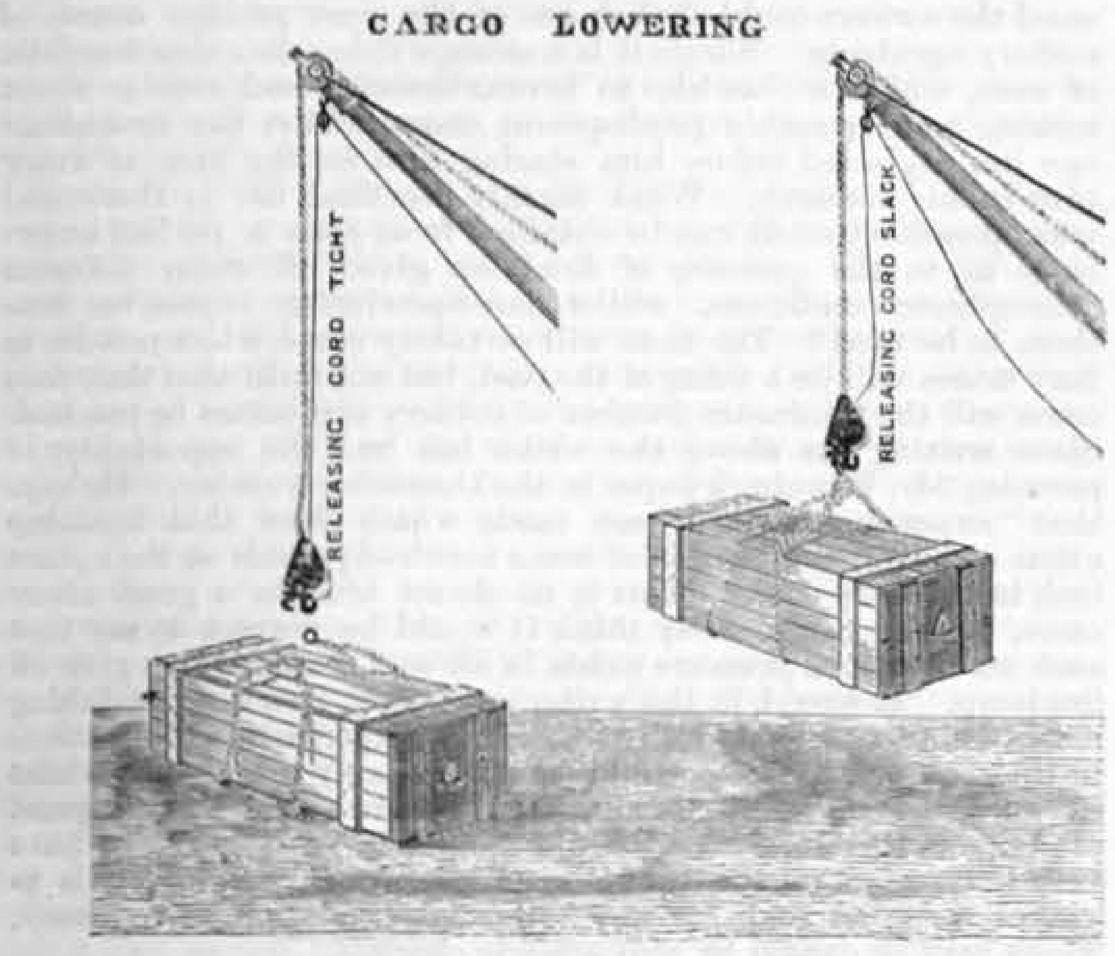
The accompanying illustration gives some idea of one of the most tastefully and effectively arranged trophies in the Dusseldorf Exhibition. It comprises the chief part of the collection of tubes exhibited by the well-known firm of J. P. Piedboeuf and Co, of Oberbilk, near Dusseldorf, the tubes made by whom have not only a large sale in Germany, but their superior quality has enforced their adoption for locomotive and other work in this country. The tubes are made of the best iron, are twice welded, and drawn over mandrils and through dies. In the Dusseldorf Exhibition, tubes so made are shown from a little over one millimetre to about

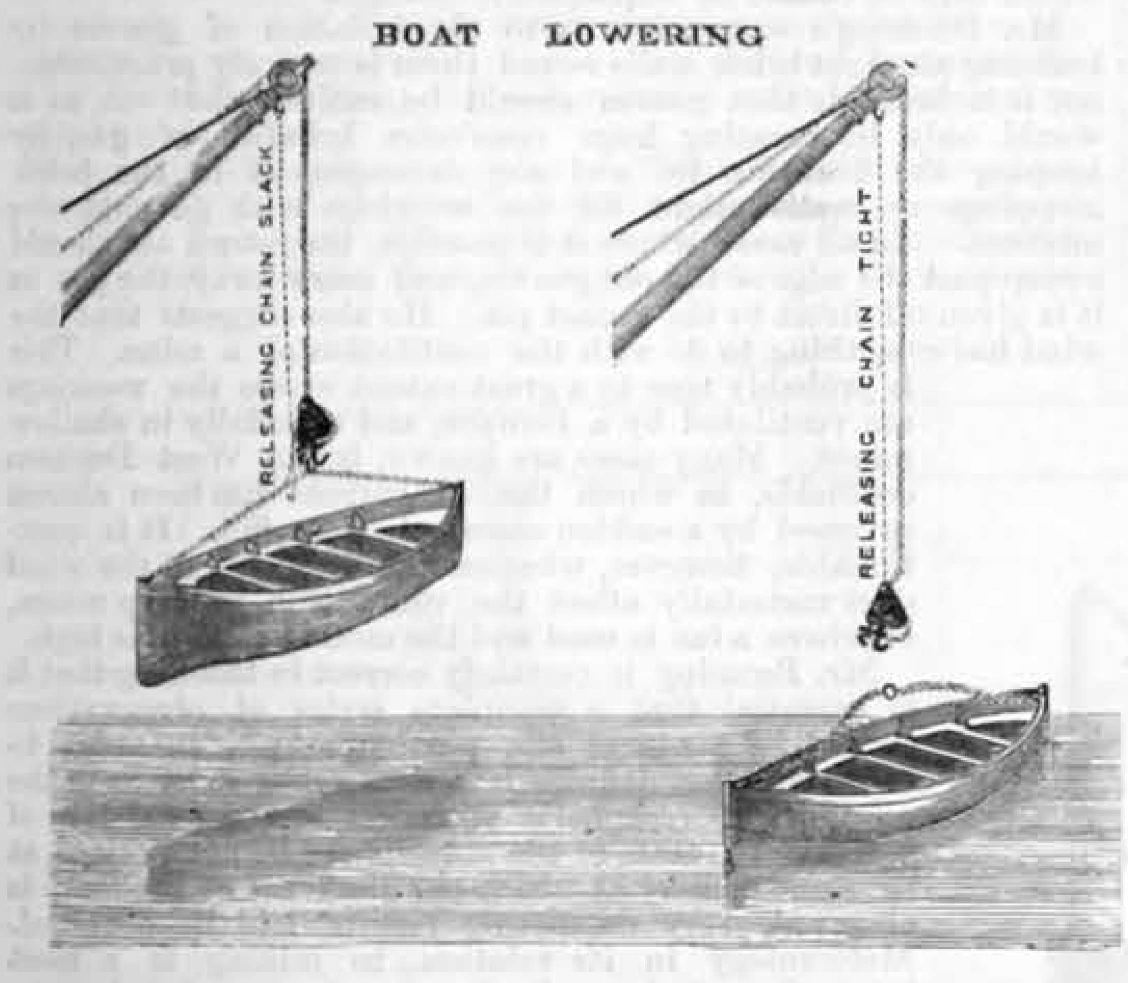
12in. in diameter. The trophy, it will be seen, is constructed of tube and fire-box plates for the pedestal and capital. The base, die, and cornice of the pedestal consist of one flanged fire-box plate and two tube plates, while the capital consists of similar parts of boilers, all of which are pressed from flat-plates by Piedboeuf's stamping machinery as used to some extent in this country. The entablature is of wood, as no parts of boilers would come in for representing this. The tubes forming the column are about 16ft. in length, and bent to the curvature necessary for the optical preservation of a true form of the column. The trophy has a very fine and striking appearance not conveyed by a small engraving.

A New Telegraph Machine.—Mr. Royal E. House, the last of the original telegraphers of the Morse time thirty years ago, has, it is said, perfected a system by which from 250 to 300 words a minute can be transmitted, received and permanently recorded, and which is automatic. The first is built on the general principle of the type-writing machine, but instead of printing characters cuts long slits of greater or less length in some strip of hard and stiff Manilla paper, with pointed knives, which are raised alternately through the lower and upper edges of the paper by a system of levers worked by a series of brass keys, the strip of paper passing from a wheel through a narrow brass galley and under a constant pressure over the little slots through which the knives work. The length of the slit indicates the letter to a small fraction of an inch. The strip of paper, whose marks are not those of a punch, but cut slits in a rapidly moving strip, is then placed in a machine connected with a battery, and moves quickly through it. Two constantly revolving wheels with sharp but not keen edges fall readily into the slits—upper and lower alternately—of the paper, and thereby make an electrical connection with a receiving instrument at another office, with a set of knives similar to those in which the original slip is placed. The knives in the second machine cut slips of a length corresponding to those in the original and can be read by an expert, although they can be printed in the fourth machine with such rapidity as to make handwriting comparatively tedious and useless. This last instrument prints on somewhat the same principles as the gold and stock automatic telegraph, but the letters are printed from the cut slip without any interference than that of the power, by which the machine is run. These messages record themselves, and the presence or absence of an operator at the receiving end is of no consequence. They can be sent with all the rapidity of which perfect mechanism is capable, and will, it is claimed, average 200 to 250 words per minute, or approximate 15,000 words per hour of constant work. All delay will be in preparing the instruments, and the work then can be accomplished by operators at such times as the wires are occupied from other stations. Perhaps the most remarkable feature of the system and the one which will strike operators and electricians as the most improbable is the simplest. It is that all messages can be sent to any particular station and to no other, and without being heard or repeated at any other. The "call" is so arranged in its automatic way that while the machinery is in movement in every office, the knife-like wheel only fills the call slits on the tape in the office for which it is intended, giving an automatic reply, and the similarly moving wheels in every other office, failing to fit the slits, have no impression.

LAWRENCE'S BOAT LOWERING APPARATUS.

The accompanying engravings illustrate a new block, invented by Captain G. Lawrence, Fenchurch-buildings, Fenchurch-street, for lowering boats. This block is made of two cheeks, rivetted together through a cast iron arched piece, round which the hauling chain is passed. The chain is kept in its place by a boss or stud, which prevents it coming out of the groove in the block. The end of the chain terminates in a slotted shackle, C, which is passed over the two hooks at the bottom of the block. One of these hooks, A, is a fixture, whilst the other, B, is free to swing upon a pin



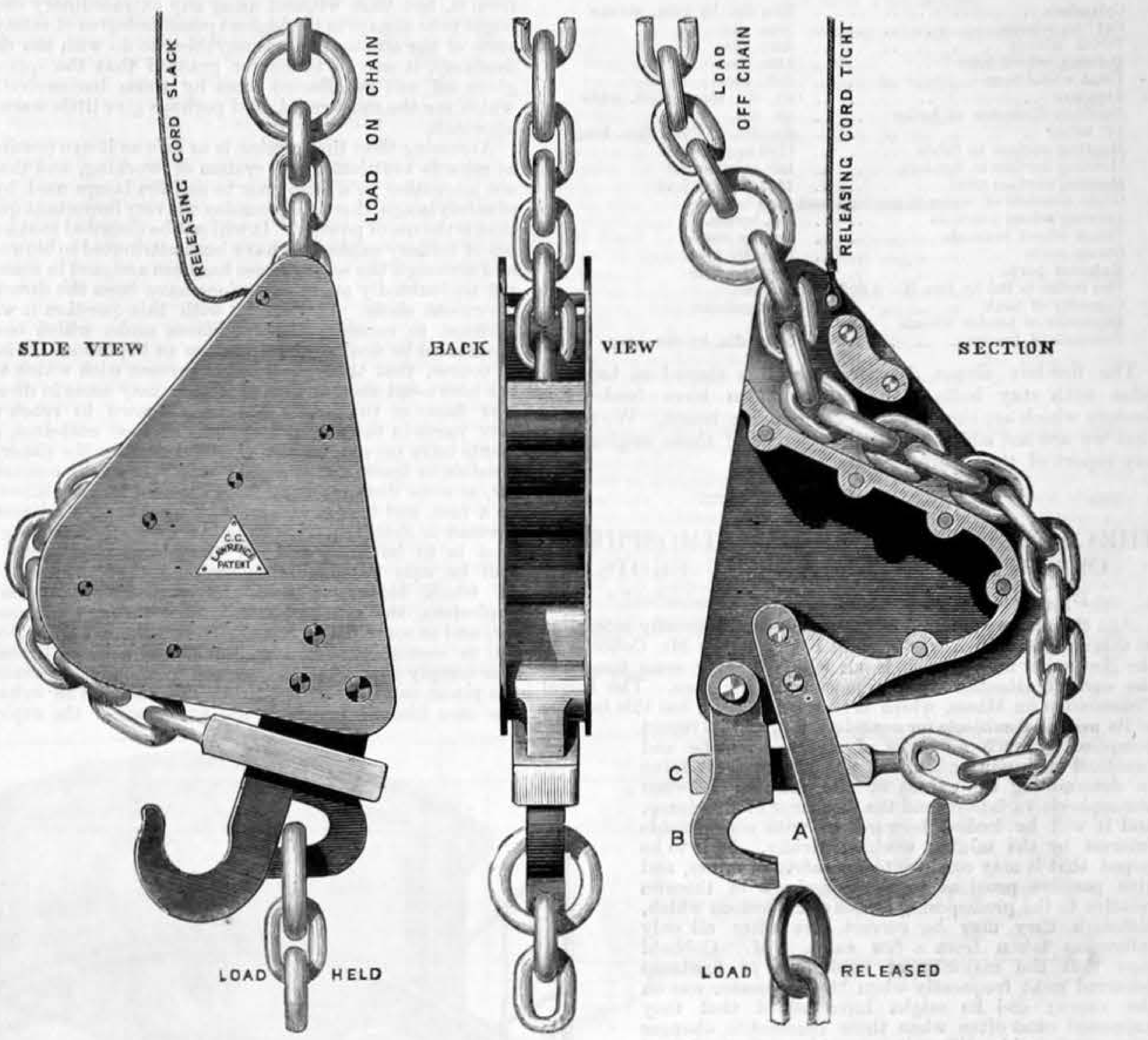


in its upper end. This latter is the detaching hook, whilst the former may be used for the other end of the sling, and will thus draw the sling away when one end is released. The detaching is effected by a light releasing cord, carried back over the davit of the crane to the man in charge, or it may be secured, and the hooks will act automatically. One essential characteristic of this detaching block is that it may be arranged so that the weight cannot possibly be set free until it is safely landed.

It will be seen that the detaching or releasing cord is very light, and is attached to the block, so that whilst the weight is on the fall, the whole weight must be lifted before the releasing action could take effect. When, however, the load is safely landed, the weight is taken off the block, which may then be easily lifted and canted, as shown. By the removal of the strain on the fall chain, the shackle and swinging link fall perpendicularly by their own weight, and allow the slinging chain to be released.

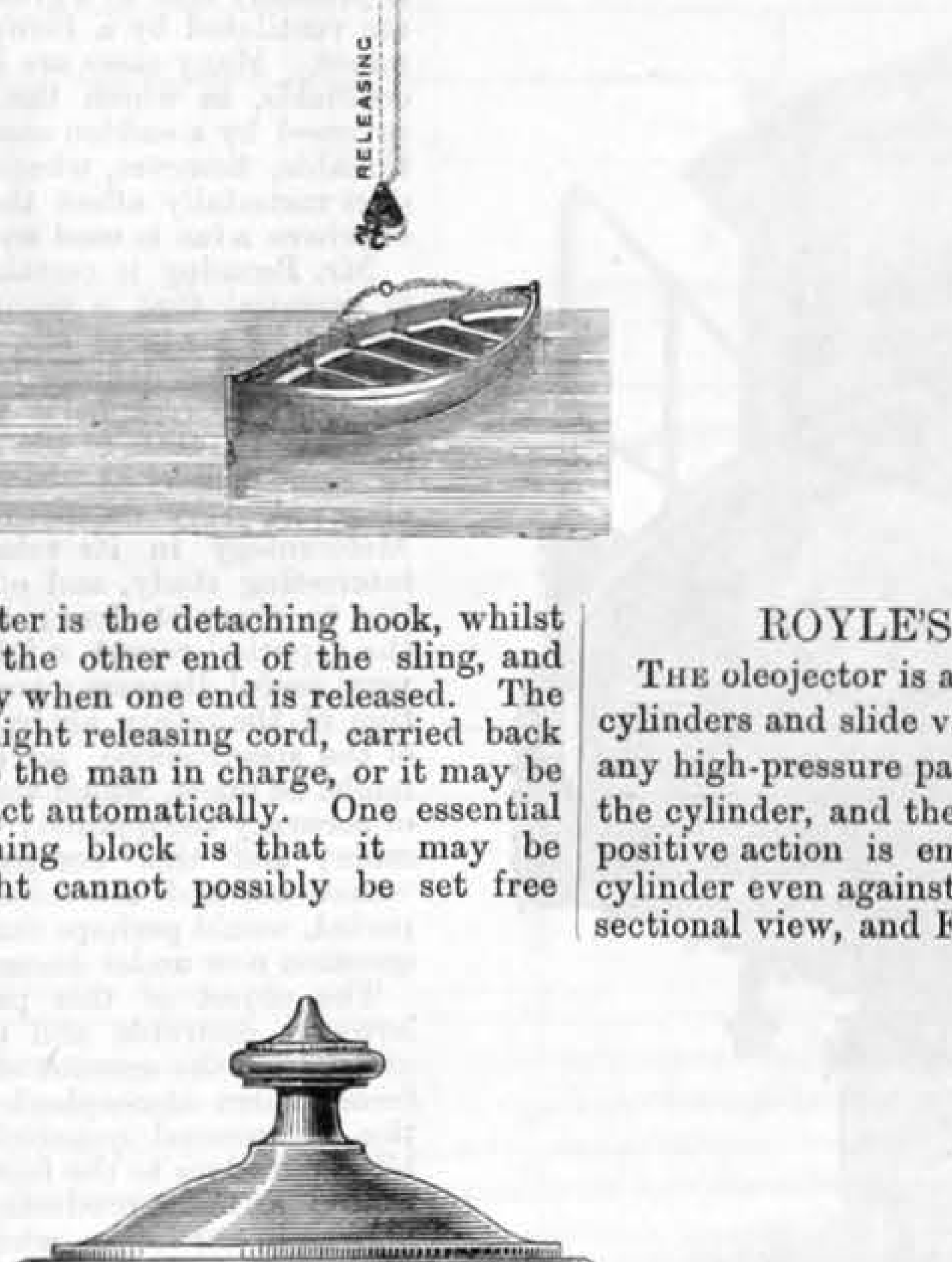
This block has had a considerable application to cranes and davits for lowering cargo at sea, and boats on the Thames Conservancy piers. The boat is detached before she is waterborne, and can be released automatically and instantaneously from the pier. For the prompt release of boats before they are water-borne, the releasing chain is made sufficiently strong to be belayed so as to take the weight sufficiently to release the boat before she is water-borne. The block has now been tried extensively, and all the reports we have heard of it are highly favourable. Captain Lawrence is a practical sailor, and his experience at sea has kept him clear of mistakes made by those who lack his knowledge. The block is mechanically right, and will, we fancy, conduce to give satisfaction.

This "block," as a means of expediting and simplifying the "letting go" of anchors from ships, &c., has only to be attached to the hook of the lower purchase block of the davit tackle, now in use for "catting" and "fishing" the anchor, and used in a manner similar to that shown in the drawing illustrating this boat lowering from the piers of the Thames Conservancy. The anchor having been lifted off the vessel's deck by the tackle, is swung out board and lowered until the releasing chain or wire rope, which is made fast between the block and the davit-head, becomes tight, when the immediate release of the anchor is effected. In order to keep down the size of the stopper chain or "sling" used for carrying the anchor, one end of it can be placed in the hook, and the other end after passing through the ring of the anchors, in the jaw. The jaw end being slipped, the sling, when away from the anchor, can be brought back on the hook ready for use again.



ROYLE'S PATENT OLEOJECTOR.

The oleojector is an invention for lubricating steam engine cylinders and slide valves. A small jet of steam taken from any high-pressure part of the engine is allowed to play into the cylinder, and the suction created by this well-known and positive action is employed to carry the lubricant into the cylinder even against considerable pressure. Fig. 1 is a side sectional view, and Fig. 2 a side elevation of the oleojector.



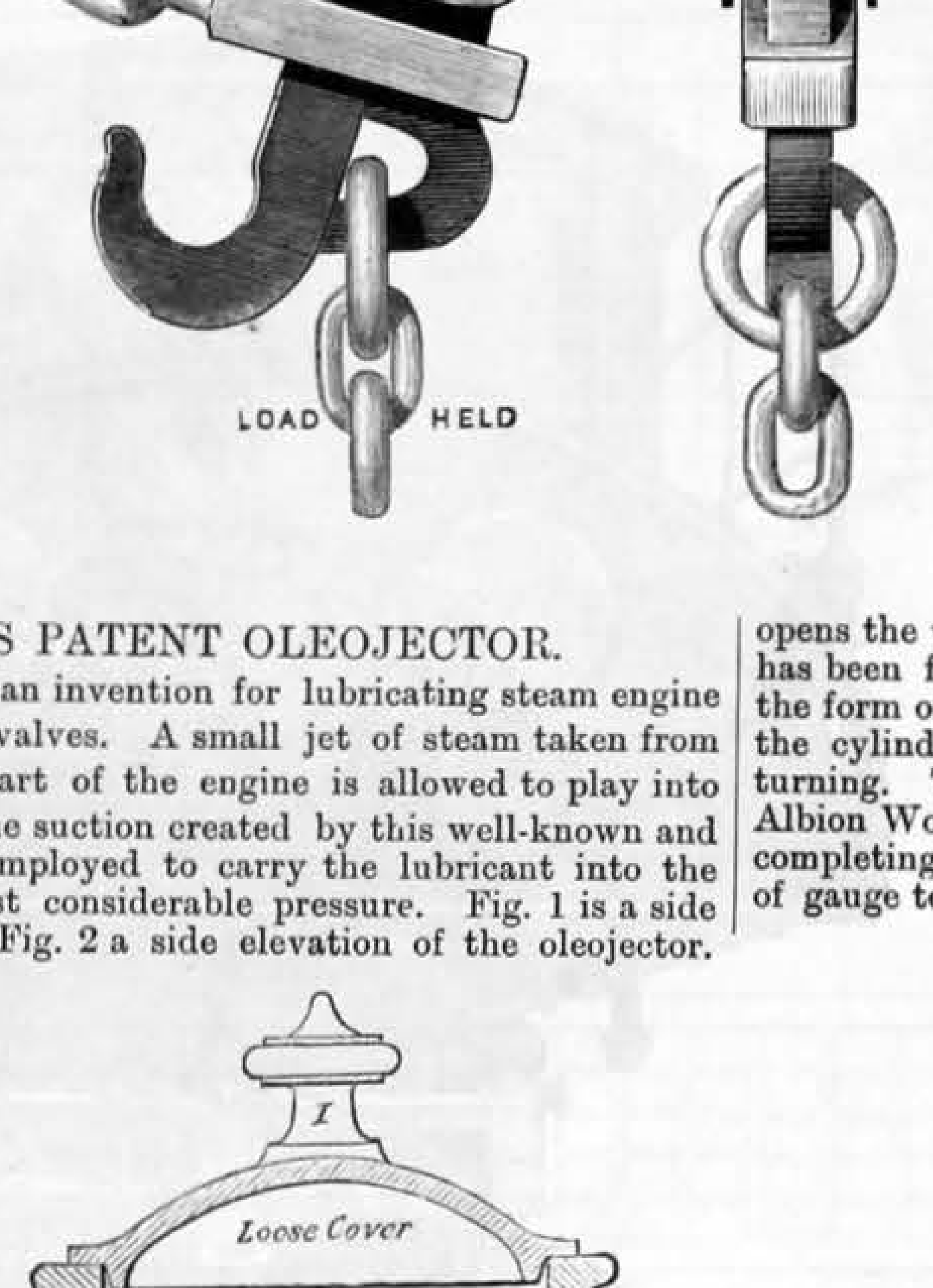


FIG. I

A is the body or injector portion provided with the cones B and C, which are fixed in position and require no adjustment. The inlet cone B is connected to the main steam pipe or other source of steam supply, and the rear of the outlet cone communicates with the engine cylinder about the middle in horizontal engines, and the upper end in the case of vertical engines. The suction produced by the small jet of steam passing these cones as the piston reciprocates on the cylinder is utilised to draw the lubricant into the cylinder, which falls on to the cup O in a measured quantity. A valve F is arranged to prevent the return of the oil. G is a cistern or receiver for containing the lubricant, and which is provided with a loose cover I. A regulator L controls the quantity of lubricant—falling drop by drop out of the cistern G on to the cup O—to the greatest nicety. At each successive period of low pressure in the cylinder a jet of steam passes through the cones B and C, and the suction thereby produced opens the valve F and draws in any oil or other lubricant that has been fed to the cup O, and carries it into the cylinder in the form of a fine spray. At the period of high pressure in the cylinder the valve F closes, and so prevents the oil returning. The makers are Messrs. W. H. Bailey and Co., Albion Works, Salford, Manchester. This firm are just now completing under Government inspection the fifth of a series of gauge testing cabinets for the East Indian State Railways.

Trial Trip of a Tyne-Built Steamer.—On Monday the s.s. Otway Tower ran her trial off the Tyne. She has been built by Messrs. Wigham Richardson, and Co., of Newcastle-on-Tyne, and is of the following dimensions:—Length, 290ft.; breadth, 35·3 ft.; depth, 25·6ft.; classed 100 A1 at Lloyd's, under special survey of hull and machinery. She is constructed on the three-decked rule, and fitted with water ballast on the bracket system, has short poop and topgallent forecastle, and is covered in amidship for one-fourth of her length, affording protection to her machinery in heavy weather, and providing shelter for cattle or deck passengers. Special facilities are afforded for the rapid working of cargo, and the vessel is steered from amidships by Higginson's patent steam-steering gear. She has lofty 'tween decks, 8ft. high, suitable for carrying troops or cattle, carefully ventilated, and all holds are fitted with special apparatus for extinguishing fire. The engines, also by Messrs. Wigham Richardson, and Co., are of the following dimensions:—Cylinders, 31in. and 62in. diameter, by 48in. stroke, designed to indicate when under full steam 1000-horse power. The boilers, of Siemens-Martin steel, are constructed for a working pressure of 90 lb. to the square inch. On the measured mile she averaged eleven knots per hour, the high-pressure engine indicating 487 and the low-pressure 492, making a total of 979-horse power, the pressure at the time being 84 lb,, vacuum 27½in., and revolutions 64. This very satisfactory result was attained [in the face of a strong north-east breeze and a heavy beam sea. This fine vessel, owned by Messrs. Stumore, Weston, and Co., of Liverpool and London, is intended for the American and East Indian trades.

CONSOLIDATION LOCOMOTIVE FOR THE PHILADELPHIA AND READING RAILROAD.

We are indebted to our contemporary, the *American Railroad Gazette*, for the particulars concerning a somewhat remarkable locomotive, which we illustrate this week on page 288. This is one of several heavy goods engines recently built for the Reading Railroad by the Baldwin Locomotive Works, of Philadelphia. These engines have the Wootten fire-box, for burning fine coal. Its construction is shown clearly by the engravings, from which it will be seen that it extends laterally over the frames and trailing driving wheels, so as to be 8ft. wide inside. The following are the principal dimensions of these engines :—

Cylinders	20in dia. by 24in. stroke
Driving wheels	50in. dia.
Truck wheels	30in. dia.
Driving wheel base	14ft. 9in.
Total wheel base	22ft. 10in.
Fire-box	9ft. 6in. long by 8ft. wide
Smallest diameter of boiler	4ft. 8in.
197 tubes	2in. dia. by 11ft. 6½in. long
Heating surface in tubes	1190 square feet
Heating surface in fire-box..	167 square feet
Heating surface total	1357 square feet
Grate consists of water-tubes and cast iron bars.	
Driving wheel journals	7in. by 8in.
Truck wheel journals	5in. by 8in.
Steam ports	16in. by 1¼in.
Exhaust ports..	16in. by 2½in.
The boiler is fed by two No. 8 Sellers injectors.	
Capacity of tank	2800 gallons
Diameter of tender wheels..	30in.
Journals of tender..	3½in. dia. by 8in. long

The fire-box slopes downward and is stayed on top and sides with stay bolts. The engines also have feed-water heaters which are shown under the running board. We regret that we are not able to give the weight of these engines nor any report of their performance.

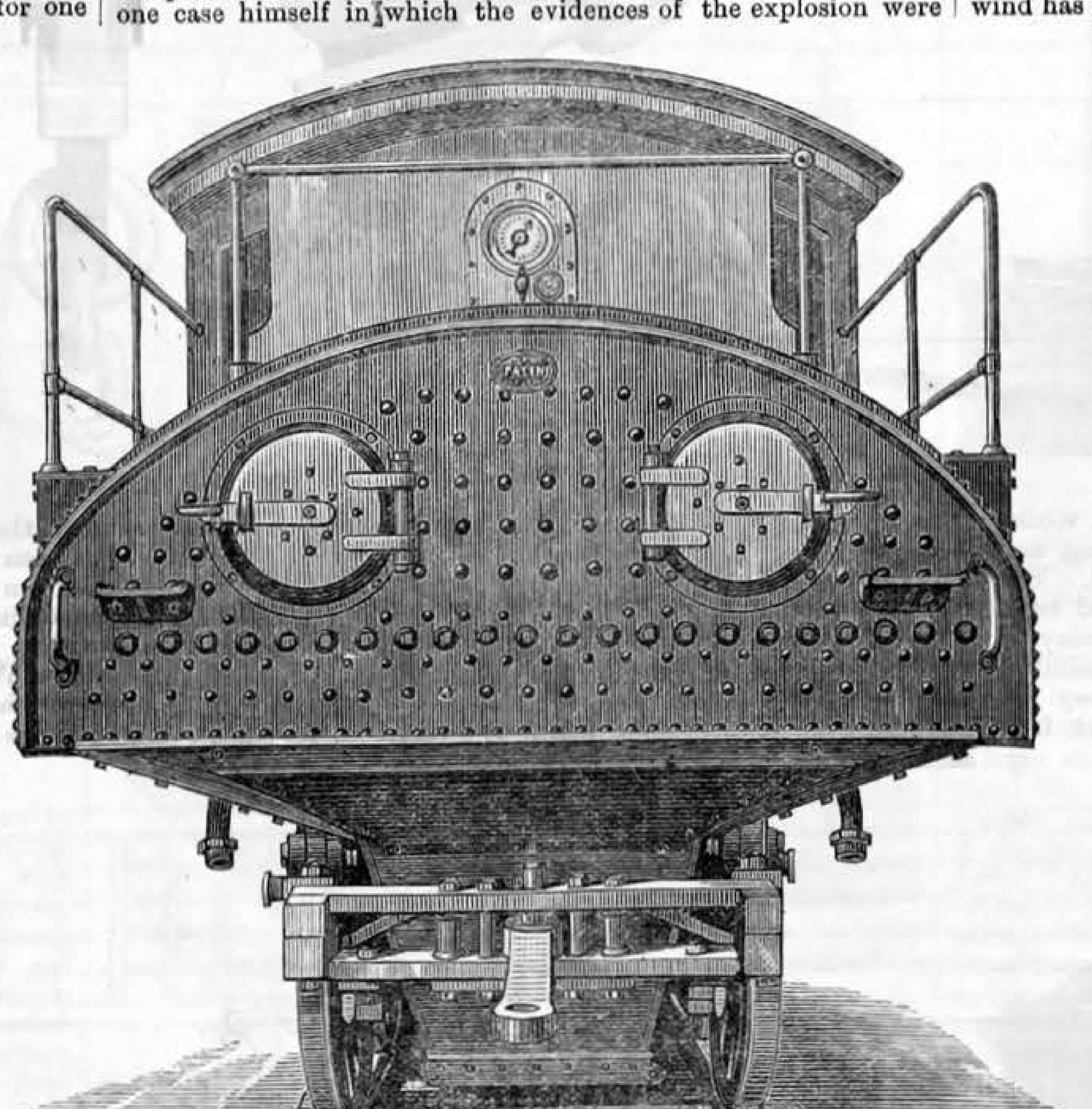
THE CAUSES OF EXPLOSIONS.—ATMOSPHERIC CHANGES AND BLOWN-OUT SHOTS.

By A. H. Leech, Staveley Colliery, Chesterfield.*

All the readers of this journal are no doubt greatly interested in this subject, which was brought before us by Mr. Cobbold in the November number. It is one which has for some time had the careful attention of our most scientific men. The Royal Commission on Mines, which is now being held, has this for one of its principal subjects for consideration, and its report compiled by such an array of clever, scientific and practical men, will undoubtedly be of very great value in determining the extent of the relation between atmospheric variations and the discharge of fire-damp, and it will be looked forward to with considerable interest by the mining world generally. It is to be hoped that it may conduce to the safety of mines, and give positive proof as to the soundness of theories relative to the predisposing causes of explosions which, although they may be correct, are after all only inferences taken from a few cases. Mr. Cobbold says that the majority of explosions of firedamp occurred most frequently when the barometer was on the move; and he might have added that they happened most often when those barometric changes were most rapid. When it is considered that a fall of an inch of the mercury is equivalent to a diminution in the atmospheric pressure of about 70 lb. per square foot, it may be readily conceived that such depression may affect not only the discharge of gas, but the stability of the roof and sides of the roads in mines, to a very considerable degree. This is easily understood, but the fact that there may be as great a discharge with a rising barometer is at present inexplicable. In looking over the deputies' or firemen's reports, it is generally found that much more gas is reported when the barometer is changing than when it is steady. The writer has in his possession a copy of some observations which were made some months ago at a colliery, as to the relation of atmospheric pressure to the discharge of firedamp, and having thought that they may be of some interest as illustrating this subject, he has appended them to this paper. It will, perhaps, be necessary to explain briefly how these observations were taken. At the colliery in question a fire had occurred which had spread so rapidly that it had been necessary to isolate that portion of the workings in which the fire had taken place. This was done by building strong air-tight brick stoppings round the district. A 6in. pipe with a flap-valve opening outwards was inserted in the stopping at the return end, and in this pipe a water gauge was fixed which was registered four times each day, and at the same time the height of the barometer was read. This was carefully done for a period of about six months, until the stoppings were broached, and the district re-entered. The stoppings were all perfectly air-tight, and consisted of two 9in. brick walls about a foot apart, with sand rammed between them. It was found that the pressure of gas given off did not vary inversely with that of the atmosphere, as might be expected; but with a settled barometer the water gauge showed a moderately uniform line, the more important changes only occurring when the barometer was unsteady. It was also noticed that for the most part the pressure of gas was lower during the night than in the day time, which may perhaps be accounted for by the difference in density of the atmosphere due to the lower temperature. These observations do not exactly prove, but they go a long way to confirm the theory that the discharge of gas in mines is ruled to some extent by the barometric variations. It does not follow that with a high barometer there is least gas given off, nor does it follow that with a low atmospheric pressure there is most gas, but it appears to the writer that it is in sudden changes, whether up or down matters not, where lies the danger of unusual quantities of firedamp being discharged. It is for scientists to solve the seeming paradox which allows a greater escape of gas with a higher barometric pressure, while what colliery managers have to do is to be well prepared for such occurrences. There is strong proof that the unsettled state of the atmosphere has something to do with the escape of gas, but to what extent it affects it is yet uncertainly known.

Here it may be well to consider the practical application of this knowledge to mining. What provisions must a viewer make to guard against any danger arising from these barometric variations? It is absolutely impossible to carry out a rule that no shots must be allowed when the barometer is unsteady, and it is equally impracticable to enforce a rule which requires that immediately any atmospheric change is predicted, or as soon as the barometer ceases to be steady, the fan must be increased in speed, or the furnaceman must use more coals in order to keep up a bigger fire than usual; nor would it be at all practicable to enact that on being told of such changes of atmospheric pressure, the deputies must use more care in examining the places which ordinarily he is supposed, and compelled by Act of Parliament to thoroughly inspect and report upon; for a manager in adopting such rules would give a tacit admission that great caution is not always exercised in his pits. It is necessary at all times, whether the barometer is behaving in such a manner as to foretell innumerable thunderstorms and an excessive exudations of fire-damp, or whether it is as steady as a clock, that the workings in any mine should be carefully inspected and the lamps thoroughly examined and tested, so that the mines should be comparatively safe. I say *comparatively*, because, with the contingencies of defective safety lamps and outbursts of gas, perfect safety is impossible. And if the viewer were to receive a warning that the barometer was about to drop or rise as much as 2in. in one night, he could do no more than he had already done towards ensuring the safety of his workmen, unless he were to bring them out, and shut the pit up until the barometer had finished its vagaries, and had become settled once more. The writer would not assert that the warnings of the barometer should be disregarded altogether; far from it, but that without using any extraordinary caution a pit ought to be always in the highest possible degree of safety; for if the state of the atmosphere has anything to do with the discharge of firedamp, it may be taken for granted that the quantity of gas given off will be affected most by those barometric variations which are the most rapid, and perhaps give little warning of their approach.

Assuming then that a mine is as safe as it can possibly be made as regards ventilation and system of working, and that it would not altogether be a misnomer to call the lamps used by the name of safety lamps, there still remains one very important question, and that is the use of powder. It will not be disputed that a great number of colliery explosions have been attributed to blown-out shots; and although the wrong cause has been assigned in some instances, yet undoubtedly many explosions have been the direct results of blown-out shots. In dealing with this question it will be well, perhaps, to consider the conditions under which one of these shots must be fired so as to produce an explosion. It is necessary, of course, that there shall be gas present with which the flame of the blown-out shot, or that of a lamp, may come in direct contact. The flame of the former has been known to reach as much as fifty yards in the presence of finely divided coal-dust, and experiments have proved, as Mr. Cobbold says in his paper, that it is possible to ignite gas at a good safety lamp, by concussion in the air, at some distance away from the shot itself. Knowing this to be a fact, and that it is necessary by Act of Parliament for the fireman or shot-lighter to examine carefully the place where the shot is to be fired, and all the places contiguous thereto, it will be only reasonable to suppose that in many instances, in which blown-out shots have really been the cause of explosions, the gas has been ignited through concussion in the air, and at some distance away from the shot-hole; for it is only fair to assume that at a well-managed colliery the shot-lighter *does* comply with the 8th general rule, and does really examine the places carefully before firing the shot. The writer has seen one case himself in which the evidences of the explosion were



END VIEW OF CONSOLIDATION LOCOMOTIVE.

most severe three or four hundred yards away from the blown-out shot, and they showed to him most clearly that if the shot had really been the primary cause of the explosion, its flame did not come in direct contact with the gas, but that through concussion the flame of a safety lamp had been blown through the gauze, and so caused the disaster; and his object in writing this has been to show that with the most perfect conditions as regards inspection and ventilation, it is possible to have an explosion. Nobody will care to deny that the use of powder has resulted in explosions, and it would indeed be useless to argue about its being dangerous. The question is really one of £ s. d., and one which depends in a great measure for its settlement on the decision of the owners. It will be a long time before legislation will venture to deal with it, for the great difficulty would be in drawing a hard and fast line as to what mines are to be labelled dangerous; and it would be perhaps rather hard on those colliery proprietors who work seams which can scarcely be got without the use of some strong force like powder. It appears on the face of it rather strange that the miners themselves, who are the persons most affected, and terribly affected too, have rarely, if ever, taken the initiative in suggesting the prohibition of powder. In most instances where its use has been discontinued it is the masters themselves who have first made the suggestion that it should be no longer used, and it is the miners who have resisted the innovation. When, however, it is considered that to them as to the owners, the question resolves itself into one of £ s. d., it is perhaps scarcely to be wondered at. One cannot help thinking that if those among the miners' agents, who call themselves champions of the working classes, had only applied their energies towards establishing a kinder and better feeling between master and man, instead of having sown seeds of discord between them, there might have been fewer accidents of all kinds, for the master would have known that whatever he brought forward towards lessening the dangers of mining would have been received in a good spirit by his workmen. The difference in the cost of working is after all not much in many hard coal seams with a good roof and floor, and where the long wall system can be adopted, because the coal will generally come down easily after being holed. It is, however, in winning out where powder is most required, and here the great danger lies. Its use may be most strictly prohibited in the long wall, or broken districts, where it is possible gas may lodge in the goaf; and yet if it is allowed in the whole or headings some distance away, a blown-out shot may occur, which may through concussion blow the flame of a lamp in the long wall through the gauze, and so cause a most disastrous explosion.

In some cases the danger of using powder in a fiery mine has been acknowledged by allowing shots to be fired only in the night time. This is undoubtedly one step towards safety, as it only risks the lives of some ten or twenty men, instead of perhaps two or three hundred. But even this is not a preventive; it is only a lessening of the probable fatal results of an explosion. Many owners have abolished the use of powder in their pits, and it is to be hoped that their good example may be speedily followed by others who work seams equally fiery. However desirable it may be to know how far meteorological changes affect the discharge of firedamp, it can never be so important a question in mining as that of the use of powder. It is a hard but stubborn fact, that by a single word the owners could abolish one of the most prolific causes of colliery accidents. Surely it is a strange thing, this characteristic of man, which incites him to invent theories, and wander about seeking some possible predisposing cause, whilst the immediate one lies neglected before him staring him in the face at every turn in his research. What earthly practical use is there, and what possible benefit can be obtained from even a perfect knowledge as to the quantity of firedamp given off under different atmospheric conditions, whilst flame-producing explosives continue to be used? The time will certainly come when powder in fiery mines will be a thing of the past, but not until that time does come will the minimum number of colliery explosions be reached. Since writing the above the writer has had the opportunity of perusing Mr. Bunning's paper in the December number. He says that "experiments have been made which show that firedamp exists at a common tension of some hundred pounds on the square inch in the solid coal." This is no doubt true in a great many cases, but one can scarcely think it would be correct to say that such an enormous pressure exists in all coal seams which give off firedamp. It would, in the writer's opinions, be a very good thing if Mr. Bunning would kindly publish the experiments he mentions in this journal, as they would be exceedingly interesting whilst the subject is under discussion. If it be true that such a great pressure as this does exist, then barometric variations can have very little effect on the discharge of gas from coal, and it is to goaves we must look for any abnormal exudation of firedamp, which may be caused by atmospheric changes.

Mr. Bunning's suggestion as to the isolation of goaves by building air-tight brick walls round them is scarcely practicable, nor is it desirable that goaves should be entirely shut out, as it would only be creating huge reservoirs brimfull of gas, by keeping the firedamp in, and any derangement in the brick stoppings or walls might fill the workings with an explosive mixture. In all cases where it is possible, the return air should sweep past the edge of the old goaves, and carry away the gas as it is given off direct to the upcast pit. He also suggests that the wind has something to do with the ventilation of a mine. This is probably true to a great extent where the workings are ventilated by a furnace, and especially in shallow mines. Many cases are known, in the West Durham coalfields, in which the air current has been almost reversed by a sudden change in the wind. It is questionable, however, whether the direction of the wind does materially affect the ventilation in deep mines, or where a fan is used and the motive column is high.

Mr. Bunning is certainly correct in thinking that it is essential that a complete series of observations should be made at one particular pit, in order to ascertain what definite law does really exist as to the relation of atmospheric variation to the exudation of gas. If the state of the atmosphere be not noticed at the same colliery at which the discharge of firedamp is observed, very conflicting results will be obtained. Meteorology in its relation to mining is a most interesting study, and offers great scope for observation to every student; and the prevalence of gas in the deputies' report might be made the subject of a very useful diagram; and from a periodical examination of the return air by one who understands the use of the spectroscope, an exceedingly interesting chart might be made, which would show with a great degree of accuracy the quantity of gas given off daily in the mine; and this compared with the atmospheric variations, and the velocity of the air for the same period, would perhaps throw considerable light on the question now under discussion.

The object of this paper has been to show that however desirable and even necessary it may be to understand the amount of danger to be apprehended from sudden atmospheric changes, through the exudation of unusual quantities of gas, yet we should not blind ourselves to the fact that so long as we continue to use a flame-producing explosive, disasters will happen in our mines, which may justly be attributed to the use of powder. This is not mere sentiment, but a plain fact. Is valuable property to be destroyed, are still more valuable lives to be sacrificed, and homes made desolate, for the sake of at the most a few pence per ton? Who is to answer this question? The owners, or must Legislation step in and compel the discontinuance of the use of powder in fiery mines?

* Read before the British Association of Mining Students.

Tramway to the Giant's Causeway.—In the last session a private Bill was passed through Parliament, viz., "The Giant's Causeway, Portrush, and Bush Valley Railway and Tramway Act," which authorises the construction of road tramways on a system differing from that in ordinary practice, and by which a very great saving in the cost of construction and annual expenditure in working expenses is obtainable. The construction of tramways upon this system, at a cost of about £2000 a mile, instead of the usual £5000 to £15,000 per mile, is particularly an advantage to countries like Ireland, or remote districts in England, where tramways constructed at the usual cost could not possibly be remunerative. The proposed new system is suitable rather for road tramways, as distinct from street tramways, for connecting outlying towns, villages, quarries, or mines with the large centres, or railway stations, or for opening up any attractive bits of scenery where a railway would be most objectionable. The tramway is laid on a raised siding along the margin of the road, which forms an ordinary pathway for foot passengers, having a stone kerbing along the outer edge, and gravelled or asphalted throughout its length. This siding or pathway is raised about 3in. to 5in. above the surface of the road, so as to prevent the passage along it of carts or other vehicles, and so dispenses with the necessity of having to pave the tramway with square sets—a very large item in the usual cost of construction—and also prevents the wear and tear of the surface by other vehicles than the tramcars. The formation width of the tramway is from 6ft. to 7ft., on the outside of which the usual country road fence or wall is placed; the gauge of the tramway is 3ft., laid with ordinary railway rails weighing about 38 lb. to the yard. On the Giant's Causeway and Portrush Tramway the system above described is to be adopted, and steam traction employed, powers for such having been obtained. It is expected that by this tramway a very large tourist traffic to the Giant's Causeway will be accommodated, in addition to the ordinary local passenger traffic, and a large traffic in goods, iron ore, and limestone. The tramway will run alongside the platform of the Belfast and Northern Counties Railway Station at Portrush and be also connected directly with the harbour at Portrush; it will also form a junction at Bushmills with the Bush Valley narrow gauge railway; the tramway is expected to be open for traffic by next summer. Mr. W. A. Traill, C.E., late of H. M. Geological Survey of Ireland, is the engineer.

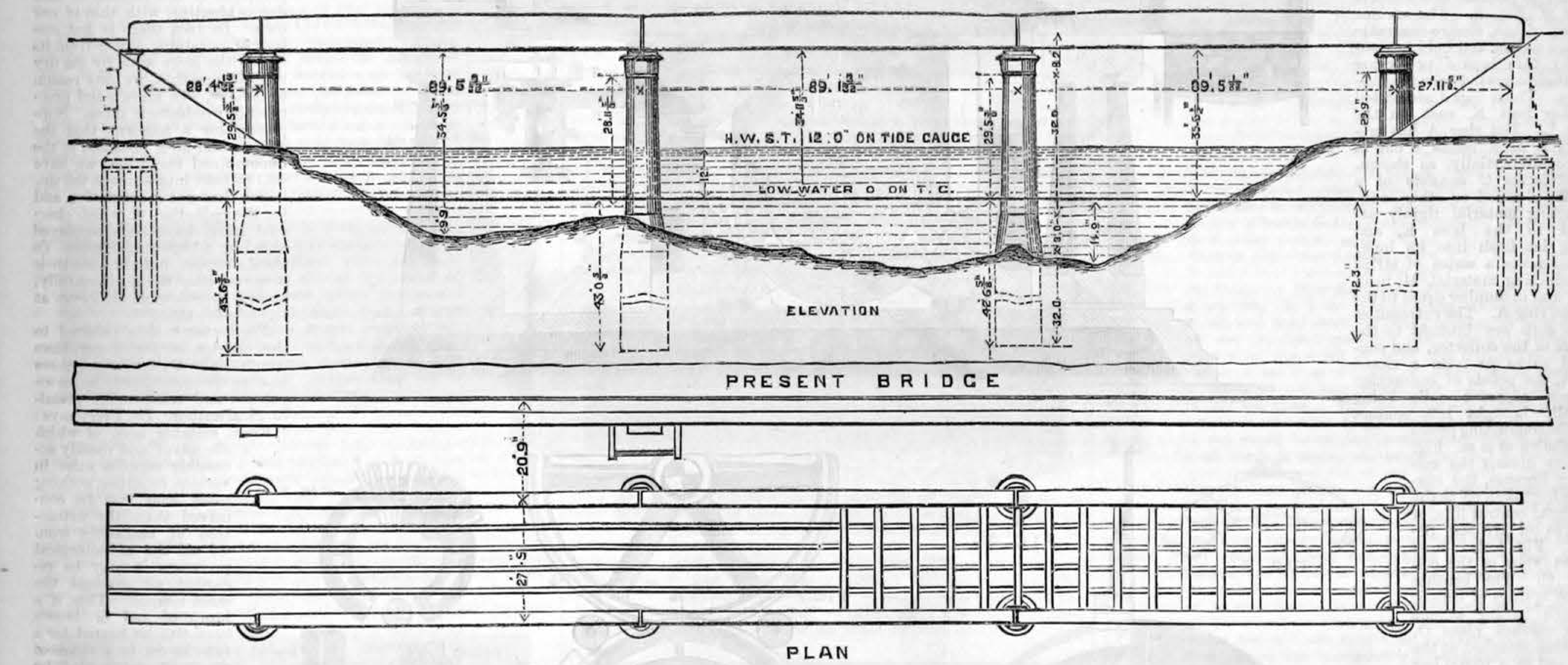
CONTRACTS OPEN.

RAILWAY BRIDGE ACROSS THE TEES.

THE works comprised in this contract consist of the erection of a railway bridge across the river Tees, on the north side of the present railway bridge; the excavation for the lowering of the level and widening of the North-Eastern Railway from the Tees Bridge to a point about 240 yards eastward from the present station; the construction of two over-bridges, and the diversion of the Thornaby-road and Mandel-road so as to pass over the said bridges; the construction of a carriage drive from the Mandel-road to the intended passenger station; the construction of a horse and carriage loading bank, and of various retaining and fence walls, and of culverts, drains, and embankments. Our engraving illustrates the bridge over the Tees. We give so much of the specification as applies to the bridge, and a bill of quantities for the whole contract.

Excavation.—The excavations for the foundation of the land piers must be conducted carefully, so as not to endanger the railway or present bridge on the river banks. The width and length of the excavations must not be more than is absolutely necessary, and the sides and ends must be properly planked and strutted or shored. The material excavated must be deposited either in the line of the railway embankment, or taken to sea in barges; if any of it is deposited in embankment, the engineer may require it to be taken an average distance of 55 yards, and carefully laid in horizontal layers. The engineer shall decide how much, if any, material is to be put into embankment, and how much taken to sea; but for the purpose of their estimates parties tendering may assume that 525 cubic yards will be deposited in embankment, and the remainder taken out to sea. In preparing for putting in the cylinders in the river, the contractor will be allowed to dredge away the slag which surrounds the piers of the present bridge to the depth shown in drawing No. 3, but no deeper, unless he takes efficient means, by driving piles of wood or iron, to prevent the slag from being removed from the sides of the present piers. The material within and underneath the cylinders must be removed by means of scooping or dredging in such a way as the engineer may approve of, or by excavating in the ordinary manner after the water has been excluded from the cylinders by the pneumatic—plenum—apparatus. Pumping the sand will not be allowed. All this material must be taken out to sea in barges.

Cylinders.—The cylinders, which are shown in the drawings, are to be of cast iron, of the quality described under the general head Cast Iron. The parts of the cylinders which are 7ft. in diameter are to be cast in rings; those of larger dimensions in segments.



PLAN

The capitals and top rings must not be cast until the test load has been removed from the columns. Any variation in height due to settlement must then be allowed for. The bolt holes in the horizontal flanges must be drilled, and also those in the vertical flanges, unless the contractor can satisfy the engineer as to the latter, that he can insure accuracy of fit by casting. The abutting edges of the cylinders, both horizontal and vertical, must be planed and the whole of the joints be made perfectly water-tight. They must be caulked with iron cement composed of iron filings and sal ammoniac. The vertical joints of the cylinders must line all the way down. The cylinder castings in the lower part of the cylinder up to the level of 3ft. above low water mark are to be dipped in a hot liquid, consisting of a mixture of coal tar and pitch, of such a consistency as to give a hard surface when cold. Concrete for a thickness of 6ft. must as soon as possible be laid in, and be properly trimmed, and beaten solid. The concrete must be well packed, and rammed under the flanges of the cylinders. The concrete must be formed of four and a-half measures of broken slag, no piece being larger than will pass through a 1½in. ring, one and a-half measures of clean sharp river sand, and one measure of Portland cement. The Portland cement must be of good quality, and very finely ground, weighing not less than 110 lb. per striked bushel, and must stand the following test. It must be capable of maintaining a weight of 850 lb. on an area of 2in. by 2in., seven days after being made and immersed six of these days in water. The brickwork resting upon the concrete must consist of plate-bricks from the Weardale Iron and Coal Company, or other firm in the Auckland district, and they must be fully equal to the sample bricks which will be shown to the contractor. The brickwork must be carefully set, and well bonded in such way as the engineer may direct. The whole of the joints, vertical as well as horizontal, must be carefully flushed with mortar, which must consist of one part by measure of Portland cement, such as has been herein before described, and three parts of sharp river sand intimately mixed together. Each pier must be tested with a load of 275 tons equally distributed over the surface of the brickwork, and this load must be allowed to remain on it until a fortnight has elapsed without any settlement. It must in any case remain on the pier for four weeks. The girder seats will be of cast iron, and it must be of the quality specified for cast ironwork. Both the upper and under bearing surfaces must be planed perfectly true and parallel, and between the girder seats and the masonry must be a sheet or stratum of 12 lb. lead covered with a sheet of vulcanite to prevent contact between the iron and the lead. The piers in the embankment at each end of the bridge are to be founded on piles of good sound Memel, red pine or pitch pine timber, and must be driven by a ram weighing 1 ton, and having a fall of 6ft., and must be driven until they will not move more than ⅛in. with each blow. The lower part of the piers will consist of brickwork of fire-bricks set in cement mortar, both bricks and mortar to be of the same quality as those prescribed in the specification for the other piers. The upper part of the piers must consist of ashlar masonry set in cement mortar. The girder seats must be secured to the masonry with proper holding down bolts and nuts. These bolts must be dovetailed, and fixed in the stone with molten lead.

Girders.—The girders must be of wrought iron, of the best Cleveland make, the brand and make to be submitted to the engineer for approval before the materials are purchased. Trial strips must be cut from such plates or other material, and tested at the expense of the contractor, and must stand the following tests:—All plates must stand a tensile strain of 20 tons to the square inch of original area without breaking. The trial strip must then be broken by tensile strain, and the reduction in area before tearing must not be less than 10 per cent. All T-irons and L-irons must stand 22 tons to the inch, and the reduction of area before fracture must not be less than 18 per cent. All rivets and bolts throughout the bridge must be of the best scrap iron, and capable of bearing a strain of 26 tons per square inch. The bolt heads and nuts must be clean, and perfectly formed, and the screws deeply and properly cut. All rivet and bolt holes are to be drilled. Those in the top and bottom flanges, and wherever it is practicable must be drilled with all the plates in position through the full thickness of the flange, and the whole of the rivet holes in the various plates, T-iron and L-irons, must fit one another perfectly. No drifting will be allowed, but in cases where the misfit is very slight, the holes must be carefully rimed out, and larger rivets inserted. All bending and cranking of the T-irons and L-irons must be done when they are hot, and any pieces showing splits, or cracks, or other damage will be rejected. The abutting edges of the plates must be planed and fitted together with great accuracy. The whole of the ironwork before it is rivetted up, and when practicable after it is drilled, must be dipped in boiled linseed oil. It must be previously scraped clean, and if required by the engineer, dipped in a weak acid solution to ensure a perfectly clean surface. It must receive two coats of good red lead paint before being sent out of the works.

Cast Iron Work.—The cast iron work in cylinders, parapets, bed-plates, and wherever it is used in the bridge must be of thoroughly good quality, straight, and true to the drawings, and free from sand holes, flaws, or other imperfections. The metal must be tough and close-grained. Test bars, 3ft. 6in. long by 2in. by 1in., must be cast from such meltings as the engineer may direct. These bars, when placed on their edges on bearings 3ft. apart, must not break with a load of 28 cwt. applied on the middle of the bars, and their deflection before breaking must not be less than $\frac{5}{16}$in. The way beams and floor planking of the bridge must be of the best Memel timber creosoted. They must be carefully bolted to the cross and rail girders as shown on drawing No. 8, and the rail timbers must be so cut out as to require no packing or dressing to insure the rails having a regular and even gradient. The timber must be creosoted at the company's works at Hartlepool. The contractor will be charged 5d. per cubic foot for the creosoting, and he must pay for the carriage of the timber each way. The whole of the bridge works must be completed by the end of the year 1882.

The quantities in the case of the Tees Bridge are as follows:—

		Quantities.
Excavation for foundations of abutments deposited in embankment inclusive of all planking, strutting, shoring, &c.	cubic yards	525
Excavation from inside cylinders taken to sea in barges	,,	1183
		T. C. Q.
Cast iron cylinders fitted together and made water-tight		420 7 0
		T. C. Q.
Bolts in ditto		10 4 1
Sinking cylinders, including staging, tackle, pneumatic apparatus, weighting, &c.	lin. feet	621
Portland cement concrete in cylinders	cubic yards	153
Portland cement concrete elsewhere	,,	95
Brickwork of plate bricks, in cement mortar, set inside cylinders	cubic yards	1275
Brickwork as above in abutments	,,	410
Ashlar masonry in cap stones of piers	cubic feet	560
Ashlar in moulded cap stones of abutments	,,	583
Ashlar rusticated, drafted, and broached as in abutments of present bridge and elsewhere	,,	216
Piles in foundations of abutments, including driving, and contingencies	,,	2401
Crown trees, and planking fitted and fixed	,,	689
		C. Q. lb.
Bolts and spikes in ditto		7 1 22
		C. Q. lb.
Wrought iron pile shoes, 20 lb. each, fitted and fastened		14 1 4
		T. C. Q.
Wrought iron girders, including scaffolding and erection		485 9 0
		C. Q. lb.
Wrought iron straps round tops of cylinders, 14in. by ⅝in.		46 3 14
		T. C. Q.
Cast iron parapets, fitted and fixed		8 5 1
		C. Q. lb.
Bolts in ditto		2 0 4
		T. C. Q.
Cast iron bed plates, planed		6 18 1
		No.
Fixing ditto	each	8
		C. Q. lb.
1½in. bolts for cast iron bed plates, run with lead		5 0 8
		C. Q. lb.
Sheet lead laid over caps of columns		31 2 24
Vulcanite under girder seats	sup. feet	156
Creosoted Memel way beams, and planking, fitted and fixed	cubic feet	3568
		C. Q. lb.
Bolts and spikes in above		35 1 20
		C. Q. lb.
2½in. by 2½in. by ⅜in. L iron fixing curb		33 0 11
		C. Q. lb.
Bolts in cross girders over piers		2 3 0

Works other than Tees Bridge.

Excavation for widening and lowering railway, deposited in embankment		
From south side of travelling lines	cubic yards	28,044
From north side and site of present travelling lines	,,	22,120
Excavation from railway, as above, placed in 12in. layers in approaches to bridges, and in filling up subways, and well beaten	,,	4832
Excavation for foundations placed in approaches to bridges in 12in. layers, and well beaten	,,	2250
Rubbish from old houses deposited in approaches to bridges, and in altered roads	,,	500
Ballast found by railway company, unloaded and placed in approaches to bridges, and in altered roads	,,	5066
Loading up, and placing in embankment, excavation from foundations of intended passenger station	,,	400
Culvert as per drawing No. 25, Fig. 1, exclusive of concrete in foundations	lin. yards	38
Culvert as per drawing No. 25, Fig. 2, exclusive of concrete in foundations	,,	3
Concrete in foundations of bridges, and walls, and culverts made with Barrow lime	cubic yards	2206
Concrete in foundations of culverts if made with Portland cement	,,	84
Brickwork in bridges and walls set in mortar of Barrow lime	,,	4497
Brickwork in bridges and walls set in mortar of Aycliffe lime	,,	3083
Additional price for facework of pressed bricks	sup. yards	7069
Dry slag walls in backing of brick walls	cubic yards	1417
Drains of 9in. sanitary pipes properly seated and protected	lin. yards	180
Drains of 6in. sanitary pipes properly seated and protected	,,	1800
		No
Junction pipes for the above drains		60
Ashlar masonry in string courses, coping, caps, quoins, girder-stones, &c.	cubic feet	11,958
		T C. Q.
Wrought iron girders in road bridges, fixed in		218 1
		T. C. Q.
Floor plates, fixed and rivetted		73 17 0
		C. Q. lb.
Wrought iron bolts		38 0 0
		T. C. Q.
Cast iron in parapets of bridges, fitted and fixed		39 18 2
Concrete of hard coke on bridges	cubic yards	321
Wood brick paving, creosoted and fixed	sup. yards	1177
Broken slag in roads, well rolled	cubic yards	4056
Fine screened slag on footpaths	,,	356
Top cover of whinstone and limestone, well rolled	,,	1802
Curbstone, 10in. by 8in., set	lin. yards	1530
Flagging, 2½in. thick	sup. yards	2851
Slag masonry in fence walls	cubic yards	668
New granite steps, fixed	cubic feet	168
Paled fencing, as per specification	lin. yards	315
Pavement for road crossings, blue stone blocks 7in. thick	sup. yards	252
Pavement for road crossings, Tees scoria slag blocks 7in. thick	,,	252
Drains in 8in. tiles	lin. yards	1000

The tenders must be marked "Tender for Works at South Stockton," addressed to the Secretary North-Eastern Railway, and delivered at his office in York not later than 5 p.m. on Wednesday, the 20th inst.

MR. HENRY TIPPING, whose yacht engines we recently illustrated, has been commissioned by the Nawab of Bahawalpur to provide him with a steam yacht for use on the many excellent canals which he has had constructed by his staff of English and native engineers. The yacht is to measure 30ft. in length, 6ft. 9in. in breadth, 3ft. in depth, and is expected with its complement of passengers and stores on board not to exceed 1ft. 8in. in mean draught. The hull is to be formed of steel, with teak lining and deck. The cabin, which will be fitted with ice wells and luxurious appointments, is 9ft. long, and is also built of teak; while the funnel, rails, and stanchions will be nickel plated. The little craft will be propelled by means of twin screws, worked by a pair of inverted direct-acting engines, which are built on each side of the boiler, a little abaft the smoke-box. The cylinders are 5½in. in diameter, with a stroke of the same length, and working up to 300 revolutions. The boiler, which is to be heated by wood, will work at a pressure of 120 lb., and the engines will be worked at a high rate of expansion, the cut-off in the slide being at half-stroke. The indicated power will be about 20-horse, and the speed, it is expected, 10 knots.

FITZGERALD'S MAGNETO AND DYNAMO-ELECTRIC MACHINES.

The improvements in magneto and dynamo-electric machines we now illustrate are the invention of Mr. Desmond G. Fitzgerald, and deserve careful attention, inasmuch as they show a decided advance in the right direction. The main idea of the inventor seems to have been to aim at perfecting the Gramme machine, and so, instead of rotating the ring between the poles of a magnet on the ordinary system, he wholly or partially surrounds the ring both longitudinally and transversely, thus increasing the effective inductive action. The ring is thus magnetised directly, and with the least possible loss, and the direction of the inducting magnetic polarity is in the circle constituted by the ring itself, as it should be. Fig. 1 shows a transverse sectional elevation of a dynamo-electric machine, Fig. 2 is an elevation partly in section looking on to the left-hand side of Fig. 1, with the driving pulley removed. In Fig. 1 A is the soft iron ring carrying sixty, more or less, coils B of wire, all wound in one direction. The ends of these wires are connected to the collector C. The ring A, with its coils, is mounted on a disc D attached by a boss E to the shaft F, mounted in suitable bearings on the standards G G, and at one end carrying the driving pulley H. The ring A is almost wholly surrounded by a hollow electro-magnetic ring I I¹ I². For convenience of manufacture the ring I I¹ I² is divided into several portions, of which the two represented by I¹ and I² are annular, while two are semi-annular, and make up the largest diameter I, the division between the halves being preferably at the top and bottom. The separate portions of this hollow magnetic ring are so wound with coils of wire as to constitute two magnets having their like poles opposed on the vertical plane traverse to the ring A. The reverse direction of the winding near the poles required to produce this effect is shown at Fig. 3. The various sections of the electro-magnetic ring are united and held in position by thin lugs J projecting from their cores between the coils of wire. These lugs J are bolted to other lugs K cast on the frame L. The ring A has preferably a deep recess a cut in it circumferentially, as shown. The collector C consists of a cylinder of wood or other non-conducting material rigidly attached to the boss E, and having let flush into its inner circumference a series of strips of conducting material, M, insulated, and in number equal to the coils on ring A. The extremities of the coils are brought to the outside of the collector, and connected so as to form a closed circuit, the points of connection between adjacent coils being severally brought into contact with the conducting pieces M as shown at m m. Fig. 4 shows clearly the collecting brushes, the current being taken off at the horizontal central line, or the line of greatest polarity. Fig. 4 also shows a front view of the collector C. The brushes are flat springs of copper O', each having at one end a contact piece O, and being attached at the other end to a round bar P, passing through a terminal Q, and being fixed in position by a set screw R. A short lever S is fastened to the end of the bar P, having an adjusting screw S' tapped through it, and bearing on the plate underneath. This screw enables any required tension to be put on to the springs O', thus regulating the contact friction. The terminal Q is fixed to and insulated from a plate T, connected by screws U, to the end standard of the machine. The whole of the current collecting portion of the machine is liberated by means of these screws.

Considerable modifications are made in the construction of the ring. The method of construction is shown by Fig. 5. Ordinarily, in winding a number of coils of wire upon a ring, more especially if it be of circular section and if the number of turns of wire be the same in each layer, interstices are left between the coils. These interstices are filled by Mr. FitzGerald with soft iron wedge-shaped blocks V. These blocks can either be made with the ring, or separately and slipped on, the ring being made in halves to receive them, as shown.

Fig. 6 shows a modified form of the ring A and the encircling magnets I I¹ I², the ring being cylindrical instead of circular, and the encircling magnets having modified shapes to correspond. The principle is the same whichever form is used. Figs. 7 to 10, however, illustrate a modification in which the ring A is wholly encircled on its cross section by coils W, in lieu of inducing magnets.

Figs. 7 to 10 illustrate a totally new form of machine in which the ring A is wholly encircled on its cross section by coils W of wire in lieu of inducing magnets. These encircling coils W are supported in a suitable framing X, and the ring A, to rotate through them, is mounted between three or more rollers Y, by one of which—preferably the upper—it is driven by frictional contact, the surface of this roller or pulley being of india-rubber, as seen at i i, Fig. 8. The extremities of the coils of ring A are attached in a manner similar to that before described to a series of strips of conducting metal, Z, let flush into the external surface of an ebonite or wooden ring A¹ fitted round the outside of ring A. The current is taken off at an aperture in the outer circumference of the coils W left in each between the coils of wire. Preferably, the coils W are wound so as to leave a longitudinal groove W on their inner surfaces, where they pass over the ring A¹ on the outside of ring A. This allows of the two surfaces of the ring and encircling coils being brought into very close contact. Fig. 8 is a transverse section taken at a b. Fig. 9 is a sectional plan of ring A at centre line, and Fig. 10 a section of coils W, taken at line c d, Fig. 7.

It is obvious that in the three forms of machines shown permanent magnets may be substituted for the electro-magnets, the permanent magnets retaining substantially the same shape, but being necessarily divided at the points where their similar poles are opposed.

The coils on the ring A and those on the inducing electro-magnets I I¹ I², or the inducing coils W, may be connected in multiple arc or in series, as is well understood. The apparatus may be advantageously constructed in duplicate, the current from one of the rings A being employed to magnetise both of the hollow electro-magnetic rings and the current for the external portion of the circuit being taken from the second in ring A. The coiled ring A may be enclosed in a casing of soft iron provided with a circumferential slot to allow of the passage of the wires from the coils. The arrangement of the inducing magnets I I¹ I² and the coils W is applicable to ring-armatures generally. The saddle-back magnets—as they are called by Mr. FitzGerald—of double or single curvature, are, the *Electrician* says, applicable to a great variety of purposes.

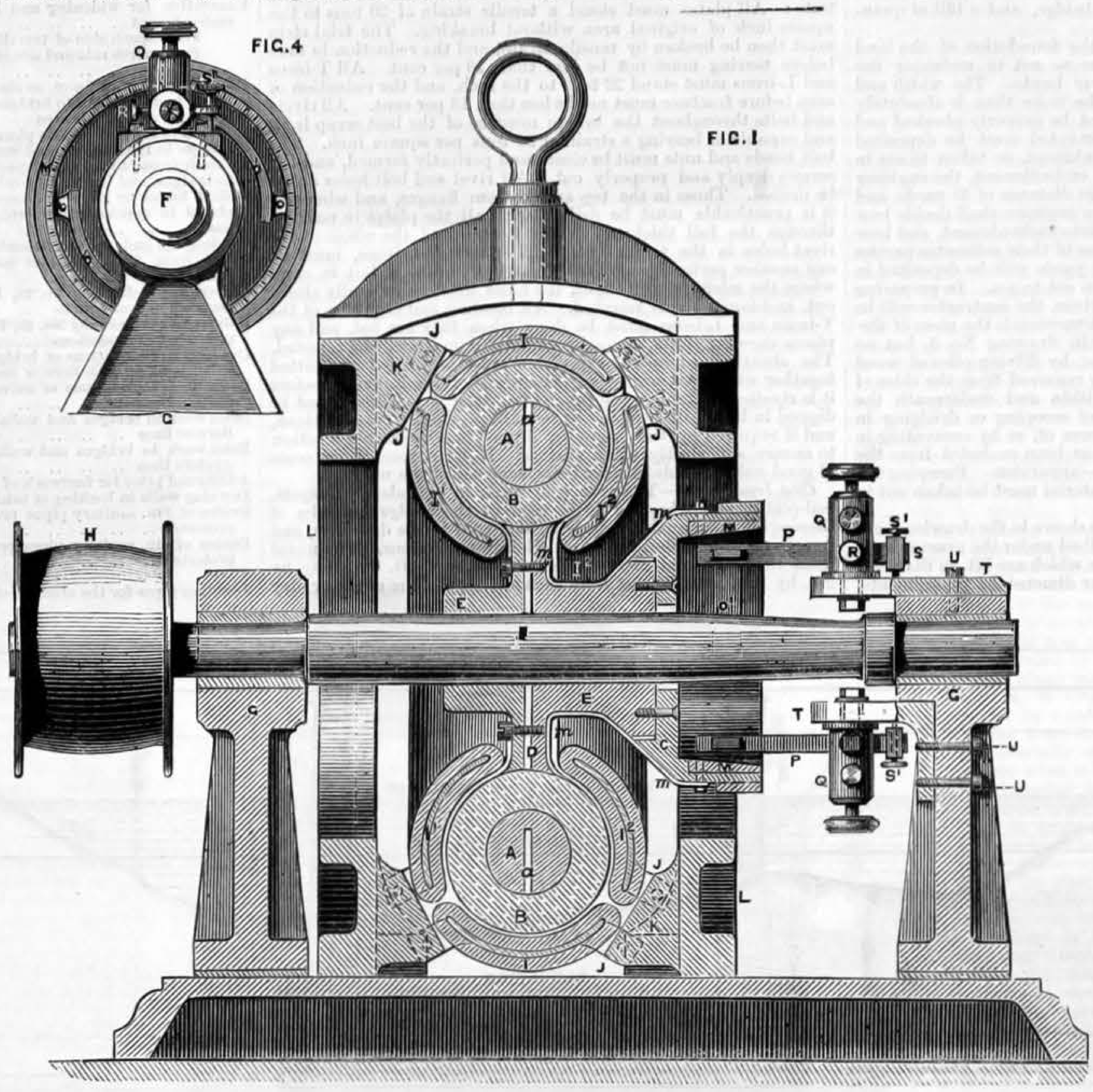


FIG. 4 FIG. 1

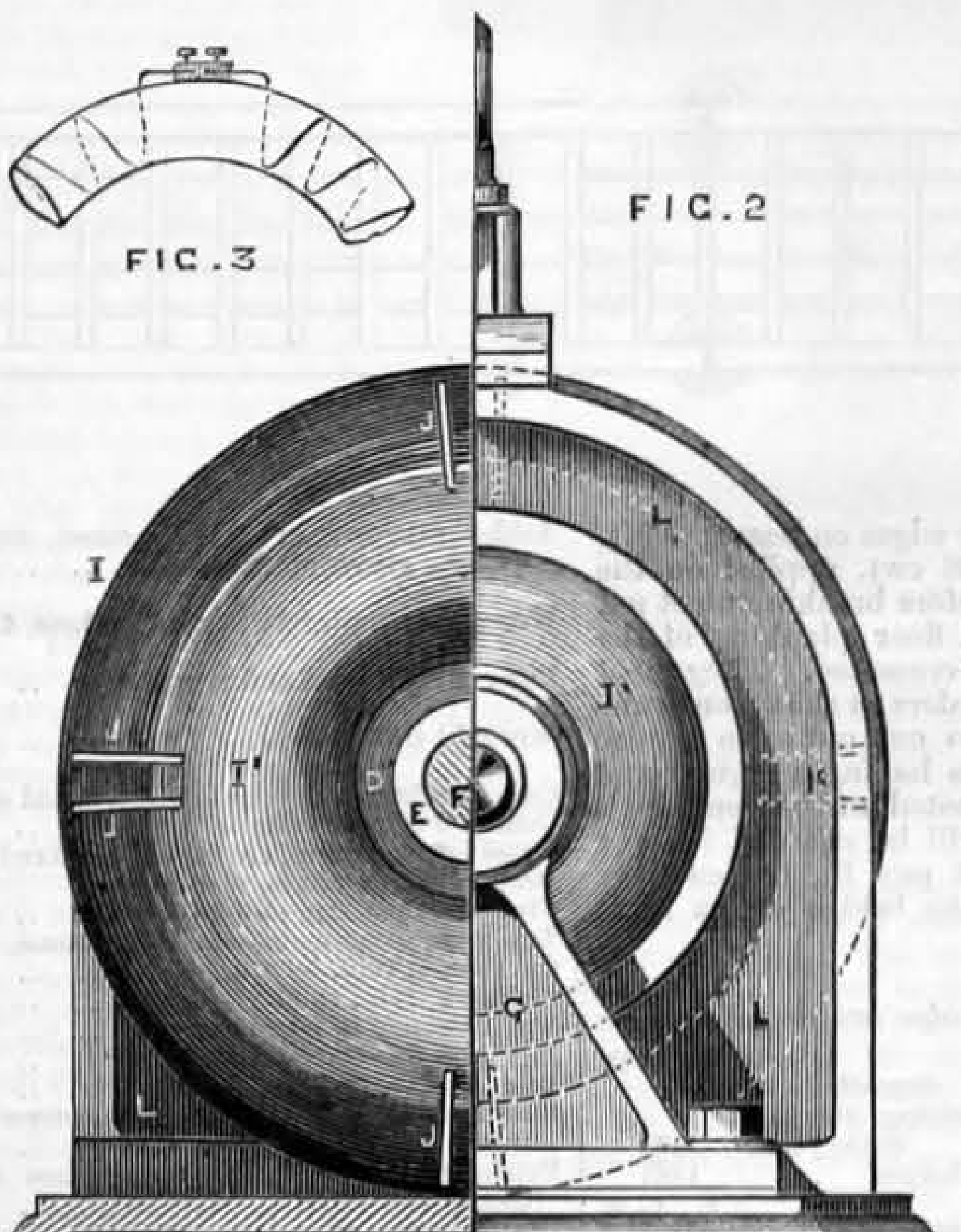


FIG. 3 FIG. 2

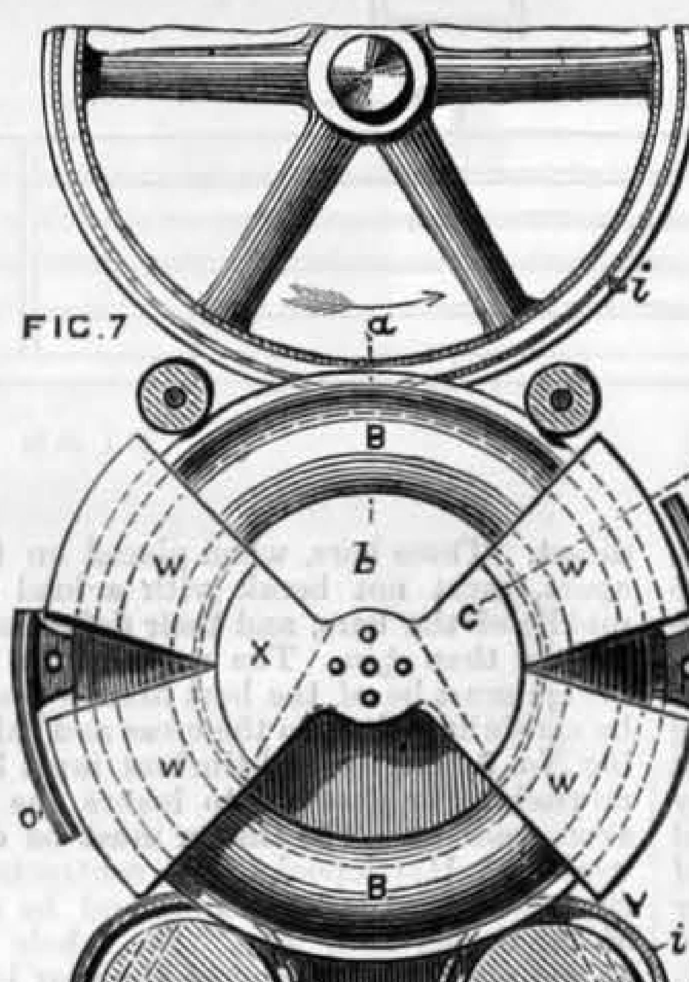


FIG. 7

FIG. 9

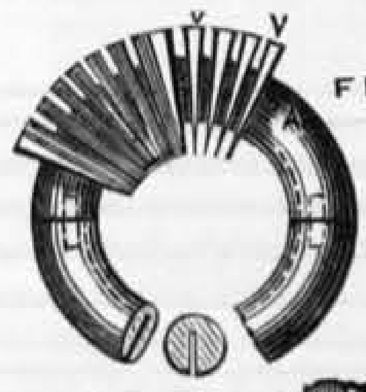


FIG. 5

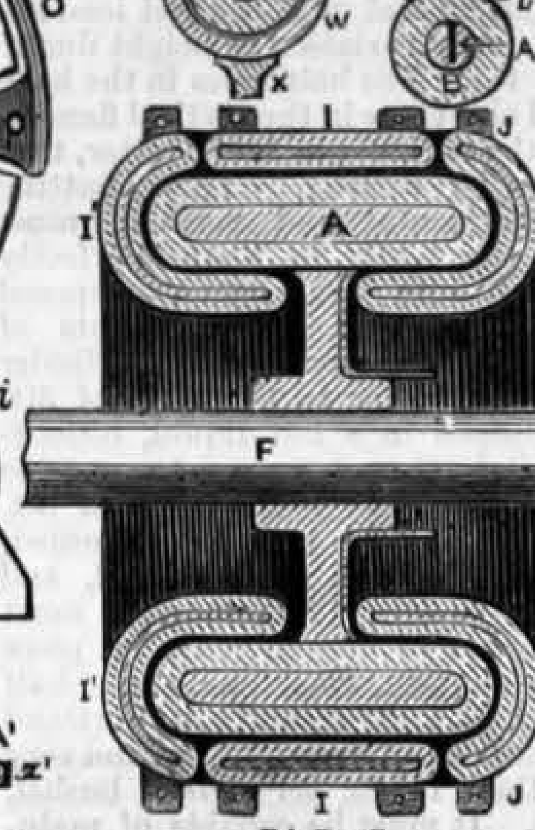


FIG. 10 FIG. 8 FIG. 6

An iron railway bridge is to be built at a cost of £30,000 over the Yarra, near Melbourne.

KING'S COLLEGE, LONDON.

The opening address to the evening classes department was given on Friday last, by Professor Huntington, to a large audience. The Dean of this department, the Rev. S. Wiltshire, who was in the chair, before introducing the lecturer briefly referred to the last academical year, during which there had been 1500 students. The number of the staff was now 50, a very great many subjects being taught. Two new professorships, "metallurgy" and "fine arts," had been founded by the aid of the City and Guilds' Institute for the Advancement of Technical Education.

The Clothworkers' Company had with much liberality created further scholarships and prizes.

Professor Huntington then gave his address, which had special reference to the use of iron and bronze amongst the ancients. Referring to the dictum of archæologists regarding the succession of the stone, bronze and iron ages, he pointed out that the statement so often made that copper was more likely to have been first used than iron because the latter is difficult to reduce from its ore and the former is found native, is erroneous. There is no reason to suppose that the ancients obtained their copper in the native condition; we know of no locality whence at that time it could have been obtained, considering the great quantities which must have been used. It is well known that the Greeks and Romans obtained their copper from Cyprus. We learn from Pliny and Dioscorides the nature of the ore worked in Cyprus in the days of Agamemnon. Pliny calls its chalcite and speaks of the "scolesia" which forms upon it. This "scolesia," or malachite, is also referred to by Dioscorides, who speaks of it as "rust of copper," a felicitous expression. At the present day copper pyrites and malachite are plentiful in Cyprus. From Pliny's description of the methods pursued to obtain the metallic copper, which he states was very malleable and ductile, it is evident that the principle of the method of that day is identical with that of our own. In fact there is but one way of obtaining copper from its ore on the large scale by the dry process, and that, we have reason to believe, was known and practised in pre-historic times. Supposing for a moment that the copper had been obtained in the uncombined condition, we have still to take into account the tin, which does not occur native, and for the reduction of which charcoal must have been employed aided by a high temperature. To obtain copper and tin from their ores and alloy them successfully, argues considerable skill even at the present time.

The lecturer then referred to the opinion of Dr. Percy, than whom, he justly remarked, there has never yet lived a more learned and trustworthy metallurgical author. Dr. Percy says: "From suitable ores, of which abundant and readily accessible supplies exist in various localities, nothing more easy can be conceived than the extraction of malleable iron. Of all the metallurgical processes it may be regarded as amongst the most simple. Thus if a lump of red or brown hematite be heated for a few hours in a charcoal fire, well surrounded by or imbedded in, the fuel, it will be more or less completely reduced, so as to admit of being easily forged at a red heat into a bar of iron. The primitive method of extracting good malleable iron directly from the ore which is still practised in India and in Africa, requires a degree of skill very far inferior to that which is implied in the manufacture of bronze."

This part of the subject was well illustrated by diagrams, and a cleverly-fashioned assegai made in the way just described was exhibited.

Professor Huntington concluded this part of the subject by stating it as his opinion that from a metallurgical point of view there is no reason why iron should not have been used before bronze. Whether it was so or not depended on other circumstances.

The remainder of the discourse was principally occupied in discussing the evidence of the early rise of iron afforded us by the study of history and philology and the "finds" in Babylonia and Egypt, all throwing considerable light on the question and of much interest. It was pointed out that the rapidity with which iron oxodises fully accounts for the small number of "finds" in that metal. A number of weapons and implements of iron found at Nimroud although intact when unearthed fell to pieces directly afterwards, being entirely converted into rust. Two of them—a pick and a saw—which have been preserved, are to be seen in the British Museum. They are computed to date from not later than 880 B.C., so that they are now 2760 years old. They are identical in shape with those in common use at the present time, but are entirely converted into oxide. The lecturer urged that we should not finally decide that bronze was known before iron. It is very possible it was, but we do not as yet know the reason why. He for one should welcome any discovery throwing light on the question, as a valuable contribution to the world's general history. In conclusion Professor Huntingdon said—Looking back at the work of these ancient nations, who existed 4000 or 5000 years ago, and the result of whose labours we to-day collect in our museums, we cannot but feel that intellectual power was as great then as now. If we are superior, it is due to the humanising effects of the Christian religion, and the truly wonderful progress which science has made within recent years. Until lately, education was entirely classical and mathematical, to the entire exclusion of the so-called natural sciences; but now the tide has turned, and institutions in which science is the principal object are springing up with increasing rapidity throughout the country. This is good; but, as in all cases of reaction, we are as likely to err in going too far as formerly we erred in not going far enough. At the present day to give a person a scientific education and neglect literature would be like building a ship on lines calculated to enable it to pass swiftly and safely through a heavy sea, and then forget to throw in the ballast. For literature gives to the mind weight, dignity, and all those characteristics, which blended, constitute true civilisation and a cultured intellect. Let me urge then that those who are engaged in scientific pursuits should seek in literature their recreation. And those whose daily occupations are of a literary nature should make science their pastime. The days in which education was considered complete without a knowledge of science have been swept away with the wooden walls of Old England. Our walls are of steel now and the future greatness of our country depends in no slight degree on those who strive to utilise the subtle powers of nature, clothing themselves around with the invulnerable truths brought to light by the truth-loving hand of science.

Those specially interested in metallurgy then inspected the well-appointed laboratory of the college.

TENDER.

BARMOUTH.

FOR extension of promenade and works connected therewith. Thomas Roberts, Portmadoc, engineer.

	£.	s.	d.
Evans and Jones, Dolgelly	1895	19	9
Owen, Portmadoc	1843	0	0
Jones, Barmouth	1656	0	0
Davies, Portmadoc	1552	0	0
R. Williams, Harlech	1534	0	0
Davies, Waenfawr	1500	0	0
Hughes, Portmadoc	1475	0	0
Pritchard, Portmadoc	1349	0	0
Jeffreys, Colwyn Bay	1138	2	8
G. Williams, Harlech—accepted	1113	1	6

THE PHOTOPHONE.

IN our impression of the 24th September we gave an account of the photophone of Professor Bell. In the paper read before the American Association for the Advancement of Science, to which we then alluded, Professor Bell said:—"In arranging the apparatus for the purpose of reproducing sound at a distance, any powerful source of light may be used, but we have experimented chiefly with sunlight. For this purpose a large beam is concentrated by means of a lens upon the diaphragm-mirror, and, after reflection, is again rendered parallel by means of another lens. The beam is received at a distant station upon a parabolic reflector,

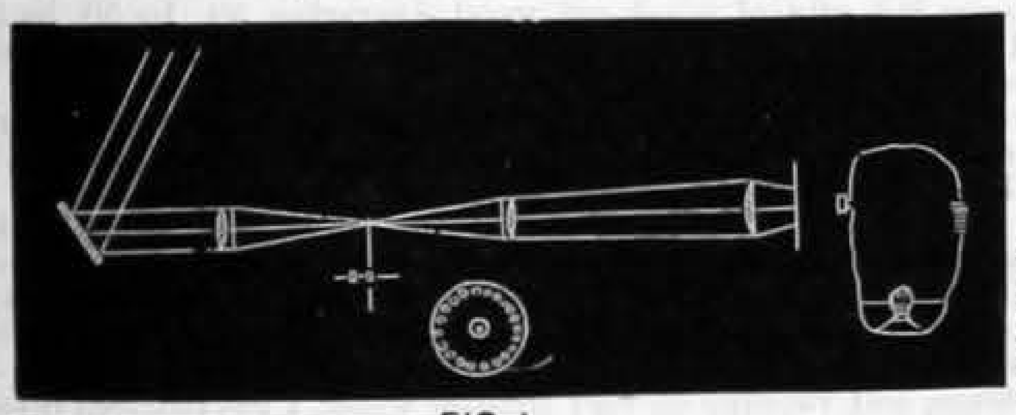


FIG. 1

in the focus of which is placed a sensitive selenium cell, connected in a local circuit with a battery and telephone. A large number of trials of this apparatus have been made with the transmitting and receiving instruments so far apart that sounds could not be heard directly through the air. In illustration, I shall describe one of the most recent of these experiments. Mr. Tainter operated the transmitting instrument, which was placed on the top of the Franklin schoolhouse in Washington, and the sensitive receiver was arranged in one of the windows of my laboratory, 1315 L street, at a distance of 213 metres. Upon placing the telephone to my ear I heard distinctly from the illuminated receiver

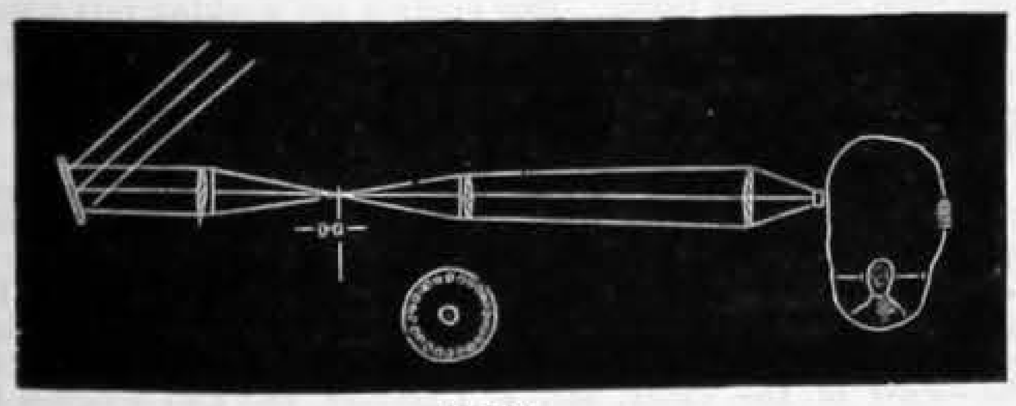


FIG. 2

the words:—'Mr. Bell, if you hear what I say, come to the window and wave your hat.' In laboratory experiments the transmitting and receiving instruments are necessarily within earshot of one another, and we have, therefore, been accustomed to pooling the electric circuit connected with the selenium receiver, so as to place the telephones in another room. By such experiments we have found that articulate speech can be reproduced by the oxy-hydrogen light, and even by the light of a kerosene lamp. The loudest effects obtained from light are produced by rapidly interrupting the beam by the perforated disc. The great advantage of this form of apparatus for experimental work is the

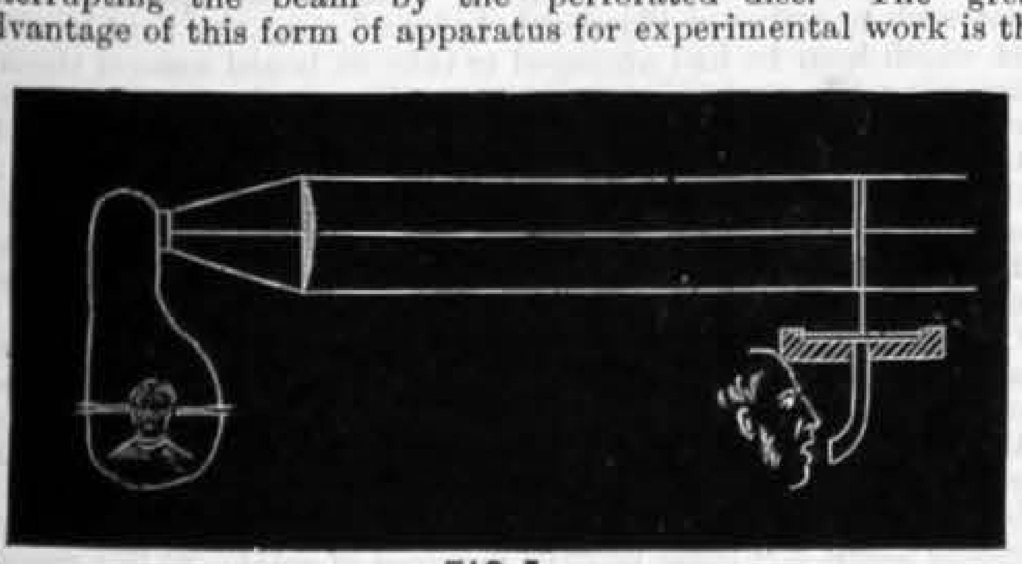


FIG. 3

noiselessness of its rotation, admitting the close approach of the receiver without interfering with the audibility of the effect heard from the latter; for it will be understood that musical tones are emitted from the receiver when no sound is made at the transmitter. A silent motion thus produces a sound. In this way musical tones have been heard even from the light of a candle. When distant effects are sought another apparatus is used. By placing an opaque screen near the rotating disc the beam can be entirely cut off by a slight motion of the hand, and musical signals, like the dots and dashes of the Morse telegraph code, can thus be produced at the distant receiving station.

"We have made experiments, with the object of ascertaining the nature of the rays that affect selenium. For this purpose we have placed in the path of an intermittent beam various absorbing substances. Professor Cross has been kind enough to give me his assistance in conducting these experiments. When a solution of alum or bisulphide of carbon is employed, the loudness of the sound produced by the intermittent beam is very slightly diminished; but a solution of iodine in bisulphide of carbon cuts off most, but not at all, of the audible effect. Even an apparently opaque sheet of hard rubber does not entirely do this. When

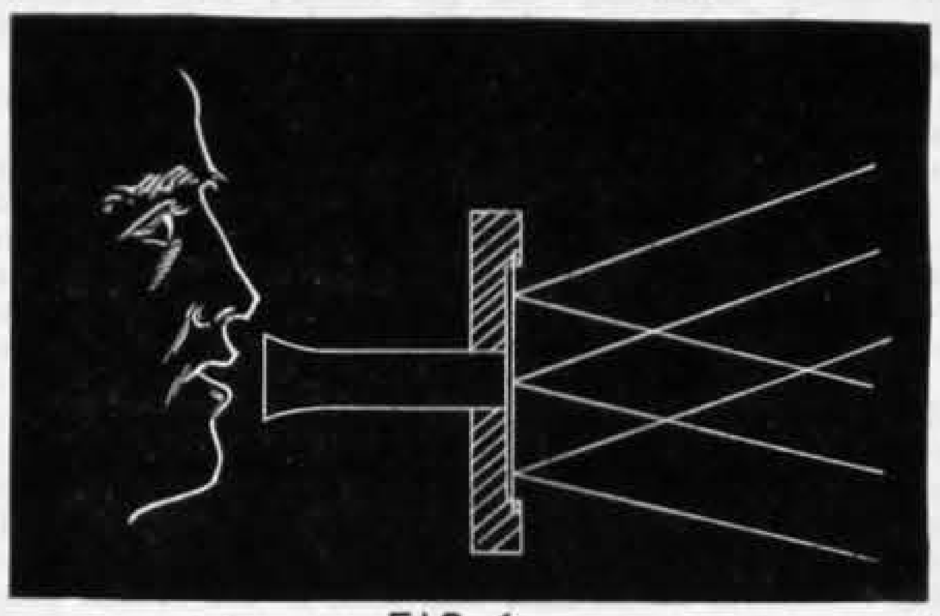


FIG. 4.

the sheet of hard rubber was held near the disc interrupter, the rotation of the disc interrupted what was then an invisible beam, which passed over a space of about 12ft. before it reached the lens which finally concentrated it upon the selenium cell. A faint but perfectly perceptible musical tone was heard from the telephone connected with the selenium. This could be interrupted at will by placing the hand in the path of the invisible beam. It would be premature, without further experiments, to speculate too much concerning the nature of

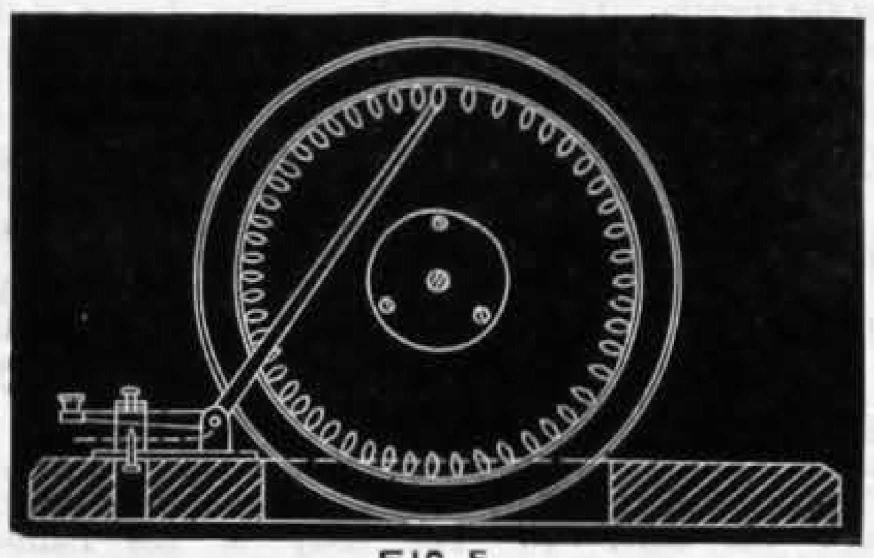


FIG. 5.

these invisible rays; but it is difficult to believe that they can be bent rays, as the effect is produced through two sheets of hard rubber, containing between them a saturated solution of alum. Although effects are produced as above shown by forms of radiant energy which are invisible, we have named the apparatus for the production and reproduction of sound in this way 'The Photophone,' because an ordinary beam of light contains the rays which are operative.

It is a well-known fact that the molecular disturbance produced in a mass of iron by the magnetising influence of an intermittent

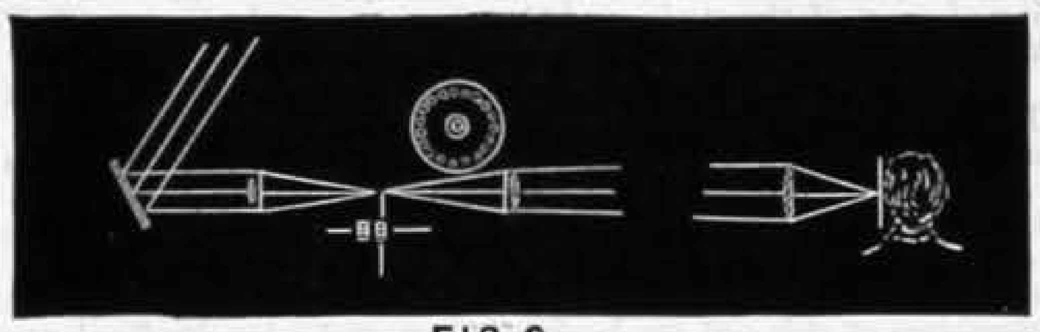


FIG. 6.

electrical current can be observed as sound by placing the ear in close contact with the iron. It occurred to us that the molecular disturbance produced in crystalline sellenium by the action of an intermittent beam of light should be audible in a similar manner without the aid of a telephone or battery. Many experiments were made to verify this theory without definite results. The anomalous behaviour of the hard rubber screen suggested the thought of listening to it also. This experiment was tried with extraordinary success. I held the sheet in close contact with my

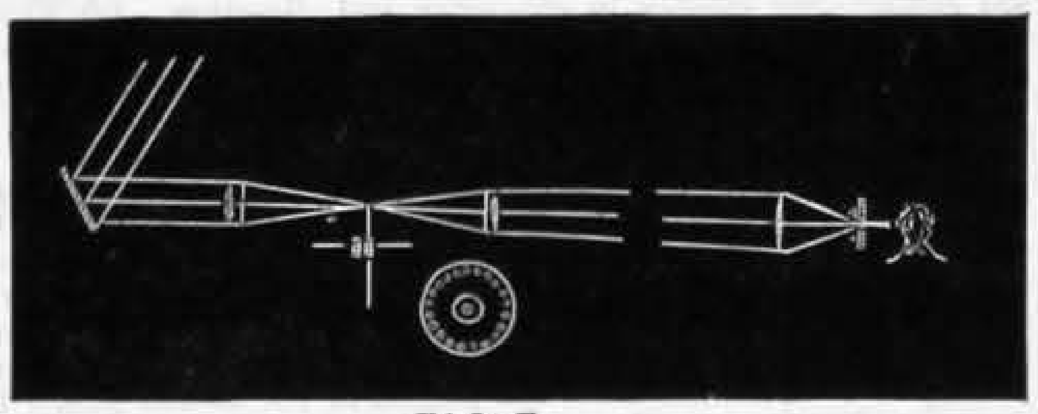


FIG. 7.

ear, while a beam of intermittent light was focussed upon it by a lens. A distinct musical note was immediately heard. We found the effect intensified by arranging the sheet of hard rubber as a diaphragm, and listening through a hearing tube. We then tried crystalline selenium in the form of a thin disc, and obtained a similar but less intense effect. The other substances which I enumerated at the beginning of my address were now successively tried in the form of thin discs, and sounds were obtained

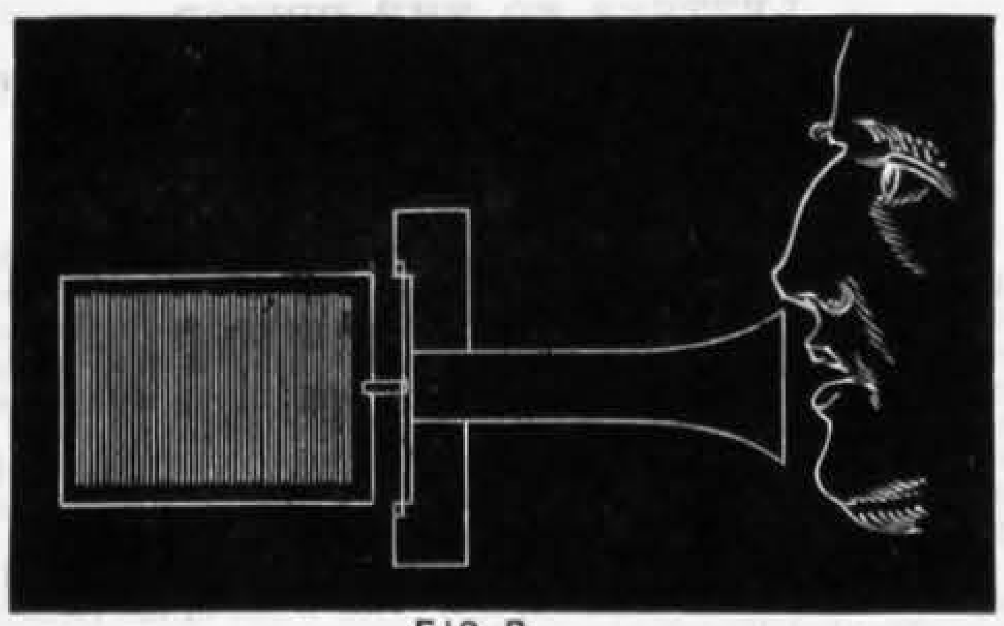


FIG. 8

from all but carbon and thin glass. We found hard rubber to produce a louder sound than any other substance we tried excepting antimony, and paper and mica to produce the weakest sounds. On the whole, we feel warranted in announcing as our conclusion, that sounds can be produced by the action of a variable light from substances of all kinds, when in the form of thin diaphragms. We have heard from interrupted sun light very perceptible musical tunes through tubes of ordinary vulcanised rubber, of brass, and of wood. These were all the materials at hand in tubular form, and we have had no opportunity since of extending the observations to other substances."

We now reproduce illustrations from *Science*, which show the steps in the experiments leading to the final form of the photophone.

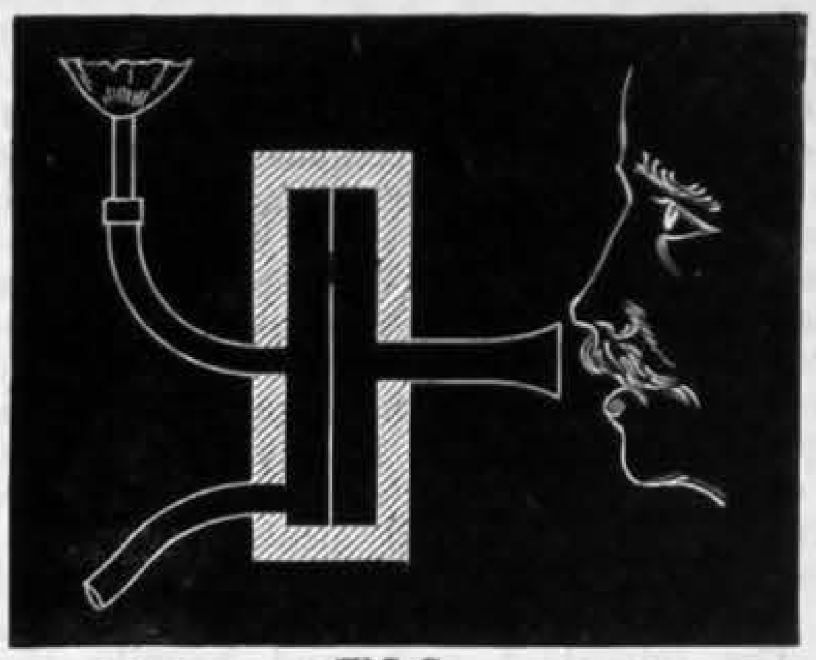


FIG. 9

phone. It will be seen that the ray of light falls on a mirror, by which it is directed to the discs and receivers as referred to above. In our illustrations, Fig. 1 shows the interposition of hard rubber plate. Fig. 2 shows the light passed through opening in rapidly-revolving diaphragm, and reflected in selenious recesses. Fig. 3

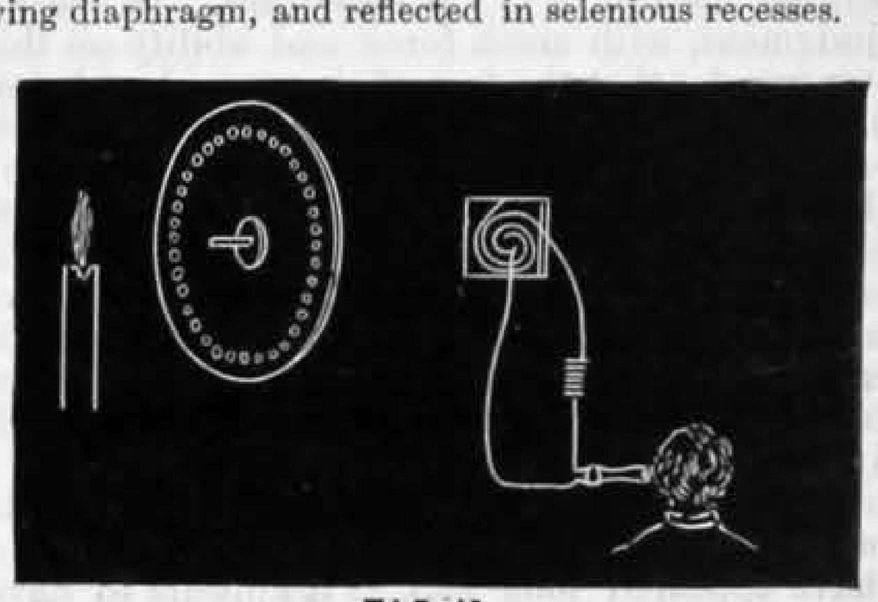


FIG. 10.

shows application of Fig. 4. Fig. 4 shows action of voice on thin plate of silvered mica. Fig. 5 shows application of Morse system of telegraphy to photophone. Fig. 6 shows listening directly to receiving plate. Fig. 7, another form of receiver. Fig. 8, one of the first forms; voice passed through slits. Fig. 9 shows the direct action of voice on gas flame. Fig. 10 shows the action of candle light on selenious recesses.

DR. PHIPSON takes sulphide of barium, or some other substance which is rendered phosphorescent by the solar rays, and incloses it in Geissler tube, through which he passes a constant electric current of a feeble but regular intensity. He claims to obtain in this manner a uniform and agreeable light, at a cost lower than that of gas.—*Les Mondes.*

A NEW OIL CAN.—A New England man has lately invented an illuminating oil can. It is so arranged that the can holds the light and the oil, and is adapted for oiling machinery in the dark, and when in use, the light, which is made after the bull's eye pattern, strikes upon the point of tube that ejects the oil, and enables the oiler to see just what he is doing. Its usefulness to locomotive engineers for oiling engines in the dark, should make it a valuable tool for them. The oil cannot harden or become stiff as the light in the can furnishes heat enough to keep it warm, and it can easily be carried in one hand. Different sizes, intended for all kinds of work, will be made.

GUNPOWDER IN COAL MINES.—A correspondent writing on this subject to the *Times* says, in an interesting letter, "The prohibition of the use of explosives would render the working of many of our coal mines so unremunerative that it would be impossible to keep them open, the pits would have to be closed and the hands discharged, the supply of coal would be lessened, the price would be increased, and our great iron and cotton industries would suffer to an extent disagreeable to contemplate. These were some of the reasons which led the Home Secretary to reply to a deputation which waited on him on this subject, that he could not recommend the compulsory discontinuance of the use of gunpowder in coal mines, but that he hoped next Session to be able to submit a plan by which the danger of its use could be got rid of. To many of your readers this hope of Sir William Harcourt's will appear as a Utopian idea; nevertheless, it is a fact that in some of the fiery pits in the neighbourhood of Barnsley a system of blasting is performed where water is used in addition to gunpowder, with the best possible results. The system is simple in the extreme, and, so far from its being costly, it is an economy; for, in the blasting operations performed with water in conjunction with gunpowder, a greater amount of work is done with considerably less powder, and the powder is rendered harmless. The value of the foregoing will be best appreciated by a short description of the operation. Ordinarily, blasting with gunpowder is done somewhat as follows:—A bore-hole is made in the face of the coal about 2in. in diameter and 4ft. or 5ft. deep. Into this hole a powder cartridge is inserted, with a slow fuze attached; the hole is then tamped—that is to say, it is filled with any available dry refuse rammed in tight; the fuze is lit, and the cartridge fired. In this operation a flame, very dangerous in fiery pits, is created, and carbonic acid and sulphurous acid gases and smoke are generated. Blasting with water and gunpowder is performed in the following manner:—Into the bore-hole is inserted a powder cartridge, with fuze attached; next to the powder cartridge is inserted into the bore-hole a tube containing water. These tubes should be as large as the bore-hole will admit, and of any convenient length; the longer the better. They may be made of any convenient, cheap material, thin tin-plate, or of stout brown paper turned round on a wooden roller and pasted together, the ends closed with corks; the bore-hole is then tamped, the fuze lit, and the cartridge fired in the usual manner. The result of this operation may be briefly summed up. The powder, in exploding, bursts the tube containing the water; the rending force of the powder is extended through the water by the well-known principles of hydraulics demonstrated years ago by Bramah over the enlarged interior area of the bore-hole, due to the space occupied by the water tube. A much larger quantity of coal is thereby brought down with a smaller quantity of powder; the heat given off by the burning of the powder and the gases converts a portion of the water into steam, the elastic force of which assists in the operation of blasting; the steam and water together put out the flame and flash of the powder, and absorb and neutralise the greater portion of the gases and smoke resulting from the explosion. It will readily be seen that herein are met together economy and safety by the adoption of a system simple as it is effective, and it is to be hoped that, in the best interests of humanity, our large and intelligent coalowners will not be slow to adopt an amelioration in their present crude and dangerous practice of blasting, which will tend in a great measure to make explosions in coal mines a thing of the past, rather than of almost daily occurrence."

PARLIAMENTARY REPORT ON THE THUNDERER GUN.

We publish herewith part of the report of General Gordon's committee on the Thunderer gun experiment, together with the conclusions to be drawn from them as to the accident. Those who read the reports we were enabled to furnish of the successive experiments will find no essential difference, we think, in this authoritative summary of them. The conclusion on the successive stages of breaking up of the projectiles in the bore, and the bursting of the gun itself, is clearly and boldly expressed. The committee even speak with considerable confidence on the wedging action of the base portion of the Palliser projectile, by which the muzzle end of the gun was shattered into small fragments. There is much to support the belief that the account they suggest is more or less correct. As we remarked, however, comparatively little interest attaches to the *modus operandi* of a process which occurred after the work of destruction had already proceeded so far. The important part, and happily that about which there is most certainty, is the identification of each feature which indicates explosion of both charges, of the peculiarly violent action of the front one, and of the setting up of the front—common—shell; on this point the scratch noticed in C 2 is important. In speaking, in our judgment, with much force and ability on this subject, we wonder that the fact of the cartridge choke being driven unburnt into the head of the shell is not noticed; a more conclusive proof of abnormal behaviour, we think, could hardly be found. With regard to the question of wads and air space, it is to be observed that the committee in a final note wisely abstain from committing themselves beyond the conditions under which they experimented. The superintendent of the Royal Gun Factories makes a remark much to the same effect in an Appendix.

This report, in our opinion, ought to be most satisfactory in all respects. We only regret that it should not have appeared long ago, as it appears to have been signed by the president on April 30th last.

Deductions.

First Series. — Air-space Trials. — As already mentioned in Report No. 9—see Appendix II.—there is a general reduction of presure in the bore as the air space between the cartridge and projectile is inclreased.

The following table compares the pressures obtained in the experiment with those due to the explosion of powder in closed vessels :—*

Charge of P. powder.		Distance (in feet) of base of shell from cartridge.	Pressure tons per square inch.		Pressures tons per square inch in closed vessels at equal densities.
Weight.	Density.		Base of cartridge.	Base of projectile.	
lb.					
		Common Shells.			
85	24·97 / 1·09	Nil.	20·2	15·2	49·6
"	40·4 / 0·686	1	12·4	10·8	18·3
"	56·78 / 0·488	2	9·9	8·0	10·1
"	89·44 / 0·310	4	4·0	3·6	5·6
"	122·08 / 0·227	6	2·2	1·7	3·8
"	154·71 / 0·179	8	1·5	2·0	2·8
"	187·37 / 0·148	10	1·0	1·75	2·4
		Palliser Shells.			
110	21·34 / 1·132	Nil.	21·8	18·1	52·5
"	36·57 / 0·758	1	15·2	12·8	22·5
"	49·2 / 0·564	2	12·7	9·9	12·7
"	74·42 / 0·372	4	12·6	8·9	7·0
"	99·64 / 0·278	6	8·9	6·4	5·0
"	124·86 / 0·222	8	7·4	6·4	3·6
"	150·09 / 0·184	10	6·2	7·6	3·0

It will be seen that the pressures now obtained are, in the case of the 85 lb. charge, lower, and in that in the 110 lb. charge with an air space exceeding 2ft., higher than those due to the simple pressures of the gas at the same densities. This may be due to the fact that a larger amount of gas is generated in a given time by the larger charge, so that while with the smaller charge the slipping away of the projectile permits of a reduction of pressure, the more rapid evolution of gas in the larger charge sets np a dynamic or wave action before the motion of the projectile affords a certain amount of relief. The committee have no doubt that with smaller-grained and more rapidly igniting powders this action would become more marked.

Second Series.—Wad Trials.—This experiment, as far as it goes, seems to show that the effect of leaving a wad in the bore 5ft. in front of the shot is insignificant. Although there was a slight increase of pressure on the base of the projectile as compared with a similar round fired under normal conditions, an examination of the gun gave no indication that any obstruction in the bore had been caused by the wad. In the absence of more data the committee have no further remarks to offer on this subject.

Third Series.—Double Loading.—After a careful examination of the facts of the case in all their bearings, the committee offer the following hypothetical description of the various phenomena of the burst, taking them in their order, from the ignition of the charge to the final destruction of the gun :—(*a*) The rear charge having been ignited in the middle near the top, the gas generated — before the pressure became sufficiently great to expand the gas-check and thus seal the windage—rushed over the top of the Palliser shell and through the nine grooves round its circumference, filling up the space round the head of the Palliser shell, forcing its way past the wad, and lighting the front charge. (*b*) Meanwhile, sufficient gas has been generated behind the Palliser shell to set it in motion, and raise the pressure in the chamber to the maximum usually indicated by the crusher gauges for this charge—viz., about 20 tons per square inch. (*c*) During the early motion of the Palliser shell the ignition of the front charge proceeded, the gas escaping round the common shell before expanding the gas check; the common shell then moved forward, a short interval elapsing between the commencement of its motion and that of the Palliser shell. (*d*) The Palliser shell, having started slightly before the common shell, gained upon it and therefore caused the front charge to burn up in a gradually diminishing, instead of gradually increasing, space, as is the case in a round fired under ordinary conditions. The pressure was thus increased instead of being relieved. (*e*) The common shell had moved forward about 27in. when the advancing Palliser shell caused so great a compression of the front charge—which by this time was in a state of complete combustion—that the rear part of the body of the common shell was set up and forced into the grooves of the gun, the base at the same time being crushed in, momentarily wedging the shell in the bore, which at once yielded all round. The fracture of the gun at this moment probably extended from the circumferential fracture at 82in. from the muzzle forward to about 66in. from the muzzle and back to the breech piece, the destructive effect on that portion of the gun between the breech piece and the circumferential fracture being no doubt intensified by the action of the rear charge. The evidence on which the opinion here given is based is—(1) The circumferential fracture of the steel tube at 82in. from the muzzle. (2) The longitudinel scratch, extending over fragments 83, 88, and 84, the rear end of which coincides with the position of the rear ring of studs of the common shell before firing. (3) The line of fracture of the common shell coinciding with the rear ring of studs. (4) The appearance of the fragments of the base of the common shell. (*f*) The front portion of the common shell, the fragments of its base end closely accompanying it, now passed through the bore and out at the muzzle. The uninjured condition of most of the studs in the front portion of the common shell proves that they did not over-ride the grooves of the gun; and the position, when found in the butt, of the front of the shell and of the fragments of the base shows that they must have passed through the bore together. (*g*) The fore part of the chase from the muzzle to about 66in. back was detached from the rest of the gun by the explosion, and had altered its original position slightly when the Palliser shell reached it and entered the bore obliquely, the shock breaking off the head of the shell and also fragments of the gun. This view is borne out by the marks on the fragments at about 66in. from the muzzle (21, 56, 23, 40, 16, 57, 042, 27) which indicate that this was the rear end of the then unbroken portion of the chase of the gun when it was struck by the Palliser shell. (*h*) The head of the Palliser shell, on being broken off, passed through the bore. (*i*) The body of the Palliser shell being oblique to the axis of the bore acted as a sort of wedge; its sharp front edge cutting into the metal of the gun on the right side, and its base breaking off fragment after fragment on the left. When this front edge of the shell had thus advanced to within 27in. of the muzzle, the steel tube was so deeply gouged out on the right that it broke; the base of the shell meanwhile breaking up the other side of the bore into small pieces. The tube and shell were probably turning in the air at this time, as when found in the butt the front of the tube pointed to the rear. The evidence for the above view is :—(1) The appearance of the exterior of the Palliser shell, the wearing down of the base at one part, the impression of the rifling near the same place, the peculiar sheering of most of the studs, and the compression of others. (2) The marks on the various fragments of the steel tube.

Comparison of the "Bursts" of the two "Thunderer" Guns.—It will be observed, by comparing Figs. 9 and 11 with Figs 19 and 20,* that the general character of the burst in the two guns is very similar. The disruption extends from the same point in both guns, viz., the front of the breech piece, and the fragments agree closely in size and shape. Taking the guns in detail :—(*a*) In the original gun the C coil is intact, whereas in No. 2 gun the shoulders of this coil are broken away, and a longitudinal crack extends the whole length of the coil on the left side. Fig. 1 shows that this difference, though great in appearance, is but slight in reality, the 1 B coil at the point of fracture being nearly equal in strength to the shoulder of the C coil, so that in the one case the 1 B coil when forced outwards by the explosion broke off short in rear, and in the other the same action carried away the shoulder of the C coil. The tearing action thus induced, aided by the expansion of the gun from the interior pressure, caused the longitudinal crack in the C coil. (*b*) The burst in both cases extends from the breech-piece forwards, the breech-piece itself being uninjured. (*c*) The fractures of the 1 B coil in the two guns are remarkably similar in character and direction. (*d*) The B tube of the first gun, as far as recovered, has fragments closely resembling those of the corresponding parts of the second gun; but the portion of the first gun which was in or beyond the port— viz., 51in. of the chase, is missing. (*e*) The fracture of the steel tube, in line with the front of the breech piece, is identical in character in the two guns; and the small number of fragments of the first gun that have been recovered agree closely in size and character with those in corresponding positions in the second gun. There is an indication of a circumferential crack at 84in. from the muzzle in the first gun, just as there is at 82in. from the muzzle of the second gun. The graze marks of projectiles occur at about the same place in both guns—*i.e.*, at about 66in. from the muzzle. (*f*) With regard to the projectiles, the common shell in the second gun had lost none of its front or middle ring of studs; the Palliser shell, on the other hand, was fractured through the front ring of studs, four of which were detached from the shell; one of these was picked up in the gun cell, four were not found. In the first gun, one Palliser front stud was picked up in the turret. The recoil of both guns was of exceptional violence.

* "Researches on Explosives. Fired Gunpowder," by Captain Noble (late R.A.), F.R.S., F.R.A.S., F.C.S., &c., and F. A. Abel, F.R.S., Prest. C.S., &c. Philosophical Transactions of the Royal Society. 1875.

* Practically the same illustrations have already appeared in our pages.—Ed. E.

LETTERS TO THE EDITOR.

(*We do not hold ourselves responsible for the opinions of our correspondents.*)

COLD AIR MACHINES.

Sir,—In reference to the letter on cold air machines which appeared in your issue of the 1st inst., will you permit us to point out the very great difference which exists between the refrigerating machines now being constructed by us and those made by the Bell-Coleman Refrigeration Company—a difference of which your correspondent was probably not aware when he forwarded to you the statistics of the very large machines required for the cooling of the meat chambers on the Bell-Coleman system.

Premising that in the case of either of the machines dry air is required in the meat chamber, it is to be noted in the Bell-Coleman plan that liquefaction of the aqueous vapour contained in the air and the depositing of the water before the air is admitted to the expansion cylinder, is accomplished by bringing the partially cooled compressed air through bent ranges of pipes in the meat chamber, in order that its temperature may be lowered so as to cause the moisture to be deposited. This naturally entails a very important sacrifice of cold, as the air in the pipes imparts considerable heat to the cold air in the chamber, so that although the large machines mentioned in "W. F. C.'s" letter may discharge their large volume of air at a temperature of from 60 deg. to 100 deg. Fah. below zero with a corresponding large consumption of fuel; yet all this cooling is of little avail in the meat chamber, as the heat given off from the compressed air in the pipes raises its temperature to comparatively a few degrees of the freezing point, the result being that on this system, for even quite moderate temperatures in the meat chamber, very large and powerful machines are required.

In our dry air system there is none of this loss and no cumbrous apparatus; and if, as can easily be accomplished, the dry air is discharged at a temperature of 60 deg. or 100 deg. below zero, Fah., all this cold is available in the meat chamber for cooling purposes, the consequence being that a much smaller machine is required with a proportionately less consumption of fuel.

We must not at the present time further occupy your valuable space with a description of the apparatus we employ, but in proof of what we have stated, we have the pleasure to enclose for your perusal an outline description of our system, which at some future time we hope to see illustrated in The Engineer.

Dartford Ironworks, Dartford, Kent, J. and E. Hall.
October 13th.

STERN WHEEL STEAMERS ON THE MAGDELENE RIVER.

Sir,—Having read in your valuable paper some twelve months ago, an account of two stern wheel steel steamers, built by Messrs. Yarrow and Co., Poplar, London, for navigating the river Magdelene in the United States of Colombia, South America, and as I have been engaged to superintend their reconstruction here, I thought it might be interesting to some of your numerous readers to give an account of the steam trial of the first, which is now in running order, and named General Troujillo. The run was from Baranquilla to Honda; estimated distance 202 leagues, or 606 miles, against an average current of five miles per hour, in some places increasing to ten or more, as at Wetta Nuevo, Yarinao Masoona, &c., as we ascend the current increasing; amount of cargo about 100 tons. Draught leaving Baranquilla, with fuel sufficient for five hours' steaming, all wood, 3ft. forward, 2ft. 9in. aft. I may remark that this is the driest time of the river, and most difficult of navigation. Left Baranquilla 12.33 p.m. 10th August, 1880; arrived in Honda 10.20 a.m. 19th August, day running. I give below an account of the distances and running time from station to station :—

	Distance.	H.	M.
From Baranquilla to Matta de Cana	30 miles	3	47
" Matta de Cana to Calamar	36 "	5	23
" Calamar to Sambrano	48 "	8	40
" Sambrano to Yati	42 "	7	20
" Yati to El Banco	93 "	15	18
" El Banco to Rejidor	30 "	6	15
" Rejidor to Puerto National	24 "	4	35
" Puerto National to Dique de Paturia	60 "	11	0
" Dique de Paturia to Sam Pablo	12 "	1	45
" Sam Pablo to Carara	54 "	12	19
" Carara to Purto Berio	45 "	8	45
" Purto Berio to Aungostura	27 "	5	37
" Aungostura to Nare	3 "	0	48
" Nare to Mula	12 "	2	23
" Mula to Penas Muertas	72 "	14	15
" Penas Muertas to Honda	18 "	4	50
	606 "	113	4

Between the two last stations are three strong rapids. The consumption of fuel was remarkably light, being 325 booras—a boora is a pile of rough-cut wood, averaging 3ft. by 5ft. by 2ft. This result is highly satisfactory, as it is less than one-half that of other steamers here of the same carrying capacity, as, for example, the s.s. Maria Pino, side paddle, high pressure, carrying 800 cargoes, or 100 tons consumption, about 700 booras for the same journey in longer time.

The many advantages of the surface condenser are very marked when working in the invariably muddy waters of tropical rivers. I found from actual experiment when on fairly deep water, with 140 lb. steam pressure, 25in. vacuum full open, main engines making twenty-one. Then under precisely similar conditions for steam, and running on very shallow water, I got fourteen revolutions off main engines. I hope I have not trespassed to far upon your valuable space. John Tobin, Engineer.

Baranquilla, U.S. Columbia, Sept. 12th.

THE YACHT WANDERER.

Sir,—We think perhaps your readers may be interested in the performance of the steam yacht Wanderer with the new engines made by us, and beg therefore to hand you an extract from a letter dated Madeira, August 25th, from her chief engineer.

"I beg to inform you of our arrival here; we have been consuming 1·6 lb. or rather less of coal per indicated horse-power per hour from diagrams taken. Our engines are working very nicely, and I was never shipmate with a more comfortable pair of engines. We have not had a sign of hot bearings since starting, and leave to-morrow for Teneriffe, thence to Cape de Verdes, St. Helena, Ascension, &c."

The Wanderer's present pair of engines are of the ordinary inverted compound type, with cylinders 25in. and 50in. diameter by 2ft. 6in. stroke. There are two circular boilers made of Landore-Siemens steel and loaded to 80 lb. per square inch. The specifications for this machinery were drawn up by Mr. Harrington, of Gracechurch-street, who acted as consulting engineer for the owner of the yacht, Mr. T. Lambert, and also designed the new poop and forecastle which we constructed, and which added very largely to the accommodation and comfort of the vessel.

As the owner made it a condition in our contract with him for the new machinery that the trial instead of being as usual one of a few hours only on the measured mile, should be of at least twenty-four hours at sea, it was determined to make a run from Southampton to Plymouth and back. The Wanderer got under weigh from Southampton on Monday, June 28th, at 1.15 p.m., leaving Cowes Roads at 2.15 and the Needles at 3.45. She proceeded down Channel, steaming easily ten knots an hour, until 6 p.m., when Captain Gordon, her commander, ordered half-speed, as he did not wish to arrive at Plymouth before 6 a.m. the next morning, at which hour he had arranged to take on board some of the crew awaiting the yacht's arrival there. The engines were therefore eased down, and the Wanderer anchored in Plymouth Sound at the appointed time. She left again at 9.15 a.m., passed the Start at 11.10, Portland 3.20, and the Needles at 7.15, thus making the passage from Plymouth to the Needles in ten hours. From this, however, must be deducted half an hour which was taken up by the adjustment of the yacht's compasses in the Channel. The actual time under weigh was therefore nine and a-half hours, and the distance 105 knots, giving an average speed of rather over eleven knots per hour. No sail was carried, and the tides were partly with and partly against the vessel. The engines worked exceedingly well, without any priming or hot bearings, and averaged eighty-two revolutions per minute, indicating about 550-horse power; pressure of steam, 80 lb.; vacuum, 26in. to 27in. The engines were let out to their full power for a short time, and gave the yacht a speed of twelve knots per hour, with 717-horse power indicated. The trial was conducted by Mr. Harrington, and the results were entirely to his satisfaction, both as regards the working of the machinery and the speed of the vessel. The Wanderer was in sea-going trim, with all her weights on board, the draught of water forward being 12ft. 4in., and aft, 15ft.; coal, 100 tons; ballast, 105 tons; fresh water, 20 tons; displacement, 855 tons.

The Bevis feathering propeller, previously fitted to the Wanderer, was set to 16ft. pitch during the trial, the slip being about 15 per cent. Day, Summers and Co.

Northam Ironworks, October 7th.

RAILWAY MATTERS.

THE use of native coal on railways in the Middle Island, New Zealand, is expected to effect a saving of £8500 for the current year; a similar amount has already been saved by its use in North Island.

THE French Minister of Public Works has announced that tenders are required for 2200 tons of steel, in part payment for which an equal quantity of old iron rails are to be taken by the contractor.

MESSRS. BERRY AND NEWMAN'S tender for the Waingongoro section of the Foxton and New Plymouth—New Zealand—Railway has been accepted, the amount being £13,400. This section will bring the line up to within four miles of Normanby.

IN the district of St. John, Canada, track-laying on the Grand Junction Railway was, at departure of last mail, proceeding at the rate of a mile per day. The grading of the line had been fully completed, and the bridges were nearly all finished. It was expected, according to the *Colonies and India*, that the whole of the track would be laid by November.

THE Engineer-in-Chief of the Victorian Railways has been directed to devise a cheap method of constructing railways at a cost not exceeding £2000 per mile, so that such lines could be carried out in localities where no high rate of speed was required. It appears that 1600 miles of railway have been proposed, but funds will only allow of 360 being completed, unless the cheap method can be brought into operation.

THE Louisville Car-wheel and Railway Supply Company have closed a contract with the Louisville and Nashville Railroad Company for all the car-wheels required by the Louisville and Nashville railroad system for the year 1881, estimated at from 30,000 to 40,000 wheels. This will require from 7500 to 10,000 tons of metal, part of which will be supplied by the old wheels to be taken from the railway company, and the pig irons to be employed are exclusively the Red River, Woodstock, Dover, Hecla and Buckhorn brands.

THE directors of the London and North-Western and Lancashire and Yorkshire Railways, the lessees of the North Union Railway, have resolved to erect a fine hotel in connection with the Preston new station, the largest passenger depôt that is not a terminus in Europe. The tender of Messrs. Neild and Co., Manchester, has been accepted. Major-General Hutchinson, who has just completed his inspection for the second time of the railway extension between Euston and Preston, states that he will report favourably. The new West Lancashire railway is progressing rapidly.

THE following statistics relating to the annual production of Bessemer steel rails in Germany are taken by the *Frankfurter Zeitung* from a private estimate, and show what a large percentage of the whole steel-making capacity of the country is devoted to rail making, the total production of iron and steel for the whole of Germany being only 500,000 tons. The list includes the 11 great German Bessemer steel rolling works:—Krupp's, of Essen, 110,000 tons; King and Laura Works, 96,000 tons; Dortmund Union, 96,000 tons; Bochum Association, 96,900 tons; Osnabruck Steel Works, 72,000 tons; Red Earth Works, near Aachen, 60,000 tons; Phœnix, in Ruhrort, 60,000 tons; Good Hope Works at Oberhausen, 60,000 tons; Hoerder Association, 60,000 tons; Queen Mary Works, 60,000 tons; Bayreuth Maximilian Works, 50,000 tons; total, 820,000 tons.

ACCORDING to the report of Colonel Rich on the accident on the 3rd of August, to the Wemyss Bay train at Ralston, the engine and train were thrown off the road by the detachment of the brake air reservoir from the engine. He says:—"On examining the road after the accident marks were found on the sleeper 50 yards east of the tunnel, and from thence at intervals up to the crossing where the permanent way was broken up. A broken stud has been found 106 yards east of the tunnel, and some blocks of wood and a piece of the iron back strap by which the Westinghouse air reservoir was fixed to the foot-plate of the engine were found 194 yards east of the tunnel, and there can be no doubt that the permanent way at the crossing was torn up by this air reservoir becoming detached from the engine. The air reservoir referred to was fixed under the foot-plate of the engine by two iron straps, which are 2½in. broad and ½in. thick. The ends of the leading strap were formed into screws, which passed through the foot-plate and were fixed to it by double nuts at the top side of the foot-plate. The ends of the back strap were bent at right angles so as to form lugs, and were bored for a stud to pass through each lug. The train came to a stand about 500 yards from where the first mark was found on a sleeper, and about 130 yards east of the crossing where the tender first got off the rails."

MOST of our readers have, no doubt, been surprised by some of the accounts which have been published of the accident to the Midland Scotch express, near Kibworth. There seems to be a little of truth in most of the first accounts, but a very little, inasmuch as the running backwards cannot be looked upon as more than a start to run backwards, the whole affair being the work of a few seconds—we cannot say few minutes. The truth is the driver of the Scotch express was slackened by signals on approaching Kibworth station, but as he neared them they were taken off for him. While he was slackening, however, he heard the big end of one of the connecting rods knocking; and after passing Kibworth station a short distance, he stopped at the Kibworth north signal box, for the purpose of examining the big end. He put the engine out of gear before doing so; and on his return to the foot-plate, he placed the reversing screw in back gear, instead of forward gear, and started his engine, thinking he was going ahead, his attention being fixed on listening to the connecting rod, and his fireman's attention was taken up in putting on the injector. The night was very dark, and neither of the men noticed that they were going backwards. The train ran back some short distance towards the station, and the collision occurred almost before the driver found out his error. How it was that a second train could or was allowed to follow the express so closely, we are not yet informed.

DURING the month of August there were on the American railways a total of 112 accidents, whereby forty-nine persons were killed and 214 injured. Sixteen accidents caused the death of one or more persons; twenty-eight caused injuries, but not death, while in sixty-eight, or 60·7 per cent. of the whole number, there was no injury serious enough for record. As compared with August, 1879, there was an increase of thirty-three accidents, of thirty in the number killed, and of 155 in that injured. These accidents are classed by the *Railroad Gazette* as to their nature and causes as follows:—Collisions: Rear collisions, 31; butting collisions, 15; total, 46. Derailments: Broken rail, 3; broken wheel, 4; broken axle, 1; broken truck, 2; broken switch rod, 1; broken bridge, 2; spreading of rails, 1; wash-out, 3; accidental obstruction, 4; cattle, 5; misplaced switch, 8; runaway, 1; running off end of siding, 1; malicious obstruction, 1; unexplained, 26; total, 63. Boiler explosion, 1; cylinder head burst, 1; car burned while running, 1; total, 112. Eight collisions were caused by misplaced switches; four by trains breaking in two; two by mistakes in giving or receiving orders; one each by bad brakes, by fog, and by a runaway engine. The worst accident of the month—at May's Landing—"was caused, as nearly as can be ascertained, by the ignorance of an engine driver, who did not know how to use the excellent brake with which his train was provided." A rough classification shows fifty accidents caused by carelessness or defects in management; twenty-four by defect or failure of road or equipment; six by unforeseen or accidental obstructions; five directly by the elements; one maliciously caused, and twenty-six unexplained. Seventy-two happened in daylight; thirty-one during darkness.

NOTES AND MEMORANDA.

A DIAGRAM of a Sprengel pump is given in the August number of the *Beiblätter*, which is constructed in such a manner that a make-shift pump can be made with the materials always at hand in the laboratory.

HERR A. SCHERTEL has determined the fusing-points of a number of difficultly-fusible substances by comparing them with those alloys of gold and platinum in various proportions. He gives the fusion-point of basalt as 1166 deg. C.; that of adularia—from the St. Gotthardt—is stated as being between 1400 deg. and 1420 deg.; and nickel between 1392 deg. and 1420 deg.

THE origin of the intermittent action of geysers forms the subject of a paper by Herr Otto Lang, recently presented to the Göttingen Society of Sciences. Bunsen's theory he considers inadequate, and he proposes another, which bears a remarkable likeness to that of Mr. R. Mallet, F.R.S., which has special reference to the mechanism of the rhythmical action of the volcano Stromboli.

AT a recent meeting of the Paris Academy of Sciences a paper was read on the results obtained by M. Rondaire in his exploration of the Tunisian and Algerian chotts, by M. de Lesseps. M. Rondaire's conclusions are entirely favourable to filling the basin situated between the Gulf of Gabes and the projected line of railway from Biskra to Tuggert. This would make an interior sea about 400 kilometres in length and 1600 kilometres in circumference.

DR. WERNER SIEMENS has lately described to the Berlin Academy a new series of experiments on the electric conductivity of carbon, and the way it is affected by temperature. He finds that of gas retort carbon at 0 deg. C. 0·0136—mercury = 1—and the coefficient of increase of conductivity 0·000345 per degree Celsius. The artificial carbon rods produced by compression of carbon powder also show greater conducting power with increasing temperature, but the increase is not so great as in retort carbon.

THE electric conductivity of gas-carbon and its variability under pressure has been re-examined by MM. Naccari and Pagliani, and in such a way as to throw some doubt and some light on the theories advanced respecting the common microphone. Carbon prisms were inserted in a Wheatstone's bridge to determine their resistance. When subjected to great pressures the resistances of the rods of carbon showed scarcely any change. Hence it appears that the changes of conductivity which carbon exhibits in the microphone and in the carbon telephone under varying pressures are due to mere changes in the external contact.

ON the 1st inst. a message of sixty-nine words was forwarded by the Governor of Victoria, announcing the opening of the Melbourne Exhibition on that day. This message was despatched from Melbourne at 1 p.m., and reached London at 3.43 a.m. on the same day, or 9 hours 17 min. before the hour of its despatch. Allowing, however, for the difference of time between the two cities, it occupied only 23 min. in transit. The route of the message, according to the *Electrician*, was over the lines of the Victorian and South Australian Colonies, the cables of the Eastern Extension, Australasia, and China Telegraph Company, the lines of the Indian Government, the cables of the Eastern Telegraph Company, and the lines of the Egyptian and French Governments, and the rapidity of its transmission shows the harmony with which these various administrations work together. The total distance traversed was 13,398 miles.

ACCORDING to some recent investigations by Professor Righi on the effects of magnetism on iron and steel, magnetism produces in iron and steel (1) an increase of dimension in direction of the magnetisation. (2) On cessation of the magnetising force a part of this increase remains, and more or less of it according to the coercive force. (3) The elongations are proportional to the square of the current's intensity when this is not very great. (4) When, after a strong current through the spiral, a weak current is sent in the opposite direction, it produces a shortening; but even when it is strong enough to demagnetise the bar, the latter retains a greater length than in the normal state. (5) During reversal of the polarity of a bar its length becomes momentarily less, and it oscillates in length. (6) A bar of wire or iron traversed by a current contracts at the moment of closing the circuit. (7) On opening the circuit it elongates, but this elongation is less than the initial contraction, indicating that transverse magnetism partly remains. (8) In reversal of the transverse polarity the bar elongates for a moment, and thus oscillates in length. (9) The contraction produced by the current is greater when the bar has before been longitudinally magnetised. (10) Some iron bars show a tendency to spiral magnetisation, *i.e.*, to rotate the magnetic axes of their molecules in the direction of the spiral. This, says *Nature*, is shown by the contractions caused by a current passing through the bars, which are different according to the direction of the current and that of the previous longitudinal magnetisation.

THE following note on the length of a single convolution of wire in a telegraph cable has been contributed to the *Electrician*, by F. C. Webb:—"I cannot find in *Clark and Sabine* or any other book a method for finding the length of a single convolution of a wire in a submarine cable, the diameter of the cable and wire and 'length of lay' being given. The following may, therefore, be useful:—If a line be drawn as a helix round a cylinder, so as to go exactly one turn round, the line will evidently be the hypothenuse of a right angle triangle, of which the circumference of the cylinder is the base and the distance between the two ends of the helix is the perpendicular. If, therefore, D is the diameter of the cylinder and l the distance between the two ends of the helix, the length of the helix will be expressed by

$$L = \sqrt{(3{\cdot}1416\ D)^2 + l^2}.$$

In the case of a telegraph cable, the length l is the length of cable made by one turn of the machine and is called 'the length of lay.' To get the length of the wire in one convolution we must take for D in the formula the diameter on the centre line of the wires. Thus if d is the diameter of one of the wires, and D′ the outside diameter of the cable, then we must to get D subtract d from D′. Thus the complete formula for obtaining the length of one of the wires in making a complete convolution is

$$L = \sqrt{\left(3{\cdot}1416\ (D' - d)\right)^2 + l^2}."$$

BEFORE the recent meeting of the American Association of Science, a paper was read by Mr. E. T. Cox, on the oxide of antimony deposits in Sonora, Mexico, about thirty miles from the Gulf of California. The district is mountainous, the hills being in short narrow ranges, with table-land lying between, composed for the most part of broken and highly porous material. The formation consists mostly of granite and subcarboniferous limestone, with porphyry, quartzite, and trachite dykes. Extensive fissures exist in the rocks, and in these the metal occurs from 4ft. to 20ft. wide, and, so far as is known at present, to a depth of 30ft.; the oxide of antimony being almost pure and very uniform. The area over which these deposits occur is limited, being about five miles long and half a mile wide. They are being worked by a Boston company, who possess extensive claims, on some of which antimony ore stands up in ridges above the surface, and can be traced for some hundreds of feet. The oxide contains on an average about 50 per cent. of pure metal, much of it reaching 77 per cent. The principal impurity is silica. It is believed that at lower depths than have yet been reached the nature of the deposits will be found to change gradually to sulphide of antimony.

MISCELLANEA.

THE new Queen-square station, Glasgow, is to be lighted by electricity, by means of Mr. R. E. B. Crompton's lamps, as used in the Enoch-square station. Two engines will be fixed, so that no accidental stoppage of the light need ever occur.

BATTERIES are to be erected at Barbadoes, Demerara, and Jamaica, and armaments are being forwarded for their effectual equipment, in accordance with the recommendations of the Select Committee of Inquiry into the defence of the Colonies.

FRANCIS J. BANCROFT, a junior of sixteen, in the engineers' department, Islington Vestry, N., has been awarded a silver medal for his drawings of timber and iron roof construction, suspension bridge, road construction, and ornamental iron work.

TWO new factories have lately been established in New Zealand; one for making oil from Copra—dried cocoanut—which is imported into Auckland from the South Sea Islands; the other for subliming the rich sulphur ore found in large quantities at White Island, a few miles from the Auckland coast.

THE fatigue experienced by the eyes from reading with artificial light is—M. Javal says—due more to the want of light than to the excess. Even in a room brightly illuminated the pupils are much more dilated than by daylight, and this dilation produces fatigue. The electric light contains a large proportion of chemical rays, the injurious effect of which on the eyes may be neutralised by giving a yellow tint to the globes.

MR. P. J. MESSANT, engineer to the River Tyne Commissioners, who had been called in to advise the Whitby Port and Harbour Board as to the selection of the best plan for the improvement of the port and harbour, has examined the twenty-seven competing plans, distinguished by numbers, the names of the authors having been obliterated, and has reported in favour of that of Mr. Sandeman, of Newcastle-on-Tyne. This was finally adopted on the 6th inst.

THE Public Works Department, owing to the restriction placed by Government on expenditure, had, at departure of last mail, little or no occupation, and it was stated to be the intention of the Government to employ its officers and labourers in the Colombo Waterworks as soon as the consulting engineer, Mr. Bateman, announced that he was ready to commence work. The drought in Colombo was very great, and the lake there was fast drying up, so that the need of the early commencement of those works was daily becoming more apparent. The preliminary work, according to the *Colonies and India*, on the new railway extension was well in hand.

A RETURN issued from the Treasury Office to the House of Commons gives some interesting statistics relating to the Patent-office. The total receipts at the office in 1868 were £121,311 10s. 10d., the total expenditure £40,251 8s. 10d., leaving a balance of £81,060 2s. In 1879 the total receipts were £179,875 14s. 6d., the total expenditure £40,109 7s., leaving a balance of £139,766 7s. 6d. The grand total of the receipts for the twelve years from 1868 to 1879 inclusive amounts to £1,779,891 16s. 4d., of the expenditure to £504,322 5s. 2d., leaving thus a total excess of receipts over expenditure of £1,275,569 11s. 2d.

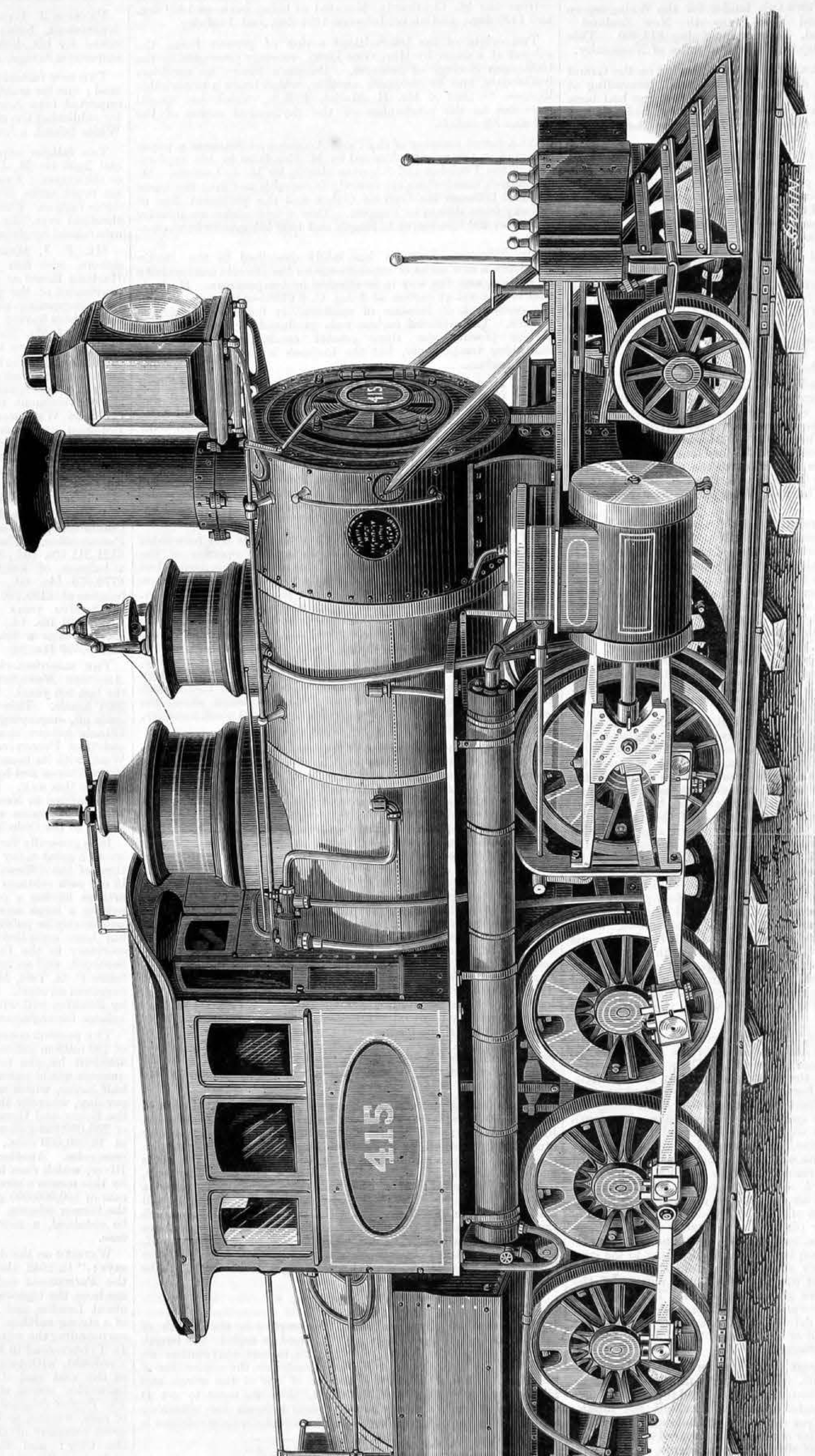
THE manufactories of agricultural implements have, says the *American Manufacturer*, doubled in the United States during the last ten years. In 1850 this industry gave employment to 5361 hands. This year it gives employment to 40,680. Ohio leads off, employing 10,248 people in this branch of manufacture; Illinois follows closely with 8000; New York next, with 7237; and then Pennsylvania, employing a few over 3000. As the West, with its broad acres, demands ploughs and harrows, mowing machines and harvesters, the men who manufacture them are moving this way. Twenty years ago all this class of manufacture was confined to New York and the New England States. Now Illinois has more capital invested in it than all the Eastern States to the Ohio line put together.

IT is generally very well known that the late Professor Rankine wrote a great many papers, which were published in the transactions of the different learned societies and scientific journals, and in our own columns he was a frequent contributor of scientific articles having a practical bearing. A memorial volume, comprising a large section of these papers, is now in the press, and will shortly be published by Messrs. Griffin and Co. The volume has been compiled and edited by Mr. W. J. Millar, C.E., secretary to the Institution of Engineers and Shipbuilders in Scotland, and an introductory memoir has been written by Professor P. G. Tait, M.A., which will be accompanied by a portrait engraved on steel. The collection of the known scattered papers by Rankine will without doubt afford a valuable and interesting volume for engineers.

THE present consumption of water in New York is at the rate of 100 million gallons per day; but as it is felt that, should any accident happen to the Croton Aqueduct, very serious consequences would ensue, it is proposed to build a new conduit one-half larger, which will be capable of delivering 150,000,000 gallons per day, whereby the present service and the projected one from the Bronx and Byram rivers would be increased to a daily supply of 250,000,000 gallons. The cost of the new conduit is estimated at 10,000,000 dols., which does not include additional storage reservoirs. Another scheme is to tap the water of the Housatonic River, which rises in the Berkshire Hills of Massachusetts, and by this means a stream could be diverted into the Croton at a rate of 100,000,000 gallons per day, at a more moderate cost than the former scheme. From whatever source the new supply is to be obtained, a new aqueduct will have to be built in either case.

WRITING on the defences of the City of London, the *City Press* says: "In 1642, shortly after the breaking out of the Civil War, the Parliament ordered that trenches and ramparts should be made on the highways leading to the City, and in different parts about London and Westminster. These fortifications consisted of a strong earthen rampart, flanked with bastions and redoubts, surrounding the whole City and its liberties, including Southwark. In Tyburn-road in 1643 there were three forts erected—namely, a redoubt, with two flanks, near St. Giles's Pound; a small fort at the east end of the road, and a large fort, with four half bulwarks, across the road, opposite to Wardour-street. From *The Perfect Diurnal* of this period we gather that many thousands of men, women, and servants assisted in the works, as also did a great company of the Common Council and other chief men of the City; and the train bands with spades, shovels, and pickaxes; likewise feltmakers, cappers, shoemakers, and porters, to the number of many thousands, assisted in raising the defences."

BARRELS made from pulp are among the latest inventions, and as described by the Detroit *Tribune*, they are likely to become an important article in commerce. The advantages claimed are lightness, durability, and cheapness. The body of the barrel is all made in one piece, from coarse wood pulp. The pressure to which it is subjected is 400 tons. The heads are made of one piece in the same way, and when put together the barrels are exceedingly light, strong, and satisfactory every way. There are two kinds; one for fruit, flour, and other dry substances, the other for oil, lard, and liquids of all kinds. A flour barrel made in this way and filled, can be dropped from a wagon to a pavement without injury. Fruit packed in these receptacles keeps longer than when put up in the usual way, being dryer and excluded from the air. The barrels for liquid substances are made by subjecting the first form to a simple process, and oil can be kept in them without any leakage. The saving in cost is about 50 per cent. Steps are being taken for the formation of a company to manufacture barrels, tubs, &c., by the new process.



CONSOLIDATION LOCOMOTIVE, PHILADELPHIA AND READING RAILWAY.

(*For description see page 282.*)

TO CORRESPONDENTS.

*** *In order to avoid trouble and confusion, we find it necessary to inform correspondents that letters of inquiry addressed to the public, and intended for insertion in this column, must, in all cases, be accompanied by a large envelope legibly directed by the writer to himself, and bearing a 2d. postage stamp, in order that answers received by us may be forwarded to their destination. No notice will be taken of communications which do not comply with these instructions.*

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

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

J. W. H.—*We fear we do not understand your question. Please amplify it.*

H. P. (Dewsbury).—*We shall be pleased to see your drawings, and to make use of them if suitable.*

AN ANNUAL SUBSCRIBER (Southsea).—*Write to the Principal of the College for the information you require.*

E. M.—*We do not know, but you can easily ascertain by making application to the assistant-secretary for the "form" specified in the advertisement.*

A CIVIL ENGINEER.—*The Rivers Conservancy Bill has not progressed beyond the stage to which you refer. "Structures in Concrete" is published by Messrs. E. and F. N. Spon.*

W. L.—*Phosphor bronze would make a good piston ring, but if you refer to Mr. L. Perkins, 6, Seaford-street, Regent's-square, you can obtain a metal which will answer your purpose if any metal will.*

SUBSCRIBER.—(1) *You will find what you want in Box's "Practical Treatise on Heat," published by Spon. Irving's little "Manual of Heat," published by Longman and Co., will be of service to you.* (2) *Wilson's "Treatise on Steam Boilers," published by Lockwood and Co.*

TIPTON, C. B. S.—*Spretson's "Casting and Founding," published by Messrs. E. and F. N. Spon, is, perhaps, the best suited to your requirements The "Moulder's and Founder's Pocket Guide," by F. Overman, and published in England by Messrs. Sampson Low and Co., will also be of service to you.*

H. S.—*If the wood flitches are carefully fitted into the sides of the iron joist and held there by bolts through the centre of the web, the bolts having plate washers of several inches in diameter under both head and nut, and care be taken to see that the ends of the wood flitches rest firmly on the bed carrying the joist, then the joist may be supposed to be increased by the strength of the flitches.*

REFRIGERATOR.—*In practice the air will be cooled down by expanding, whether it does work or not. The more work it does the cooler it will become, because the heat which it contains is transferred into mechanical energy. There is, therefore, a distinct advantage gained by the use of the expansion cylinder. Of course the air will pick up heat as it traverses the pipes leading to the cold air chamber unless they are carefully lagged.*

DUBIOUS (Grimsthorpe-road, Sheffield).—*Your letter of inquiry respecting the Adewarke main winding engines has been overlooked. The valves of these engines are controlled, as you will see by reference to the engravings in* THE ENGINEER *of the 26th February last, page 136, by the reversing gear, and the link will enable the cut off to be effected at any desired point. Nearly full steam is required when working with full cages, but very often the engines work with steam cut off at about half stroke.*

AMATEUR.—*Your slide valve is too long for the throw of the excentric. It has too much lap. Take an eighth of an inch off at each end, set the excentric back about 5 degrees temporarily, then take a diagram, and you will find much less back pressure and probably a satisfactory card. If so, you can then fix the excentric. If you project lines on the inside of the steam chest from the edges of the steam and exhaust ports and mark on the valve the edges of the exhaust port in it, you can with the excentric temporarily set test the lap and the position of the excentric until you get both right.*

FIREMAN.—*Multiply the diameter of the cylinder in inches by the same number. Take three-fourths of the result. Multiply this by the pressure in the cylinder, by the number of revolutions per minute made by the engine, and by twice the length of stroke in feet; divide the product by* 33,000, *the result is the actual horse-power. If you have a table of areas and circumferences of circles, you can find the area of the piston at once. Thus, let the diameter be 8in. and the stroke 1ft., and the revolutions* 100 *per minute, and the effective pressure 50 lb. per square inch; the area of an 8in. piston is 50 square inches, and 50 inches multiplied by 50 lb. gives 2500 lb., and this multiplied by* 100 *revolutions gives* 250,000, *and this multiplied by 2, or twice the stroke, gives* 500,000, *and this divided by* 33,000, *gives a little over* 15 *as the horse-power.*

A. E. (Bradbourne).—(1) *Such a case as that given in your question does not often occur in practice, and when it does it is only answered by trigonometrical methods, as the angle subtended by the two straight portions of the line must be found. If you cannot find the radius by other methods, you can do it by setting off a normal or line at a right angle from the ends of the straight portions of the line, and finding where these intersect. The distance of this point from the ends of straight portions of the line will be the radius of the curve required. You may set off these normals either by means of a level or optical square and a few staffs. Having obtained the radius of the curve, you may set out the curve without trigonometry by means of the method of offsets, which you may easily learn from Baker's "Rudimentary Treatise on Mensuration," Weale's Series, which you may obtain from any bookseller, or by other simple offset or polygonal methods described by Louis D'A. Jackson in his "Aid to Survey Practice," which is published by Lockwood and Co.* (2) *The same sort of gauge may be used for the 3ft. pipe as for the 9in., but it must be much larger*

TROLLEY WHEELS.

(*To the Editor of The Engineer.*)

SIR,—I will feel much obliged if any of your readers will favour me with the name and address of any good maker of light trolley wheels.

St. John's, S.E., October 9th. C. E.

BULLEN'S HIGH-PRESSURE BALL-COCK.

(*To the Editor of The Engineer.*)

SIR,—I shall be obliged if you will allow me to ask the name of the present manufacturers of Bullen's high-pressure ball-cock, illustrated in THE ENGINEER 8th October, 1875. W. J. N.

Paisley.

MELTING SCRAP.

(*To the Editor of The Engineer.*)

SIR,—Will some reader of THE ENGINEER inform me how I can make small wrought iron scrap, mixed with hematite pig iron in the proportion of two-thirds scrap and one-third pig, sufficiently fluid to run a good casting half an inch thick? A. B. C.

POROUS CASTINGS.

(*To the Editor of The Engineer.*)

SIR,—Having experienced a great difficulty for some time past in the castings made at our shops being spongy and full of holes, we are at a loss to discover the cause. The irons we use are as follows:—Lonsdale, hematite; Coltness, Scotch; and Tipton Green, Staffordshire. We ascribe it, though perhaps wrongly, to the great quantity of sulphur in the coke, although we buy it as best Durham. Would some fellow-reader oblige with an answer as soon as possible, and state the effect of sulphur on cast iron? The holes above mentioned contain no dirt, and in the case of a cylinder cast in dry sand, the interior of the flaw was of a bright blue colour. Please say would this indicate the presence of sulphur, or what? The greatest attention is paid to the venting of the moulds.

Stafford, October 9th. W. W.

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DEATH.

On the 8th Oct., suddenly, at Tufnel Villa, 47, Tufnel Park-road Holloway, and of Glasgow, WILLIAM THOMS HENDRY, C.E., aged 47 Friends please accept this intimation.

THE ENGINEER.

OCTOBER 15, 1880.

THE PURIFICATION OF LONDON FOGS.

DURING the winter months of 1879-80 fogs killed a large number of persons in the metropolis and its environs. They assumed proportions almost unheard of before. They lasted longer, were more dense, and more deleterious than any London fogs within, perhaps, the memory of man, and we are not surprised to find that a great many persons look forward with no small dread to the winter now close upon us. November used to be notorious for its fogs; but of late years they are even more plentiful in January and February. Nothing, one would imagine, could be urged in favour of a London fog; but one gentleman has stated recently in the pages of a daily paper that without excusing them they may nevertheless act as disinfectants. We hold in common with most people that they are an unmitigated evil, in defence of which not one word can be urged. Now, as it seems not improbable that fogs will prevail this winter as they did last winter, people begin to think that "something should be done," and this something, so far, consists in stating that London fogs are due to London smoke—are in fact frequently made up of smoke, and nothing else—and that if we could get rid of smoke we should probably be rid of fogs at the same time. Dr. Alfred Carpenter has urged that a tax should be put on all grates which do not consume their own smoke, and that a non-illuminating gas should be supplied for heating purposes at a cost of 2s. to 2s. 6d. per 1000ft. In this way he thinks that the nuisance could be abated. We fancy that Dr. Carpenter has written without taking time to think, for it is certain that his letter contains some fallacious reasoning based on a want of knowledge of the facts. The subject is of sufficient importance to claim some expression of opinion from us.

In dealing with the questions involved, it is above all things necessary that we should keep the facts constantly in mind. Sentiment will creep into all dealings with what are known as nuisances, if people are not very careful to keep it out; and in the statement that London fog is London smoke, we cannot help thinking that sentiment plays a part. In the first place the fogs of the earlier portion of the present year were not confined to London. They formed belts which reached from Paris in the south, to Liverpool in the north. The whole English Channel was shrouded in them. River traffic was stopped repeatedly by them in Liverpool. But it is none the less true that what in the country was a clear and comparatively harmless white fog, was in London a dirty and noisome fog. The vesicles of water become, it is supposed, coated with carbon and hydrocarbons, which prevent them from breaking up, and so give permanence to the fog. It must also be conceded that there are specific London fogs when there are no fogs elsewhere. To these last we may confine our attention, and endeavour to find out whether smokeless grates could or could not prevent them. "Smoke" is a compound of atmospheric air, sulphurous acid gas, carbonic acid gas, carbonic oxide, and several other gases which we need not stop to name. It likewise contains small quantities of tar and ammonia. It holds particles of carbon in suspension, and these give it its dark colour. The quantity of carbon thus present is, however, astonishingly small. The late Mr. C. Wye Williams was the first, we believe, to point out this fact. We make no apology for quoting the following passage from his "Treatise on the Combustion of Coal and the Prevention of Smoke:"—"The weight of carbon in a cubic foot of black smoke is not equal to that of a single grain. Of the extraordinary light-absorbing property and colouring effect produced by the inappreciable myriads of atoms of this finely divided carbon forming part of the cloud, some idea may be formed by artificially mixing some of it, when in the deposited form of soot, with water. For this purpose collect it on a metallic plate held over a candle or gas jet, and touching the flame. Let a single grain weight of this soot be gradually and intimately mixed on a palette, as a painter would with a palette-knife — first with a few drops of gum water, enlarging the quantity till it becomes a spoonful. On this mixture being poured into a glass globe containing a gallon of water, the whole mass, on being stirred, will become opaque, and of the colour of ink. Whatever, then, may be the quantity or number of its atoms, we see from the cloud of incombustible matter with which this carbon is so intimately associated as smoke, that even attempting its separation and collection independently of its combustion borders on absurdity." The meaning to be extracted from this passage and the lesson we desire to convey is that the quantity of carbon in smoke is so exceedingly small that it is next to impossible to prevent its evolution from any grate in which coal is burned, no matter how perfect as a smoke consumer that grate may be. In other words, an engine furnace burning coal under conditions which render its combustion nominally smokeless, yet gives off enough unconsumed carbon to discolour an enormous volume of air. But even if it were possible to totally prevent the evolution of carbon in a finely divided state, we should have advanced but a short way on the path to be trodden. The carbon renders, it is true, a fog dirty and dark, but it is not the carbon which is the principal cause of the sore throats, bronchitis, and "colds in the head," which are beyond question brought on by the persistent inhalation of London fog. These are more than probably due to the presence in the fog of sulphurous acid gas, and carbonic acid, and carbonic oxide, the two last fruitful causes of violent headache. No matter how perfect the combustion of the coal might be, these gases would be as plentiful as ever. To illustrate this truth, we may cite the Metropolitan Railway. The engines on it burn Welsh smokeless coal, and the conditions of combustion are made as perfect as science can make them; but the tunnels are filled with an atmosphere charged with carbonic acid, carbonic oxide, and sulphurous acid. The utmost that could be attained by smoke-preventing grates would be the prevention of the discharge of carbon in powder. For the rest, the conditions would remain the same; the fogs would be cleaner, and that is all.

Beyond question this would be a great advantage gained—but is it practicable to gain it? We fear not by any form of grate or other contrivance for ensuring the total combustion of coal. In domestic fire-places the temperature is never very intense; the supply of air for combustion is ample; and the smoke is evolved only because the temperature is not high enough to cause the ignition and combustion of the gas and suspended carbon. It is not practicable in any open fire to get a sufficiently high temperature to secure the required end. If a partially closed grate were employed the effect would be disagreeable in a room, and the grate would have to be continually replenished, for only a small quantity of fuel would be burning at once. In the ordinary open grate we have a comparatively considerable mass of coal ignited at the same time. The effect if the whole were burning at a high temperature would be intolerable. Therefore high temperature and small quantities of fuel on fire must go together, and as the fuel will burn with great speed, constant replenishing of the grate, as we have said, would be necessary. The performance of this by manual labour is out of the question; nor is it easy to see how an automatic grate could be contrived which would not with its bunker occupy too much space. These objections may also be urged against all manner of stoves. These are constantly put forward as the cure for all ills in heating houses; but coal-burning stoves make just as much smoke as an open grate, only it is not seen till it escapes at the chimney-top. When stoves do not give off smoke it is because they burn wood, as is the case abroad; or anthracite as in the United States, or coke or Welsh coal. The universal adoption of stoves to-morrow would not purify the air of London. The end can only, we hold, be accomplished in a different way or ways. The first, and by far the most troublesome, would consist in establishing a gas producer in the basement, and leading the gas from this in iron pipes to each room; the gas would then be burned in suitable open grates or hearths. The gas furnace would require replenishing but once every twelve hours. A great deal may be urged in favour of this scheme, but we believe it to be totally impracticable; in the first place, because a certain amount of danger of explosion attends the use of gas furnaces; and secondly, because the gas producer must work constantly, and as fires are not—with a few exceptions—kept up all night, the system is inapplicable to the demands of modern life. The next, and far more hopeful scheme, would leave us our open fires and our coal just as they are. It consists in depriving the smoke of its suspended carbon. To a large extent this is done for us already by our chimneys. The sweep every year takes away enough soot to render London fogs—were it found in them—ten times worse than they are. There is every reason to believe that the partial or total cleaning of household smoke is not at all beyond the reach of the inventor who will approach the subject with an intelligent perception of facts. Why is it that much of the soot is now deposited in our chimneys? The answer is that the particles come in contact with the sides, lose their velocity, and fall, or adhere to the bricks. It is well known that wherever an eddy can be formed in a chimney there will soot be deposited in quantity. Soot is delivered from the top of a chimney solely because the particles are very small, so small that their superficies is enormous as compared with their solidity. Consequently they are when set afloat in a current of air easily borne up and carried to the top of the chimney. Once there the current is gone, and they fall by their own gravity as a shower of "blacks." Now, if the velocity is once taken out of them and they are not permitted to be caught up by a current again, we are done with them as far as smoke is concerned. To get rid of them we must do just what is done in getting moisture out of steam—permit the current to strike a series of flat surfaces from which it is deflected. These surfaces, so to speak, "knock" the water out of the steam. The principle has been very elegantly employed in a gas purifier which we illustrated in our pages not long since. The object in view is to get rid of carbon in suspension in the gas. To do this the gas is passed through a large number of holes and strikes against a plate in front; the carbon is deposited, the gas goes on its way purified. This is the principle which must be adopted if we would have smoke from house fires cleared of its carbon. How it is to be effected we must leave it to inventors to decide. That the scheme can be applied we have little doubt, and that it would do much to purify the air of the metropolis we are equally certain, but that trouble and expense would be incurred must not be denied. Its great claim to popular support would consist in the fact that its adoption would interfere with no popular prejudice in favour of open fires and their existing management.

THE PHENOMENA OF EXPLOSION.

The letter from a practical miller which appeared in our columns last week raised one or two questions of considerable interest, and will not have been written in vain if it directs renewed attention to the phenomena of explosion. These phenomena make themselves unpleasantly prominent now and then, as for example in the case of the explosion at Tottenham-court-road, and more recently in the Seaham Colliery. Our correspondent once again told the wonderful story of the disaster at Minneapolis, when three huge flour mills were destroyed almost in a moment, and other property was extensively damaged. In the present day explosions may be said to play a large part in the world's business and pleasure. Gas engines depend on explosions for their action. Whenever a shaft has to be sunk, a quarry opened, or a tunnel driven, recourse is had to gunpowder or dynamite. We need say nothing of great guns. As for small arms, the sportsman is absolutely dependent on the explosive power of gunpowder for the killing of game. At every turn we find explosions either purposely induced by elaborate contrivances; or intruding themselves on our notice unsolicited, and, indeed, after every precaution has apparently been taken to avoid their recurrence. It cannot be said that the phenomena of explosion are unfamiliar; and considering all the circumstances, it is not a little strange that hardly any sufficient thought has been given to the phenomena by scientific men, and that we may seek in vain for trustworthy and complete theory of the action of explosives. We have no intention of attempting to supply what is wanting. We write now in the hope that those who have the time and the means, and the requisite skill, will devote their attention to the subject, investigate the phenomena of explosion, and give us some definite information, which can hardly fail to prove useful. To this end we propose here to place before our readers certain considerations which lead up to queries, which may or may not admit of being answered.

When a mixture of hydrogen and oxygen is ignited, an explosion takes place, and water results. Two atoms of hydrogen H — O — H combine to form water. Two volumes of hydrogen combine with one volume of oxygen to form two volumes of aqueous vapour. If more than the right proportion of either gas be present, an explosion will nevertheless take place, but there will be left just as much of either gas as was present in excess. Thus if 100 measures of hydrogen were mixed with 80 measures of oxygen, there would, after explosion, be 30 measures of oxygen left, quite pure—as far at least as hydrogen is concerned. If we ask what takes place during explosion, we can obtain no answer, save that there is, first, a great dilation of the gas attended with the evolution of light and heat, subsequently a reduction of pressure, and, lastly, a very great reduction of pressure, as the steam formed in the first instance is condensed. It would appear from what we have said that it is impossible to make hydrogen and oxygen combine to form water without an explosion. This idea is supported by the fact that the well-known singing noise made when hydrogen burns in air is attributed to the rapid succession of a multitude of minute explosions. On the other hand, however, there is some reason to believe that the mixture can be made to flame quietly without any approach to an explosion, as, for example, in a Bunsen burner, or, indeed, in any ordinary gas jet; and it should be borne in mind that in the laboratory the combination of the two gases is generally effected by the electric spark. When gun-cotton is inflamed a somewhat complex chemical reaction takes place, akin in some respects to that occurring when gunpowder is burned. But gun-cotton presents a peculiarity of very great importance, namely, that if ignited in one way it will burn rapidly away without exploding, whereas if it be ignited in another way it explodes with great violence. Dynamite behaves in much the same manner, and can at will be made either to explode or to burn quietly. The importance of these facts will be seen when we ask is it not possible that many other things besides dynamite and gun-cotton may or not be explosive according to the way in which they are ignited? Fine flour dust or stive can, there is every reason to believe, be burned quietly or made to explode with great violence according to circumstances; and it is not impossible that the same statement may be quite true of mixtures of air and coal gas in mines or gas mains.

As to the conditions determining explosion or not in gun-cotton, to which for the moment we may confine our attention, they are well known. A cake of wet gun-cotton can hardly be induced even to burn; but if a percussion cap be caused to detonate in the cake, the whole will explode with just as much violence as though the cotton were dry. Before we can attempt to arrive at an explanation of the cause of this somewhat puzzling phenomenon, it is necessary to know why gun-cotton explodes at all. We have already referred to explosions of mixtures of hydrogen and oxygen, and we have done this advisedly, because such explosions are typical. With certain comparatively unimportant exceptions, all explosions are caused by the combination of oxygen with something else. In gunpowder we have the oxygen of the nitrate of potash uniting with the charcoal and sulphur. The formula of gun-cotton is probably $C_{36}H_{21}O_{30}NO_4$; what precisely takes place during explosion is not certainly known, but we have at all events hydrogen and carbon ready to form a new combination with the oxygen. The basis of gunpowder, gun-cotton, and dynamite—nitro-glycerine—is nitric acid, $NO_5\,H_0$, and nitric acid gives explosive vitality to its compounds solely by virtue of the ease with which it gives up oxygen; in fact nitric acid is, broadly stated, a very unstable compound of oxygen and nitrogen. It is the most easily decomposed of all the acids, and cannot be kept pure in the sun's rays, the actinic rays causing it to give off oxygen. It is accordingly one of the most powerful oxidising agents known. Powdered charcoal will burst into flame if a little strong nitric acid be dropped on it, and many experiments are well known to every student of chemistry proving the same thing. When nitric acid is employed to produce an explosive, it appears that nitric peroxide NO_2 is substituted for an equivalent of hydrogen, and NO_2 is an excessively unstable compound, giving up its oxygen on the smallest provocation. We have stated that there are certain comparatively unimportant exceptions to the rule that oxygen is always present in explosions. As one exception we may refer to chlorine, which is competent to play much the same part as oxygen, and which enters into the composition of some of the most unstable chemical compounds known. We may put these on one side, however, and turn now to what are known as fulminates. One of these is fulminating mercury $2(HgO), Cy_2O_3$, another is fulminate of silver $2(AgO), Cy_2O_3$. In both these we have again nitric acid present as the oxidising agent. The first is readily caused to explode either by heating it or striking it. It is, however, a stable compound when compared with fulminate of silver, which can be exploded by touching it with any hard substance. We may contrast both with another detonating material, namely, fulminating powder, composed of three parts of nitre, two of carbonate of potash, and one of sulphur, intimately mixed and dried. If this powder be touched with a hot iron it will burn away slowly; indeed, it is difficult to cause it to burn at all. If a small spoonful be placed on a sheet of tin over a slow fire, the powder as it heats will gradually assume a pasty condition, then a lambent blue flame will begin to burn on its surface, and then the whole explodes with a report, the tremendous noise of which is out of all proportion to the quantity of the powder used, and the explosion is strangely enough practically harmless, and incapable of displacing even a light sheet of tin. We have not been able to find a reference to this powder, giving any information of use, in any work on chemistry. It is mentioned in some books, but that is all. Chloride of nitrogen and iodide of nitrogen are violently explosive. They contain, however, neither oxygen nor carbon, and their effects seem to be due to the sudden liberation of a very large quantity of nitrogen from a very small quantity of the powder. Again, all chlorates—as, for example, chlorate of potash—part with their oxygen more readily than nitrogen, and this is one reason why chlorate of potash is more powerful as an explosive ingredient than nitrate of potash.

Now what we have said suffices, we think, to prove that combinations exist which can be caused to assume new relations, and to form new combinations either quietly or with explosive violence; and we have further shown that mere mechanical concussion will cause explosion without the application of heat in any shape or form. Again, there is one substance certainly, namely, the fulminating powder, to which we have just referred, which can be made to detonate only by somewhat long-continued heating. We have thus certain forms of matter requiring diverse conditions to bring about identical results. For example, wet gun-cotton will not explode, no matter how great the heat to which it is exposed. Heat alone is powerless in this case to bring about the required result; but heat and percussion together, that is to say heat, and what we may call mechanical shock, will induce an explosion at once. The same statement holds true of dynamite. Neither percussion nor heat alone will make it explode, but the combination of the two, as when a small quantity of fulminate of mercury is fired in contact with it, has the desired effect. Thus then, as we have said, explosions result in some cases from the application of heat alone; in others from the application of percussion alone; and in yet other cases from the application of both heat and percussion alone; and we have also seen that forms of matter which under ordinary conditions burn slowly or quickly away, can under other conditions be made to explode with awful violence. May we not now ask, are we at all certain that we can identify all the forms of matter which certainly cannot be made to explode under the combined influences of heat and percussion? If we cannot, we may, perhaps, have not far beyond our reach the key to the cause of such events as the flour mill explosions at Minneapolis, and those which occur, alas too frequently, in our coal mines. If coal or flour dust hangs in the air we have oxygen and carbon in very close proximity. The nitrogen of the atmosphere plays only the part of a diluent; the oxygen has no affinity for it. Let a flame be applied, the oxygen and the coal dust or flour dust may combine quietly and produce a flame. But it is quite as certain that these combinations may produce an explosion, and what is required to bring about the explosion is apparently percussive action of some kind. No doubt the Minneapolis explosions followed each other because shocks followed each other. In the same way it is by no means impossible that a shot fired in a coal-mine may play nearly the same part with the mixture of air and gas present as the percussion cap does in a cake of wet gun-cotton. When oxygen and hydrogen are exploded in an eudiometer, the electric spark supplies the equivalent of the percussive action necessary to produce that instantaneous combustion which causes so much mischief when it is effected on a large scale. We might pursue this section of our subject and go on heaping up illustrations of the effect of percussive action on what are known as unstaple compounds, but it is not, we think, necessary. The lesson to be drawn from what we have written is that it is advisable to carry out some experiments to ascertain the effect of percussion on compounds believed to be tolerably staple. It may, for instance, be shown, perhaps, that a mixture of coal gas and air which cannot be exploded in the ordinary way may be caused to explode by a detonator. The same experiment may be tried with an atmosphere charged with coal-dust or stive. It is obvious that if explosion can be caused in the way suggested something very important in the management of coal mines will have been learned. The study of this department of molecular physics ought not to be delayed any longer.

HARBOUR WORKS AT COLOMBO AND MADRAS.

The harbour works at Colombo and Madras have for some years been running a race towards completion, and for a long time it had been thought, and confidently predicted, that the slighter construction given to those at Madras would lead to failures which would insure the winning the later commenced works at Colombo. But to all appearances this prediction seems likely to be falsified, and so much delay has arisen at Colombo owing to the unsettled nature of the ultimate design to be adopted, that there can now be but little doubt but that the Indian port will be safely enclosed some time in advance of Colombo being in a state of preparedness to give entire shelter to the shipping resorting to it. We have from time to time noticed the relative progress made at both places, and we are now in receipt of the latest information respecting each work. Mr. F. W. Thorowgood, the superintending engineer of the Madras harbour works, reports the advance on the two piers there to have been satisfactory, in spite of the heavy sea which seriously impeded diving operations during the month of June. The number of blocks set in that month in the superstructure of the north pier had been 272, which had added 157ft. to its length, the total completed having reached 3025 lineal feet. The curved work at the changing sea face had been finished, and the Titan was being advanced in a straight line to the proposed pier head, which, as has determined upon by Mr. Parkes, the designing engineer, will be at a point 685ft. in advance of the completed work. Mr. Thorowgood writes:—"The construction of the curved work of the north pier gave us from the commencement some anxiety, as it has never been before attempted under similar conditions. It is satisfactory to be able to report its completion without one single mishap, and with a deviation of only 8in. at its extreme end—637ft. from the tangent point—from the exact spot where theoretically it should terminate, notwithstanding the great and varying settlement of the blocks as the Titan passed over them." The rubble base to this pier had not made quite corresponding progress, owing to the occupation of the two steamers at the south pier. During June 8558 tons had been tipped, making the advance in front of the superstructure about 600ft., of which 450ft. were fully made up. On the south pier the superstructure had not progressed at the same rate as at the north pier, owing to the difficulty in accurately marking out the curve arising from the swell from the south-east, the site receiving the full force of the waves and currents. The rubble base at this pier-head, however, made considerable progress, it extending at the date of the report 390ft. in advance of the blockwork, and being fairly made up for the whole of that distance. Generally, the progress on each pier during the first six months of the year had been greater than in any corresponding six months since the commencement of the work. The following statement proves this:—January 1st to June 30th, 1877, north pier, 228ft.; January 1st to June 30th, 1878, north pier 420ft., south pier 381ft., total 801ft.; January 1st to June 30th, 1879, north pier 356ft., south pier 627ft., total 983ft.; January 1st to June 30th, 1880, north pier 653ft., south pier 688ft., total 1341ft. The expenditure on the works as a whole has hitherto been well within the estimate, though on some sections that had been exceeded. Whilst on the plant and preliminaries there had been an excess of expenditure of 107,587 rupees, and on the establishment charges of 57,811 rupees, being a total excess of 165,668 rupees, there had been savings on the estimate for the north pier of 32,837 rupees, on the south pier of 143,302 rupees, on blocks in stock 11,361 rupees, and on contingencies 244,797 rupees, being a total saving of 431,847 rupees, against the excess item of only 165,688 rupees. In English money, therefore, the works, as far as they have advanced, have been completed for £26,617 18s. less than was estimated for them. Mr. Parkes would consequently appear to be well justified in his anticipation that his original estimate for the whole scheme is not likely to be exceeded.

From Colombo we learn that the block setting season there was expected to shortly commence, and preparations were being made for the active resumption of work. The Titan had been hauled out and anchored down to the blocks within about 150ft. from the sea end of the work. The service road had yet to be completed, and on that being done, the Titan would be advanced to the setting end. A large number of artificers were engaged on these preliminary operations. Owing to the limited space available in the immediate neighbourhood of the works, the resident engineer, Mr. Kyle, experienced great difficulty for want of a convenient site upon which to store the concrete blocks already prepared, and some 300 or 400 of these would have to be stacked along the top of the now completed breakwater. The yard can only contain 900 blocks, and these, with the 300 to be stacked as before described, will only be sufficient to build 600ft. of breakwater wall. It will be necessary, therefore, to press forward the manufacture of further blocks as the work proceeds seaward. The dredging operations within the line of the breakwater, as far as it is already advanced, had been much delayed by the non-completion of the steam dredger Merak. The ladder buckets had not been received from England, and it was scarcely expected that they would arrive in time to admit of the dredger being fairly at work before the end of October at the earliest. This delay was said to have arisen from faulty forgings of the steel mouthpieces of the buckets, many of which had been rejected. Mr. Kyle was preparing a plan of the mode of working out and deepening the harbour, and some of the dredge punts had been locally built and were already launched. Of these there will be two trains of five, each punt being capable of carrying 20 tons. A 500-ton steam hopper barge was expected from England, but it could scarcely reach Colombo before January or February next, and in the interim the punts above referred to will carry the dredged stuff to the foreshore now being reclaimed in front of the Pettah, or native town. A small tug is now being built by Messrs. Green and Co., of Blackwall, for their towage.

We understand that Sir John Coode has sent in to the Government his final proposals for the ultimate design of these Colombo harbour works, but the nature of them has not yet been made public. The Ceylon Government is particularly reticent on all such matters. As will have been seen, full details are periodically published by the Madras Government, but that of Ceylon withholds all such information, and we are indebted for the above particulars given as to the Colombo works to the *Ceylon Observer*. Were it not for periodical notices —necessarily only of a general character—in that journal, the engineering profession at home, and, indeed, the colonists themselves, would be ignorant of all what was being accomplished, and even from these last, all information as to expenditure seems to be strictly withheld. This is a perfectly useless course, and one which gives rise to much unfavourable comment.

THE PERFORMANCE OF LOCOMOTIVE ENGINES.

THE sums expended on the haulage of trains constitute an important portion of the expenses incurred by a railway company, but they by no means represent the whole of its expenses. They are, however, sufficiently great to make economy in the working of locomotive engines a matter of no small interest. Indeed, it is not too much to say that while a railway must be very badly off if it cannot pay some dividend if the locomotive expenses are kept down, it must be very wealthy indeed if it can pay dividends and maintain a lavish outlay on its engines. A great deal of the success of some of our great lines is beyond question due to the skill and caution of their locomotive superintendents. But a wide diversity of opinion seems to exist as to what is and what is not cheap coaching and goods traffic. This diversity is not to be found so much among our own engineers, as between the engineers of different countries, and what is called cheap in one country may be regarded as dear in another. All things considered, it seems that British locomotives are the most economical in the world, though it is not easy to prove this positively, because different conditions prevail in different countries. For example, there is every reason to think that Austrian locomotives are very economical; but they burn to a large extent lignite, which is far inferior to coal as a fuel. Concerning American locomotives, it is not easy to get at figures, for American railway accounts are not kept with the same minute accuracy as English railway accounts. Judging from the statements made on this subject, however, the American locomotive is not nearly so economical as the British engine. We shall give some figures in a moment to support this statement.

It will not be out of place if we tell such of our readers as are not familiar with the working of railways that what are known as locomotive expenses are made up under the heads of Fuel, Oil, Tallow, Waste, Wages, Material for Repairs, Labour for Repairs, and Proportion of General Charges. For different railways these expenses vary very much. Thus, for instance, the London, Brighton, and South Coast Company paying about 20s. a ton for coal will have a larger outlay for fuel per mile, other things being equal, than, let us say, the Great Western Company paying less than one-third of the sum named per ton. We have lying before us a set of old reports—charge sheets—for locomotives working the Liverpool and Manchester Railway, and some of the figures are so suggestive and interesting that we reproduce them here. These accounts begin in March, 1840, and we find that the average consumption of coke per mile per passenger engine was 33·5 lb., the average load being about six coaches, the trips were thirty miles each. The goods engine burned 45·5 lb. of coke per mile, the heaviest load being twenty-two trucks hauled by the Mammoth with a consumption of 52·5 lb. per mile, and the lightest being twelve trucks hauled by the Milo with a consumption of 44·3 lb. of coke per mile. In August, 1840, we find that premiums at the rate of 7½d. and 5d. were given to the drivers and firemen respectively of the goods trains, but none to other drivers. The result seems to have been an immediate reduction in the consumption of fuel to 33·6 lb, of coke per mile, the loads being heavier than in March; the passenger engines burning 27·1 lb. per mile. A little further on the premium was raised to 10d. for drivers and 7d. for firemen, but without doing good, the consumption being 35·5 lb. per mile, so the following week it was brought down to 6d. and 4d., the consumption being 34·3 lb. In September the premiums were done away with, and the consumption rose to 39·9 lb. per mile, the loads remaining about the same. In the week beginning the 6th of November, 1840, a premium of 2d. and 1½d. was given to the drivers and firemen of the coaching engines, with the immediate result of cutting down the consumption from 27·9 lb. to 25·9 lb. per mile. The week following it fell to 23·7 lb., but it rose again slightly. We cannot extend our figures on this subject, and it must suffice to say that in March, 1841, all drivers and firemen had premiums varying from 3d. to 8½d., and the coaching engines were burning but 23·3 while the goods engines were burning 32·3 lb., all the loads being heavier than in the March preceding, and before the expiration of the year they had got down to less than 20 lb. per mile for passenger and 28 lb. per mile for goods traffic. As regards total expenses, we find them for the six months ending June, 24th, 1842, amounting, for thirty-five engines — passenger and goods—to 8·19d. per mile, including charges under all the heads we have given above. Coke cost 2·24356d.; oil, 0·42428d.; tallow, 0·06584d.; waste, 0·01286d.; wages, 1·43708d.; materials for repairs, 0·32583d.; wages for repairs, 0·39085d.; proportion of general charges, 3·28562d. per mile; the outlay on new engines building, being charged as locomotive expenses, raised the total cost per mile run to 19·07d., but the latter item we may neglect. As we examine these reports, we find that the cost gradually decreased, while the work done augmented; and so in 1845 the average cost was but 6·124d. per mile run. The saving was principally in general charges, which fell to 1·733d. The total cost per mile run was 12·07d. As to the mileage of the engines, the greatest for the six months was made by the passenger engine Pluto—12,337. Among the goods engine the best performance was that of the Petrel—9915 miles. A total of forty engines, of which seven were employed in shunting, ran 282,146 miles, or an average of 7053 miles each in the six months. Two engines, however, ran only a few hundred miles, and may be excluded, leaving the average about 7400 miles, or nearly 15,000 miles per annum —a very respectable performance indeed, when it is considered that engines in 1845 were not nearly so well built as they are now, and that the roads traversed were much worse than modern permanent way. Indeed the expenses, as a whole, compare very favourably with modern locomotive charges, the great advance of the present day over the past being in the speeds and the weights hauled. The consumption of fuel per mile is nearly the same now that it was in 1840, but the loads and velocities are very much greater. The superior economy of the modern locomotive is to be sought more in a small expenditure for repairs, perhaps, than in anything else; but it is evident that the heavy trains of the present day could not be hauled with from 25 lb. to 35 lb. of coal per mile if the engine itself were not better than its predecessor. The modern locomotive is more economical in this way than its ancestors, because it uses steam of a higher pressure more expansively. In 1845 expansion was hardly used at all, and pressures of about 75 lb. were then commonly adopted. Again, great improvements have been effected in burning coal and in the evaporative efficiency of the boiler, and it is by no means clear that finality has been reached in any department of locomotive construction as yet.

An American contemporary supplied last week some figures apparently trustworthy, which enable us to compare the working cost of a modern American locomotive with that of English engines in 1845. The statement refers to the Panhandle Railway, on which are employed 101 engines, and it is claimed that the last monthly sheet shows the most economical outlay on engines to be found. We give the figures in the words of the *Pittsburgh Telegraph*. "During the month of June the combined distance traversed by the engines was 263,919 miles. During the same period, the total mileage of cars of all kinds was 4,052,586. In order to accomplish this, the large sum of 47,111·52 dols. was spent for the motive power, which includes the repairs to engines, fuel, stores, engineers, and firemen. With all of the latter causes of expense taken into consideration, it is shown that the average cost of running each passenger engine on the road was only 13½c. per mile, for freight engines 2c. more, for ballast engines 3c. less. The average cost of running switching engines was about 9½c. per mile. The above figures are estimated on an average mileage of 2613 for each engine per month. In a recapitulation the report shows that the average cost of running each engine on the road, counting motive power accounts not included in the above statements, to have been 17·85c., made up as follows: —Cost per mile run for repairs, 5·28c.; cost per mile run for fuel, 2·92c.; cost per mile run for stores, ·35c.; cost per mile run for engineers and firemen, 5·55c.; cost per mile run for cleaners, ·41c.; cost per mile run for all other motive power accounts, 3·34c. In the above the cost of coal is estimated at 82c. per ton, and wood at 2·50 dols. per cord. The average number of miles run to one ton of coal was by passenger engines, 45·12; by freight engines, 24·85."

These figures give an average of 31,356 miles per engine per annum, and it would appear that the loads averaged 11·6 cars only. The total mileage of vehicles being very small compared to that of engines, it would be interesting to know how the mileage of the latter was reckoned. The cost of repairs amount to 2·64d. per mile, which compares very unfavourably with the cost of repairing locomotives on the Liverpool and Manchester Railway in 1842 when it reached but ·71668d. per mile. The cost of fuel is low, 1·46d. per mile, as against 2¼d. nearly, on the Liverpool and Manchester Railway, but then the American engines get coal for 5s. 2d. a ton, a price at which coke was never supplied to a railway to our knowledge. The passenger engines burned 44·3 lb. of coal per mile, while the goods engines actually contrived to get rid of no less than 80·4 lb. per mile. From this it appears that the engines on the Panhandle Railway burn about 75 per cent. more coal per mile than English engines doing heavier work. There are other points about the figures we have given which will interest our readers. The return is, however, incomplete, in that it gives no idea of the tonnage moved. If we take the very high figure of 20 tons gross per vehicle, we have an average load of but 222 tons. Coal trains in Great Britain generally weigh 350 to 450 tons gross, without the engine, and the passenger trains on most of our main lines will average over 120 tons. As for our speeds they are, especially for goods trains, far higher than are ever met with on American lines. It is certain that if the engines of the Panhandle line are to be taken as representative, American locomotive engine builders have little to boast of. The excellence of their engines appears to consist in beating English engines in the cost of fuel and repairs—in fact in all those things which English engineers like to keep as small as possible.

RAILWAY PROJECTS NEXT SESSION.

THERE are some indications that next session of Parliament will be a busy one in railway matters. Already there are many rumours of projected railways and of amalgamation. One of the latter—that suggesting the revival of the project for the leasing by the Midland and Great Northern Railway Companies of the docks, canals, and railways of the Manchester, Sheffield, and Lincolnshire Company—has been easily disposed of by the official denial, but numbers of projects are still spoken of as more or less probable in various parts of the kingdom. It is said that there will be a struggle between some of the great companies, and that the extraordinary growth of the revenue of the mineral railways is likely to bring about attempts to enter some of these districts, by companies which, by those "in possession" will be considered intruders. It is as yet too soon to speculate as to the truth or otherwise of these rumours; but there are some considerations that may be well urged. Last year Parliamentary contests were generally discountenanced, and were very few. But despite this fact they were very large. The North-Eastern Railway charged to revenue in the last six months not less than £11,000 for parliamentary and law charges; the Midland charged over £5000; the Great Northern, £8000; and the London and North-Western, £24,800. These vast sums spent in six months must be considered in considerable degree waste of money, so far as the shareholders are concerned; and the latter might fairly consider how they shall take steps to prevent the recurrence of such expenditure. Still, it must be confessed that generally the cause for the attempt of one company to enter the "district" of another is to be found in the fact that the occupying company renders too scant a service. At the present time the towns, for instance, between the Tees and the Tyne are urging the Midland Railway Company to extend its system to that district. Whether or not it is likely to do so, we need not stop to inquire—it is sufficient to say that if the wants of the district were met by the company which has of that part a monopoly there would be no such urging. The wisest course, and that most likely to keep down the unsatisfactory parliamentary expenditure, would be for the companies to exercise a wise liberality in meeting the wants alike of the Legislature and the districts they are supposed to serve, and thus increasing gradually their revenue, preparing for the time when Parliament will make more stringent traffic regulations, and securing themselves against the "invasion" of companies which are ever and again urged to go forward and "possess the land."

THE NORTH OF ENGLAND'S FUTURE.

THE industrial district extending from the Tyne to the Tees, which is known by the name, "The North of England," has been the subject of a great deal of speculative wonder at various times, and the predictions as to its future position have been tinged by the hues of pessimist and optimist opinion alternately. The rapid development of a district is necessarily attended with a tendency towards reaction. Like a lad who has grown in stature too quickly, a rude shock, which a more advanced district would bear quietly and without apparent harm, causes a serious degree of ruin and alarm to it. The iron and coal industries in the north have made such rapid strides within the last decade, that the depression which hung over them for a lengthened period was felt as a national calamity. Then, when from the depths of commercial woe, the district arose upon a suddenly revived trade to the height of apparent prosperity, the depression was forgotten as the dream which flies with the morning light. Eighteen months ago it was declared that nothing but an application of cheap steel to the uses to which iron had been put would save the Cleveland district from utter collapse. Twelve months ago, when orders for pig iron literally poured over from America, the raw material was in great favour, and attention was diverted once more from steel to iron. We are glad to observe that lately the intoxication of reaction has worn away, and without any spur upon them in the shape of the wolf at the door the attention of those engaged in the iron trade has been directed to the future of the district, and efforts are being made to provide for that future. A faint resemblance of the growls against the North-Eastern Railway Company which used to be of everyday occurrence in the halcyon days of '73 is now observable. There is actually a talk of the advent of the Midland Railway Company into the domains of the great monopoly. But while perhaps there are grounds for complaint against the North-Eastern Railway Company on the score of high charges, it must be admitted that that company has not been behind any firm or individual in the district in preparing for the future greatness of the iron and coal industries. The magnificent docks recently opened at West Hartlepool prove that the North-Eastern Railway Company believes in a great future. Similarly, Messrs. Bolckow, Vaughan, and Co., Limited, who might have rested satisfied with their enormous profits, have been actively working and spending a large amount of capital upon developing their manufacturing powers. So great have been their efforts in this direction, that the Cleveland district may now fairly claim to rank as a steel-producing district. In every way, either by improved machinery for the production of manufactured iron or steel, or by the utilisation of waste until the vilest refuse has become a marketable commodity, there is an exhibition of a laudable purpose, to make the Cleveland district what it never before has been—stable. In the coal trade there is more providence amongst working men, and more scientific knowledge amongst mine managers, than could have been deemed possible ten years ago. Taking these things as indications of the character of the future, it is now more than probable that, notwithstanding the commercial reverses which may come, the ruinous failures of firms which have marked and disgraced the past few years will not be repeated.

LITERATURE.

The War Ships and Navies of the World. Containing a complete and concise description of the construction, motive power, and armaments of the modern war ships of all the navies of the world, naval artillery, marine engines, boilers, torpedoes, and torpedo boats. By Chief Engineer J. W. KING, United States Navy, late Chief of the Bureau of Steam Engineering. A. Williams and Co., Boston, U.S.A. E. and F. N. Spon. London. 1880.

IN 1877 the world was not a little astonished by the publication at Washington of a report by Mr. King on European ships of war and their armament, prepared for his own Government. This report contained information to be had nowhere else. Our own naval officers for the first time obtained information about British ships of war which they had before sought in vain, and the information was not confined to British ships; it was accurate and complete, in no small sense of the word, for all the navies of Europe.

It so happens that naval construction is constantly assuming new phases; noval ships are being added year by year to the strength of nations, while others become obsolete and are broken up. Mr. King marches with the times, and his report has already virtually gone through three editions. The volume before us is to a large extent yet another edition; but whereas the first report contained but 273 pages, the present volume contains no fewer than 613. We have already fully reviewed Mr. King's book, and we have often quoted from it. It is unnecessary therefore to dwell at any length on the volume before us. It contains all that Mr. King has already published and more. A large part of its contents is pure compilation. This journal, for instance, is largely drawn upon. We may cite as an example the celebrated Meppen trials. The drawings which we gave of the targets have been reproduced by Mr. King, who duly acknowledges the source from whence they are derived.

Not the least interesting feature in the work are the illustrations, which are very good and accurate, considering their size. There are no fewer than sixty-six full page engravings, however, and some of them, as for example the frontispiece which shows the Duilio at sea, are very effective. For the rest it will perhaps be enough to say that the promise contained in the lengthy title, which we have quoted above is kept; and that the book is a species of "Inquire within for everything" connected with ships of war, their engines or their guns. Mr. King's chapter on the United States navy is so interesting that we may have something more to say on the subject. He has brought down information concerning all the navies in the world to a very recent date, and the book stands at present quite without a rival. The publishers have done the author justice, type and paper being alike good. If we have any objection to urge against the volume it is that it is rather too ponderous in its dimensions.

Resultate aus der Theorie des Bruckenbaus. By R. Kohrn, Ingenieur und ausserordentlicher Lehrer am Konigl. Polytechnicum zu Aachen.

This work, as its title implies, does not bring forward any new methods for dealing with the stresses in bridges, but is intended mainly to illustrate by practical examples the application of theory to practice. The author in this volume limits himself to girder bridges, proposing in a future treatise to investigate arched bridges and bridges of combined forms. The work is, however, by no means a mere collection of worked out formulæ, and the principles on which the methods of procedure are based are rationally explained. The worked numerical examples occupy rather more than half of the entire work.

In his preface the writer appears to favour analytical in preference to graphic methods, stating that the former can be more easily presented in a form suitable for immediate application by the "less theoretically trained engineer." Scattered through the work, however, numerous graphic processes will be found, and whenever the latter afford unquestionable advantages, preference has been very properly given to them. It is possible, indeed, that the writer assumes a greater familiarity with the employment of the familiar polygon than is at present universal in this country. Graphic processes have, perhaps, the disadvantage that they are less easy to work after the mind has grown unaccustomed to them; and this, perhaps, has told against their more general adoption.

The work begins with an introduction dealing with the general ideas of the elasticity and resistance of materials, and defining the nature and limits of the class of problems under consideration. The exterior forces acting upon beams are then discussed in two sections—the first dealing with beams on two supports, the second with continuous beams. The latter part of the subject is more fully treated than is usual in English works. Interior stresses, and the determination of the requisite form of section to resist them, are dealt with in the case of beams of uniform and of variable section, followed by girders with parallel booms and single triangulation, and trellis girders. The stresses in girders with polygonal booms of general form, on two supports, under various conditions of loading, are next investigated. In the above subject matter a large number of formulæ are introduced which are subsequently turned to account.

The general questions having been thus disposed of, thirteen important numerical examples are given, five of which relate to continuous girders. The travelling load is treated both as an equivalent uniformly distributed load and as a system of concentrated loads—Wohler's formula being adopted for the safe load. The thirteen examples are well chosen, and cover a wide field of bridge construction.

The work is throughout remarkably straightforward and systematic, and it will be found very easy to follow and to apply. The plates, though giving the figures at a rather small scale, are clear and well executed. It is a very common complaint against works of this class that one cannot find what one wants in them, and that, even if they contain the information required, it is not presented in a form which renders it readily available in practice. This complaint will not be brought against Herr Krohn's book, and the latter cannot fail to recommend itself to practical men. There is, perhaps, no English work of similar scope, but the small knowledge of German required to enable a technical book to be read is fortunately becoming more and more common, and the value of a work of this kind will be little lessened by the language in which itis given to us.

The Council of Ministers at St. Petersburg have assented to the construction of the Ekaterinburg and Tiumen branch of the Siberian Railway.

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

(*From our own Correspondent.*)

The third quarter of 1880, which has just closed, has been an improvement upon that which preceded it. The pig iron makers have found a little better demand. Stocks at the furnaces had got down to less serious proportions, and this encouraged proprietors to blow in furnaces that a quarter ago were idle. Makers of part-mine and cinder pigs have done more than the producers of high-class sorts. These last, indeed, have met with little if any improvement. Large quantities of pigs have been sold made in Northampton, South Yorkshire, Derbyshire, &c. Hematites produced in Barrow and other Lancashire towns, in Cumberland, and in South Wales, have found a market to only a limited extent, the prices being mostly prohibitive.

Prices of Staffordshire all-mine pigs have, upon the open Exchange, mostly ruled the same as last quarter, namely, £3 10s. to £3 12s. 6d., but the actual selling price has been £3 7s. 6d. and less. Hematites have been priced at £3 15s. to £4, but have hardly realised the higher figure. Cinder pigs have been about £2 to £2 2s. 6d. Northampton pigs have sold freely at £2 10s. to £2 12s. 6d.; and best Derbyshire sorts slightly above that rate.

Medium and common qualities of finished iron have been in quite active demand during the quarter for home and export. Sheets, required by the galvanisers mainly, and to be used in the block for roofing purposes in Russia and India, and elsewhere, have been in chief request. From £7 10s. to £8 for singles has been the market price, but numerous sales have been effected at as low as £7. This branch has assumed additional prominence by the association lately formed to keep up the prices of the gauges known as "doubles" and "latens." Hoops and strips and small rounds have stood next in order of demand. A great many American inquiries have been about for hoops and strips, but not a commensurate number of orders. Common bars have been plentiful at £6 to £6 5s.

"Marked" iron has been very slack of sale, and two or three of the leading works have had hardly anything to do. This led Messrs. Philip Williams and Sons, and Messrs. William Millington and Co., at the close of July, acting independently of any of the other "list" houses, to reduce their prices 10s. per ton all round, leaving bars at £7 10s. The little additional business that resulted was not, however, deemed sufficient to warrant other houses in pursuing a similar course at that time. Now, however, this quotation has become general throughout the marked iron branch of the industry. The determination of the other "list" houses to drop their prices 10s. per ton—which was come to during 'Change hours in Birmingham upon Thursday last week, and which I announced at the time—has been followed by the issuing of circulars establishing the drop.

The Earl of Dudley's new prices are as follows:—Ordinary bars, £8 2s. 6d.; single best, £9 10s.; double best, £11; and treble best, £18; rivet iron, single best, £10 10s.; double, £12; and treble, £14; angle iron, strips, and hoops of the ordinary sizes are, lowest quality, £8 12s. 6d.; single best, £10; double, £11 10s.; and treble, £13 10s.; T-iron is £9 2s. 6d., £10 10s., £12, and £14 according to quality; for strips of ⅝in., and not thinner than 20 w.g., his lordship's prices are, lowest quality, £9 12s. 6d.; single best, £11; double, £12 10s.; and treble, £14 10s.; ⅝in. of similar w.g., £10 12s. 6d., £12, £13 10s., and £15 10s., according to quality.

Messrs. Barrows and Son's fresh quotations are as here:—Bare B.B.H., £7 10s.; best, £9; and best best, £10; best chain bars, £9; best best chain bars, £10; and best charcoal bars, £16; plate bars become from £8 to £9 10s.; and rivet iron, £9 10s.; B.B.H. plates are £9 10s.; best boiler ditto, £10 10s.; and best best ditto, £11 10s.; sheets of £20 w.g., £9 10s., 20 to 24 w.g., £11, and 25 to 27 w.g., £12 10s.; strips are £9; hoops, £8 10s.; and rods from £8 15s. to £9 10s.

The altered prices of Messrs. E. T. Wright and Son, of the Monmoor Ironworks, Wolverhampton, are:—Monmoor best boiler plates, £9; Monmoor sheets, £8 10s.; Monmoor Crown bars, £7 5s.; and Monmoor hoops, £7 15s. The "Wright" qualities are 10s. lower as usual.

The Patent Shaft and Axletree Company, Limited, of Wednesbury, inform me that instead of giving open market quotations at the present time they prefer to quote upon definite specifications. Moreover, they state that the recent reduction was anticipated by them some time back.

Declared prices have now touched the low point which they reached two years ago. It was in September, 1878, that by a reduction of £1 per ton, bars last became £7 10s., and they remained at that figure for twelve months. Since that date there has been an advance of £1 10s. per ton. In November, 1879, a 10s. rise was declared, and at the end of the year an additional £1 was put on. Towards the close of May this year the 20s. was, however, taken off again, and by the present declaration the other 10s. has been sacrificed.

At the quarterly meeting yesterday—Wednesday—in Wolverhampton, the above prices ruled the transactions in high-class finished iron, and influenced the quotations for all other kinds, which generally were from 2s. 6d. to 5s. down in respect of all but sheets and gas strip. The combination among the sheet makers kept medium singles at £7 10s.; doubles at £9; and latens at £10 10s. High-class singles sold in small lots for prompt delivery at £8, and some doubles at £9 10s. Gas strip was also strengthened by makers' action, a meeting being held in the afternoon with the object of bringing back certain firms to the observance of the old rule affecting the sizes which for many years have been regarded as extras.

Common bars were abundant at from £6 down to £5 15s. and £5 12s. 6d. "Severn" sheets, singles, were yesterday still quoted at £11; B., £12; B.B., £13; and B.B.B., £14 per ton, but with a tendency towards change in the spirit of the drop announced by the marked bar firms.

Likewise at yesterday's meeting the Lilleshall Iron Company, which has now six furnaces in blast producing, half of them hot and the other half cold blast iron, announced its quotations at £3 5s. for the former, and £4 5s. for the latter quality. This is a drop in quotations of 5s. per ton. A similar quotation drop was announced by the proprietor of the Spring Vale furnaces, who asked £2 for his common, £2 10s. for his all-mine, and £3 for his hydrate quality. Most descriptions of all-mine produced by the other firms were quoted at from £3 5s. to £3 7s. 6d. Hematite was mostly purchasable at £3 10s. This was the quotation of the Tredegar Company, and buyers regarded the quotation as "easy." Cinder pigs were plentiful at from £2 down to in a few instances even £1 17s. 6d. and £1 16s. 3d. Northampton pigs were quoted £2 3s. 9d.; but it was no secret that the commodity might have been bought for slightly less money.

Coal was plentiful and was variously quoted. The most general price was 6s. 6d. per ton for forge qualities at the pits, and with about 23 cwt. to the ton in boat loads.

In Birmingham to-day—Thursday—there was an overflowing attendance and plenty of inquiry; but only a small aggregate of actual business. There was a tendency to ease in the sale price of both raw and rolled iron, but the ease was insufficient to satisfy consumers. Sheets were to be had for galvanising and for working up at, in a few cases, from 5s. to 10s. under the association prices, but galvanisers held off.

Alike in Wolverhampton and Birmingham the market was strengthened by the expectation of the firms that there will soon be a considerable business once more doing on account of the United States. The purchase recently for that market of the 15,000 tons of steel rails announced in the Sheffield correspondence of The Engineer was not without its beneficial effect; and there was one broker on 'Change to-day who spoke of much heavier quantities of steel and iron being about to be required by Transatlantic consumers.

The galvanisers yesterday reported the receipt that morning of much better orders for roofing sheets than by any one post for some time past. The orders were mostly upon Australian account. Some brands were quoted £15 10s. per ton for 24 w.g. packed in cases, delivered in London, and £17 10s. for 26 w.g.

In Wolverhampton, which is an important centre of the bicycle trade, machinery upon what the inventor claims is an entirely new principle, is being employed in the manufacture of steel rims for velocipedes. Any sized rim can be made, and with four times the rapidity possible by the methods mostly in vogue. The requisite length of grooved steel is first scarfed down at each end upon an emery wheel, and it is then taken to a bending and "trueing" machine. This consists of an action table, provided with five rolls, which is attached to a stationary surface plate of large dimensions. The strip assumes a circular shape when it has been passed through the rolls, and the ends having been rivetted, it is again brought under the action of the rolls for the circle to be "trued" and the joint tested. Under most processes the "trueing" has to be done by hand, whereas, except in the rivetting, the use of the hammer upon the rim is, under the new method, altogether avoided. Machinery is also being adopted in the same town with much success in the production of every description of brass, and brass and wood combined, coal vase furniture. Thus the casting shop is superseded, greatly to the advantage of that furniture in particular, which is of an intricate design.

Hardwares tend downwards in price. Cut nails, which during the last few weeks have been gradually declining, are now declared lower by 10s. per ton. Cut clasp nails from 1in. upwards, become 9s. to 11s. 6d. per cwt., and cut lath nails, 1in. and upwards, 12s. to 13s. 6d. per cwt. The discount on cut tacks and brads sold by the paper remains as before. Chains, cables, and anchors, are sensibly lower that a month ago. Wrought iron tubes, on the contrary, fairly well maintain, for the present, the last declared advance.

At a meeting of the Staffordshire Potteries Board of Arbitration on Monday, a resolution was passed to the effect that the Board having fully considered the question of workman's prices with a view to a settlement, and being unable to arrive thereat, the matter should be referred to the umpire for further decision.

Sir Henry Hunt, C.B., has issued his award fixing the price to be paid by the Tipton and Oldbury Local Boards for their respective portions of the gas undertaking of the Corporation of Birmingham. The price for the Tipton district is fixed at £33,700, and that for the Oldbury district at £22,750. The price paid by the West Bromwich district under Sir Henry's award was £70,750.

At a meeting of the Tame and Rea District Drainage Board, on Tuesday, in Birmingham, it was decided to lease 123 acres of land at Tyburn as an addition to their present sewage farm for a period of 99 years, at a rent of £3 an acre for the first seven years, and £4 an acre for the remainder of the term.

In accordance with the instructions of the Sanitary Authority of the Tamworth Union, the Sanitary Inspector and Surveyor and the Medical Officer have made a joint report on the condition of the river Tame. They state that the river is greatly polluted by sewage and chemical matter, causing it to be a serious nuisance to the district, highly dangerous to health, and injurious to the adjacent land throughout the whole of its course.

NOTES FROM LANCASHIRE.

(*From our own Correspondents.*)

During the past week there has again been very little doing in the iron trade of this district, and the depression would seem to be felt here more keenly than in the other centres of iron industry. Of course this district is largely dependent upon the cotton trade, and this branch of industry has not yet shown sufficient recovery to encourage any very large new development of the means of production. The consequence is that there is very little local work coming into the hands of machinists and engineers, although many of them have been kept tolerably busy with foreign orders, and for their present consumption the chief users of iron are generally well covered by the tolerably large purchases which were made several months back. The bulk of the consumers are, therefore, in no immediate want of iron, and even those who have to come into the market only buy from hand to mouth, the weakness shown in prices inducing them to hold back until the last moment, with the view of purchasing what little iron they do want at the lowest possible figure. But amidst the general depression which prevails throughout the district there is still a certain feeling of hopefulness with regard to the future; makers as a rule are very cautious about entering into long forward engagements at present rates, and amongst speculators the opinion is gaining ground that prices are not likely to recede much further is evidenced by the fact that just now there is a considerable business doing here in warrants.

The Manchester market on Tuesday was well attended, but there was a disinclination to do any business pending the result of the quarterly meetings this week, and I could hear of very few orders being given out. The firmer tone reported from Middlesbrough had very little effect, as north country iron is for the present almost completely out of this market on the face of the much lower price at which other outside brands can be bought.

Lancashire makers of pig iron, although they are still delivering a good deal of iron on account of old contracts, report very few new orders coming in. For delivery into the Manchester district their quotations nominally remain at 47s. 6d. for No. 3 foundry, and 46s. 6d. for No. 4 forge less 2½ per cent.; but they are not firm holders at these figures, and for early delivery they would no doubt be open to offers at less money.

Of the outside brands coming into this district Lincolnshire and Derbyshire brands continue to be offered at extremely low figures. Some makers are holding for 48s. less 2½ for No. 3 foundry, and 46s. 6d. for No. 4 forge delivered equal to Manchester, but I have heard of offers at as low as 45s. per ton. Middlesbrough iron is nominally quoted at about 47s. 4d. to 47s. 10d. per ton for g.m.b.'s delivered equal to Manchester.

In the finished iron trade there is a tendency towards less firmness. The reductions in the Staffordshire list rates, although they had previously been pretty fully discounted, naturally having a weakening effect upon the market here. The quoted prices are not materially altered from last week, but manufacturers who are finding very little new work coming into their hands are as a rule open to both orders for prompt specification at under current rates. For bars delivered into the Manchester district the average quoted prices are about £6 to £6 2s. 6d. per ton.

In the coal trade there is a rather stronger tone so far as house fire classes of fuel are concerned. For these there is now generally a tolerably fair demand, and some of the pits have been put in to full time. In a few cases advanced lists are being sent out, but there is not yet any general action amongst coal owners, most of whom are still working short time, and in many cases have heavy stocks on hand. The quotations under list rates made during the summer are, however, generally being withdrawn, and there is not much disposition to sell forward at present rates. Common round coals for iron making and general manufacturing purposes are still without change, works in this district are not taking any larger quantities, and as supplies continue abundant, low prices have still to be taken. Engine fuel continues steady, the increased productions of slack not as yet having had any material effect upon prices. The average quotations at the pit mouth are about as under: Best coal, 8s. to 8s. 6d.; seconds, 6s. 6d. to 7s.; common coal, 4s. 9d. to 5s. 6d.; burgy, 3s. 9d. to 4s. 3d.; and good slack, 3s. to 3s. 6d. per ton.

In shipping a moderately fair business has been doing, but the prices taken are still very low, steam coal delivered at either Liverpool or Garston being obtainable at 6s. to 6s. 6d. per ton, and house coal from 7s. per ton upwards according to quality.

The demand for hematite pig iron is not sustained, and the past week or two has shown evidence of weakness not experienced for a considerable period of time; but this is only regarded as a lull in the demand which, after the quarterly meetings, and after so much attention ceases to be directed to the shipping orders, will receive new life. The orders in hand are still very considerable, and the works are very actively employed. Out of eighty-four furnaces sixty-three are in blast, and two or three of those standing idle are old charcoal furnaces which have done nothing for years. There is a very large delivery of both iron and steel, and this is likely to continue, as the orders in hand are expected to furnish employment for a considerable part of the winter. From all quarters there is a cheerful aspect, and it is known that with the very active future in store for the steel trade there must be a good market for both Bessemer and ordinary qualities of hematite pig iron. Prices are easier and are now quoted at 65s. for Bessemer and 60s. for forge iron, but several sales are noted for Bessemer below this figure. The iron ore trade is very steadily employed. Shipbuilders and finished iron workers are busily employed.

There are evidences of an extension in the coking industry in West Cumberland.

The stern post of the steamer City of Rome, weighing 34 tons, has arrived at Barrow from the Mersey Iron and Steel Works, Liverpool. It is said to be the largest forging ever made for this purpose.

The metal exports from Barrow-in-Furness for the month of September, according to Browne's Export List, represent 19,343 tons, being 10,823 tons of pig iron, 6358 tons of steel rails, &c., and 2162 tons of scrap. In the list of ports in the United Kingdom, Barrow stands third in respect to the tonnage of metal exports, Middlesbrough being first and Liverpool the second.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

WE are evidently in the period of fluctuations. For several weeks I have had to record alternately good and bad trade. Last week the outlook was gloomy. This week it is much brighter. The inquiry for pig iron has been brisk, and prices have consequently had an upward tendency. Makers are now holding back in the hope of securing better prices. No. 3 is very firm at 39s. No. 4 forge at 38s., and the other qualities in proportion. The American demand shows symptoms of again reviving, and shipments to continental countries continue large.

It must not be forgotten that the year is now contrasting with a period of undreamt of prosperity last year, when the district arose from its ashes on the springing up of the American demand. The fact is that although trade is very quiet now as compared with the corresponding period of last year, it is very much brighter than the most sanguine expectations could have believed.

The North-Eastern Company's traffic returns show an increase of £13,740 on the corresponding week of last year, and £1825 on the corresponding week of 1878. The large amount of £8694 is attributable to minerals. For the fifteen weeks which have now expired of the current half year the total traffic returns have amounted to £1,880,833, as compared with £1,668,870 in 1879, and £1,847,774 in 1878.

The manufactured iron trade is much improved. Large orders for plates have been given out owing to the briskness of the shipbuilding trade to which I referred last week. Prices are stiffer, and manufacturers are more sanguine of a good winter's work. Indeed, plate-makers especially are almost safe from the orders they have recently received.

Messrs. Bolckow, Vaughan, and Co., are perfecting their new machinery, and will very shortly be able to turn out steel rails on a gigantic scale. The President of the Board of Trade, on his visit to this district last week, was shown over the splendid works of this company at Eston.

Engineering trades are well employed with medium class work. There is no manifestation of great enterprise in the shape of new undertakings apparent in the district.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

I HEAR that next week several of the colliery companies intend to raise the price of coal by 1s. per ton. Coalowners are at present supplying Silkstone house coal as follows:—Hand-picked branch, 13s. per ton; best "hards," 10s. 6d.; best screened, 9s. 7d.; second ditto, 7s. 11d; screened nuts, 6s. 8d. The ordinary consumer does not profit by the owners' perplexities. It is the large consumer—the railway company—who can command something like his own terms.

There is every probability that the miners will again have recourse to the demand for the eight hours' system of working. At a conference held the other day at Barnsley, from which the representatives of the press were excluded, the men—or to speak more correctly, the delegates of the men—went strongly in for restriction. Mr. Macdonald's panacea for the languor in the coal trade was that the miners should not work so hard. His doctrine of idleness was at first scouted by the men, but the delegates appear to be veering round to his way of thinking. The coal trade continues in a very disturbed state, and there are many disputes still unsettled.

Mr. Frith, the secretary of the South Yorkshire Miners' Association, has been authorised to adopt a peculiar course in dealing with the wages difficulty. He has been instructed to forward a circular letter to the coalowners of the district, requesting them to increase the price of coal, so as to admit of an advance in wages to the miners. It is all very well to increase the price, but will the public continue to pay a higher price than the article can be supplied at?

In the iron trade there is little change to report. The fluctuations which take place from day to day do not materially alter current price lists. In one or two quarters there is a good deal of work doing in heavy orders, but generally these departments are not so busy as might be expected. In the lighter branches there is more briskness.

The wire mills are well employed. In addition to the order for the Indian Government recently referred to, I hear of several good "lines" for wire ropes for collieries and towing purposes. Of late years wire has been abundantly used for towing, and two firms in Sheffield are now engaged on large contracts for that speciality.

Several orders for rails, mainly for light weights, have been placed since my last. The price of rails is maintained, and the fall in the value of hematite and district pig must enable the maker to have a better profit.

At the Atlas Works there is much briskness in the boiler and ship-plate departments. Messrs. John Brown and Co. have a special reputation for ship-plates, which secures them orders when firms elsewhere are almost idle.

There is a slight improvement in the general steel trade, both on home and foreign account. The demand for Bessemer slabs for America has not revived, but there is a continued improvement in the call for manufactured goods, which is more satisfactory than the exportation of raw material.

Cutlery is generally in good demand, the United States being by far the most active, but the home markets are also better, in view of the approach of the festive season, which tells favourably, not only on the hardware trade generally, but on silver and electro-plated goods.

The Dronfield Silkstone Coal Company, Limited, offered their colliery for sale at Sheffield this week. In order to secure a sale, the coal rent was fixed as low as £150 an acre, with the small minimum rent of £1000 a year. Great part of the coal was purchased by the Dronfield Company at £300 an acre, and the reduction of the price by one-half was with the view of enabling the purchaser to meet the possible event of continued depression in the coal trade. The output of the colliery has been 500 tons a day, and its coke can be consumed almost entirely by Messrs. Wilson, Cammell, and Co., whose rail mills and steelworks adjoin the colliery. Still, with every possible inducement, not a bid could be procured for the property. In a few days, Summerly Colliery —Messrs. James Rhodes and Son—will also be offered for sale.

Langley Mill Iron and Steel Works, in the parish of Heanor, Derbyshire, adjoining the Erewash Valley line of the Midland Railway, are to be sold. The works are in the centre of the Derbyshire furnaces and collieries, and are said to be capable of an output of 10,000 tons of merchant iron and about 750 tons of ingot steel per annum. The Midland Iron and Steel Works, lately known as the Cardigan Works, in Saville-street East, Sheffield, are now to be offered by private treaty. I understand they are to be sold at a sacrifice, owing to the 12th Patriotic Building Society, to whom they are mortgaged, being compelled to realise.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

THE tone of the iron market has this week on the whole been steadier, with a very slight tendency to better prices. Although the shipments last week were not quite so good, the warrant market has from various causes been firmer, principally owing to the better conditions of trade at home. Three additional furnaces have been put in blast, there being now 104 in all blowing, as compared with eight-five at the same date last year. Rather less Cleveland iron is being imported, and there is a decrease in these imports on the year to date of not less than 14,105 tons. The poorer qualities of Scotch iron are in request for manufacturing purposes in preference to the Middlesbrough pigs. There are now 474,953 tons of pig iron in Messrs. Connal and Co.'s stores, or 1197 more than in the preceding week. From the United States the inquiry is flat, and lower rates are asked for all consignments; but it will pay makers at present to continue increasing their stocks at the small current expense of production, even although the demand should in the meantime not be very extensive.

In the warrant market on Friday prices fluctuated between 50s. 6d. and 50s. per ton. On Monday the price advanced from 50s. 3d. to 50s. 7½d., but subsequently went back to the former figure. The market was steady on Tuesday forenoon, with business from 50s. 3d. fourteen days to 50s. 6d. cash, and 50s. 8d. one month. In the afternoon transactions were effected at 50s. 6d. to 50s. 9d. one month, and 50s. 5d. to 50s. 8d. cash. On Wednesday market fluctuated between 51s. and 50s. 6d. cash; there was a steady market with a good business to-day—Thursday—at 50s. 6d. fourteen days to 50s. 8d. cash, and 50s. 10½d. one month.

The quotations of makers' iron show an upward tendency. G.M.B. No. 1 is quoted 1s. higher; No. 3, 6d.; Gartsherrie, 2s. higher for No. 1; and the other special brands are from 6d. to 1s. 6d. over the prices of last week, with a few exceptions.

The malleable iron trade continues in a satisfactory state as far as the demands of home consumers are concerned, but there is room for improvement in the foreign department of the trade. Prices of all sorts of malleable iron are practically unaltered.

Last week's shipments of iron manufactures from the Clyde included £18,283 worth of machinery, of which £8350 was despatched to Madras, £3900 to Calcutta, £3800 to China, and £1380 to Mauritius; £34,300 worth of other iron articles, of which £19,000 went to Calcutta, £3750 to Madras, £1650 to Mauritius, £1300 to Bombay, £1100 to Rangoon, £1370 to Gothenburg, £1100 to New Zealand, £2000 the Mediterranean, and £1285 to Rio de Janeiro; £3000 sewing machines, in certain proportions to the Mediterranean and Oporto.

The coal trade in the west of Scotland is quiet, with the demand for household sorts gradually improving. Some of the larger contracts made are reported at slightly lower prices, but as a rule the rates are without alteration. The foreign shipments are moderate in extent. In the eastern mining counties the trade appears to be quieter, and a scarcity of shipping is reported at the Fife ports. A good steady trade, nevertheless, seems to be done.

A meeting of the miners of the Glasgow district was held a few days ago in the neighbourhood of Rutherglen—Mr. John Steel presiding—when it was reported that the Wellshot men were working on a sliding scale, based upon the selling price of coals per wagon. When coals were 6s. per wagon at the pit head, the men were paid 3s., and they received 6d. for each 1s. of advance up to 12s. Their present wage was 3s. 6d. per day. A set of rules drawn up by Mr. Daniel Brown, writer, Glasgow, was adopted, and it was resolved to form the district into a separate union, the objects of which were said to be the protection of the miners from intimidation on the part of the employers and managers; securing the regulation of wages by arbitration; looking after correct weighing on pit heads; giving compensation in cases of accident; and assisting in the prosecution or defence of law cases affecting the men.

Although the experimental trials of the Czar's yacht Livadia have been conducted privately on the Clyde, it has transpired that they have been most successful. Her three engines have a horse-power of between 11,000 and 12,000, and they have been found to propel her at a speed of about 18½ statute miles an hour, which is said to be two knots over the speed guaranteed by the builders, Messrs. Elder and Co. She has been fitted with Sir William Thomson's compasses, and all the apartments lighted with the electric light.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

THE output of best coals continues excessive, and the competition in pushing business at the various ports is as keen as ever I have known it. Cases have been instanced to me of late where prices have been ruled at the very lowest market quotations, and then, as an additional temptation, a discount offered of 5 per cent., or an equivalent to 6d. per ton. Viewed broadly the coal trade is well sustained, and export coastwise, and railway business, continues large.

Since January, and up to the end of September, the total coal sent from Cardiff foreign has been 3,707,670 tons; from Newport Mon., during the same period, 763,554 tons; and from Swansea, 618,336 tons. The quantity of coke from all Wales exported during the same period has been slightly under 28,000 tons, and of patent fuel 224,000 tons. Patent fuel is rapidly becoming one of the great specialities at Swansea, and in this article that place takes high precedence over the other ports. During this year the quantity sent from Swansea amounted to over 137,000 tons, while from Cardiff, in round numbers, only 85,000 tons were sent, and from Newport 4645 tons. Most of the Swansea business is being done in this article by the Atlantic Patent Fuel Company and Messrs. Cory and Co. The total exports of coal during the week from all Wales was a little over 125,000 tons, of which Cardiff sent 97,000 tons, being an increase, as compared with the week before, of 3000 tons. Newport showed a falling off to some extent; Swansea an increase, in comparison with the two weeks, of 5000 tons.

I note that the Garth Anchor and Chain Works, Taff Well, near Cardiff, are at last going to the hammer. They will be offered for sale this month. If prices had not been so stiff, they might have been floated during the last American spurt, and the same thing applies to Gadlys, Aberdare. I expect that if we get another American "boom," holders will show more sagacity. There are hopes of another, I hear; whispers are abroad amongst ironmasters that tenders on American account are coming into the market for 250,000 tons of steel rails.

Americans continue buyers, and Dowlais Works enjoy a fair share. In the Swansea district iron rails have been sold for £5 f.o.b. During the year the shipments of iron and steel from all Wales have been as follows:—From Cardiff, 133,402 tons; Newport, 143,940 tons; and from Swansea, 13,496 tons. During the past week the total has only reached 4462 tons.

There will be a start soon of the Western Mills, Cwmavon. The new furnace at the Treforest Iron and Steel Works, to which I have referred on several occasions, was blown in this week. It is of the pattern known as the Middlesbrough kind, is 70ft. in height, boshes are 17ft., and the hearth about 7ft.; capacity about 80 tons daily.

A strike is "on" at Brynaman amongst the puddlers. The managers wish to pay on the finished bar, and that the men should watch their own iron. This is objected to, and the strike has now lasted over a week.

There was a meeting at Swansea last week of tin-plate workers to confer on a grievance claimed to be suffered in respect of the number of sheets allowed by them to their employers as waste. Mr. Wm. Lewis occupied the chair, and deposed to a most varied arrangement in respect of waste at most of the works. At Abertillery the plates are weighed by the hundredweight. At Lydbrook, in the Forest, it was stated that the number of sheets detained from the men amounted to 3000 in the course of the year. The opinion at the close of the meeting seemed to be that two sheets each box would about meet the case.

Prices of tin-plate still rule slow. During the last month the quantity of Middlesbrough pig sent into Wales amounted to 6416 tons, and of finished iron 84 tons only.

A railway is projected from Bridgend to Southerndown. There is also a quiet movement going on to "tap," as it is called, the Rhondda Valley from the western side.

The colliers of the Neath district have had a meeting supporting the other districts in regard to the nine hours movement and the appoinment of working men inspectors.

The chief buyers of Welsh iron this year have been America and India, South America and Bombay taking the largest shipments. It will be seen by the price list that lower quotations are ruling. These may be taken as authentic, but in the matter of quantity still lower figures might be accepted. I hear of ordinary iron rails sold for under £5.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending Oct. 9th, 1880:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 8569; mercantile marine, building materials, and other collections, 2996. On Wednesday, Thursday and Friday, admission 6d., from 10 a.m. till 4 p.m., Museum, 1751; mercantile marine, building materials, and other collections, 419. Total, 13,735. Average of corresponding week in former years, 18,576. Total from the opening of the Museum, 19,399,295.

NAVAL ENGINEER APPOINTMENTS.—The following appointments have been made at the Admiralty:—William F. Coope and Henry T. Liversedge, engineers, to the Superb, for temporary service; Richard S. Wilcocks, engineer, to the Mallard; John J. Warren, engineer, to the Whiting; and George Brewer, engineer, to the Zephyr; Henry Gallery, assistant-engineer, to the Superb, and Henry Attwool, assistant-engineer, to the Asia, additional, for temporary service in the Mercury; John A. Lodge, chief engineer, to the Indus, additional, for service, in the Reserve; Peter Murray, engineer, to the Cockatrice; Edward Little, engineer, to the Nankin, additional, for service in the Ajax; and Richard Irwin, engineer, to the Duncan, additional, for service in the Hydra.

THE INVENTION OF THE REAPING MACHINE.—Since the publication of the particulars respecting the inventor of the reaping machine in the Society of Arts "Journal" (Vol. xxvi.), Mr. G. K. Thompson has continued his inquiries on the subject, and now sends some further corroboration of the claims of John Common. Mr. Thompson writes as follows:—"Sir,—Two years ago, you kindly inserted in your 'Journal' some particulars respecting the invention of the reaping machine, and in support of the claim of Mr. John Common to that honour. I have been since then making further inquiries on the subject, and I think the enclosed communication, which I have just received from a descendant of the Mr. Thomas Brown, who made parts of the machine from Common's instructions, will strengthen that claim, and thus prove conclusively that Mr. McCormick is not the inventor; nor is the machine American, but wholly English. The dates given coincide with Common's statements in every way. (See 'Journal' of Society of Arts, March 22nd, April 5th and 26th, 1878.) Perhaps you can find space in your 'Journal' for this further light on the matter, and oblige yours faithfully, G. H. THOMPSON." The following is a copy of the letter alluded to above:—"74, Brook-street, Toronto, March 15th, 1880.—My dear Sir,—Your favour of Feb. 13th, and copy of *Alnwick Journal* are duly to hand. In reference to your inquiries regarding my grandfather, the late Thomas Brown, and his family, formerly of Alnwick, I beg to say they emigrated to Quebec, Canada, and shortly after removed to the town of Sterling, Cayuga County, State of New York, United States, where he purchased a farm, and resided there until his death, in March, 1850. With respect to the invention of the reaping machine, all I know is what my grandfather, the late Thomas Brown, and his son Peter told me, which is that McCormick, who at that time resided at Auburn, some 20 to 30 miles south from Sterling, in the same county, having heard of my grandfather, came to him and inquired about his reaping machine. He explained it to McCormick fully, and gave him a model of the machine (I never heard patterns mentioned). This was a few years (perhaps five) before I came to see my grandfather, in 1848; I, therefore, never saw a pattern or model of the machine, and, consequently, can give you no information regarding it; nor did I ever hear the name of a Mr. Common mentioned. I have in my possession a scrap-book belonging to my late grandfather, containing a controversy, or series of letters, published in the *Newcastle Chronicle* of August, 1821, between him and John French, a blacksmith, regarding the invention of turnip seed drill, and herein I enclose you a copy of part of one of the letters, being the only mention made of the reaping machine. During my residence with my grandfather and uncle Peter, I had several conversations in regard to his inventions of the 'Northumberland iron plough,' 'seed drills,' 'tobacco cutter,' 'turnip cutter,' 'tallow cutter,' 'fruit crusher,' &c., also his reaping machine, but nothing was ever elicited about the reaper but that McCormick, of Auburn, got the model, and soon commenced manufacturing them. It is, therefore, beyond all doubt that McCormick got his first idea of the reaping machine from my late grandfather, Thomas Brown.—Very truly yours, J. P. NICHOL. Mr. G. H. Thompson, Alnwick." Extract from the *Newcastle Chronicle*, August 8th, 1821:—"With respect to my reaping machine, I can give Mr. F. the lie direct in every statement. I never received 30 guineas, and I made a machine fit for the field. The *Newcastle Chronicle* of October 19th, 1816, states that it was tried on October 3rd, 1816, in a field of wheat belonging to T. Dodds, Esq., south side, and far exceeded the expectation of everyone who saw it work, and bids fair to give satisfaction; it will cut six or seven acres a day, and much more even and low than by the sickle, &c. It was also tried before a number of gentlemen farmers at the barn-yards, and gave equal satisfaction. The labouring people reproached me with taking the bread out of their mouths, and I was induced to desist from (making) the machine, from the extreme opposition they showed to it.—THOMAS BROWN."

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

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

Grants and Dates of Provisional Protection for Six Months.

2546. Steam Traps or Drain Valves, W. Davis, Enfield. —*29th June*, 1880.
3176. Engines, W. H. Northcott, Hatcham Ironworks, Pomeroy-street, London.—*3rd August*, 1880.
3204. Cooking Stoves, I. Chorlton, Manchester.—*5th August*, 1880.
3300. Tempering Cast Steel, &c., C. Kesseler, Mohrenstrasse, Berlin, Germany.—A communication from D. W. Reunert, Annen, Westphalia, Germany.—*13th August*, 1880.
3314. Beating, Scouring, and otherwise Purifying Carpets, &c., J. Lea, Lark-lane, Toxteth—*14th August*, 1880.
3500. Closing or Fastening Gloves, J. Tréfousse, Chaumont, France.—*28th August*, 1880.
3502. Safety Cases, F. Cooper, Handsworth.—*28th August*, 1880.
3678. Purifying and Cleansing Gases, W. Foulis, Glasgow.—*10th September*, 1880.
3681. Jacquard Machinery for Weaving, T. Spivey, Birstal.—*10th September*, 1880.
3686. Cooling Atmospheric Air, J. Sturgeon, Newlay. —*10th September*, 1880.
3688. Springs, H. L. Wilson and J. Clegg, Atlas Works, Clayton-le-Moors.—*10th September*, 1880.
2692. Damask Looms, W. R. Lake, Southampton-buildings, London.—A communication from J. L. Döhmer, Crefeld, Germany.—*10th September*, 1880.
3694. Spring Mattresses, H. Lazarus, Old-street, London.—*10th September*, 1880.
3696. Couplings or Unions for Taps and Pipes, S. Mason, Birmingham.—*11th September*, 1880.
3698. Converting Skins into Leather, R. Brown, Ayr.—*11th September*, 1880.
3700. Sash Fasteners, W. Lea, Bloomsbury Foundry, Wolverhampton.—*11th September*, 1880.
3704. Screw Propellers, C. Jones, Liverpool.—*11th September*, 1880.
3708. Self-acting Cask-tilters, J. and H. J. Brookes and F. Mason, Smethwick.—*11th September*, 1880.
3710. Lids or Covers of Tea and Coffee-pots, &c., J. Clarke, Cobridge.—*11th September*, 1880.
3712. Tool for Cutting Circular Holes in Metal Plates, &c., E. H. Bennett, Leadenhall-street, London.—*11th September*, 1880.
3714. Beating Carpets, S. Simmons, St. Augustine-road, Camden-square, London. — *11th September*, 1880.
3716. Sewing Machines, T. Chadwick, T. Sugden, and C. Shaw, Oldham.—*13th September*, 1880.
3718. Motive Power Engines, W. Adair, Liverpool.—*13th September*, 1880.
3720. Liquid Meters, H. J. Haddan, Strand, Westminster.—A communication from P. T. y Puig, Barcelona, Spain.—*13th September*, 1880.
3724. Pianofortes, R. Howson, Middlesbrough.—*13th September*, 1880.
3726. Furnaces, D. A. Horsnell, King's-road, Chelsea, London.—*13th September*, 1880.
3728. Gunpowder and Cartridges, G. V. Fosbery, Southampton-buildings, London.—A communication from H. Studer, Paris—*13th September*, 1880.
3730. Gas, A. Pope, Gotha Ironworks, Slough.—*13th September*, 1880.
3732. Boxes, A. C. Henderson, Southampton-buildings, London.—A communication from A. Henry, Lyon, France.—*13th September*, 1880.
3734. Signalling at Sea or on Land, A. M. Ritchie, Dundee.—*14th September*, 1880.
3736. Rolling Mills, G. W. von Nawrocki, Leipzigerstrasse, Berlin, Germany.—A communication from J. Schmidt, Schwelm, Westphalia, Germany.—*14th September*, 1880.
3738. Floats for Fishing Purposes, G. J. Archer, Westbourne Park, London.—*14th September*, 1880.
3740. Safety Nuts for Axles of Vehicles, &c., H. Anderson, San Francisco, U.S.—*14th September*, 1880.
3742. Securing the Fastenings of the Permanent Way of Railways, &c., R. J. Hinton, Southall, and S. W. Yockney, Queen Anne's-gate, Westminster.—*14th September*, 1880.
3744. Bicycles, &c., M. Webb, Junior Garrick Club, Adelphi-terrace, London.—*14th September*, 1880.
3746. Match-box, J. Jacoby, King's-street, Covent-garden, London.—*15th September*, 1880.
3752. Turning, &c., Wood and other Materials, L. Vallet, Liverpool.—*15th September*, 1880.
3754. Coating Iron with Zinc or Tin, &c., W. R. Lake, Southampton-buildings, London.—A communication from J. B. Jones and H. W. Shepard, Brooklyn, U.S., and R. Seaman, New York, U.S.—*15th September*, 1880.
3756. Railways and Rolling Stock, J. le Clair and J. de Rees, Newport.—*16th September*, 1880.
3760. Wheelbarrows, F. Wirth, Frankfort-on-the-Maine, Germany.—A communication from A. W. Pletsch, Landstuhl, Germany.—*16th September*, 1880.

Inventions Protected for Six Months on the Deposit of Complete Specifications.

3966. Pianofortes, &c., F. Wolff, Copenhagen.—A communication from A. Hellig, Little Ferry, New Jersey. —*30th September*, 1880.
3984. Horseshoe Nails, W. R. Lake, Southampton-buildings, London.—A communication from J. M. Laughlin, Boston, Massachusetts, U.S.—*1st October*, 1880.
4034. Threading or Screwing Bolt and Screw Blanks, S. Pitt, Sutton.—A communication from S. L. Worsley, Buffalo, U.S.—*5th October*, 1880.

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

3708. Spinning, &c., Machinery, M. Dunlop, Croft-head.—*5th October*, 1877.
3752. Decorticating, &c., Rice and other Grain, G. H. Carbutt, Great Tower-street, London. — *9th October*, 1877.
3768. Fabrics, W. J. Sly and T. Wilson, Lancaster.—*11th October*, 1877.
3720. Boots, Shoes, &c., H. C. Gros, South Hackney, London.—*6th October*, 1877.
3722. Producing a Temporary Vacuum in Condensers, &c., of Steam Engines, G. Rodger, Barrow-in-Furness.—*8th October*, 1877.
3742. Dyeing Textile Fibres, T. Holliday, Huddersfield.—*9th October*, 1877.
3803. Working Self-acting Grapple Buckets and Forks, W. D. Prestman, Kingston-upon-Hull.—*13th October*, 1877.
3839. Distributing, &c., Atmospheric Electricity Currents, P. Jablochkoff, Paris.—*17th October*, 1877.
1387. Fixing Glass, &c., to Windows, Roofs, Floors, and other parts of Structures, A. H. Price, St. John's, South Norwood.—*8th April*, 1877.
3712. Substitute for Coffee, J. L. de Montoison, Manchester.—*6th October*, 1877.
3736. Steam Boilers, H. Wedekind, Fenchurch-street, London.—*9th October*, 1877.
3732. Forming Flanches on Cylinders, &c., G. Kellett, T. Holdsworth, and J. Levick, Croft-street Boiler Works, Bradford.—*8th October*, 1877.
4878. Lenses, W. P. Thompson, Lord-street, Liverpool.—*24th December*, 1877.
4071. Condensing, &c., Gas and other Vapours, T. N. Kirkham, Abingdon-street, Westminster, D. Hulett, High Holborn, London, and S. Chandler, Newington-causeway, London.—*2nd November*, 1877.
3771. Permanent Way of Railways, A. J. Acaster, Princess Works, Sheffield.—*11th October*, 1877.
3877. Furnaces of Steam Boilers, J. Head and J. R. Jefferies, Orwell Works, Ipswich.—*19th October*, 1877.
4244. Producing Optical Illusions, C. E. Reynaud, Paris.—*13th November*, 1877.
4467. Mouldings, A. C. Engert, Three Mills-lane, Bromley-by-Bow, London.—*27th November*, 1877.

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

3252. Cupola Furnaces, E. Voisin, South-street, Finsbury, London.—*7th October*, 1873.
3257. Knitting Machinery, H. J. Griswold, Hop and Malt Exchange, Southwark-street, London.—*8th October*, 1873.
3272. Cutting Splints, E. Pace, Warwick-road, Upper Clapton.—*9th October*, 1873.
3287. Treating Oils and Fat, R. Hutchison, Glasgow. —*10th October*, 1873.
3298. Fixing Capsules on Bottles, P. Paterson, South back of Canongate, Edinburgh, and J. Ritchie, Roseburn Works, Murrayfield, near Edinburgh.—*11th October*, 1873.

Notices of Intention to Proceed with Patents.

2266. Knives and Forks, W. E. Darwin, Sheffield.—*3rd June*, 1880.
2267. Table Cutlery, T. McGrah and C. H. Wood, Sheffield.—*3rd June*, 1880.
2272. Electricity, T. Slater, Westbourne Park, London. —*3rd June*, 1880.
2277. Ring Spinning, Doubling, and Twisting Frames, T. Guest and T. Brookes, Manchester.—*4th June*, 1880.
2281. Stands for Decanters, Bottles, and Jar J. Betjemann, Pentonville-road, London.—*4th June*, 1880.
2282. Repairing Shafts, &c., W. P. Thompson, High Holborn, London.—A communication from Messrs. Chavignot et Gérard.—*5th June*, 1880.
2284. Excavator, J. F. Sang, Sackville-street, Piccadilly, London.—*5th June*, 1880.
2291. Spring, &c., Bottom Beds, R. Hunt, Liverpool. —*7th June*, 1880.
2298. Steering Ships, &c., T. B. Heathorn, Knightsbridge.—*7th June*, 1880.
2304. Copying Plans, &c., W. P. Thompson, High Holborn, London.—A communication from A. Joltrain.—*8th June*, 1880.
2306. Metallic Alloys, G. A. Dick, Cannon-street, London.—Partly a communication from C. J. A. Dick.—*8th June*, 1880.
2315. Vehicle, W. R. Lake, Southampton-buildings, London.—A communication from A. Vick and T. J. Harbach.—*8th June*, 1880.
2316. Dessert Plates, &c., C. H. Wood, Sheffield.—*8th June*, 1880.
2319. Moving Heavy Bodies, T. Hodge, Kingston-upon-Hull.—*9th June*, 1880.
2361. Umbrellas, J. Forster, Vienna. — *11th June*, 1880.
2377. Waterproofing Leather, Hides, &c., W. R. Lake, Southampton-buildings, London.—A communication from J. Ballatschano and C. Ballatschano.—*11th June*, 1880.
2386. Metal Founders' Blacking, J. S. Sawrey and A. Paterson, Ulverston.—*12th June*, 1880.
2391. Varying the Height of Seats, &c., W. Dawes, Leeds.—*12th June*, 1880.
2477. Bookbinding, W. L. Wise, Westminster.—A communication from Messrs. Martini and Co.—*18th June*, 1880.
2491. Slotting and Planing Machines, J. Barrow and J. Craven, Leeds.—*19th June*, 1880.
2501. Braiding Machinery, W. E. Jefferson and E. Lee, Leicester.—*21st June*, 1880.
2539. Operating Points and Signals, H. J. Johnson, Eccles.—*22nd June*, 1880.
2595. India-rubber Products, H. Gerner, New York. —*25th June*, 1880.
2636. Umbrellas, &c., S. E. Carlisle, Duke-street, London.—A communication from A. MacMillan.—*28th June*, 1880.
2832. Stamp Cushions, G. W. von Nawrocki, Berlin.—A communication from W. Haber.—*9th July*, 1880.
2899. Fuel Products, W. Gorman, Glasgow.—*14th July*, 1880.
3256. End-plate for Steam Boilers, J. A. Hopkinson and J. Hopkinson, Huddersfield.—*9th August*, 1880.
3476. Lock Nail, R. C. Perry, Manchester. — *27th August*, 1880.
3541. Fastening Sacks or Bags, D. A. B. Murray, jun. —*1st September*, 1880.
3544. Horseshoe Nails, &c., W. W. Clark and J. Priestley, Bolton-le-Moors.—*1st September*, 1880.
3607. Gas Engines, H. W. T. Jenner, Handsworth.—*4th September*, 1880.
3663. Boiling Eggs, J. C. Mewburn, Fleet-street, London.—A communication from L. M. A. Couchoud. —*9th September*, 1880.
3740. Safety Nuts, H. Anderson, San Francisco.—*14th September*, 1880.
3754. Coating Iron with Zinc or Tin, W. R. Lake, Southampton-buildings, London.—A communication from J. B. Jones, H. W. Shepard, and R. Seaman.—*15th September*, 1880.
3851. Ploughs, P. M. Justice, Southampton-buildings, London.—A communication from C. E. Sackett.—*23rd September*, 1880.
2290. Road Vehicles, &c., L. Hardaker, Leeds.—*7th June*, 1880.
2325. Discharging Torpedoes, J. E. Atkinson, Greenwich.—*9th June*, 1880.
2332. Feeding Animals, W. Griffiths, Shrewsbury.—*9th June*, 1880.
3335. Securing the Covers of Umbrellas to their Frames, H. Shaw and W. Spencer, Birmingham.—*9th June*, 1880.
2336. Receptacles, H. Shaw and W. Spencer, Birmingham.—*9th June*, 1880.
2337. Gasaliers, R. Phelps, Birmingham.—*10th June*, 1880.
2338. Condensing Steam Engine and Boiler, J. G. Wilson, Manchester.—A communication from H. Hoffmeister and E. Friedrich.—*9th June*, 1880.
2339. Holding Together Letters, Bills, &c., T. Birbeck and J. E. Miller, Sunderland.—*9th June*, 1880.
2345. Engine Governors, H. J. Haddan, Strand, Westminster.—A communication from E. Mas.—*9th June*, 1880.
2348. Steam Generators, J. C. Mewburn, Fleet-street, London.—A communication from L. Dulac.—*10th June*, 1880.
2352. Metal Heels, J. W. Jones, Holloway, and E. K. Bridger, London.—*10th June*, 1880.
2365. Packing Substances into Parcels, W. A. G. Schönheyder, Stoke Newington, London.—*11th June*, 1880.
2367. Wire Heddles, H. E. Newton, Chancery-lane, London.—A communication from A. Argo.—*11th June*, 1880.
2372. Paper-making Machinery, J. Hird, Bishopston. —*11th June*, 1880.
2373. Copying Letters, S. A. Cochrane, Dublin.—*11th June*, 1880.
2385. Harvesting Machines, C. D. Abel, Southampton-buildings, London. — A communication from M. Gorel.—*12th June*, 1880.
2410. Combing Wool, &c., J. H. Johnson, Lincoln's-inn-fields, London.—A communication from A. Skene and L. Devallée.—*14th June*, 1880.
2411. Combing Wool, &c., J. H. Johnson, Lincoln's-inn-fields, London.—A communication from A. Skene and L. Devallée.—*14th June*, 1880.
2416. Marine Chronometers, J. S. Matheson, Leith. —*15th June*, 1880.
2457. Brake Levers, E. W. Lomm, Brixton.—*17th June*, 1880.
2482. Heating, Hardening, and Tempering Steel Wire, J. Sykes, Lindley, near Huddersfield.—*19th June*, 1880.
2639. Railway Brakes, W. T. Clark, Crick, near Rugby, and W. H. Ashwell, The Oval, Bedford.—*28th June*, 1880.
3119. Warping, &c., Yarn, J. Walmsley and S. Lang, Blackburn.—*29th July*, 1880.
3197. Power Looms, W. H. Beck, Cannon-street, London.—A communication from J. Lehoux and A. Rigot.—*4th August*, 1880.
3199. Preparing Grain or Corn for Brewing, &c., E. R. Southby, Holborn Viaduct, London. — *5th August*, 1880.
3281. Sewing Machines, F. Cutlan, Cardiff. — *11th August*, 1880.
447. Mixture for Medicinal Purposes, W. Williams, Hampden-street, Clarendon-square, St. Pancras.—*25th August*, 1880.
3451. Traps for Birds, &c., R. J. Sankey, Margate.—*26th August*, 1880.
3474. Excavating Machinery, F. Hurd, Wakefield.—*27th August*, 1880.
3494. Electric Lamps, St. G. L. Fox, Telegraph-street, London.—*28th August*, 1880.
3572. Paper-making, J. Hawthorn, Newtown.—*3rd September*, 1880.
3622. Compressing Black-lead, &c., W. C. James, Woodside.—*6th September*, 1880.
3630. Regulating the Flow or Pressure of Illuminating Gas, D. B. Peebles, Bonnington.—*7th September*, 1880.
3634. Looms, W. Clayton, Macclesfield.—*7th September*, 1880.
3701. Locks and Latches, J. M. Hart, Cheapside, London.—*11th September*, 1880.
3984. Horseshoe Nails, W. R. Lake, Southampton-buildings, London.—A communication from J. M. Laughlin.—*1st October*, 1880.
4034. Threading or Screwing of Bolt and Screw Blanks, S. Pitt, Sutton.—A communication from S. L. Worsley.—*6th October*, 1880.

All persons having an interest in opposing any one of such applications should leave particulars in writing of their objections to such application at the office of the Commissioners of Patents within twenty-one days after date.

List of Specifications published during the week ending October 9th, 1880.

678, 2d.; 812, 6d.; 823, 6d.; 848, 4d.; 865, 6d.; 870, 2d.; 891, 6d.; 952, 2d.; 990, 6d.; 991, 6d.; 992, 2d.; 993, 4d.; 994, 2d.; 995, 6d.; 996, 2d.; 999, 4d.; 1000, 6d.; 1001, 6d.; 1003, 6d.; 1004, 4d.; 1005, 6d.; 1006, 2d.; 1008, 8d.; 1010, 2d.; 1011, 2d.; 1012, 2d.; 1013, 6d.; 1016, 2d.; 1019, 2d.; 1020, 6d.; 1021, 6d.; 1022, 2d.; 1024, 2d.; 1025, 6d.; 1026, 6d.; 1027, 6d.; 1028, 6d.; 1029, 6d.; 1030, 2d.; 1031, 2d.; 1032, 8d.; 1033, 6d.; 1034, 4d.; 1036, 2d.; 1037, 2d.; 1038, 2d.; 1039, 2d.; 1040, 6d.; 1041, 2d.; 1042, 6d.; 1043, 2d.; 1044, 4d.; 1046, 2d.; 1047, 4d.; 1048, 6d.; 1049, 2d.; 1050, 2d.; 1052, 8d.; 1054, 6d.; 1055, 6d.; 1056, 6d.; 1057, 2d.; 1058, 4d.; 1059, 6d.; 1060, 6d.; 1061, 6d.; 1062, 6d.; 1064, 2d.; 1065, 2d.; 1066, 2d.; 1067, 6d.; 1068, 2d.; 1070, 6d.; 1071, 6d.; 1072, 2d.; 1073, 6d.; 1074, 6d.; 1075, 6d.; 1076, 2d.; 1077, 2d.; 1078, 6d.; 1080, 6d.; 1081, 2d.; 1082, 10d.; 1083, 2d.; 1084, 6d.; 1086, 6d.; 1087, 4d.; 1088, 6d.; 1089, 2d.; 1090, 2d.; 1091, 10d.; 1094, 2d.; 1095, 6d.; 1096, 6d.; 1097, 2d.; 1098, 6d.; 1099, 2d.; 1105, 6d.; 1116, 6d.; 1130, 6d.; 1170, 4d.; 1225, 6d.; 1235, 1s.; 1268, 8d.; 1437, 4d.; 2132, 4d.; 2734, 6d.; 2956, 4d.; 2978, 6d.

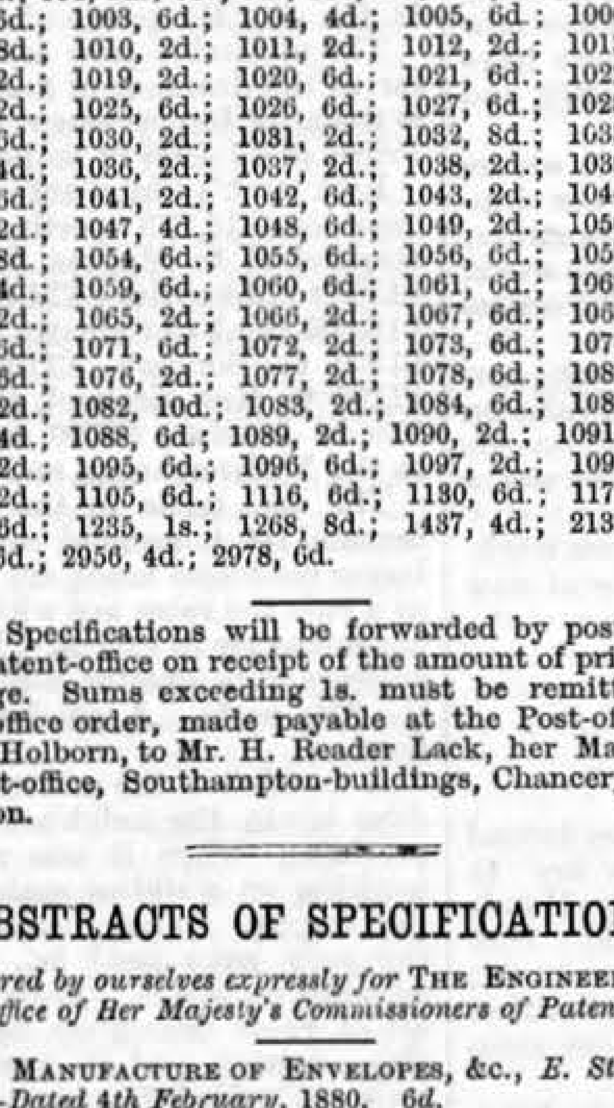
*** Specifications will be forwarded by post from the Patent-office on receipt of the amount of price and postage. Sums exceeding 1s. must be remitted by Post-office order, made payable at the Post-office, 5, High Holborn, to Mr. H. Reader Lack, her Majesty's Patent-office, Southampton-buildings, Chancery-lane,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

ABSTRACTS OF SPECIFICATIONS.

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

482. Manufacture of Envelopes, &c., *E. Sturge.—Dated 4th February*, 1880. 6d.

This relates to improvements on patent No. 1745, dated 5th May, 1877, in the dabbing and folding mechanism, the gum cistern, and corner guides, and in the creaser or die, and an arrangement of bellows and puffers.



671. Electric Telegraph for Railway Trains, *G. Dalström.—Dated 16th February*, 1880. 6d.

This consists in arranging telegraph wires along lines of railway and in connection with trains, in such manner as by apparatus to place each running train in uninterrupted communication with the various stations as also with every other train on the same line.

678. Internal Construction of Cottages, &c., *T. W. Yardley and B. Goodhead.—Dated 16th February*, 1880.—(*Provisional protection not allowed.*) 2d.

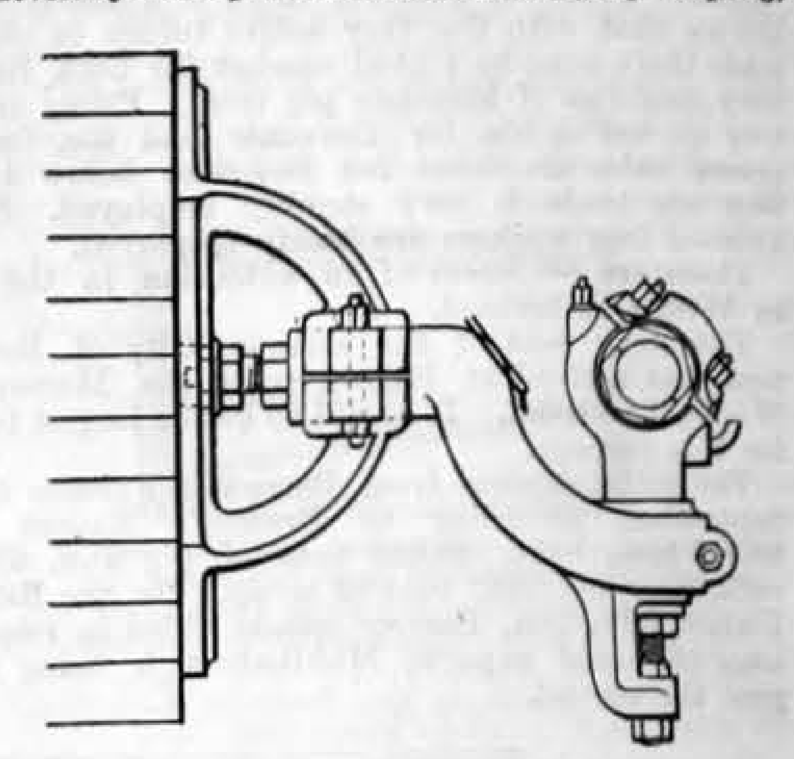
This consists in making a returned staircase standing at the top in a space of between 2ft. and 3ft. less than the starting at the bottom.

759. Applying Several Colours to any Surface at the same Time, *D. T. Powell.—Dated 20th February*, 1880.—(*Not proceeded with.*) 2d.

The apparatus consists of an ink table divided into two, three, or more channels, and is attached to the bed of the printing machine in like manner as an ordinary ink-table. Movable strips of suitable material are so arranged in the channel that they correspond with the lines of type or surface to be inked or coloured. At the end of the machine where the ink duct is generally placed, is fixed two, three, or more ink ducts at distances from each other equal with the widths of the channels in the ink-table, and below each of these ink ducts having its axis in the side frame, is a distributing cylinder or "mouse" to which is imparted, in addition to a continuous revolutionary motion, a lateral or oscillating motion for the more even distribution of the colour or ink.

676. Shaft Brackets, &c., *J. S. Taylor and S. W. Challen.—Dated 16th February*, 1880. 10d.

This consists partly in the construction of bracket base pieces of various forms, such base pieces having severally a sole plate and either a cramping coupling,



a split-boss or a half-bearing, respectively furnished with lugs from cramping bolts, either straight or staple, formed for the purpose of gripping and rigidly holding the adjustable ends of extension pieces after their final adjustment.

782. Rotary Knife Cleaners, *W. Scott.—Dated 23rd February*, 1880.—(*Not proceeded with.*) 2d.

This consists in forming two discs with hollow centres and covering the inner faces with rubbing surfaces, such as corticine or other like body, which is fixed by cement or otherwise to the projecting inner portions of each disc as to rotate with them. The hollows of the discs serve to contain the desired quantity of emery or other powder between the corticine or like body and the dished back of each disc, a hole being formed at the bulged edge of the dishing for the hollow to be charged and closed by a plug or closer.

802. Textile Driving Belts or Bands, *H. Birkmyre.—Dated 24th February*, 1880.—(*Void.*) 2d.

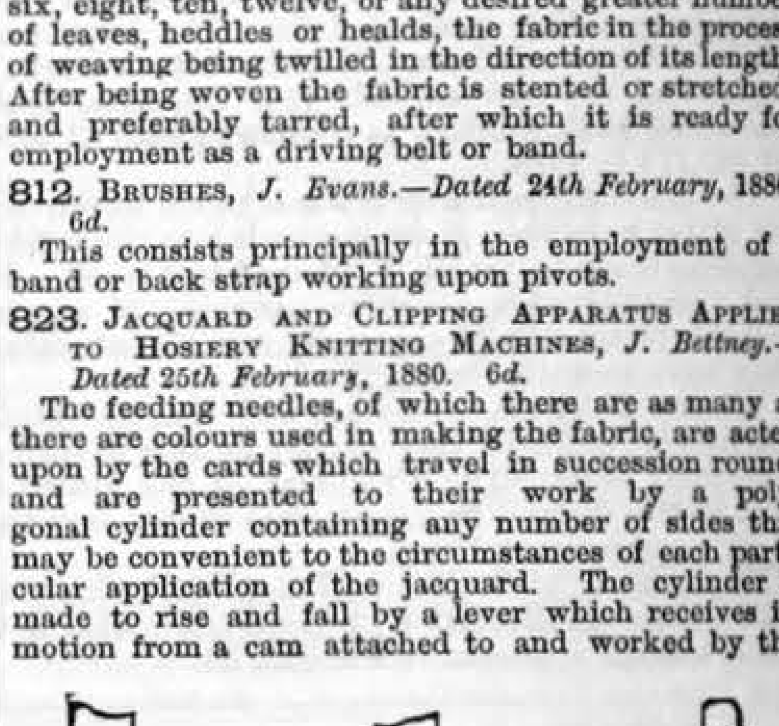
The flax, hemp, or other yarn, which may be composed either of a single thread or of a number of threads stranded or twisted together, is warped in the usual manner and then woven in a loom with four, six, eight, ten, twelve, or any desired greater number of leaves, heddles or healds, the fabric in the process of weaving being twilled in the direction of its length. After being woven the fabric is stented or stretched, and preferably tarred, after which it is ready for employment as a driving belt or band.

812. Brushes, *J. Evans.—Dated 24th February*, 1880. 6d.

This consists principally in the employment of a band or back strap working upon pivots.

823. Jacquard and Clipping Apparatus Applied to Hosiery Knitting Machines, *J. Bettney.—Dated 25th February*, 1880. 6d.

The feeding needles, of which there are as many as there are colours used in making the fabric, are acted upon by the cards which travel in succession round, and are presented to their work by a polygonal cylinder containing any number of sides that may be convenient to the circumstances of each particular application of the jacquard. The cylinder is made to rise and fall by a lever which receives its motion from a cam attached to and worked by the



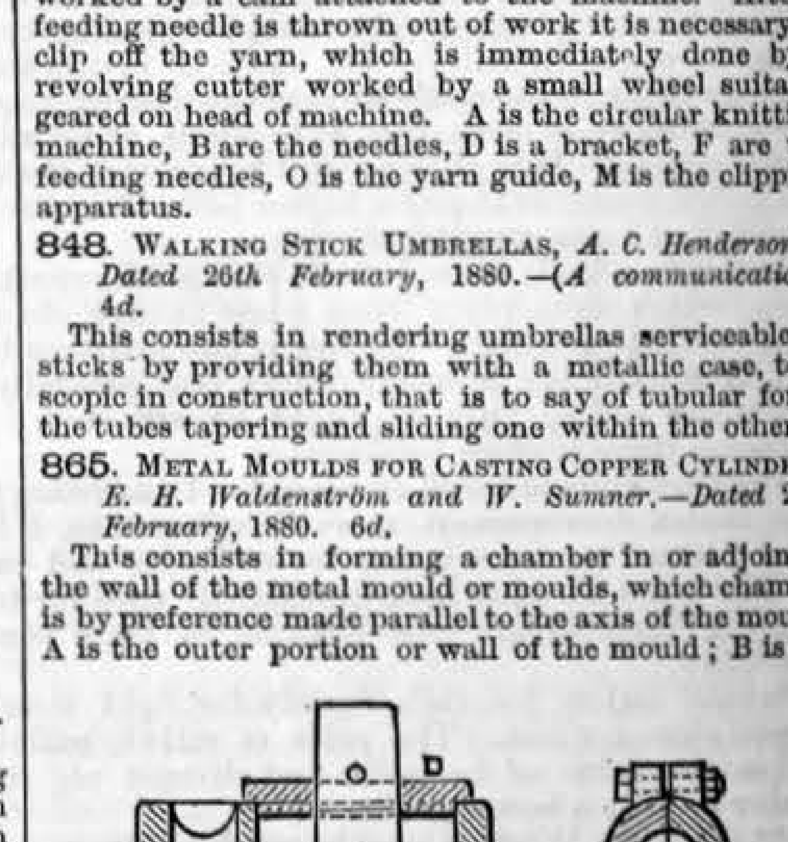
machine. The cylinder is also made to revolve while falling, so as to present a fresh side and card to act upon the feeding needles every time it rises again. When a feeding needle is put into work by a card it is held there by a spring while the cylinder and card descends, and until it is required to put another into work, when it is released by a lever which is also worked by a cam attached to the machine. After a feeding needle is thrown out of work it is necessary to clip off the yarn, which is immediately done by a revolving cutter worked by a small wheel suitably geared on head of machine. A is the circular knitting machine, B are the needles, D is a bracket, F are the feeding needles, O is the yarn guide, M is the clipping apparatus.

848. Walking Stick Umbrellas, *A. C. Henderson.—Dated 26th February*, 1880.—(*A communication.*) 4d.

This consists in rendering umbrellas serviceable as sticks by providing them with a metallic case, telescopic in construction, that is to say of tubular form, the tubes tapering and sliding one within the other.

865. Metal Moulds for Casting Copper Cylinders, *E. H. Waldenström and W. Sumner.—Dated 27th February*, 1880. 6d.

This consists in forming a chamber in or adjoining the wall of the metal mould or moulds, which chamber is by preference made parallel to the axis of the mould; A is the outer portion or wall of the mould; B is the



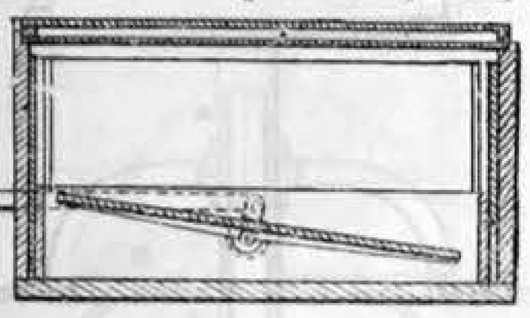
interior in which the cylinder is cast; C is the mandril; D is the cover of the mould; and D¹ the bottom plate; E¹ is the chamber and E is the aperture, tangential, or nearly so, to the inner circumference of the mould, connecting the chamber with the lower portion of the interior of the mould; F is a hole out of which the mandril drops when it is knocked out of the casting. The moulds are made in two parts, and are bolted together, as shown at G.

870. Spinning and Twisting Fibres, *J. Walsh and J. Farran.—Dated 27th February, 188'.—(Provisional protection not allowed.)* 2d.

To the trail lever a curved or excentric lever is attached, which is connected with the backing-off chain. There is also an anti-friction bowl or pulley, in such position as that during the traverse of the carriage the curved lever is brought in contact with the pulley or bowl referred to, the curved or excentric lever being thereby operated so that the backing-off snail is pulled over, and the slack of the backing-off chain is taken up, ensuring the regular formation of the cop.

887. Making Artificial Ice, *C. E. Young.—Dated 28th February, 1880.* 4d.

In the bottom part of each bank or receptacle is placed an apparatus working on a fixed pivot constructed of a board or flap of metal, wood, hardened



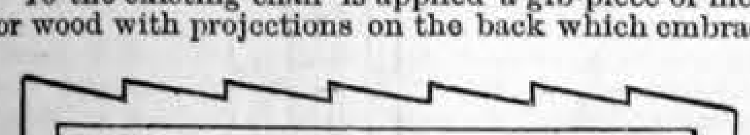
india-rubber, or any appropriate material adapted, by the combination of pivotted levers to produce the rising and falling movement of the water like a wave, maintaining in each of the cells a continual movement of revolution in the water.

891. Folding, Doubling and Twisting Machinery, *T. Coltman.—Dated 1st March, 1880.* 6d.

This consists in the construction and employment of a series of thread guiding balanced weighted levers, each of which upon the thread it guides breaking, releases a catch lever which holds two ends of a three-ended lever clear of the teeth of two incline wheels or plates, but upon the thread breaking the two ends of the lever stop the said wheels without stopping the driving shaft.

892. Securing Rails to Chairs, *G. C. Barker.—Dated 1st March, 1880.* 6d.

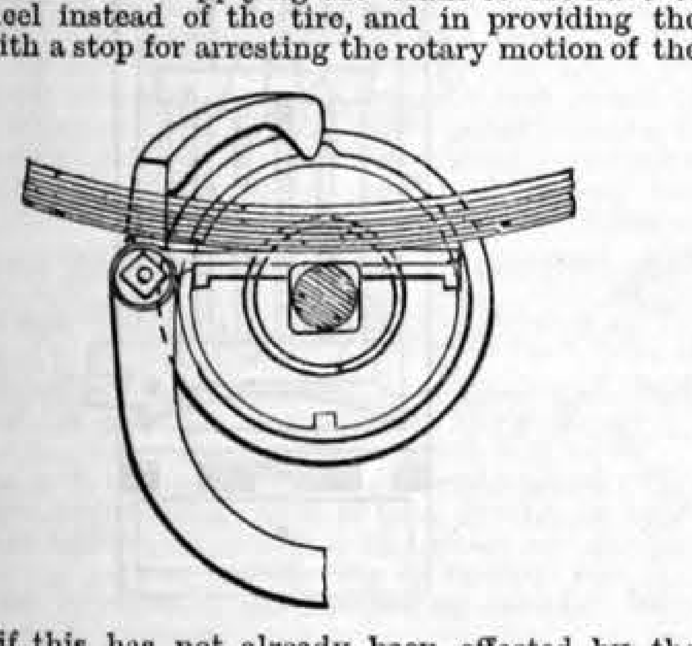
To the existing chair is applied a gib-piece of metal or wood with projections on the back which embraces



part of the sides of the chair at each end closely, so that when the gib-piece is pressed against the chair the projections prevent any lateral movement.

893. Brakes, *W. Foreman and A. H. Bennet.—Dated 1st March, 1880.* 4d.

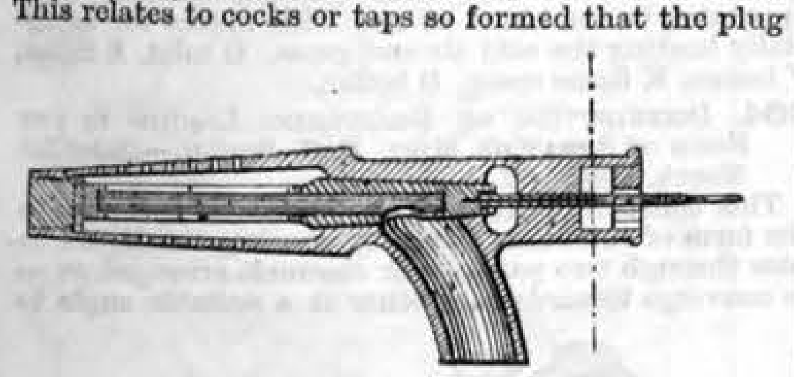
This consists in applying the brake to the nave of the wheel instead of the tire, and in providing the nave with a stop for arresting the rotary motion of the



wheel, if this has not already been effected by the friction of the brake. A hoop provided with a projection encircles the nave which comes against a projection on a crank lever under the control of the driver.

894. Cocks or Taps for Fluids, *C. J. Waddell.—Dated 1st March, 1880.* 6d.

This relates to cocks or taps so formed that the plug



is accessible and can be passed into or be removed from its position at the tail end only.

895. Furnaces, *E. F. Redfern.—Dated 1st March, 1880.—(A communication.)—(Not proceeded with.)* 2d.

This relates to devices for supplying steam and air to the fire chamber of furnaces to assist combustion.

898. Furnaces, *E. A. Brydges.—Dated 1st March, 1880.—(Partly a communication.)—(Not proceeded with.)* 2d.

This consists in a method for obtaining perfect combustion of the coal or other fuel in the furnaces.

899. Combined Galvanic Batteries and Medicated Pads for the Cure of Bodily Diseases, *A. M. Clark.—Dated 1st March, 1880.—(A communication.)* 6d.

This consists in the combination of a galvanic battery formed of plates of zinc, felt, and copper, and a medicated pad, so that a circuit of galvanic electricity may be incited by moisture absorbed from the patient's

body, while at the same time the patient receives benefit from the medicaments contained in the pad; also in the combination of a spiral conduction wire with two batteries and pads, so that the current of electricity will pass through both batteries and patient's body in the same circuit.

900. Rolling Machine for the Manufacture of Chisels, Drawing Knives, &c., *W. R. Lake.—Dated 1st March, 1880.—(A communication.)—(Not proceeded with.)* 2d.

An upper roll is provided with a segmental die and a lower roll with a circular or annular die, whereby the lower roll is enabled to act as a support and guide in presenting the blank to the action of the upper die, thereby dispensing with the guide bars usually employed for that purpose.

901. Dress for Saving Life and Property at Sea, *S. Chamanski.—Dated 1st March, 1880.—(Not proceeded with.)* 2d.

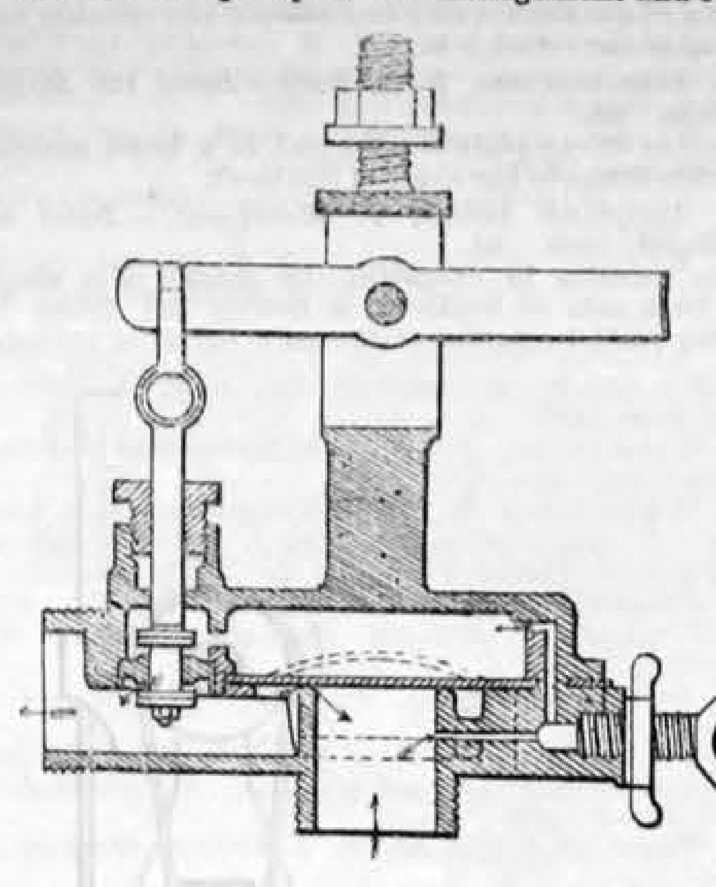
This consists of a garment made in one piece of waterproof material, covering the whole of the person with the exception of the face of the wearer. In the garment a series of air chambers is arranged in connection with one or more tubes provided with mouthpieces.

903. Fitting and Fastening of Fishing Rod Joints, *R. Wright.—Dated 1st March, 1880.—(Not proceeded with.)* 2d.

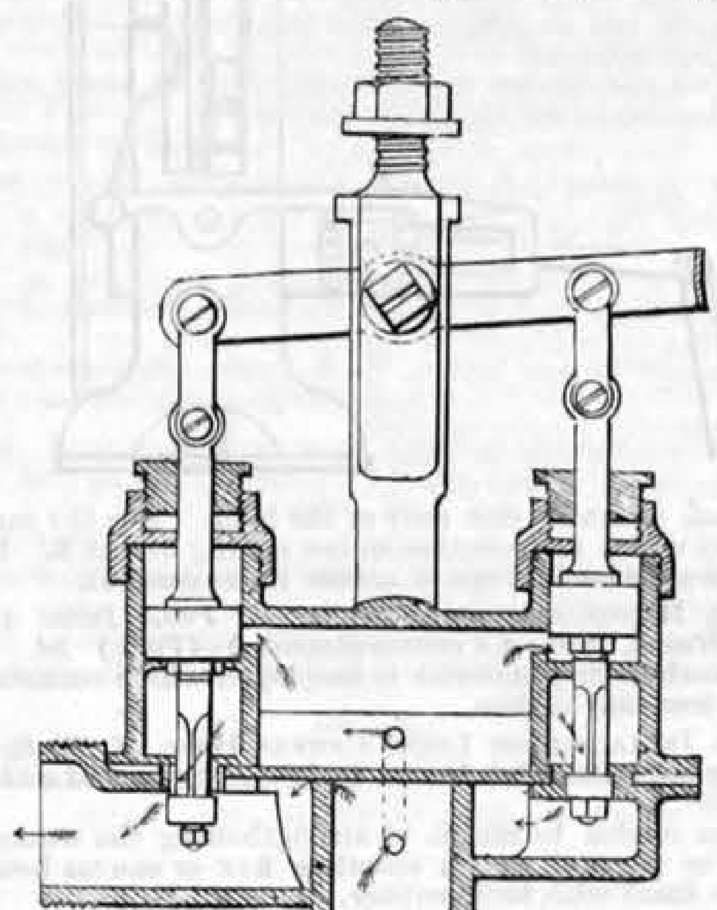
This relates to the fitting and fastening of fishing rod joints by means of male and female screwed tubes.

897. Water Supplying and Regulating Apparatus for Water Closets, &c., *R. Smith.—Dated 1st March, 1880.* 8d.

This consists partly in the arrangement and combi-



nation of the parts of a water flushing or service supply and regulating valve chest or apparatus for water closets, and other analogous uses, having, and



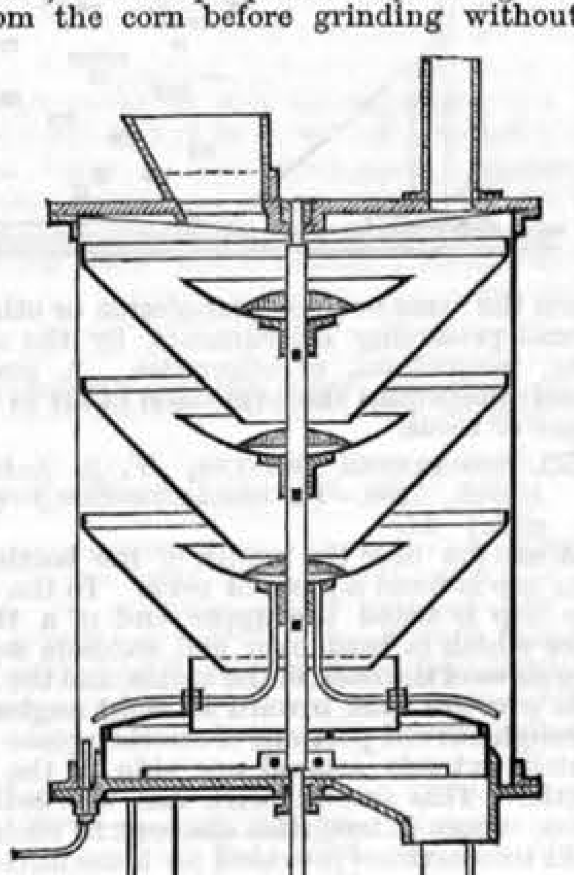
actuated by, a diaphragm with a service chamber below and pressure controlling chamber above, controlled by a double or single faced valve, and small set screw orifice.

906. Rails for Railways and Tramways, *C. Wheeler.—Dated 1st March, 1880.—(Not proceeded with.)* 2d.

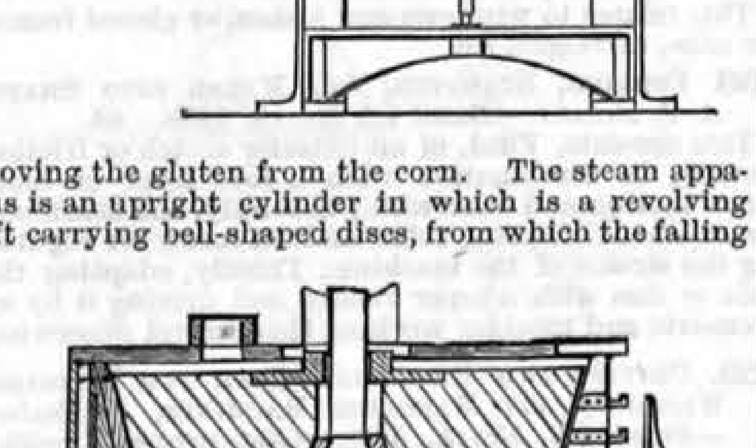
One feature consists in forming the rail in two pieces, the head of steel and the lower portion of iron.

907. Husking or Decorticating Corn, *F. H. F. Engel.—Dated 1st March, 1880.—(A communication.)* 6d.

This relates to treating corn by steam, and in apparatus therefor, for the purpose of separating the woody shell from the corn before grinding without



removing the gluten from the corn. The steam apparatus is an upright cylinder in which is a revolving shaft carrying bell-shaped discs, from which the falling



corn is thrown by centrifugal force. The steam is admitted at the bottom, a taper millstone is enclosed in a casing. The corn passing down the tapered edge of the stone is shelled thereby.

912. Moulds for Making Castings in Iron, &c., *J. Crostwaithe.—Dated 2nd March, 1880.—(Not proceeded with.)* 2d.

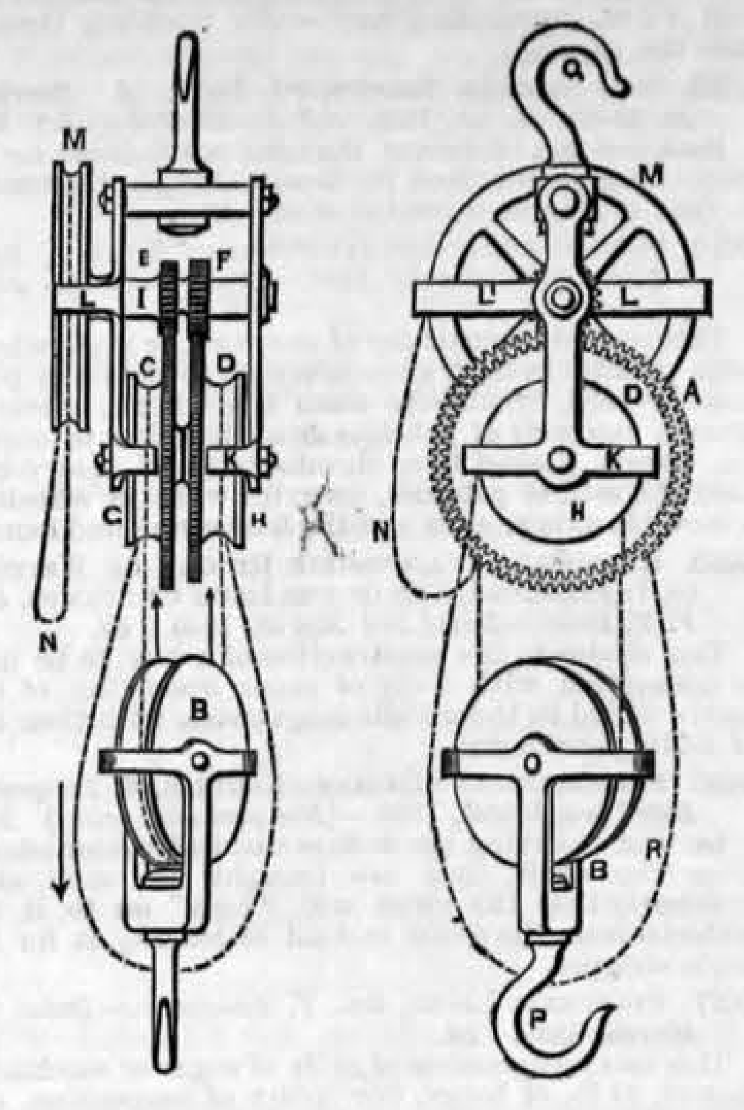
The mould is made of ganister cement, or sand and cement, or plumbago, or such other refractory material, or mixture of such materials, as will give a smooth, compact, and coherent body for the surface of the mould.

913. Umbrellas and Sunshades, *A. M. Clark.—Dated 2nd March, 1880.—(A communication.)—(Not proceeded with.)* 2d.

This consists in making the ribs of the umbrella towards one side of the stick longer than those of the opposite side, so that the centre of shelter may be occupied by the person instead of the handle.

910. Hoisting Blocks, *H. J. Haddan.—Dated 2nd March, 1880.—(A communication.)* 6d.

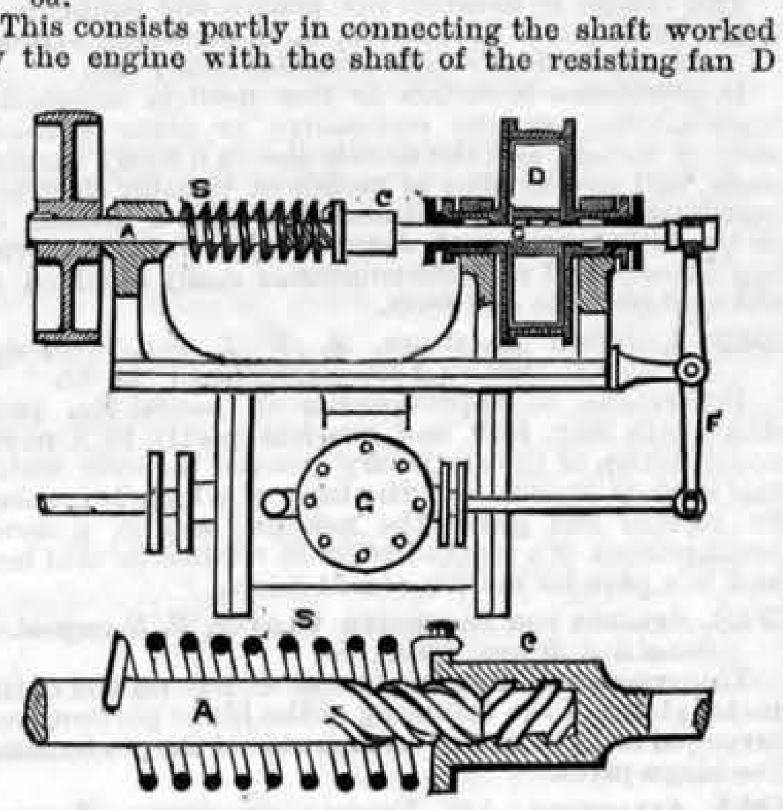
This relates to differential pulley apparatus consisting of a double top-block, lower single block, endless hoisting chain, differentially moving spur geared



sheaves, spur wheels, pinions, and shaft. A double top block, lower single block B; R chain, G H differentially spurred geared sheaves, C D spur wheels, E F pinions, I shaft, M grooved hand chain wheel.

911. Regulating the Supply of Steam to Steam Engines, *F. W. Durham.—Dated 2nd March, 1880.* 6d.

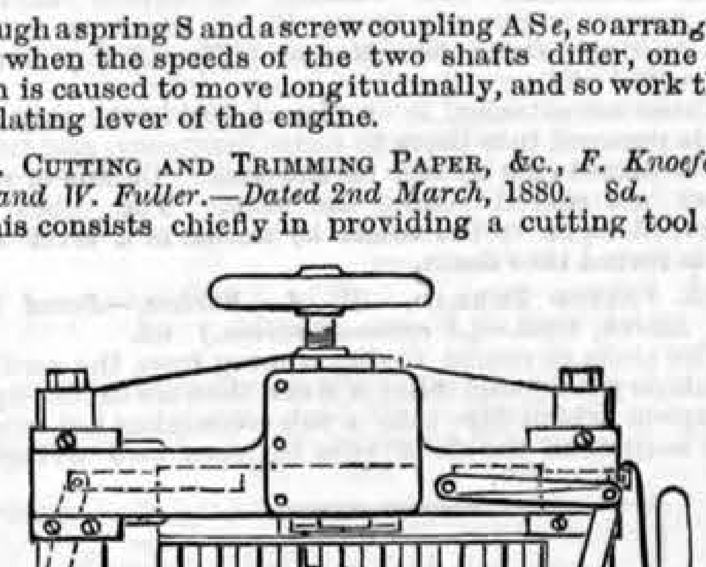
This consists partly in connecting the shaft worked by the engine with the shaft of the resisting fan D



through a spring S and a screw coupling A S c, so arranged that when the speeds of the two shafts differ, one of them is caused to move longitudinally, and so work the regulating lever of the engine.

914. Cutting and Trimming Paper, &c., *F. Knoeferl and W. Fuller.—Dated 2nd March, 1880.* 8d.

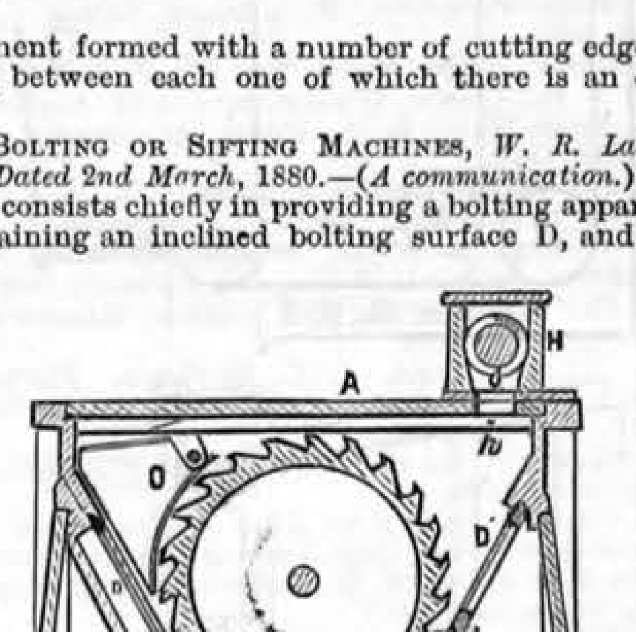
This consists chiefly in providing a cutting tool or



implement formed with a number of cutting edges or points, between each one of which there is an open space.

915. Bolting or Sifting Machines, *W. R. Lake.—Dated 2nd March, 1880.—(A communication.)* 6d.

This consists chiefly in providing a bolting apparatus A containing an inclined bolting surface D, and ele-



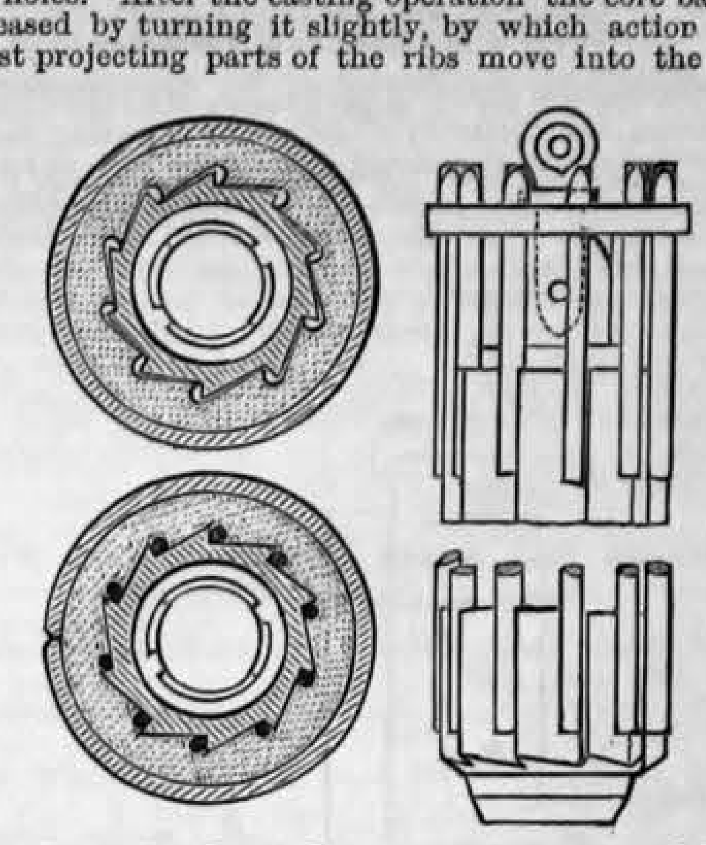
vating mechanism, so arranged that the meal is delivered by the elevating wheel directly at or above the upper end of the inclined bolting surface, and caused to pass repeatedly over the bolting surface, whereby the meal is rapidly bolted or sifted. H is a feed chamber, G is a screw creeper, Q is the delivery spout.

916. Lacing or Fastening Apparatus for Boots, Stays, Gloves, &c., *W. T. Thompson.—Dated 2nd March, 1880.—(A communication.)* 6d.

This consists in the manufacture of lacing or fastening apparatus with hooks, studs, or other fastenings bent over, so as to form loops or rings on one side the opening to be laced, but those on the other side open, in combination with the string or lacing arranged so as not to require tying.

919. Manufacture and Treatment of Cast Iron Pipes, &c., *J. W. Macfarlane.—Dated 2nd March, 1880.* 6d.

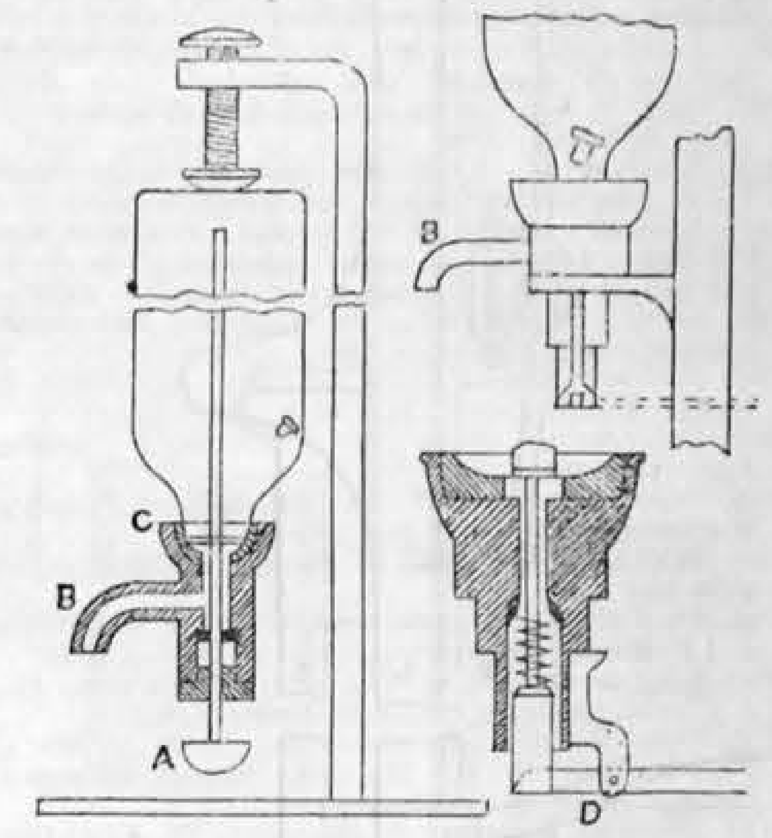
This consists principally in the constructing of core bars to be used in the manufacture of cast iron pipes, columns, and similar articles, and more particularly the shaping of the core bar, so as in cross section to resemble a ratchet toothed wheel, and the combination therewith of rods arranged to form air holes close to the projecting parts of the bar. The mould material is rammed into the space between the internal surface of the core box and the core bar, the rods being in position, and the rods are afterwards withdrawn to form air holes. After the casting operation the core bar is released by turning it slightly, by which action the most projecting parts of the ribs move into the air



holes, the inclined curved or excentric surfaces of the ribs at the same time moving slightly, but sufficiently, away from the sand with which they were in contact, and thus allowing the core bar to be easily withdrawn.

922. Discharging Aerated Waters or other Liquids from Bottles, &c., *A. Gascoigne.—Dated 2nd March, 1880.* 6d.

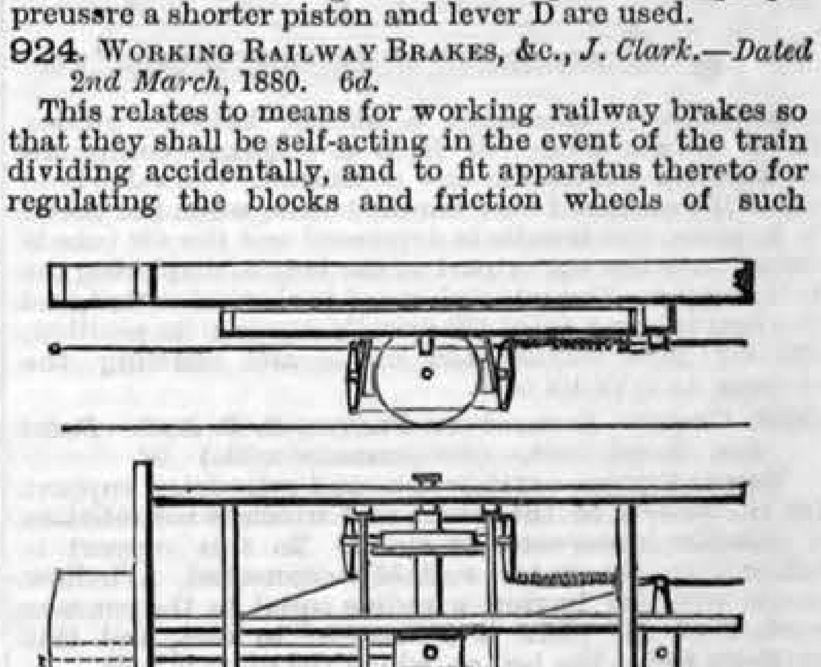
This consists of a machine adapted to the discharge of internal stoppered bottles, and by which means any quantity of the contents of such bottles may be drawn



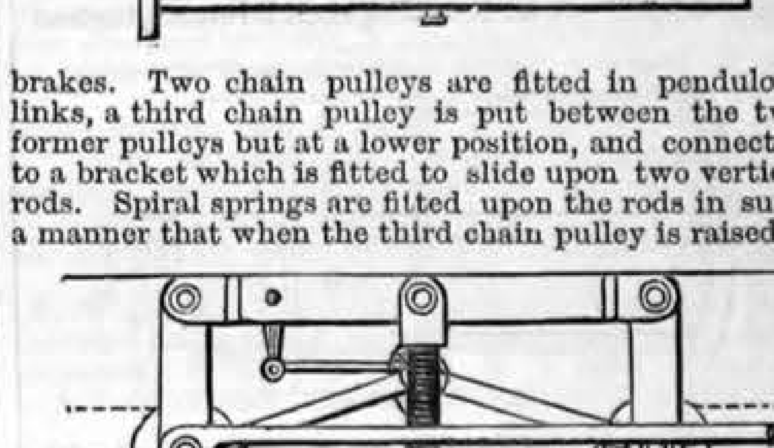
off, and at various periods. The bottle rests in the socket C and is held by a rubber washer; a blow given to the button A displaces the stopper. The contents are discharged through B. For liquids of high gas preussre a shorter piston and lever D are used.

924. Working Railway Brakes, &c., *J. Clark.—Dated 2nd March, 1880.* 6d.

This relates to means for working railway brakes so that they shall be self-acting in the event of the train dividing accidentally, and to fit apparatus thereto for regulating the blocks and friction wheels of such



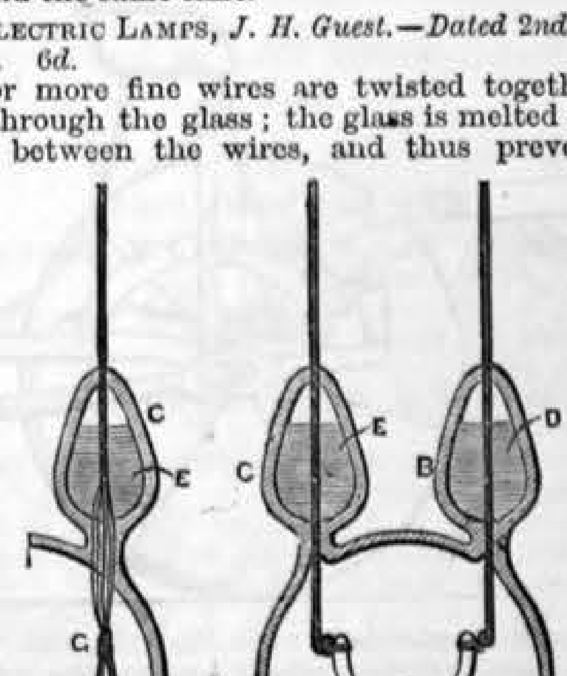
brakes. Two chain pulleys are fitted in pendulous links, a third chain pulley is put between the two former pulleys but at a lower position, and connected to a bracket which is fitted to slide upon two vertical rods. Spiral springs are fitted upon the rods in such a manner that when the third chain pulley is raised it



compresses the said springs. Compound links connect the free ends of the pendulous links, and connect them to the levers of the brake blocks. A chain along the centre line of the train operates the brakes. The said chain is fitted with coupling hooks at each carriage to work the brakes on a series or train of vehicles at one and the same time.

925. Electric Lamps, *J. H. Guest.—Dated 2nd March, 1880.* 6d.

Two or more fine wires are twisted together and passed through the glass; the glass is melted so as to flow in between the wires, and thus prevent the

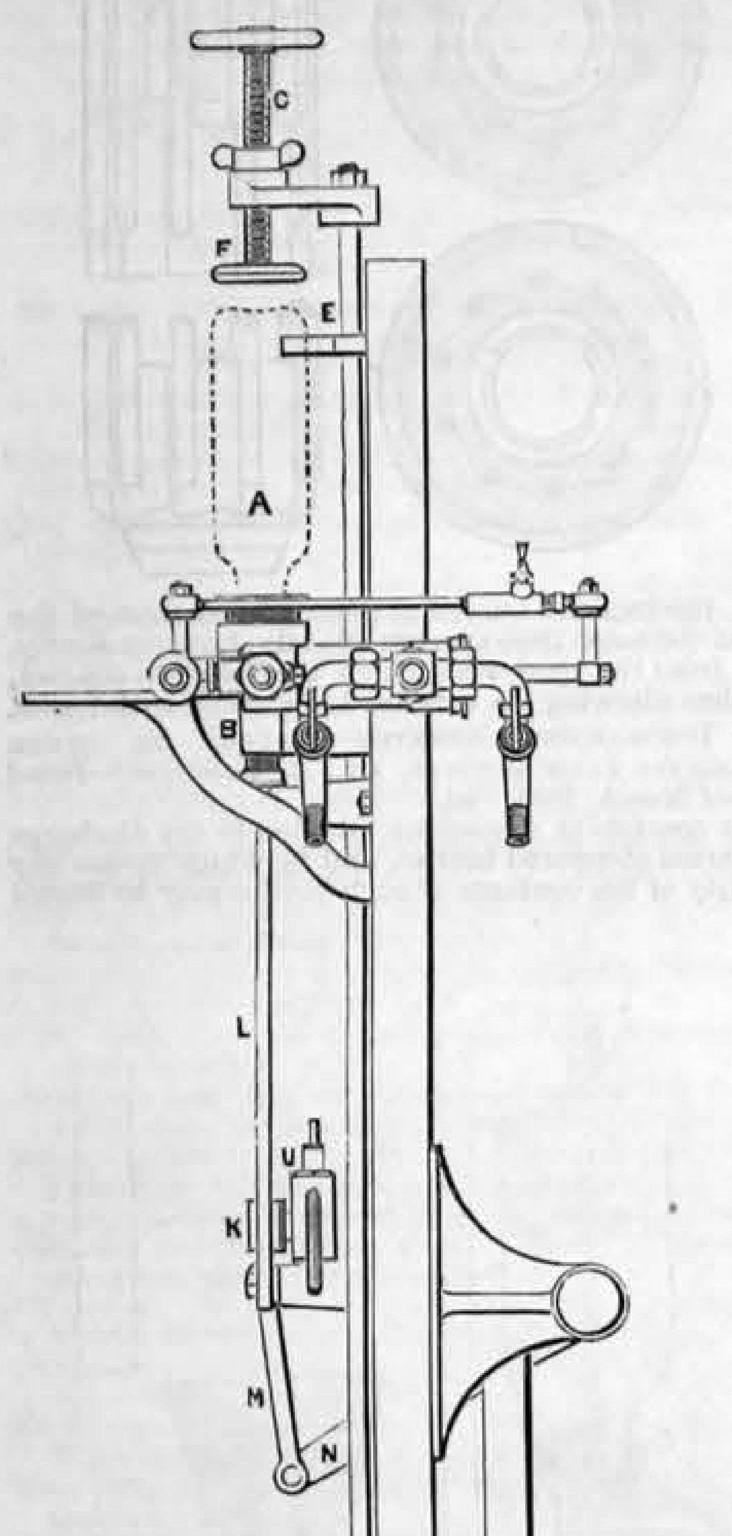


passage of air; and the wires being in a twisted form, yield as they expand, and hence the glass is not cracked. The bulb contains the carbon H. The cups

B and C surround the conductors G, mercury in D and E forms a seat.

926. Introducing, &c., Aerated Waters and other Liquids into Bottles, *R. L. Howard.—Dated 2nd March*, 1880. 10*d*.

This consists partly in performing the operations of securing the bottle in place, and of inserting the air tube therein consecutively and by the foot, or by one hand. The bottle rests in a socket C. The rod E goes to the foot lever H, the air tube is



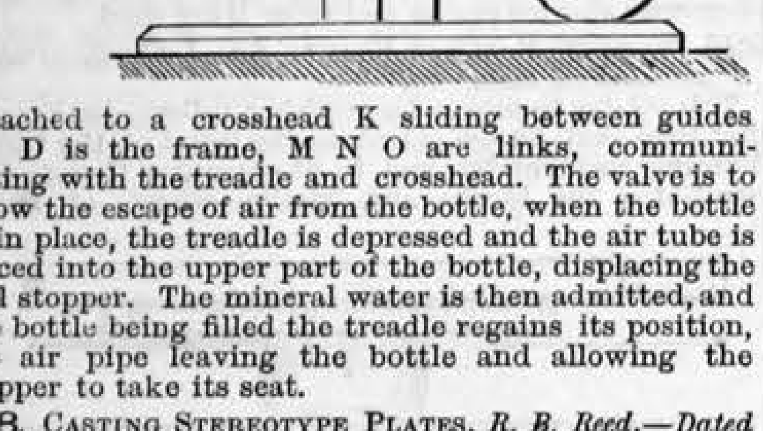
attached to a crosshead K sliding between guides L. D is the frame, M N O are links, communicating with the treadle and crosshead. The valve is to allow the escape of air from the bottle, when the bottle is in place, the treadle is depressed and the air tube is forced into the upper part of the bottle, displacing the ball stopper. The mineral water is then admitted, and the bottle being filled the treadle regains its position, the air pipe leaving the bottle and allowing the stopper to take its seat.

928. Casting Stereotype Plates, *R. B. Reed.—Dated 2nd March*, 1880.—(*Not proceeded with.*) 2*d*.

This apparatus consists of a semi-cylindrical support for the matrix of the plate, and which is mounted in a suitable framework or stand. To this support is hinged, or otherwise suitably connected, a hollow metal cylinder having a radius equal to the concave surface of the plate it is desired to cast, and this cylinder forms the bed on which the plate is cast.

929. Vehicles for the Carriage of Grain in Bulk, &c., *W. P. Thompson.—Dated 2nd March*, 1880.—(*A communication.*) 10*d*.

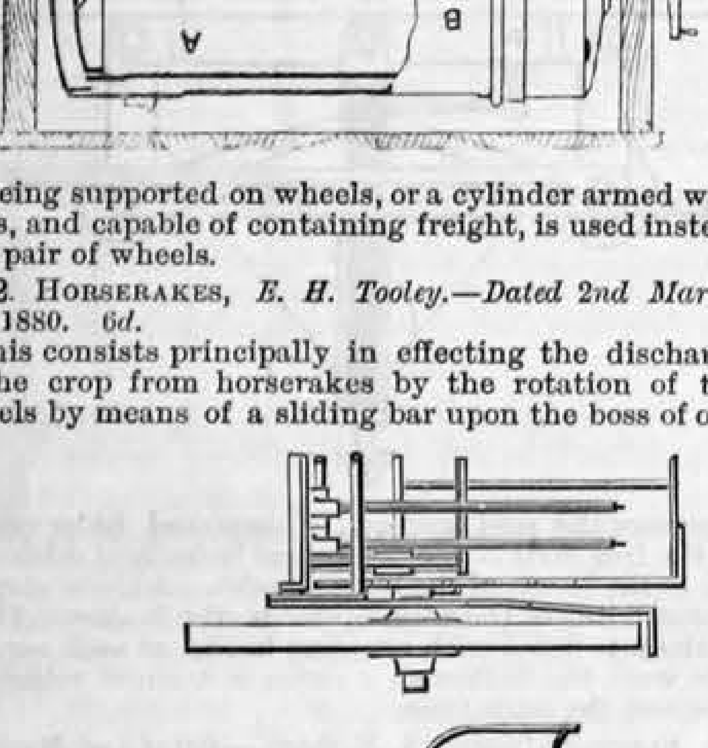
This relates to carriages for railways, in which the carriage A itself or a surrounding shell B rotates, instead



of being supported on wheels, or a cylinder armed with tires, and capable of containing freight, is used instead of a pair of wheels.

932. Horserakes, *E. H. Tooley.—Dated 2nd March*, 1880. 6*d*.

This consists principally in effecting the discharge of the crop from horserakes by the rotation of the wheels by means of a sliding bar upon the boss of one



or both travelling wheels or upon the axle, and which is moved a short distance radially, so that the outward extremity shall be drawn forward and come in contact with the tire of the wheel, and thereby be carried round with the wheel as far as required, and by its movement effect the raising of the tines.

931. Communicating between the Passengers in Railway Trains and the Guards or Engine Drivers, *H. Morris.—Dated 2nd March*, 1880.—(*Not proceeded with.*) 2*d*.

This relates to improvements on patent No. 4417, dated 23rd November, 1877, and consists partly in the employment of an india-rubber ring, which is fixed in the box let into the roof of the carriage, through which the chain passes to the rod on the top of the carriage, and upon which india-rubber ring a ball forming a link in the chain rests, thus acting in the manner of a ball valve, preventing any water trickling through into the carriage.

933. Self-heating Smoothing Iron, *A. Norris.—Dated 3rd March*, 1880.—(*Not proceeded with.*) 2*d*.

Both top and bottom of the iron are finished for the smoothing process, and the iron is slung in the handle, so that it may be turned over at will.

934. Sowing Agricultural Seeds in Rows, *J. Scott.—Dated 3rd March*, 1880.—(*Not proceeded with.*) 2*d*.

This consists essentially of one, two, or more wheels with pockets in their circumference to hold the potatoes or seed, brushes to clean the wheels, elevators from a reservoir of potatoes or seeds below to supply the wheels, a spout from elevator to wheel, reservoir to hold the seed or potatoes, an extra wheel or wheels on a movable axis or axes and the framework and handle.

935. Keeping an Inaccessible Record of Writings or Impressions, and of the Issue of Stamps, &c., *F. T. Bond.—Dated 3rd March*, 1880. 6*d*.

This relates to the construction of a box to be used in connection with a slip of paper consisting of two leaves folded in the middle lengthwise, with their line of folding perforated.

936. Scribbling and Carding Engines, *S. Tempest.—Dated 3rd March*, 1880.—(*Not proceeded with.*) 2*d*.

Instead of having the doffers a considerable distance from the swift, they are brought in such close proximity that the swift will "lash" on to it the material from the doffer instead of leaving it for the angle stripper.

937. Starching Linen, &c., *T. Lancaster.—Dated 3rd March*, 1880. 2*d*.

This mixture consists of 28 lb. of sugar or saccharine matter, 84 lb. of borax, one quart of turpentine, one quart glycerine, one quart isinglass or gelatine solution (made one ounce isinglass to the quart of water), one pint gum arabic solution or mucilage (made one ounce gum to the pint of water, and one ounce essence of lavender.

940. Writing Instruments, *W. E. Wiley.—Dated 3rd March*, 1880.—(*Not proceeded with.*) 2*d*.

This relates to fountain ink pencils and penholders.

941. Telephonic Apparatus, *R. H. Courtenay.—Dated 3rd March*, 1880.—(*Not proceeded with.*) 2*d*.

In preference to carbon as now used in telephonic transmitting, various carbonates or other suitable salts of metals, and the metals also in a finely divided state, and also an alloy of metals of variable electrical resistance, are taken and heated in such a manner as to be easily mixed with water or other fluid and forming a compound metallic substance easily moulded to the required size and form.

942. Knitting Machines, *A. W. L. Reddie.—Dated 3rd March*, 1880.—(*A communication.*) 1*s*. 4*d*.

This relates to improvements on patent No. 1932, dated 14th May, 1879, and consists partly in a novel construction of the stationary grooved bar over which the work is drawn, and the back of which is grooved to receive and guide the needles, and in a novel arrangement of a toothed roller in relation to said bar, and in a peculiar motion of said roller.

943. Springs for Fastening Gloves, *E. Horsepool.—Dated 3rd March*, 1880. 6*d*.

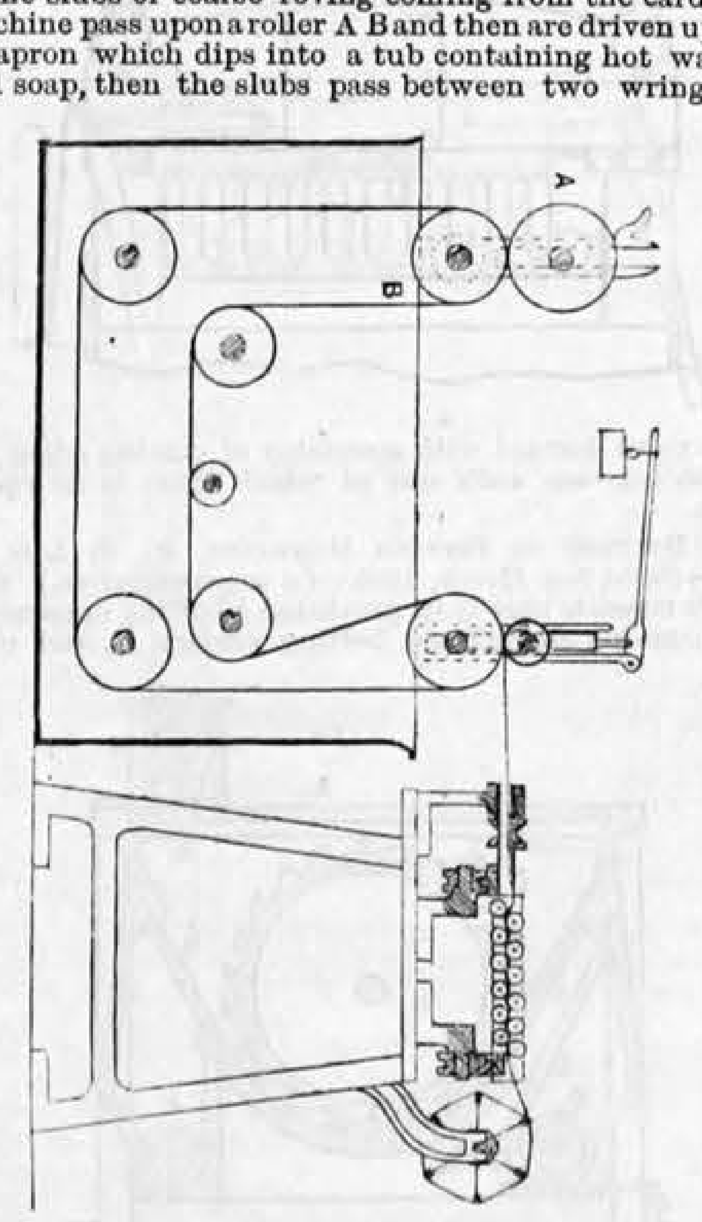
This consists in forming two short legs on one of the metal plates of the fastening at the hinge portion, and arranged so as to lie one on each side of the pin forming the hinge pivot.

944. Attaching Air Vessels or other Lifting Agents to Sunken Ships, *W. R. Mowbray and E. Murley.—Dated 3rd March*, 1880.—(*Not proceeded with.*) 2*d*.

Tubes are attached to or placed inside the ship and air is pumped into them to cause buoyancy, and tubes are arranged side by side on the deck. Chains or wire ropes are passed round the ship. The tubes are clamped tight to the vessel by means of a lever and air is forced into them.

945. Felted Thread, *W. A. Barlow.—Dated 3rd March*, 1880.—(*A communication.*) 6*d*.

The slubs or coarse roving coming from the carding machine pass upon a roller A B and then are driven upon an apron which dips into a tub containing hot water and soap, then the slubs pass between two wringing



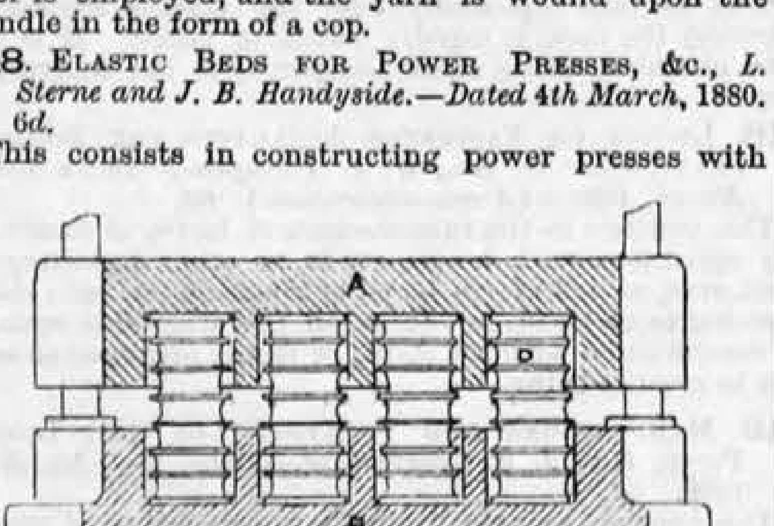
rollers. The apron is made with a series of wooden bars laid across and between a double cloth in order to keep same in straight position, and upon the said apron is sewn a band forming a pocket in which is placed the end of the slubs in order that they shall follow the course of the apron.

946. Spinning Apparatus, *E. Riley.—Dated 3rd March*, 1880.—(*Not proceeded with.*) 2*d*.

In lieu of the ordinary flyer and bobbin, an inverted flyer is employed, and the yarn is wound upon the spindle in the form of a cop.

948. Elastic Beds for Power Presses, &c., *L. Sterne and J. B. Handyside.—Dated 4th March*, 1880. 6*d*.

This consists in constructing power presses with



beds A and B, kept apart by a number of metal or india-rubber or combined metal, wood and india-rubber springs D.

947. Gas Retort Mouthpieces and Lids, &c., *A. Mackie.—Dated 4th March*, 1880.—(*Not proceeded with.*) 2*d*.

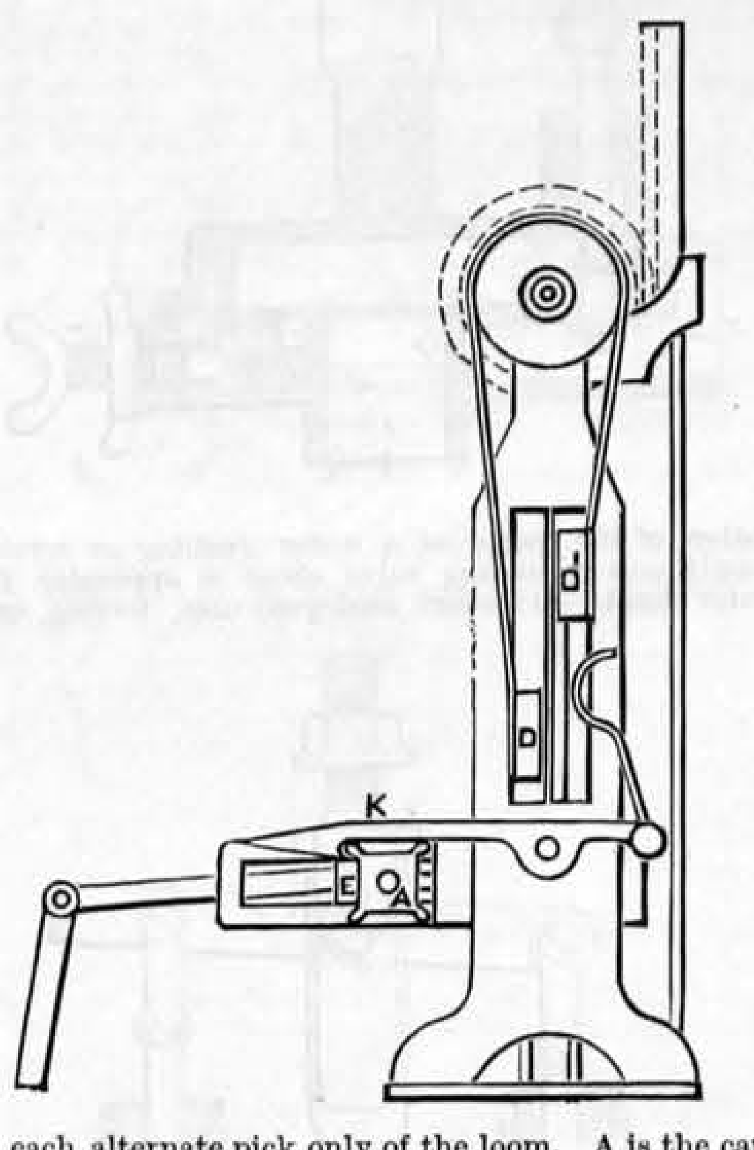
This relates to means for insuring the hermetic sealing of gas retorts and to facilitate the opening and closing of the retort lids.

949. Tobacco Pipes, *W. B. Haas.—Dated 4th March*, 1880. 6*d*.

A cover or cap plate is attached in a loose manner by studs fitted to the sides of the bowl.

950. Jacquard Looms, *T. Blackhurst.—Dated 4th March*, 1880. 4*d*.

This consists in operating, by means of a single card, both sets of hooks in a double lift dobby by causing partial rotation of the card barrel or cylinder



as each alternate pick only of the loom. A is the card barrel which has rotation in the sliding blocks E. D^1 throws the hook K out of action in its descent.

952. Manufacture of Steel, *S. Pitt.—Dated 4th March*, 1880.—(*A communication.*)—(*Void.*) 2*d*.

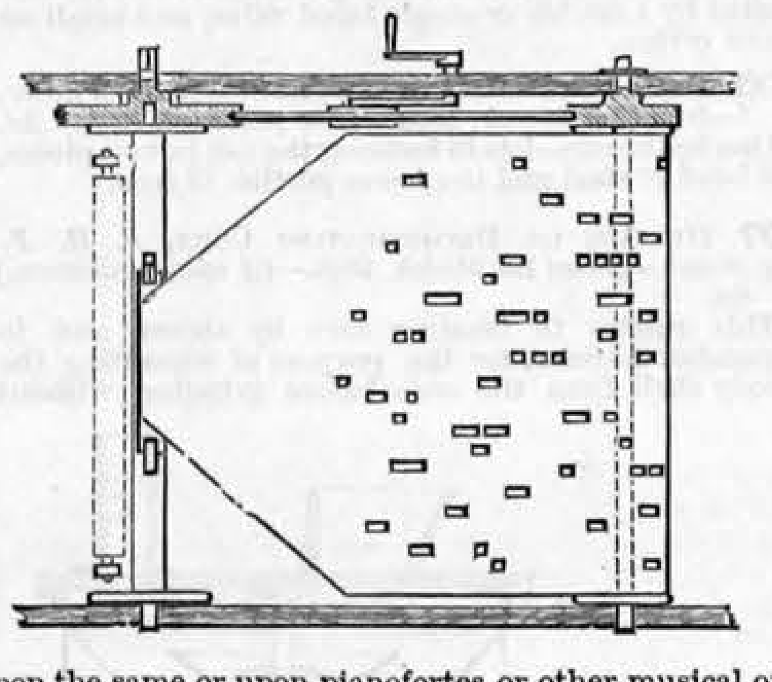
A carburating material is employed which contains only iron and carbon.

953. India-rubber Lined Canvas Hose, *F. G. Heawood.—Dated 4th March*, 1880.—(*Not proceeded with.*) 2*d*.

This relates to means of strengthening the weaker part or parts of woven seamless flax or canvas hose, when lined with india-rubber.

954. Automatic or Mechanical Organs and Harmoniums, *J. Y. Smith.—Dated 4th March*, 1880. 8*d*.

This relates to improvements in automatic or mechanical pipe and reed organs and harmoniums, and to apparatus or means for playing or performing



upon the same or upon pianofortes or other musical or sound producing instruments, by the aid of electricity, magnetism, or otherwise. A perforated tune band determines the admission of air to the speaking pipes or reeds.

955. Stoppering Bottles, *W. R. Lake.—Dated 4th March*, 1880.—(*A communication.*)—(*Not proceeded with.*) 2*d*.

A cap fits over the mouth of the bottle, and within this cap is fixed a piece of cork. To the upper part of the cap is fitted the upper end of a thick metallic wire which is bent over and extends downwards on two sides of the neck of the bottle, and the lower sides of this wire are bent inward at right angles, and project through curved portions of another piece of thick wire which extends around one side of the neck of the bottle. This second wire has upwardly extending arms, whose extremities are bent in such a manner as to fit into cavities provided for them in the neck of the bottle.

956. Windows, &c., *H. Brittain—Dated 4th March*, 1880.—(*Not proceeded with.*) 4*d*.

This relates to windows and sashes, or glazed frames for cabs, carriages, &c.

958. Forging, Stamping, &c., Metal into Shape, *A. J. Acaster.—Dated 4th March*, 1880. 4*d*.

This consists, First, of an exterior clutch or friction motion, in combination with a foot lever or hand screw motion and otherwise; Secondly, the combined arrangement of spring roller and set screw for regulating the stroke of the machine; Thirdly, adapting the slide or ram with a taper recess, and driving it by an excentric and tumbler working therein and otherwise.

959. Driving and Reversing Gear for Washing, Wringing, and Mangling Machines, *E. Taylor.—Dated 4th March*, 1880.—(*Not proceeded with.*) 2*d*.

This consists principally in an arrangement of mechanism whereby the box or tub is caused to change the direction of its revolution every three (or other desired number of) turns, whilst the driving pulley keeps continually revolving in the same direction.

960. Hydraulic and Steam Lifts, *J. and J. Shaw.—Dated 4th March*, 1880.—(*Not proceeded with.*) 2*d*.

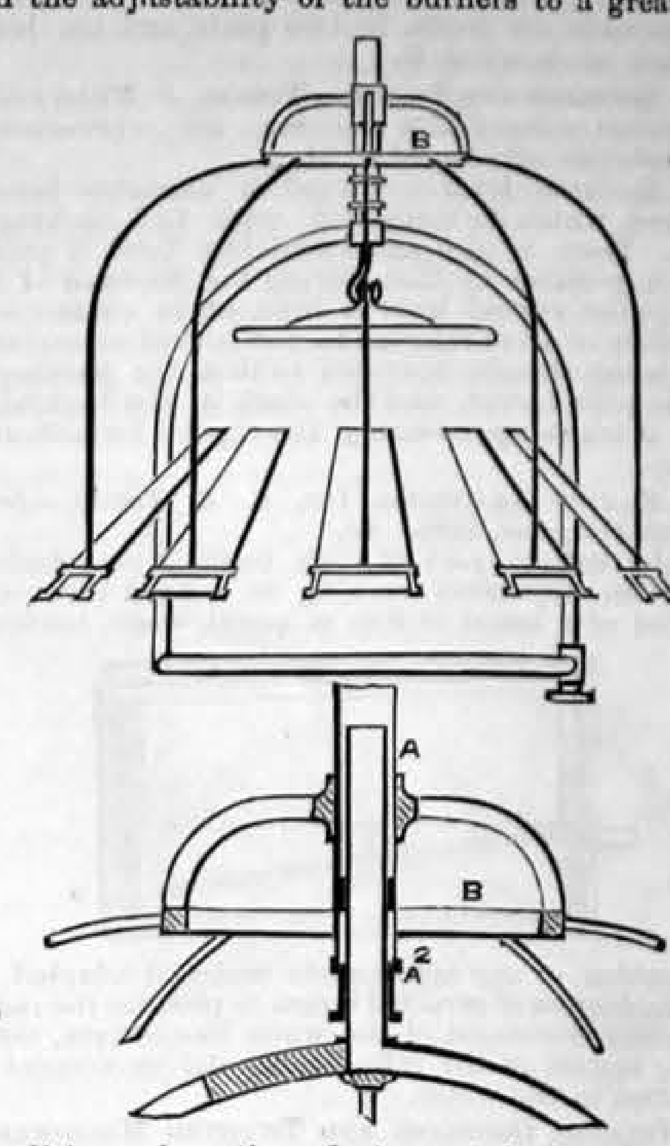
This consists principally in connecting the piston directly with the cage to be lifted by means of a flexible piston rod composed of metallic wire (or wires), or by a flexible metallic band (or bands) passing over a pulley above, one end of the wire or band being attached to the cage and the other to the piston in the cylinder or tube, which latter may be as long as the lift is high.

961. Wind Chests and Sound-boards, &c., *C. Kesseler.—Dated 5th March*, 1880.—(*A communication.*)—(*Not proceeded with.*) 2*d*.

Suitably placed beneath the pallet ends are lever supporting bars, hinged so as to be capable of being partly canted over, and in grooves across these bars work levers bent at an obtuse angle and pivotted at the bend; one end of each of these levers is so placed that when moved sufficiently it may touch the overhanging end of the pallet opposite to it and open the pallet.

962. Lamps, *D. Hynd.—Dated 5th March*, 1880. 6*d*.

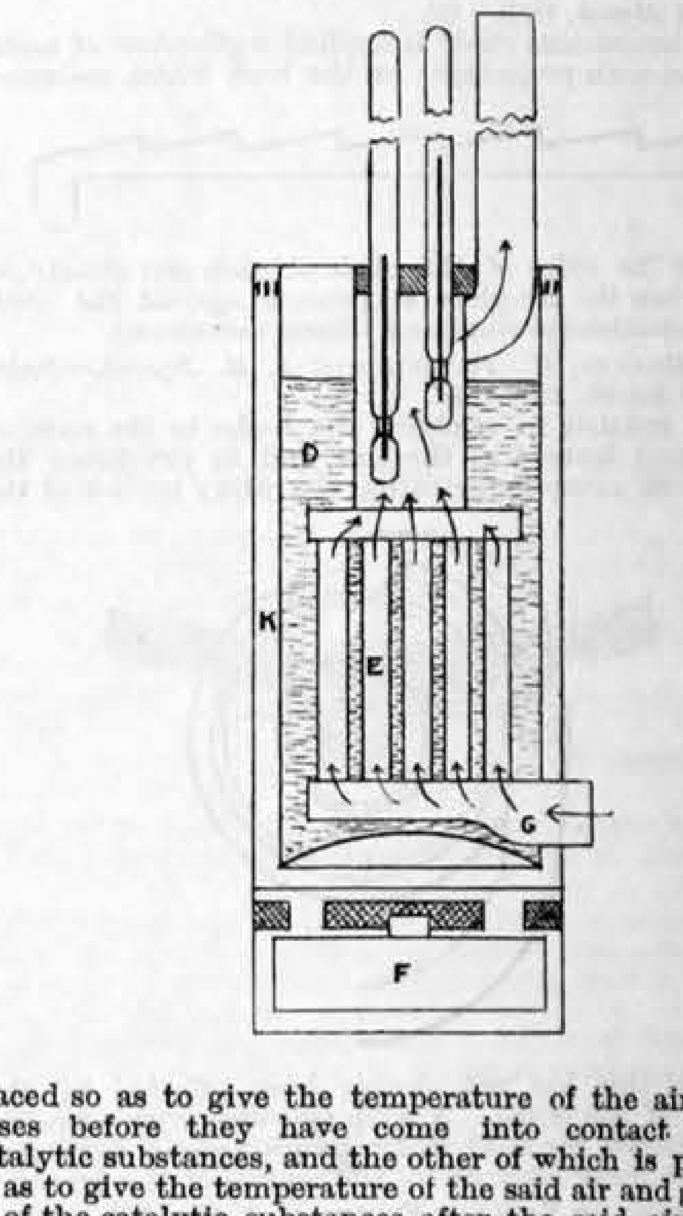
The essential features of this lamp are the reflectors formed of separate plates, supported from above, over the jets or burners, and having a space between them, and the adjustability of the burners to a greater or



less distance from the reflectors. A is the suspending tubes. B is a ring for carrying the reflectors. A^2 is the gas-tight stuffing-box.

963. Detecting and Estimating Quantity of Fire-Damp, &c., *J. Aitken.—Dated 5th March*, 1880. 6*d*.

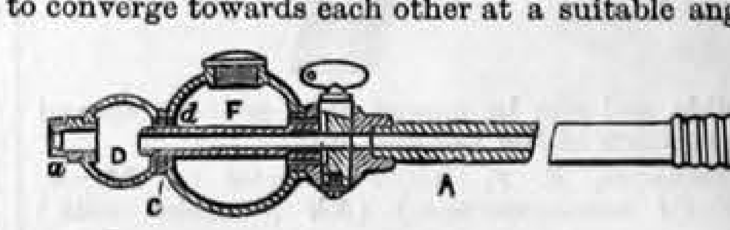
This relates to apparatus for indicating the presence and quantity of inflammable gases or vapours in the air of the place tested, the apparatus consisting in the combination of two thermometers, one of which is



placed so as to give the temperature of the air and gases before they have come into contact with catalytic substances, and the other of which is placed so as to give the temperature of the said air and gases, or of the catalytic substances after the said air and gases have come into such contact, whether such apparatus be combined or not with means for artificially heating the said air and gases. G inlet, E tubes, F lamps, K flame space, D boiler.

964. Distributing or Delivering Liquids in the Form of Spray or Mist, *T. H. Bentley.—Dated 5th March*, 1880. 6*d*.

This consists in distributing or delivering liquids in the form of mist-like spray by causing the liquid to pass through two passages or channels arranged so as to converge towards each other at a suitable angle to



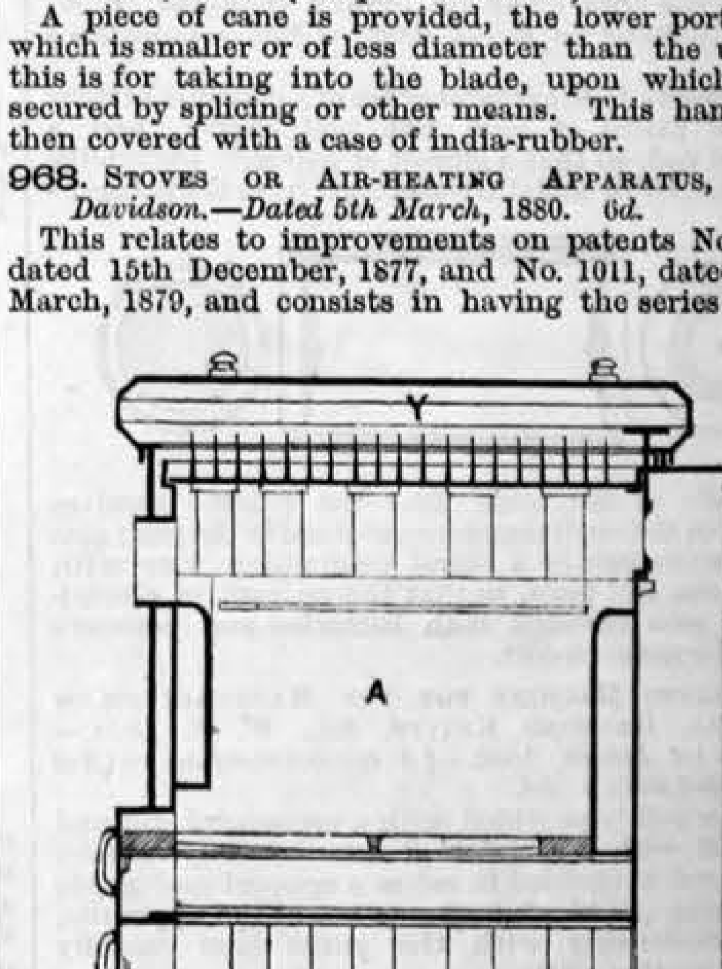
cause the two columns, streams, or sheets of liquid passing through them to come into contact with each other with sufficient force to thoroughly disintegrate or divide the liquid into minute particles. The tube conducted to the hose pipe. D is the nozzle. The chemicals to be mixed with the water are placed in F, *d* passage, *a* are adjutages.

965. Cricket Bat Handle, *W. Rushton.—Dated 5th March*, 1880.—(*Not proceeded with.*) 2*d*.

A piece of cane is provided, the lower portion of which is smaller or of less diameter than the upper; this is for taking into the blade, upon which it is secured by splicing or other means. This handle is then covered with a case of india-rubber.

968. Stoves or Air-heating Apparatus, *S. C. Davidson.—Dated 5th March*, 1880. 6*d*.

This relates to improvements on patents No. 4773, dated 15th December, 1877, and No. 1011, dated 14th March, 1879, and consists in having the series of flat



vertical chambers situated upon the two sides of the fireplace A only, and not extending over the top of the fireplace as formerly. Y is the top of external cases containing rib radiators.

969. Railway Carriages, *J. Reid, jun.—Dated 5th March*, 1880.—(*Not proceeded with.*) 2*d*.

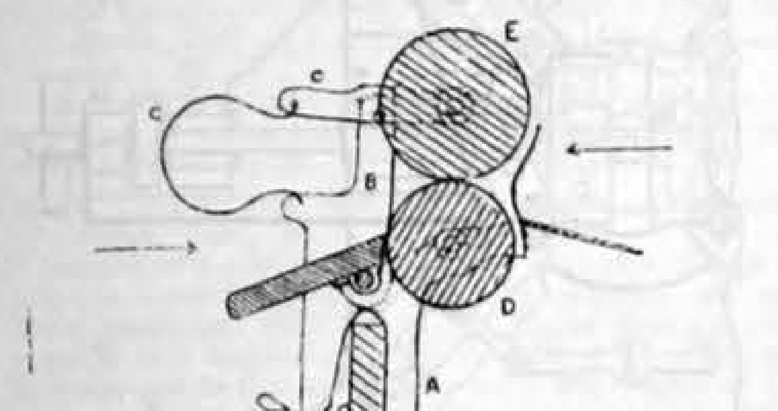
This consists in fitting the carriages with an additional pair of wheels carried in journal bearings on brackets formed on or secured to the outer sides of the axle-boxes, so that these wheels may run on vertical or inclined spindles, and bear along the side or edge of an additional line of rails carried by and secured to the transverse or longitudinal sleepers, or other suitable foundation on each side of the ordinary track.

972. IRON FENDERS, *R. Roberts.—Dated 5th March, 1880.—(A communication.)—(Not proceeded with.)* 2d.

The scroll forming the front and sides is cast in several pieces in iron or chill moulds. The top bead is provided with two flanges, which are closed by pressure upon the upper part of the scroll. The lower bead is made separately. The several parts, together with the bottom, are mounted on a frame, and are connected and formed into a fender by junction pieces of cast iron cast on the opposed edges of the contiguous pieces, and joining the pieces together.

973. WRINGING, MANGLING, AND WASHING MACHINES, *J. Cherk.—Dated 5th March, 1880.* 6d.

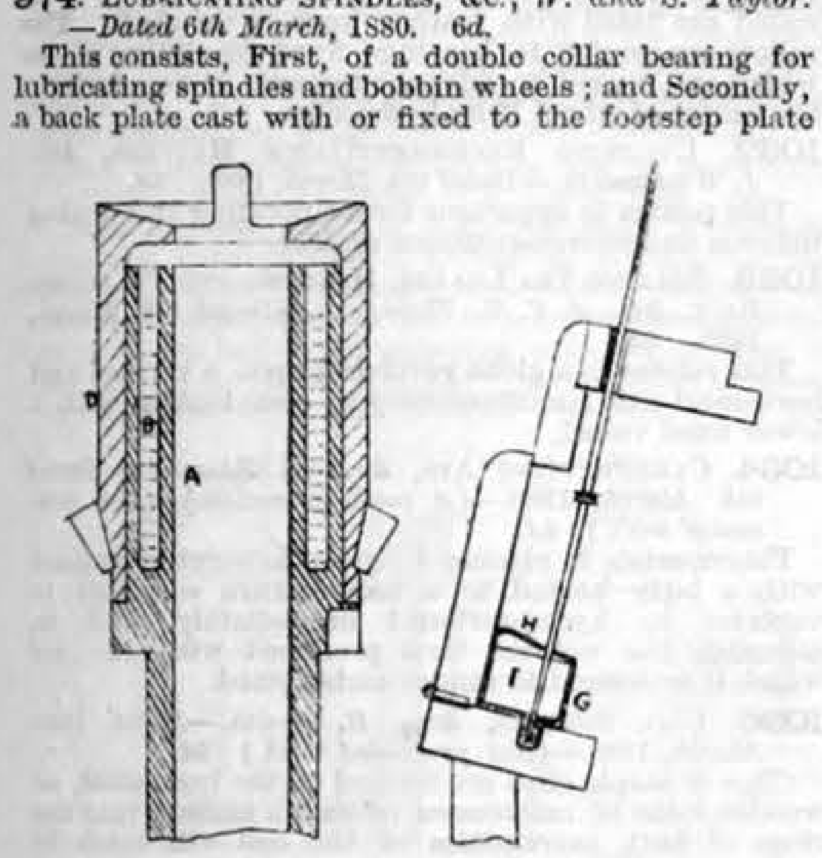
The framing consists of a pair of jaws A B and a lever C at each end of the rollers D and E, the jaws



being held at the required distance apart by a stretcher rod, which acts at the same time as a fulcrum for the jaws. G is a spring pressing the rolls together.

974. LUBRICATING SPINDLES, &c., *W. and S. Taylor.—Dated 5th March, 1880.* 6d.

This consists, First, of a double collar bearing for lubricating spindles and bobbin wheels; and Secondly, a back plate cast with or fixed to the footstep plate



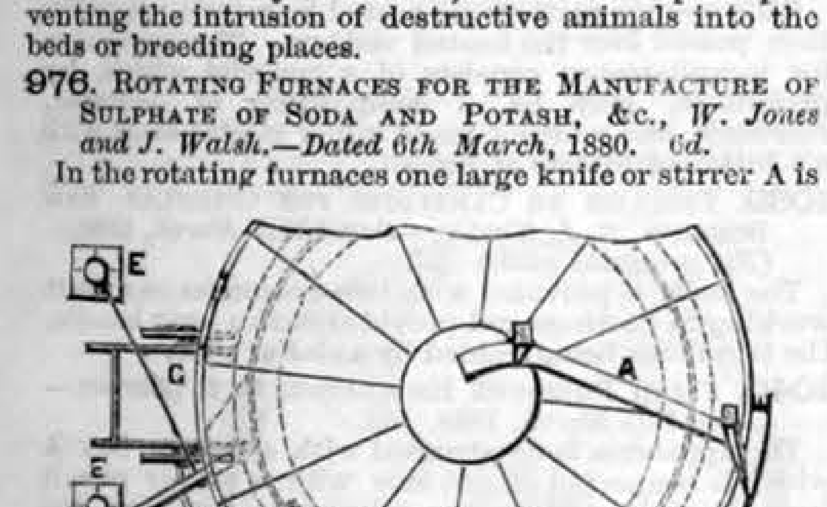
and the end plate fixed to the same. A is inner collar forming bearing for spindle, B oil cavity, D bobbin wheel, G back plate, H slotted angle plate, I sheet of metal fixed to footstep plate.

975. TILES FOR THE FORMATION OF OYSTER BEDS, *M. Bauer.—Dated 6th March, 1880.—(A communication.)—(Not proceeded with.)* 2d.

The fence is constructed of flat tiles pointed or chamfered at the bottom, so as to be easily driven into the ground and provided with a horizontal (or perpendicular to the body of the tile) rim at the top for preventing the intrusion of destructive animals into the beds or breeding places.

976. ROTATING FURNACES FOR THE MANUFACTURE OF SULPHATE OF SODA AND POTASH, &c., *W. Jones and J. Walsh.—Dated 6th March, 1880.* 6d.

In the rotating furnaces one large knife or stirrer A is



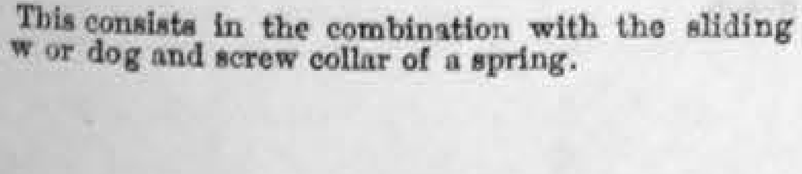
employed, preferably of a curved form, extending from near the centre of the pan to its circumference. B is the delivery hole, C recessing shelf, E E supports, G wagon.

977. SPINNING MULES, *J. Hendry.—Dated 6th March, 1880.—(A communication.)* 6d.

This relates to improvements in the construction of self-acting spinning mules, specially designed for differentially regulating the tension of the yarn being wound or built on the cop, so as to effect uniform tightness to the point of the cop without causing "snarles" or weakening or breaking the yarn at the weak part of the cop. The machine has the usual traversing carriage E E, carrying the cop spindles S,

also the faller spindles F F. A weighted lever B has fixed at one end the strap B², which reaches the sector I, to which are fixed the under guide tension fallers. The lever acts on the fallers under the yarn Y, and raise or lower it as it passes from the draw rolls R. The position of the weight B determines the tension of the faller F, and thus controls the tension of the yarn. The tension is reduced as the cop is filled by making B ride up the inclined lever A.

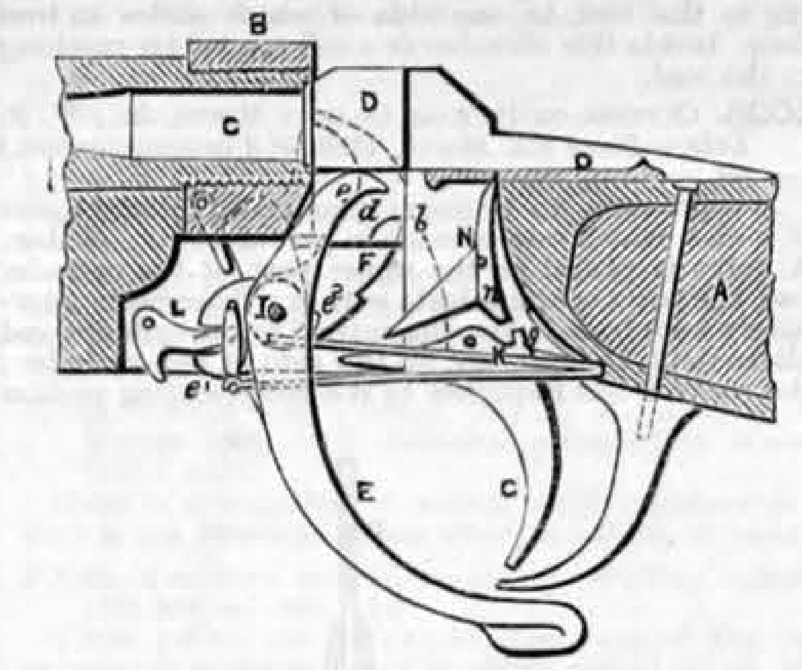
978. PIPE WRENCH, *W. J. McCormick.—Dated 6th March, 1880.* 6d.



This consists in the combination with the sliding w or dog and screw collar of a spring.

979. BREECH-LOADING FIRE-ARMS, *P. T. Godsal.—Dated 6th March, 1880.* 6d.

This consists of mechanism whereby, through the rocking of the trigger guard lever or its equivalent, a sudden, rapid, and gradually decreasing motion is imparted to the hammer for the purpose of cocking the same, and in its proper sequence a slow motion, increasing in speed, is imparted to the cartridge extractor for the purpose of removing the cartridge



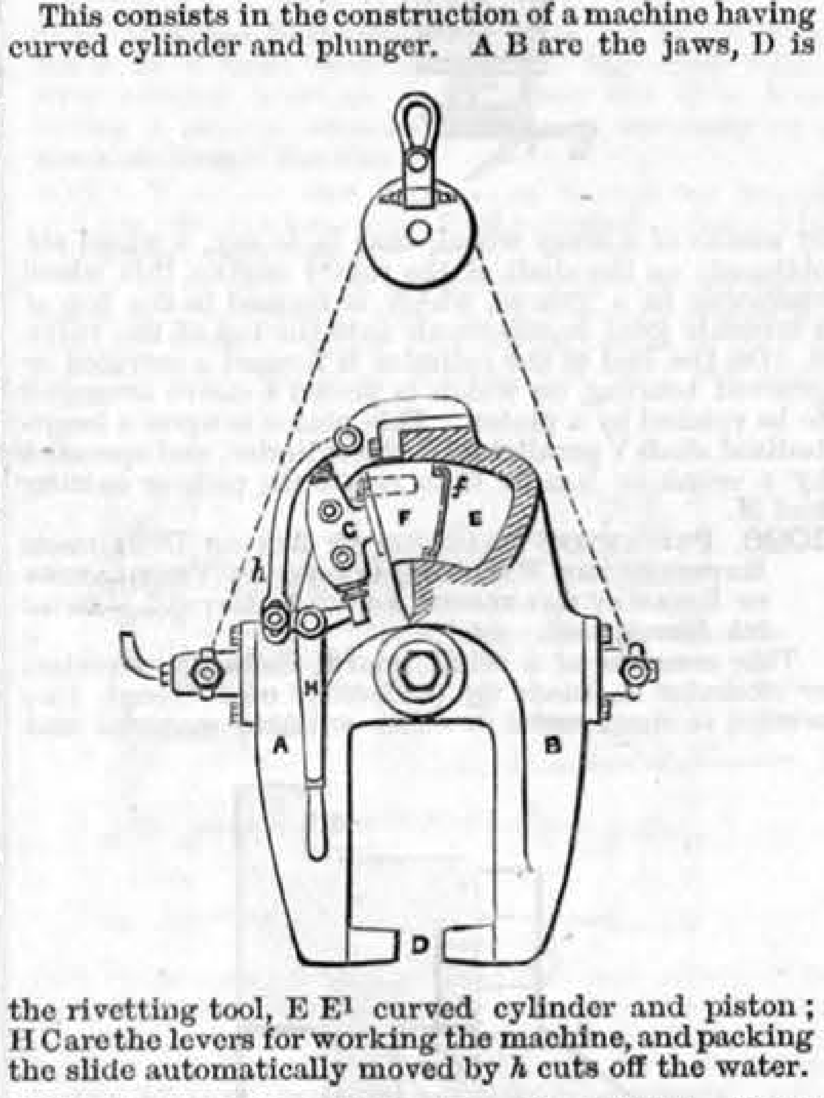
from the gun. A is the stock, B is the breech case, C is the barrel, D is the breech block. The block slides, and is held shut by the vertical facing *b*; E is the trigger guard lever by which the breech block is raised and lowered, F is the hammer, G the trigger, all working on the fulcrum I; K is the main spring, L is a finger which is lifted by the cam of the forked lever E, and thus caused to tip back the hammer into the cocked position.

980. DRAWING LIQUIDS FROM CORKED BOTTLES, &c., *F. E. B. Hooper and A. G. Luke.—Dated 6th March, 1880.* 6d.

This consists of a sharp edged or pointed tube which can be screwed or forced through the cork until lateral holes of the tube, according as they are presented below the cork or not, permit or stop issue of liquid at the exterior mouth of the tube.

981. RIVETTING, PUNCHING, AND SHEARING MACHINES, &c., *R. H. Tweddell, J. Platt, and J. Fielding.—Dated 6th March, 1880.* 6d.

This consists in the construction of a machine having curved cylinder and plunger. A B are the jaws, D is



the rivetting tool, E E¹ curved cylinder and piston; H C are the levers for working the machine, and packing the slide automatically moved by *h* cuts off the water.

982. VENTILATING MINES, &c., *T. Sutherst.—Dated 6th March, 1880.—(Not proceeded with.)* 2d.

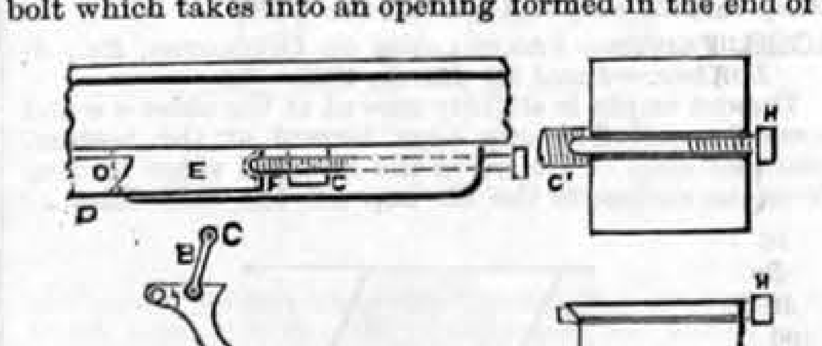
This consists of a system of pipes so arranged within the mine or other place that a constant supply of fresh air is introduced therein, and upon the escape of any foul air or gases occurring within the mine or other place the same are so diluted and weakened as to become innocuous, and are carried off by means of the fresh air so introduced into the mine through such pipes.

983. ORNAMENTING STRAW FANS, &c., *O. Thaege.—Dated 6th March, 1880.—(Not proceeded with.)* 2d.

This consists in the employment of threads of cotton or silk of various colours, and also of gold or silver threads, the said threads being introduced into the loom during the process of weaving the straws into sheets or lengths from which the desired article is to be made.

984. FIRE-ARMS, *J. S. Heath.—Dated 6th March, 1880.* 6d.

This consists, First, of arrangements for lifting the hammer or hammers of breech-loading fire-arms; Secondly, in having a screwed opening in the loop of the gun through which is passed a screw thread or bolt which takes into an opening formed in the end of



the fore end, so that by screwing the bolt into the fore end same can be adjusted at will. A is the lever carrying the bolt; B is a link secured thereto; to B, when two hammers are required, a cross bar is secured at C; D is body of gun, to which fore end E is secured. Into this takes F passing through the loop G. The other figures show arrangement to be adapted to the muzzle end of gun. These are screwed home by the pieces G¹ and H.

985. VESSELS AND MACHINERY FOR AERIAL NAVIGATION, *W. R. Lake.—Dated 6th March, 1880.—(A communication.)* 10d.

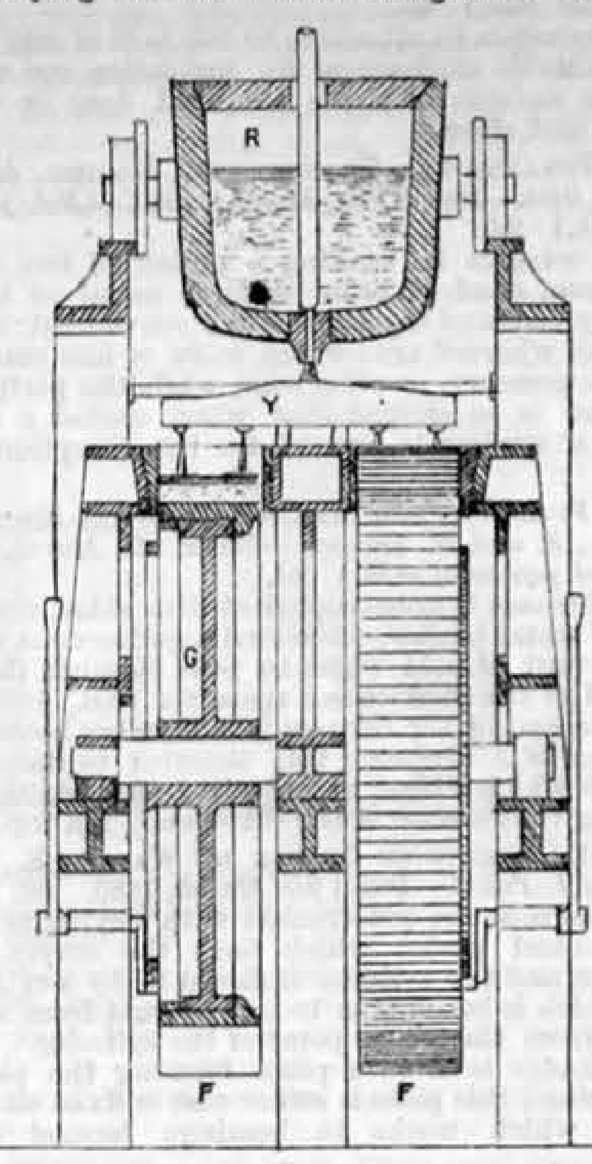
This comprises a light framework constructed of wires, rods, thin metal tubing, and cordage, or other suitable material secured at the intersections in any manner to obtain strength and lightness, the whole being covered and encased with silk, linen, thin metal, or other suitable material secured to the framework, presenting preferably the form of the grayling or salmon fishes.

986. REWORKING THE SHEARINGS OF IRON AND STEEL, *J. H. Rogers.—Dated 6th March, 1880.* 4d.

This consists in moulding the shearings into compact blocks and dissolving these blocks in molten iron or metal.

987. TREATMENT AND MANUFACTURE OF IRON, &c., *Sir H. and A. G. Bessemer.—Dated 6th March, 1880.* 8d.

This relates partly to the purification of crude iron in such manner as to obtain a purified cast iron suitable for making such castings as are to be rendered malleable by cementation in the solid state by desiliconising molten crude metal, and also in some cases alloying the metal with manganese. R is the



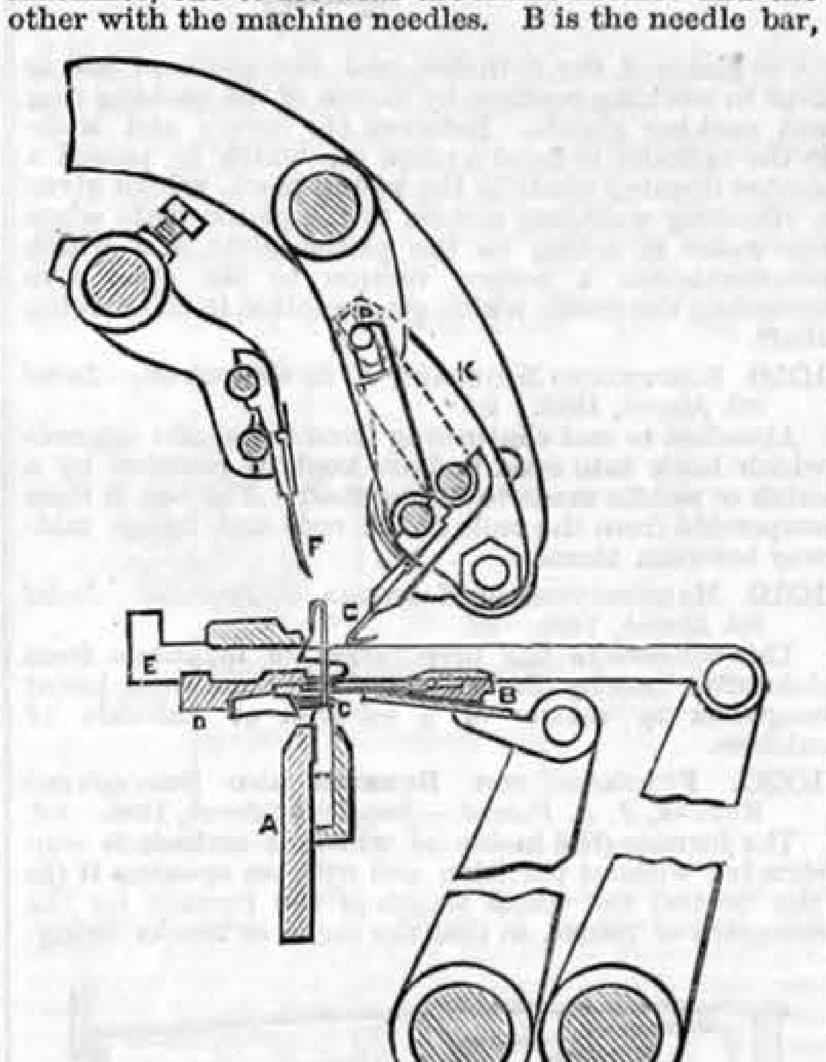
ladle carried on wheels and provided with nozzle and stopper; Y is the gutter from which the metal flows to the fire-clay nozzle into the moulds F, carried on the wheel G.

988. BED CLOTHES ELEVATORS, *J. W. Cousins.—Dated 6th March, 1880.* 6d.

The elevator is formed of an upright having a spike at its lower end to hold to the floor, and also provided with a clamp by which it can be clamped to the side or the end of any bedstead.

989. KNITTING MACHINES, *W. Cotton.—Dated 6th March, 1880.* 8d.

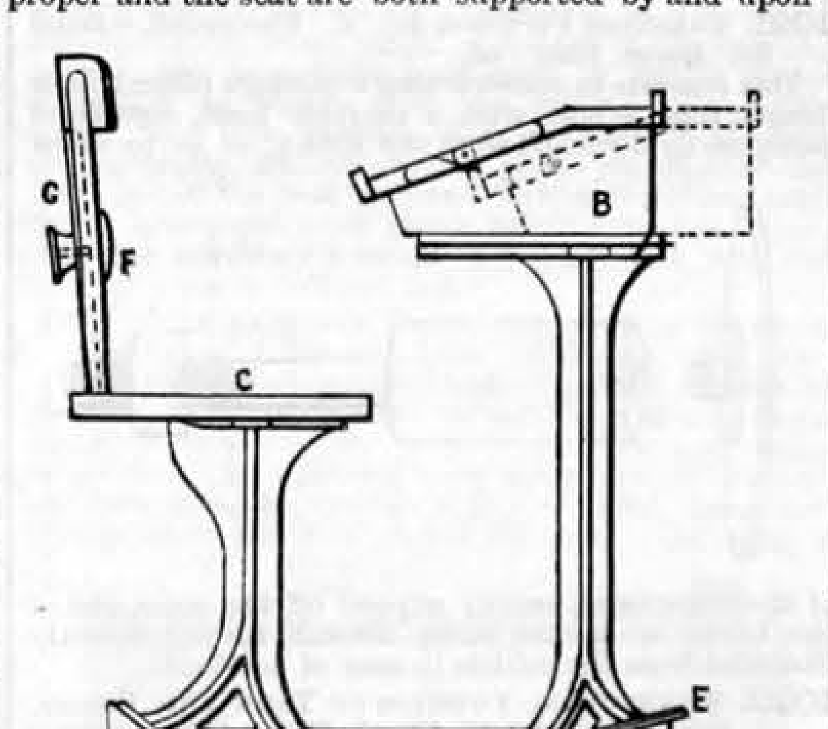
This consists in the employment of two narrowing machines, one to act with the frame needles and the other with the machine needles. B is the needle bar,



C are the knocking over bits secured to bar D, E are the sinkers, F are the points to act with the frame needles in narrowing or widening the work, and G the points to act with the machine needles.

990. SCHOOL DESKS, &c., *J. Glendenning.—Dated 8th March, 1880.* 6d.

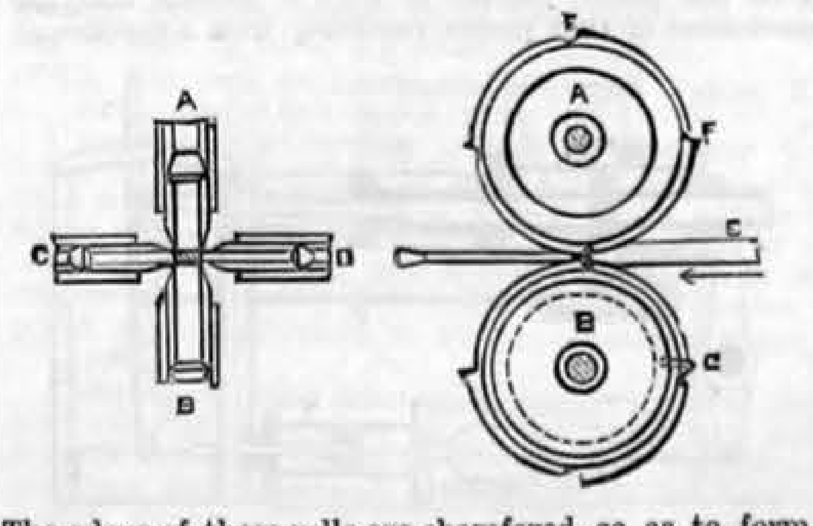
This single frame or stand consists of the base piece A* and uprights A¹, A²; B is the desk proper, on whose slope or writing board B*, the books or other articles are placed while being used; C is the seat. The desk proper and the seat are both supported by and upon



the said stand or frame, that is to say, the desk proper B is supported on one upright and the seat C on the other extending up from the base A*. The base is firmly secured by screws or otherwise upon wooden cross pieces or sleepers. E E are foot plates to form a rest or support for the feet of the pupil. F is a pad, G back support.

991. MANUFACTURE OF NAILS, *G. W. von Nawrocki.—Dated 8th March, 1880.—(A communication.)* 6d.

The machine consists chiefly of two pairs of rolls or discs—A, B, C, D—placed at right angles to each other, and between which the iron bar F passes.



The edges of these rolls are chamfered, so as to form conical surfaces which touch each other, a rectangular space being left between them, which varies during the revolution of the rolls, corresponding to the varying section of the nail (being largest at the top thereof and diminishing gradually towards its point), and as many times as there are nails produced by one revolution of the rolls. The rectangular space diminishing during the revolution of the rolls, determines thereby the shape of the nail shank, while the head of the nail is produced by corresponding recesses in the circumference of the rolls. One pair of rolls carry cutters F which separate the nail blank or nail from the iron bar, and as the formation of a new nail commences immediately afterwards no loss of material occurs by this operation.

992. VACUUM BOXES FOR PAPER-MAKING MACHINES, *R. Brodie.—Dated 8th March, 1880.—(Not proceeded with.)* 2d.

The sides of each vacuum box (which sides are transverse to the wire) are formed by rollers of brass or other suitable material, and which may be carried like the rollers ordinarily supporting the wire. The bottom of the box is formed by a plate or closed frame, which can be adjusted so as to bear up in close contact with the lower parts of the rollers, and the interior of the box may communicate with the vacuum pumps by one or more pipes connected to the bottom plate or frame.

993. TREATMENT AND MANUFACTURE OF PHOSPHATES, *W. J. Williams.—Dated 8th March, 1880.* 4d.

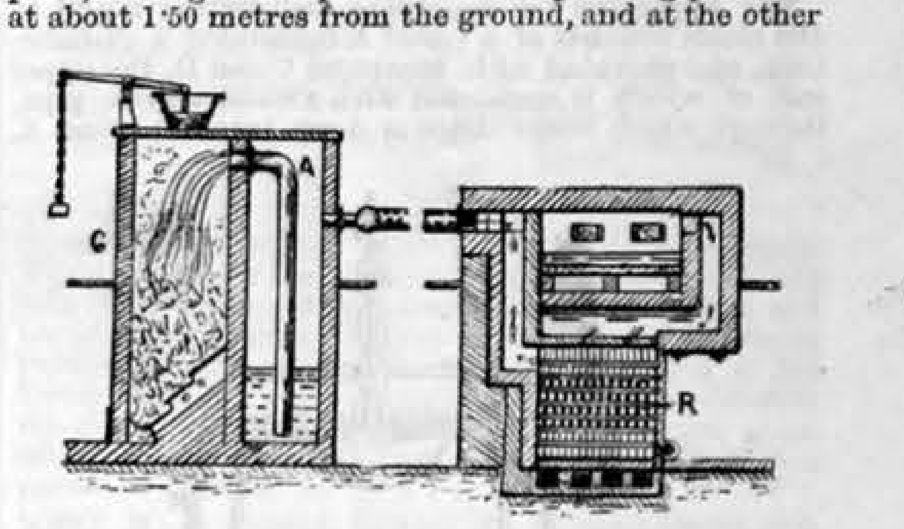
This consists in the use of coal, carbon, iron, or other deoxidising agent, together with steam and air, for the purpose of decomposing chloride of sodium (or potassium) and producing phosphates of soda (or potassa) from natural or manufactured phosphates.

994. GAS BURNERS, &c., *G. E. Webster and W. E. Fisher.—Dated 8th March, 1880.—(Not proceeded with.)* 2d.

This relates to burners wherein the current of air passing between two sheets of flame is regulated and fixed according to definite proportions for the quantity and quality of gas used through given sizes and kinds of burners.

995. GAS FURNACES FOR MELTING GLASS, *A. E. Assézat de Bouteyre.—Dated 8th March, 1880.* 6d.

Each gasogene is formed of a closed chamber G divided into two compartments by a vertical partition, which leaves under the general roof an open space of 0·40 metres in height. The anterior compartment serves as a gasometer. At a third of the height of the anterior chamber is arranged an inclined metal plate, resting at one part on the separating partition at about 1·50 metres from the ground, and at the other



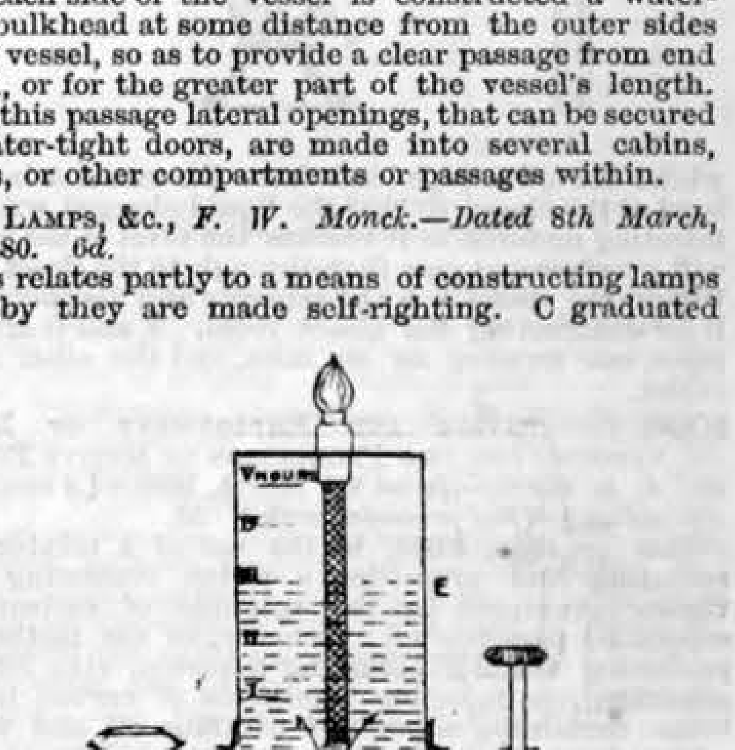
part on the floor of the gasogene, which it joins by a series of inclined steps or benches rising one above the other, under the resaults of which are a series of vertical side holes. This arrangement has for its object to shelter the holes from the inroads of the scoria. Below this plate is arranged a small air chamber, into which the vertical side holes open, and which is in communication with the pipe of a ventilator, such as that of a steam generator. This generator R as placed in connection with the melting furnace, the waste heat from which it utilises, it being sufficient for the action of the ventilator, and for the production of the steam necessary for the gasogene.

996. OCEAN STEAMERS, *J. G. S. Anderson.—Dated 8th March, 1880.—(Not proceeded with.)* 2d.

On each side of the vessel is constructed a watertight bulkhead at some distance from the outer sides of the vessel, so as to provide a clear passage from end to end, or for the greater part of the vessel's length. From this passage lateral openings, that can be secured by water-tight doors, are made into several cabins, berths, or other compartments or passages within.

997. LAMPS, &c., *F. W. Monck.—Dated 8th March, 1880.* 6d.

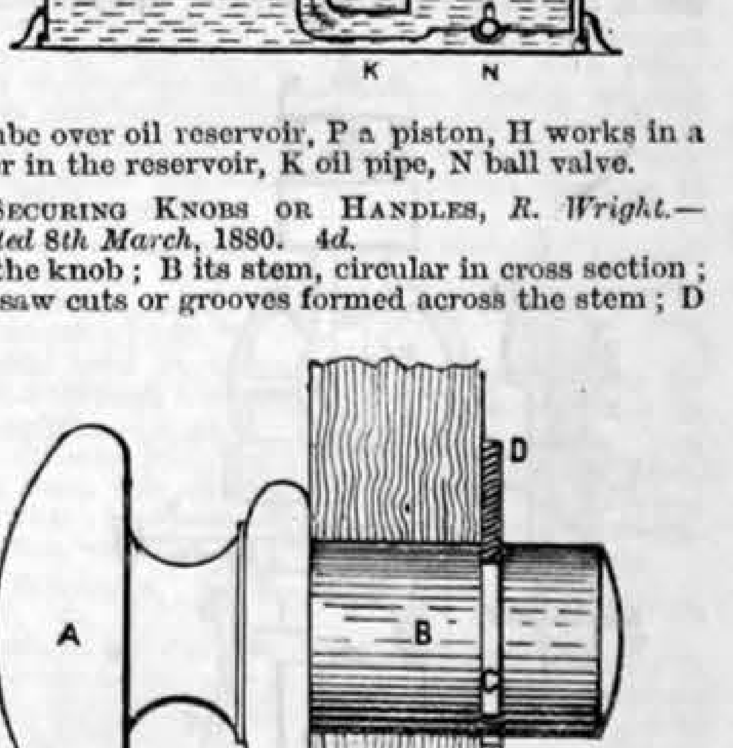
This relates partly to a means of constructing lamps whereby they are made self-righting. C graduated



glass tube over oil reservoir, P a piston, H works in a cylinder in the reservoir, K oil pipe, N ball valve.

999. SECURING KNOBS OR HANDLES, *R. Wright.—Dated 8th March, 1880.* 4d.

A is the knob; B its stem, circular in cross section; CC are saw cuts or grooves formed across the stem; D



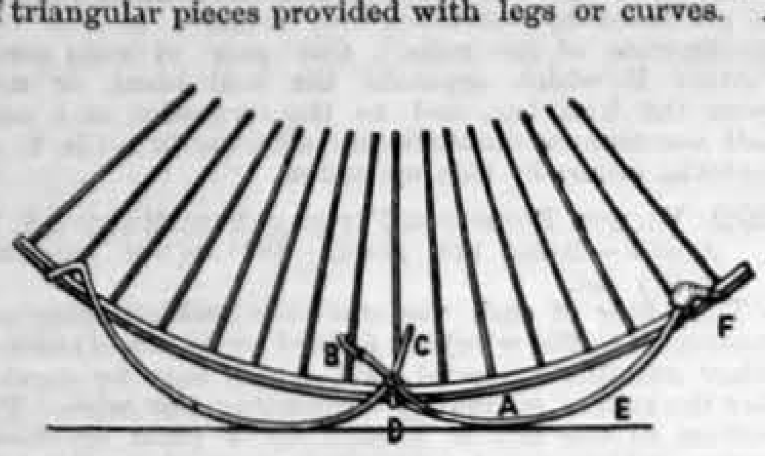
is a slotted metal plate which is caused to embrace the stem where the saw cuts or grooves are made in it; E is a small hole in the plate D to allow of a small nail or screw being passed through to keep it in place.

1000. WINDING MACHINES, *A. C. Henderson.—Dated 8th March, 1880.—(A communication.)* 6d.

This consists, First, in mechanically actuating the windle or winder by means of a friction roller acting in the groove of a fly wheel fixed to the axis of the windle; Secondly, in stopping the windle by a friction brake acting on the grooved fly-wheel; Thirdly, in dividing the silvers of thread by a click arrangement actuated by a rack solid with the guide thread bar, and receiving the habitual motion of the counter or regulator.

1001. Bicycle Stands, &c., *C. Wicksteed.—Dated 8th March*, 1880. 6d.

This consists in a bicycle stand, of the employment of triangular pieces provided with legs or curves. A



are triangular spaces, the ends of which are turned up; the ends B form hooks for the handle bar when the bicycle is inverted, and then C acts as legs when the stand is folded up.

1002. Watches, &c., *W. R. Lake.—Dated 8th March*, 1880.—(*A communication.*) 6d.

This comprises a novel manner of mounting and applying the escapement, whereby it may be readily removed and exchanged or replaced.

1003. Lock Nuts, *J. F. Wiles.—Dated 8th March*, 1880. 6d.

Instead of cutting or splitting the nut and giving each leaf or part thereof a set towards the other, the two sides of the upper portion of the nut are compressed towards each other, thereby forming the bore of the nut at the upper part thereof somewhat oval.

1004. Production of Cyanides of the Metals of the Alkalies and Alkaline Earths, *J. H. Johnson.—Dated 8th March*, 1880.—(*A communication.*) 4d.

This consists in the conversion of the oxides, hydrates carbonates, sulphates, or sulphides of the metals of the alkalies and akaline earths into cyanide, by the employment of nitrogen gas in closed vessels.

1005. Disinfecting Water-closets, &c., *J. H. Johnson.—Dated 8th March*, 1880.—(*A communication.*) 6d.

The apparatus for supplying disinfecting liquid to the closet consists of a vessel A containing a disinfectant, and provided with two pipes C and D, the upper one, of which is connected with a water service pipe, through which water drips or flows into the vessel A,

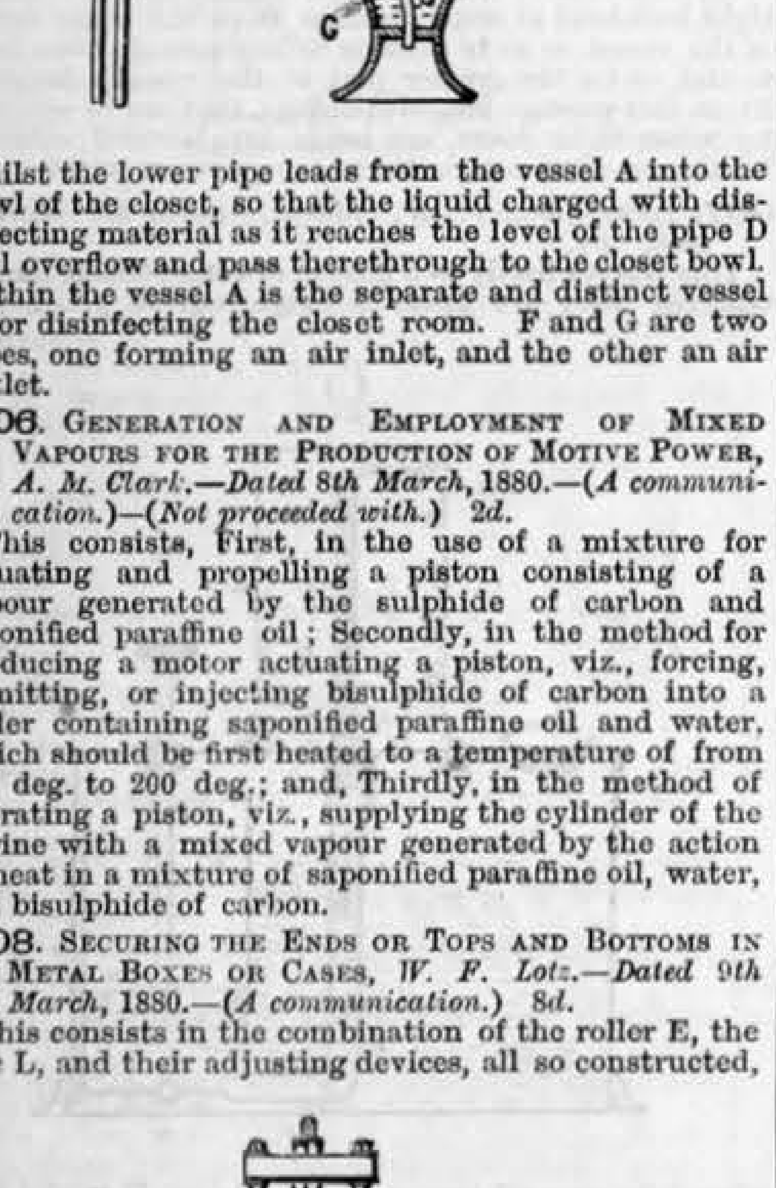
whilst the lower pipe leads from the vessel A into the bowl of the closet, so that the liquid charged with disinfecting material as it reaches the level of the pipe D will overflow and pass therethrough to the closet bowl. Within the vessel A is the separate and distinct vessel B for disinfecting the closet room. F and G are two pipes, one forming an air inlet, and the other an air outlet.

1006. Generation and Employment of Mixed Vapours for the Production of Motive Power, *A. M. Clark.—Dated 8th March*, 1880.—(*A communication.*)—(*Not proceeded with.*) 2d.

This consists, First, in the use of a mixture for actuating and propelling a piston consisting of a vapour generated by the sulphide of carbon and saponified paraffine oil; Secondly, in the method for producing a motor actuating a piston, viz., forcing, admitting, or injecting bisulphide of carbon into a boiler containing saponified paraffine oil and water, which should be first heated to a temperature of from 175 deg. to 200 deg.; and, Thirdly, in the method of operating a piston, viz., supplying the cylinder of the engine with a mixed vapour generated by the action of heat in a mixture of saponified paraffine oil, water, and bisulphide of carbon.

1008. Securing the Ends or Tops and Bottoms in Metal Boxes or Cases, *W. F. Lotz.—Dated 9th March*, 1880.—(*A communication.*) 8d.

This consists in the combination of the roller E, the disc L, and their adjusting devices, all so constructed,



arranged, and operating, as to form a double fold or lapped joint with or without the paper packing and without soldering.

1010. Indicating and Registering the Opening and Closing of Doors or Valves, &c., *J. B. Cull and J. B. Fenby.—Dated 9th March*, 1880.—(*Not proceeded with.*) 2d.

This consists in attaching to the bolt of any door or valve suitable mechanism for indicating and registering the number of times the said door or valve is opened and closed.

1011. Pulleys for Transmitting Motion, &c., *E. C. F. Otto.—Dated 9th March*, 1880.—(*Not proceeded with.*) 2d.

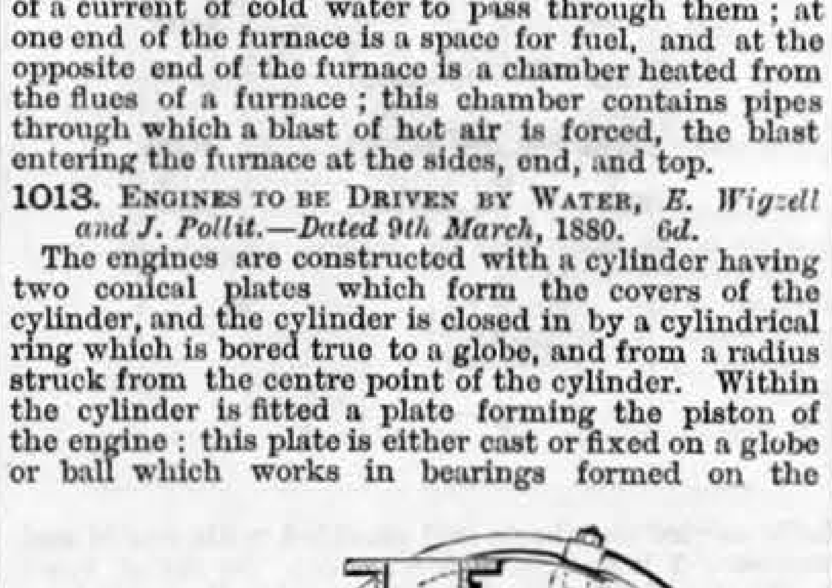
This consists in making a pulley of two discs of sheet iron, steel, or other suitable metal or material securely fastened together in any convenient manner, the sides whereof are formed more or less convex by suitable pressure, or otherwise, while the periphery of each disc is so shaped that when united a suitable groove or surface is formed for the reception of the band.

1012. Furnaces for Making Hard and Soft Steel, &c., *S. and D. Thomas.—Dated 9th March*, 1880.—(*Not proceeded with.*) 2d.

The furnace is constructed at the sides, front, and back of water boshes, connected together so as to allow of a current of cold water to pass through them; at one end of the furnace is a space for fuel, and at the opposite end of the furnace is a chamber heated from the flues of a furnace; this chamber contains pipes through which a blast of hot air is forced, the blast entering the furnace at the sides, end, and top.

1013. Engines to be Driven by Water, *E. Wigzell and J. Pollit.—Dated 9th March*, 1880. 6d.

The engines are constructed with a cylinder having two conical plates which form the covers of the cylinder, and the cylinder is closed in by a cylindrical ring which is bored true to a globe, and from a radius struck from the centre point of the cylinder. Within the cylinder is fitted a plate forming the piston of the engine: this plate is either cast or fixed on a globe or ball which works in bearings formed on the



cover plates of the cylinder, and the globe or ball is kept in working position by means of the packing ring and packing glands. Between the covers and within the cylinder is fixed a plate on which is passed a slotted opening made in the piston plate, which gives a vibrating wabbling motion to the piston plate when the water is acting on the piston plate, and which communicates a rotary motion to the steel arm actuating the crank which gives motion to the driving shaft.

1016. Suspending Nosebags, *F. H. Greenstreet.—Dated 9th March*, 1880. 2d.

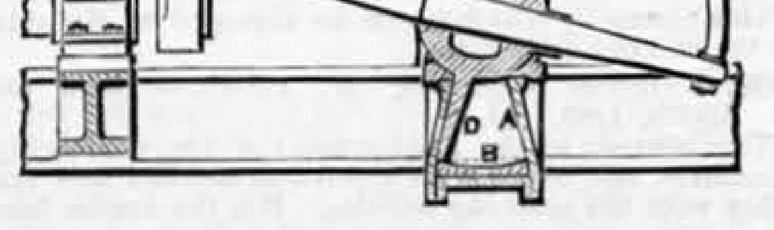
Attached to and continuing from the shafts are rods which hook into eyes, and are kept in position by a catch or saddle made to fit the shaft. The bag is then suspended from the ends of the rods and hangs midway between them.

1019. Manufacture of Magnesia, *T. Twynam.—Dated 9th March*, 1880. 2d.

This consists in the preparation of magnesia from dolomitic lime by dissolving out the lime from burnt magnesia by means of a solution of chloride of calcium.

1020. Furnaces for Burning and Destroying Refuse, *J. R. Picard.—Dated 9th March*, 1880. 6d.

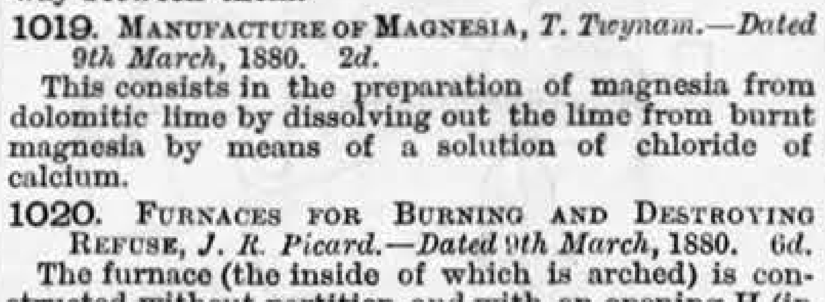
The furnace (the inside of which is arched) is constructed without partition and with an opening H (in the centre) the whole length of the furnace for the reception of refuse, so that the carts or trucks bring-



ing the refuse can shoot it direct into the opening. The exits for the heated gas are by flues constructed in the crown or top part of the furnace, which are carried separately to a chamber where the flue dust is deposited and can be removed without entering the flues. M, fire-bars; F, flues; H, dust chamber; I, purifying fires.

1021. Carriage Fittings, &c., *C. Woolnough.—Dated 9th March*, 1880. 6d.

This consists in constructing a carriage roller bolt or dragon tongue bolt with a movable head, capable of being easily detached from the shank, so as to allow



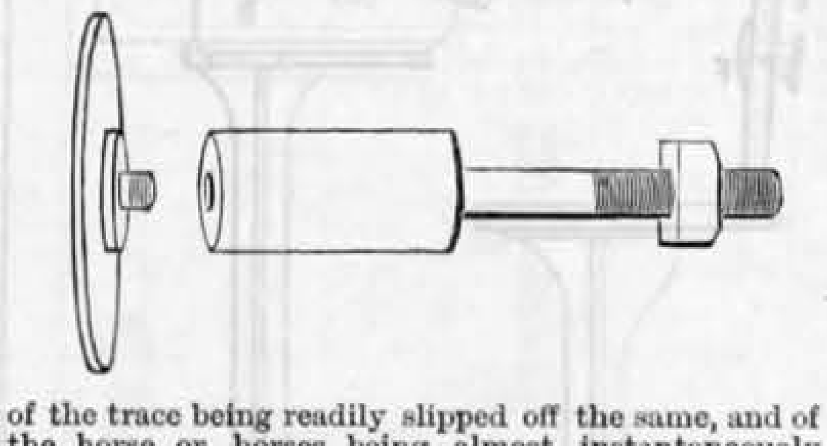
of the trace being readily slipped off the same, and of the horse or horses being almost instantaneously liberated from the vehicle in case of accident.

1022. Spinning and Twisting of Yarn and Fibres, *J. Pollard.—Dated 9th March*, 1880.—(*Not proceeded with.*) 2d.

Near the top of each flyer is attached a catch or nipper. The catches or nippers are mounted on the wire board, rod, or rails as convenient, in such position that whilst the skin is good the nipper or catch is clear of the yarn or thread, but as soon as the weft gets under the bobbin, or it runs unevenly from other cause, the thread is caught in the catch or nipper, and instead of snarling a lap is formed.

1023. Controlling by Hand the Movements of Engines, *R. H. N. Alleyne.—Dated 9th March*, 1880. 6d.

This consists in connecting the handle G which works the slide or valves of the subsidiary cylinder A to the piston thereof in such a manner that the movement of that piston resulting from a movement



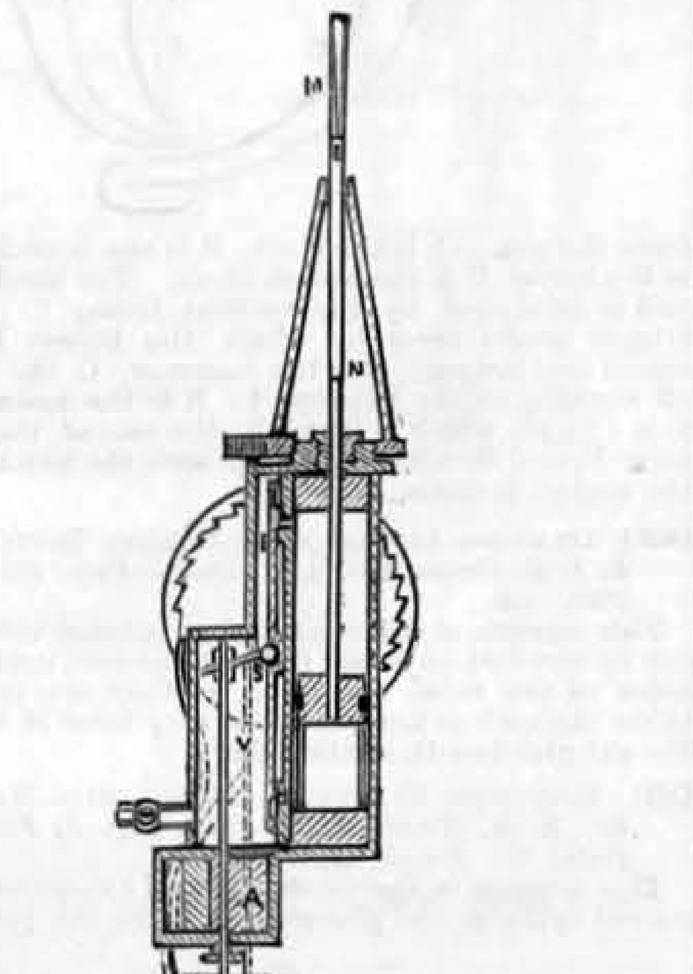
of the subsidiary slide or valves shall tend to cut off the supply of steam which is acting on the subsidiary piston. A, subsidiary cylinder; B, cataract; C, arm on rocking shaft D; F, slide rods; *h* is an arm on the rocking shaft H.

1024. Saving Life in Case of Fire, *H. J. Allison.—Dated 9th March*, 1880.—(*A communication.*)—(*Not proceeded with.*) 2d.

This apparatus is fitted in the loft of the building. Two joists are fitted into the partition wall, and a third joist is connected to them by angle irons. The space between the joists is filled in with firebricks to form a floor. Upon the joists is fitted an iron frame reaching to the roof, in one side of which slides an iron door. Inside this chamber or a cell is a ladder reaching to the roof.

1025. Cutting or Picking Coal in Mines, &c., *W. R. Lake.—Dated 9th March*, 1880.—(*A communication.*) 6d.

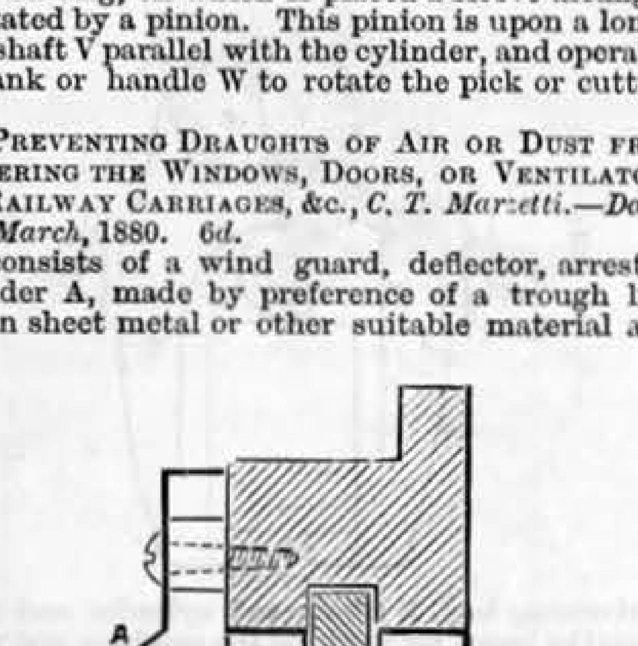
A represents an ordinary pneumatic rotary engine in a case, which case is made in part of an air chamber. A valve is placed on the upper part of the cylinder and the ports communicate with it; these ports alternately take from below the valve S to the cylinder and alternately exhaust air at the side of the cylinder; the valve S has imparted to it a reciprocating motion



by means of a crazy wheel, that is to say, a wheel set obliquely on the shaft of the rotary engine, this wheel operating in a groove, which is formed in the top of a knuckle joint countersunk into the top of the valve S. On the end of the cylinder is formed a serrated or grooved bearing, on which is placed a sleeve arranged to be rotated by a pinion. This pinion is upon a longitudinal shaft V parallel with the cylinder, and operated by a crank or handle W to rotate the pick or cutting tool M.

1026. Preventing Draughts of Air or Dust from Entering the Windows, Doors, or Ventilators of Railway Carriages, &c., *C. T. Marzetti.—Dated 9th March*, 1880. 6d.

This consists of a wind guard, deflector, arrester, or excluder A, made by preference of a trough like section in sheet metal or other suitable material and



with one or more curved or straight deflecting plates or tongue pieces D projecting therein, the whole being secured to the stile or side of the window or other opening with box-like space left between the said windguard, deflector, arrester, or excluder and the stile.

1027. Weaving Loongees, &c., *C. Cross.—Dated 9th March*, 1880. 6d.

This consists, First, in apparatus for the positive and accurate delivery of the "lap weft" or "whip threads" for forming the coloured borders; Secondly, in apparatus for stopping the loom when either of the lap threads breaks; Thirdly, in weaving ornamental cashmere borders to loongees or other ornamental fabric by the employment of tie-ups which show the warp threads only and conceal the weft.

1028. Printing Floorcloths or Oilcloths, &c., *A. L. Klein.—Dated 9th March*, 1880. 6d.

The dot or pin is slightly curved at the sides *a a* and a small rounded air cup *b b* is formed at the bottom, and four lines *c c* are cut in the bevelled sides leading from the surface to the air cup *b b*, the said lines *c c*

commencing a little below the surface of the copper, and extending to the entrance of the air cup. From the surface of the copper to the commencement of these four lines the orifice is slightly countersunk as at *d d*, and the sharp edge left from the countersinking is rounded off in order that it may not cut or otherwise injure the material whilst in the act of printing.

1030. Horseshoes, &c., *J. Holt, J. Maude and B. Jones.—Dated 9th March*, 1880.—(*Not proceeded with.*) 2d.

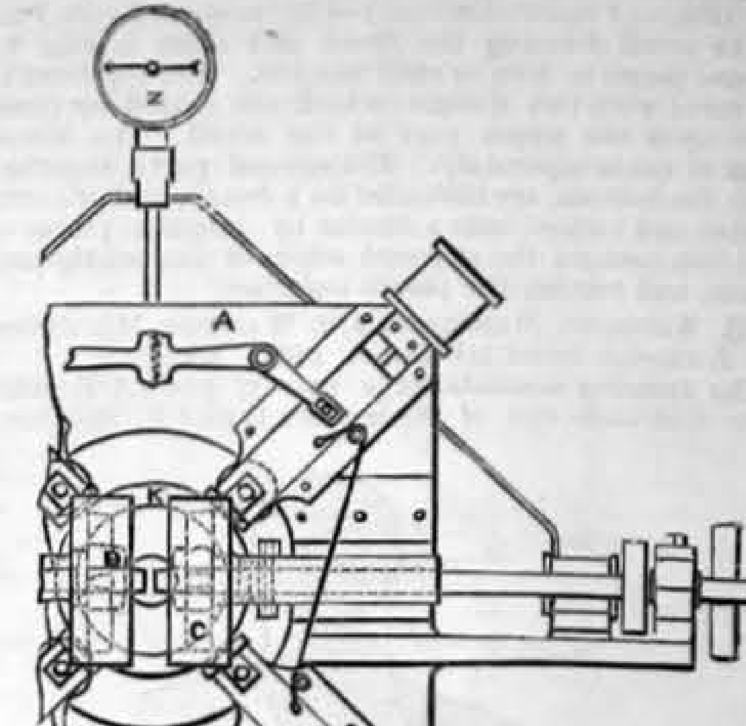
This relates to constructing horseshoes with movable calking or slip cogs.

1031. Fastening Boots, &c., *M. L. Müller and H. Hartjen.—Dated 9th March*, 1880.—(*Not proceeded with.*) 2d.

This consists of two identical members or portions, each of which is composed of a specially curved or shaped shank provided at one end with a button, knob, or head, and at the other with prongs or pin points, the said apparatus forming together, when applied to the article, one pair of fastenings.

1029. Machinery for Rolling Railway or other Wheels, &c., *G. Cotton and C. H. Smith.—Dated 9th March*, 1880. 6d.

A is the main frame of the machine; two pairs of horizontal rolls shaped to fit the sides of the wheel K to be rolled, are fixed on a shaft carrying sliding bearings which carry the bearing rollers *c*; the ends of the shafts furthest from the rolls revolve in pivot bearings. The front bearings are connected by links to a cross head attached to a piston rod working in a hydraulic cylinder, and to the back bearings are fitted anti-friction rollers which bear against one end of the



cylinder, so that the rolls on either side the wheel can be moved nearer to or further from each other. The hydraulic cylinders traverse the bearings with the rolls parallel to the sides of the wheel K. The rollers for forming the tire or flange of the wheel to be rolled are fitted with feather keys on the shaft. The rollers are carried in bearings fixed to sliding plates which are caused to advance towards or recede from the centre of wheel K by hydraulics.

1032. Utilising Excrementitious Matters, &c. *J. Wadsworth.—Dated 9th March*, 1880. 8d.

This relates to apparatus for evaporating and drying urinous and excrementitious matter.

1033. Rolling Tea Leaves, Husking and Polishing Rice, &c., *A. C. G. Thompson.—Dated 9th March*, 1880. 6d.

This relates to a globe revolving upon a vertical and horizontal axis simultaneously in combination with a lower fixed vessel.

1034. Carburetting Air, &c., *E. Edmonds.—Dated 9th March*, 1880.—(*A communication.*)—(*Not proceeded with.*) 4d.

This consists in placing a hydro-carburet in contact with a body heated to a temperature sufficient to vaporise to hydro-carburet immediately, and in mingling the vapours thus produced with the air which it is desired to render carburetted.

1036. Coil Springs, &c., *H. Smith.—Dated 10th March*, 1880.—(*Not proceeded with.*) 2d.

Clips or staple clips are formed on the iron, steel, or wooden laths of mattresses in such a manner that the rings at both extremities of the coil will catch in same, and will be held secure in position.

1037. Standard Liquid Measures, *D. Moulton.—Dated 10th March*, 1880.—(*Not proceeded with.*) 2d.

This consists of a mode of inserting in the sides of jugs and cups of earthenware or china, a small plate of pewter to receive the Government weights and measures stamp.

1038. Heating and Illuminating Gases, &c., *J. A. Stephan.—Dated 10th March*, 1880.—(*Not proceeded with.*) 2d.

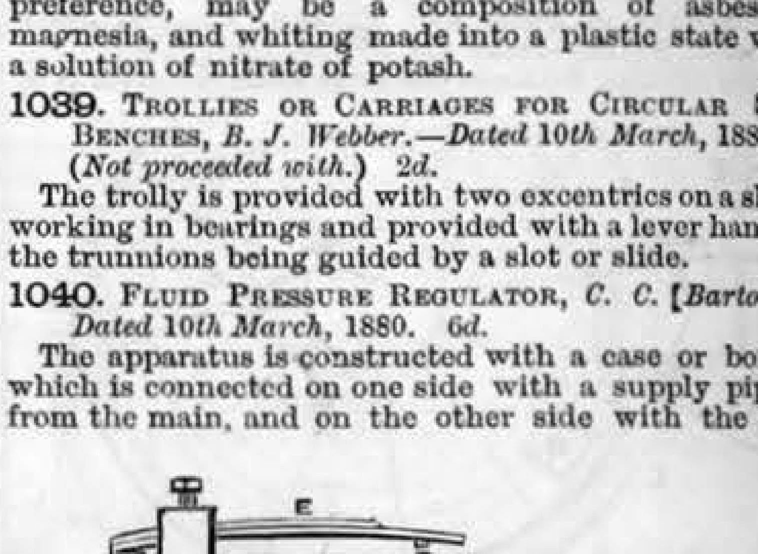
Solid sewage matters are heated in retorts; steam is then passed over the heated matters. The apparatus for incandescence consists of a material which, by preference, may be a composition of asbestos, magnesia, and whiting made into a plastic state with a solution of nitrate of potash.

1039. Trollies or Carriages for Circular Saw Benches, *B. J. Webber.—Dated 10th March*, 1880.—(*Not proceeded with.*) 2d.

The trolly is provided with two excentrics on a shaft working in bearings and provided with a lever handle, the trunnions being guided by a slot or slide.

1040. Fluid Pressure Regulator, *C. C. Barton.—Dated 10th March*, 1880. 6d.

The apparatus is constructed with a case or box A which is connected on one side with a supply pipe B from the main, and on the other side with the dis-



charge or delivery pipe C from which the water is to be drawn. Within the case or box A is arranged a valve D suspended by a flexible sheet F, which is closed by pressure in the outlet or delivery pipe C against the action of a controlling spring E or a weight.

1041. Injectors or Water-forcing Apparatus for Feeding Steam Boilers, *G. W. Garrett.—Dated 10th March*, 1880.—(*Not proceeded with.*) 2d.

This relates to an apparatus for injecting or water forcing by gravity.

1042. Knitted and Looped Fabrics, &c., *S. Thacker. Dated 10th March*, 1880. 6d.

This consists in laying in two additional threads between succeeding courses of looped or knitted work.

1043. Producing Ornamentation on Porcelain, &c., *T. Bevington.—Dated 10th March*, 1880.—(*Not proceeded with.*) 2d.

The article is coated with a solution of gum or cement in water and "water slip" by means of a brush, and then it is sprinkled with small particles of clay obtained by the mixture of gum clay, and water clay. The article is then coloured and fired.

1044. Treatment of Concrete for Building Purposes, &c., *C. Drake.—Dated 10th March*, 1880.—(*Not proceeded with.*) 2d.

This relates to the manufacture of concrete slabs and to apparatus for adjusting and holding them in correct position while being built.

1046. Compressing Air by Electricity for Obtaining Motive Power, *V. Poulet and E. Commelin.—Dated 10th March*, 1880.—(*Not proceeded with.*) 2d.

An electro-magnet attracts a rod, which serves as a piston, a lever being connected with the piston to increase the power. A connecting rod is connected to a fly-wheel and an air pump in connection with a pipe, through which air is compressed into the boiler. An inlet pipe for air is fixed on the boiler, and communicates with the slide and slide rod of a secondary piston.

1047. Long-napped Cloth, &c., *A. C. Henderson.—Dated 10th March*, 1880.—(*A communication.*) 4d.

The cloth is damped or steamed, and is acted upon by cards mounted upon a cylinder capable of being raised or lowered, so as to operate on the cloth through a perforated plate.

1048. Tables, *H. Halstead.—Dated 10th March*, 1880. 6d.

The table is provided with a nut working on a screw, to which rotary motion is imparted so as to adjust the height of the table. So as to turn the table at an angle it is connected with the nut by a shaft and pinion engaging with an internal spur wheel carried by the nut.

1049. Magneto-electric Brakes, &c., *C. Groombridge.—Dated 10th March*, 1880.—(*Not proceeded with.*) 2d.

A number of electro-magnets are arranged in a bearing between two pairs of wheels and their poles rest upon the face of the rails which form the armature of the magnets.

1050. Repulping Paper, *A. M. Clark.—Dated 10th March*, 1880.—(*A communication.*)—(*Not proceeded with.*) 2d.

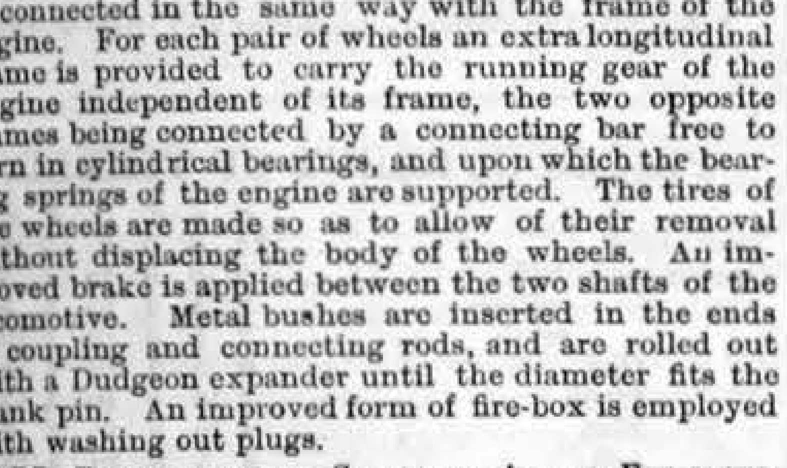
Rag stock is boiled and then placed in a beater which acts upon it while the material is suspended in hot water or other liquid.

1052. Locomotive Engines, *C. Brown.—Dated 10th March*, 1880. 8d.

Instead of guide cheeks to keep the axle boxes in position laterally, a radial rod is employed, one end being connected with one of the plates that join the opposite axle boxes rigidly together, and the other end is connected in the same way with the frame of the engine. For each pair of wheels an extra longitudinal frame is provided to carry the running gear of the engine independent of its frame, the two opposite frames being connected by a connecting bar free to turn in cylindrical bearings, and upon which the bearing springs of the engine are supported. The tires of the wheels are made so as to allow of their removal without displacing the body of the wheels. An improved brake is applied between the two shafts of the locomotive. Metal bushes are inserted in the ends of coupling and connecting rods, and are rolled out with a Dudgeon expander until the diameter fits the crank pin. An improved form of fire-box is employed with washing out plugs.

1053. Regulating the Supply of Air to Furnaces, *T. S. Prideaux.—Dated 11th March*, 1880. 6d.

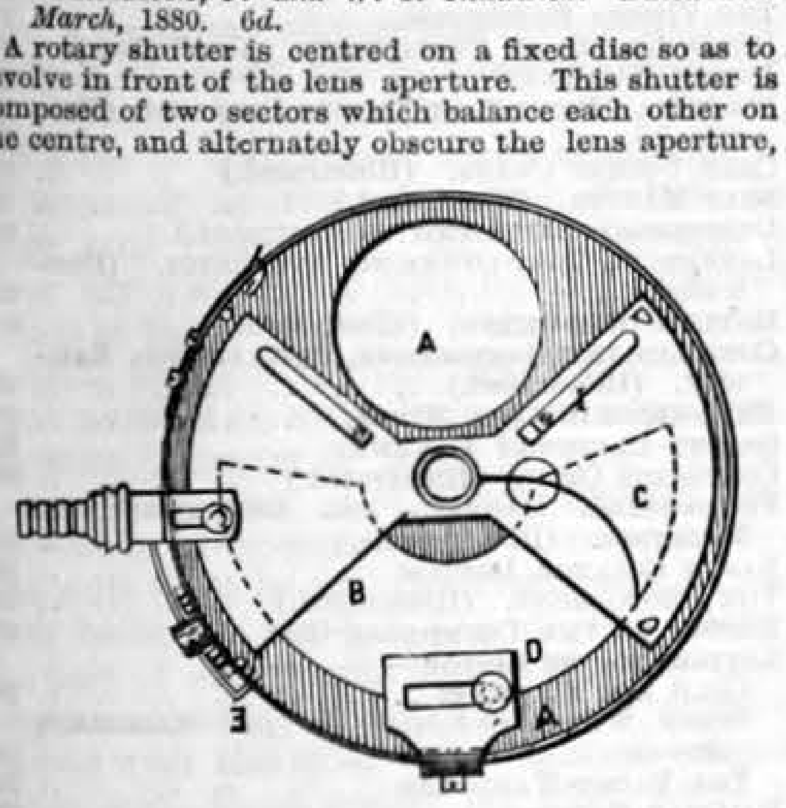
This consists, First, of a furnace door, or furnace door and front combined, having an opening for the admission of air furnished with a cover or shutters by means of which the air can be admitted or excluded at pleasure, and communicating with the interior of the furnace through a grating, so arranged as to intercept and absorb the heat radiated outwards when the



air valve is closed, and to heat and distribute the stream of air which flows through it into the furnace when the air valve is open; Secondly, of the mechanism which by its automatic action gradually closes the air valve. When the fire door is opened the cup C empties itself of mercury through orifices O and when the door is again closed the cup descends gradually as the mercury re-enters. A disc below the cup C follows it at a short distance and assists in regulating the flow of the mercury.

1054. Controlling the Exposure in Photographic Operations, *J. and W. I. Chadwick.—Dated 11th March*, 1880. 6d.

A rotary shutter is centred on a fixed disc so as to revolve in front of the lens aperture. This shutter is composed of two sectors which balance each other on the centre, and alternately obscure the lens aperture,



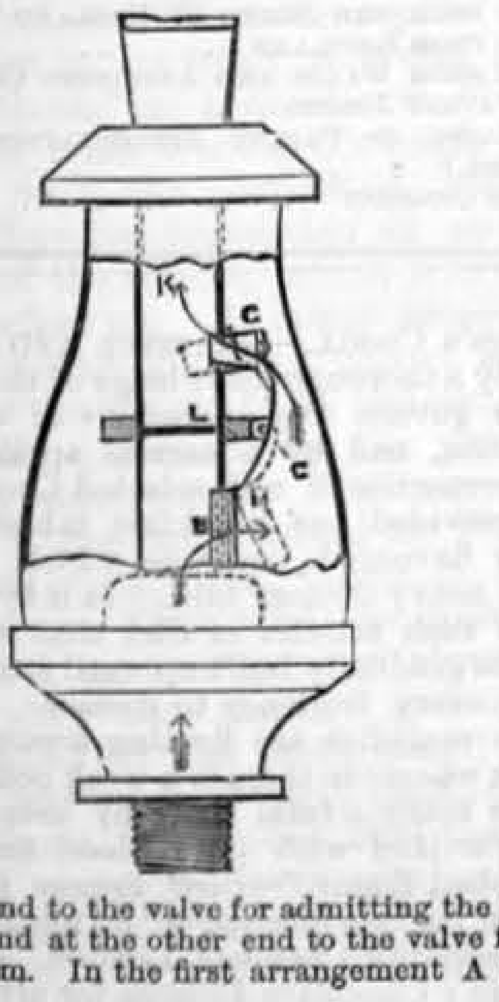
the exposure taking place during the intervening interval. The shutter is rotated by a spring. In the drawing A is the fixed disc with a flange A to protect the shutter B, and an opening A surrounded at back by a flange that screws into the end of the lens tube; B B are the two sectors, and C is the spring abutting against the stop D which is adjustable.

1056. Propelling Vessels, *J. McLennan and R. Owen.—Dated 11th March*, 1880. 6d.

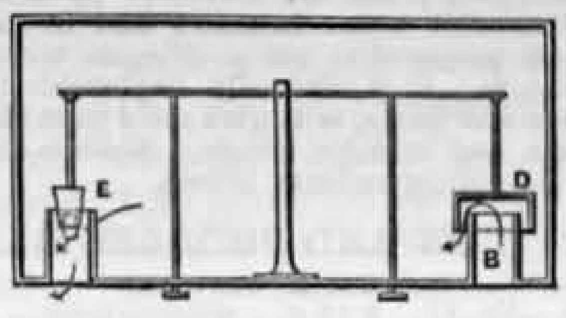
The propeller consists of a hollow drum with deep flanges, between which is fitted a series of screw blades forming an endless screw confined between two circular walls.

1055. Regulating the Supply of Gas, *J. McLennan and R. Owen.—Dated 11th March*, 1880. 6d.

A lever works in a chamber on centres fitted between the inlet and outlet for the gas, such lever being con-



nected at one end to the valve for admitting the gas to the chamber, and at the other end to the valve for its escape therefrom. In the first arrangement A is the chamber, D the inlet valve, and E the exit valve, to both of which the lever F is connected and is pivotted



at G. In the second arrangement, G is the fulcrum, B the inlet valve, and C the exit valve on opposite sides of the partition L.

1057. Making Cigarettes, *R. Gothiel.—Dated 11th March*, 1880.—(*Not proceeded with.*)—(*A communication.*) 2d.

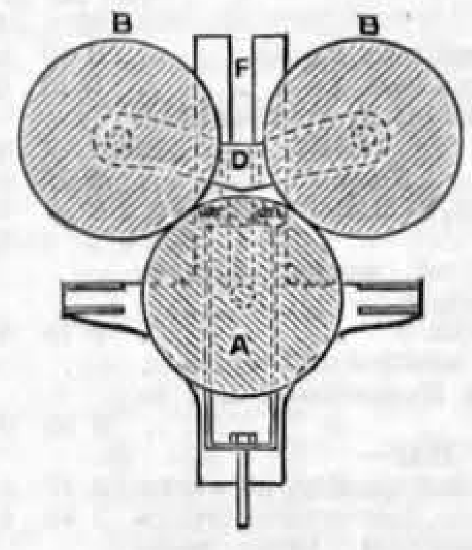
The cigarettes are made of various thicknesses by means of a band, attached at one end only, the other end being free, the cigarettes being made in a box with a transverse partition and sliding cover.

1058. Nickel and Cobalt, *H., H. A., and W. W. Wiggin and A. S. Johnstone.—Dated 11th March*, 1880. 4d.

Metallic manganese is added small portions at a time to the cobalt or nickel when in a state of fusion.

1059. Wringing and Mangling, *J. Wilding.—Dated 11th March*, 1880. 6d.

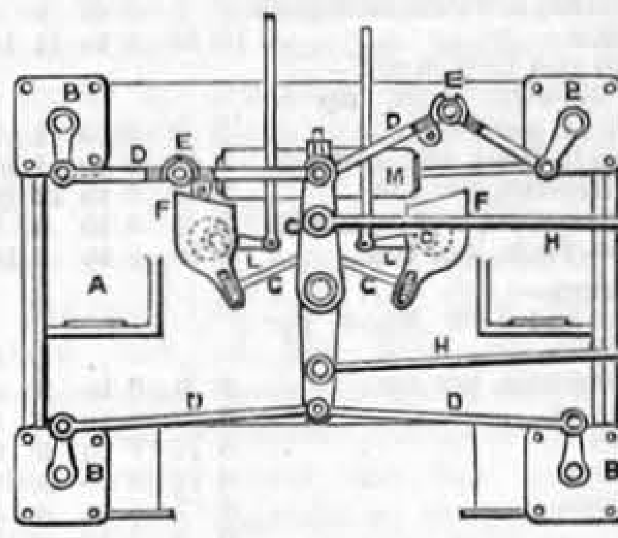
Three rollers are employed, the axes of the two upper ones being mounted at either end of a link, the pivot of which works in a vertical slot, so that the rollers can accommodate themselves to the thickness



of the material being operated upon. A is the lower roller in a fixed bearing, and B B the upper rollers with rocking bearings D on either end of a lever having a central stud, which moves vertically on a block sliding in the slot F.

1060. Working the Expansion Valves of Steam, Air, or Gas Engines, *J. Ramsbottom.—Dated 11th March*, 1880. 6d.

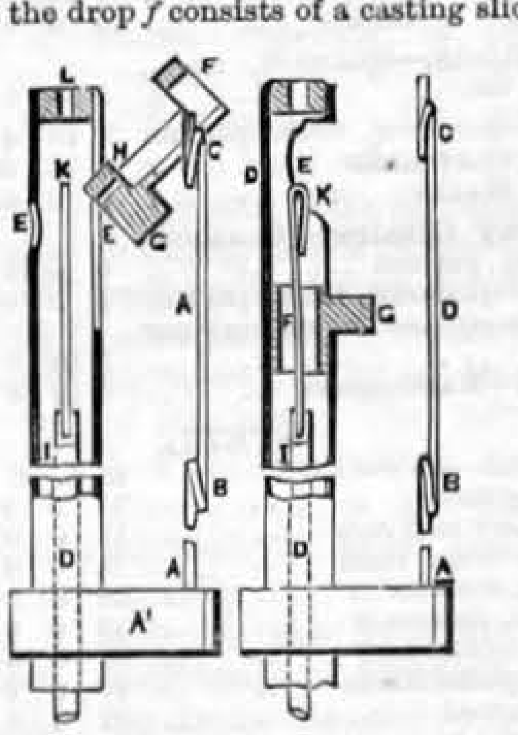
The valve rods D D are made with knee or toggle joints E E, sufficiently rigid in their action to open the valves B B^1 B^2 B^3, either by a pull or thrust, so long as the joint pins remain in a right line with the other



part of the rods; a stop is provided and arranged so that when the required distance has been travelled by the valve the knee or toggle joint is relieved or tripped and the valve is at liberty to resume its former position, by springs, pressure of steam, or by gravity. A A is the cylinder, and C C the rocking lever to work the rods D D.

1061. Spindles of Braiding Machines, *J. Booth.—Dated 11th March*, 1880. 6d.

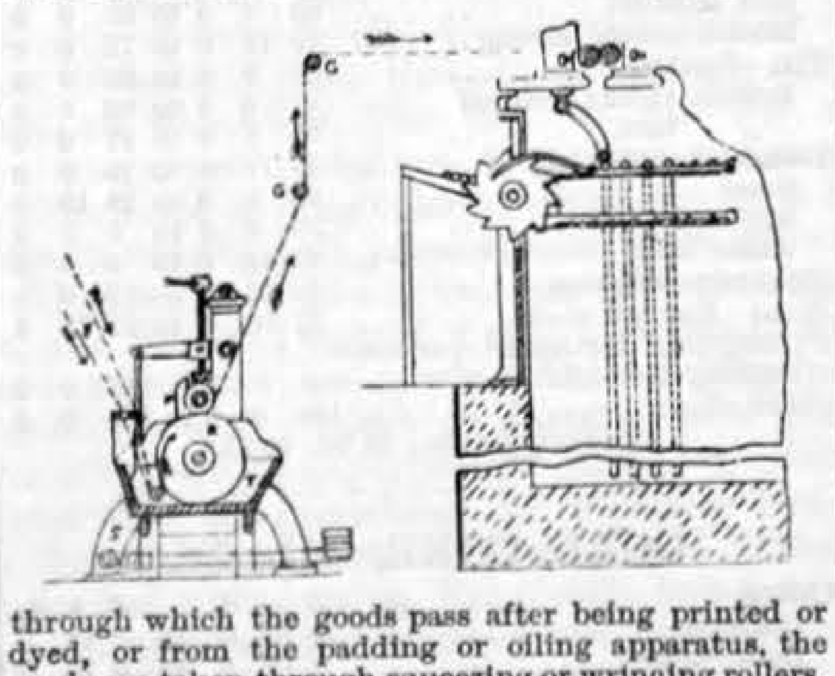
The flyer *a a* is made of a piece of wire with a curl opposite the bobbin, and a similar curl *c* at the top, so that no threading is required for the flyer, the bottom part *a'* is made separate and is stronger than usual. The top of the barrel *d d* has a transverse opening *e e* from front to back, and the drop *f* consists of a casting sliding up



and down outside the barrel, and has a projection *g* which takes into notches in the top of the bobbin, and a hole *h* is drilled through it in the same direction as *e*. The upper end of the weight *i* has a loop *k*, so that when the weight *i* is raised the thread can be drawn through the barrel *d*, the drop *f*, and the weight *i* at one operation, and then drawn through the hole *l* at the top of the barrel.

1062. Printing and Dyeing and Steaming Cotton Fabrics, *J. King.—Dated 11th March*, 1880. 6d.

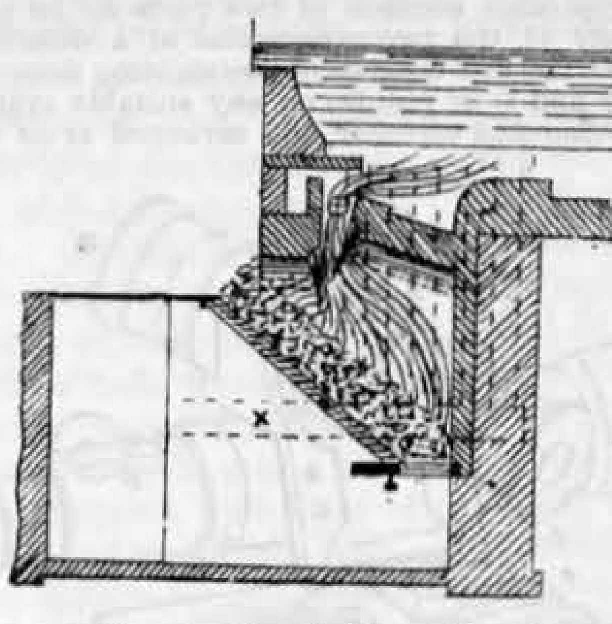
The goods are entered into the steaming chamber in a slightly damp condition, and the series of drying cylinders is abolished. From the washing apparatus



through which the goods pass after being printed or dyed, or from the padding or oiling apparatus, the goods are taken through squeezing or wringing rollers. The drawing represents an oiling apparatus in which T is a trough between the standards S of a wringing machine fitted with rollers P R, the lower one dipping into the liquor in the trough. The fabric passes in at F and is led into the trough T under a guide roller near the bottom, then up and between the squeezing rollers, from whence it passes over guide rollers G to the steaming chamber.

1063. Stoves and Furnaces Heated by Gas, *F. C. Glazer.—Dated 11th March*, 1880.—(*A communication.*) 8d.

This consists of a transverse slit in the arch of the



generator close by the stoking place in combination with the air inlet channel in the front wall of the smoke casing.

1064. Spectacles, *S. Offenbacher.—Dated 11th March*, 1880.—(*Not proceeded with.*) 2d.

The joint leaf is connected to the "side" or "temple" by a screw pivot, so as to be able to vary the angle of the glasses in respect to the sides or temples.

1065. Sheet or Cast Iron Tiles for Roofing, *L. Gilquart.—Dated 11th March*, 1880.—(*Not proceeded with.*) 2d.

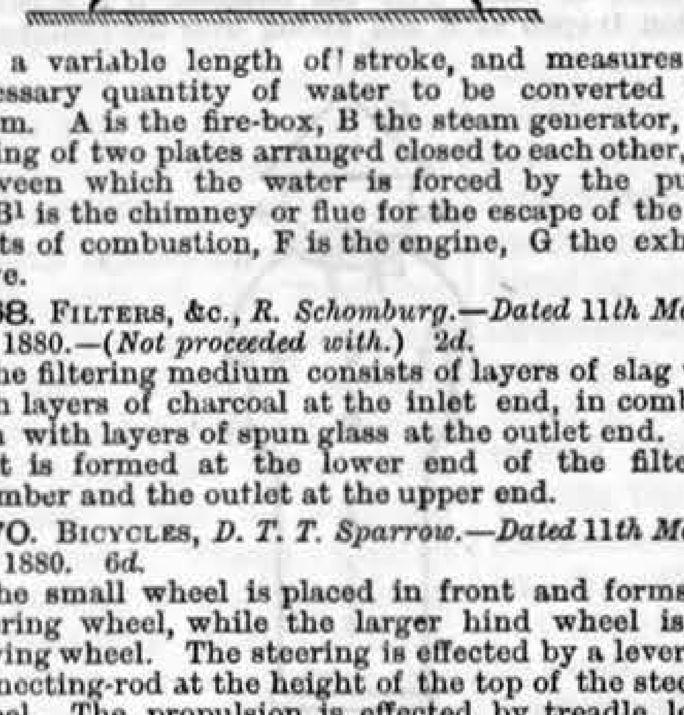
The tiles are enamelled in both sides and have a groove formed in the middle of their length, and their edges bent over one above and the other below, so as to overlap one another when placed in position. At top is a hook to fasten the tiles to the laths, and in the middle about the top of each piece is rivetted in the groove a second hook made of band iron to receive and hold the upper tile.

1066. Self-adjusting Bearings for Shafts and Axles, *F. H. F. Engel.—(A communication.)—(Not proceeded with.)* 2d.

The upper part of the bracket containing the bush or box is of ordinary construction, but its bottom part is at right angles to the bush, and is hinged to a semi-circular projecting bracket of a plate resting upon the bed plate of the bearing on which it turns.

1067. Generating Steam, *F. J. Brougham.—Dated 11th March*, 1880.—(*A communication.*) 6d.

A quantity of water is forced by a force pump between two boiler plates, almost touching and highly heated, whereby the water is converted into dry steam, which acts directly on the piston of the engine, the slide valve of which is abolished. The feed pump



has a variable length of stroke, and measures the necessary quantity of water to be converted into steam. A is the fire-box, B the steam generator, consisting of two plates arranged closed to each other, and between which the water is forced by the pump. C; B^1 is the chimney or flue for the escape of the products of combustion, F is the engine, G the exhaust valve.

1068. Filters, &c., *R. Schomburg.—Dated 11th March*, 1880.—(*Not proceeded with.*) 2d.

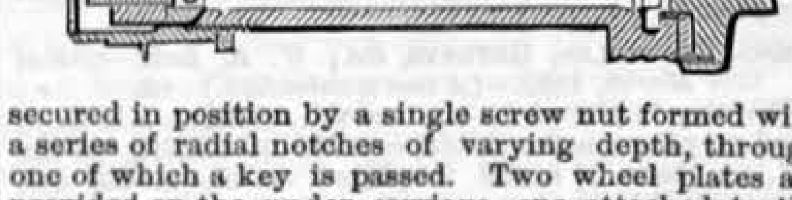
The filtering medium consists of layers of slag wool with layers of charcoal at the inlet end, in combination with layers of spun glass at the outlet end. The inlet is formed at the lower end of the filtering chamber and the outlet at the upper end.

1070. Bicycles, *D. T. T. Sparrow.—Dated 11th March*, 1880. 6d.

The small wheel is placed in front and forms the steering wheel, while the larger hind wheel is the driving wheel. The steering is effected by a lever and connecting-rod at the height of the top of the steering wheel. The propulsion is effected by treadle levers connected by cranks with the driving axles. The socket and fork spindle, and the centre steering arrangements, are replaced by plates placed near the front end of the backbone and fork, anti-friction balls being interposed, such plates being extended to provide the necessary leverage and connected with the fork by a pin or bolt and nut.

1071. Axle Arms and Under Carriage of Wheeled Vehicles, *J. Offord.—Dated 11th March*, 1880. 6d.

The axle arm adapted to receive the bush secured to the nave of the wheel is of wrought iron or gun-metal and projects beyond the outer end of the bush when in position, the extended part being screw-threaded, and over it passes a collar with a bevelled inner surface to fit on the outer end of the bush. The collar is



secured in position by a single screw nut formed with a series of radial notches of varying depth, through one of which a key is passed. Two wheel plates are provided on the under carriage, one attached to the top bed and the other to the bottom bed, the upper plate being made so as to cover the lower one. The drawing illustrates the axle A with its arm A^1 prolonged and screw-threaded; B is the bush, C the collar, and D the nut, F cap.

1072. Bicycles, &c., *A. Jennings.—Dated 12th March*, 1880.—(*Not proceeded with.*) 2d.

The driving wheel is actuated by coiled or other springs, which are wound up or compressed by gearing operated by treadles worked by the driver.

1073. Hoisting or Lowering Boats or Yards, *E. Bond.—Dated 12th March*, 1880. 6d.

A grooved pulley receives a loose endless rope for actuating the apparatus, and is held by eyes or guards. This pulley is connected by gearing with a wheel whose surface is formed to firmly hold the links of a chain passing over it, and from which the boat is suspended. A spring block takes off sudden shocks.

1074. Plaiting Fabrics, *N. Wilson.—Dated 12th March*, 1880. 6d.

A slotted vibrating lever works freely on one of the feed roller shafts, and is actuated directly by a rod from an excentric on the fly-wheel shaft. This lever carries a pall lever and a detent lever, the former having double palls engaging with one or other of two ratchet wheels with reversed teeth on the axis of one of the feed rollers. By varying the position of the excentric rod in the slot of the lever the width of the plaits is varied, and, by adjusting the knife arms or carriers, as described in Patent No. 1476, of the year 1877, the underlap is varied. An automatic lever arrangement is employed for raising the presser bar the moment the plaiter or knife advances, thereby facilitating the entrance of the knife or plaiter underneath the bar.

1075. Boxes for Muslins, &c., *G. Davies.—Dated 12th March*, 1880. 6d.

The box is of pasteboard, and has an opening cut in the front, to which an inside flap is attached. A piece of the embroidery or other article is passed round the flap, so that the pattern is seen through the front opening without exposing any other part of the goods. The back is provided with four flaps folding inwards, one at each end and one at each side, and when opened exposes the whole of the goods.

1076. Filling Bottles with Aerated Liquids, *J. McEwen and S. Spencer.—Dated 12th March*, 1880.—(*Not proceeded with.*) 2d.

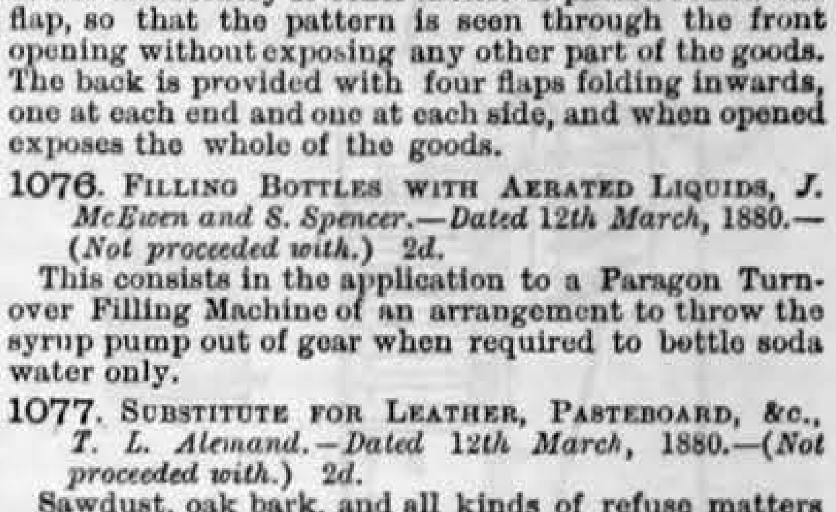
This consists in the application to a Paragon Turnover Filling Machine of an arrangement to throw the syrup pump out of gear when required to bottle soda water only.

1077. Substitute for Leather, Pasteboard, &c., *T. L. Alemand.—Dated 12th March*, 1880.—(*Not proceeded with.*) 2d.

Sawdust, oak bark, and all kinds of refuse matters in hide tanning are compressed and rendered imputrescible and homogeneous by the aid of agglomerants, such as tannate of gelatine and oxydated oils.

1078. Recovering Soda Ash from Waste Liquors, *A. Chapman.—Dated 12th March*, 1880. 6d.

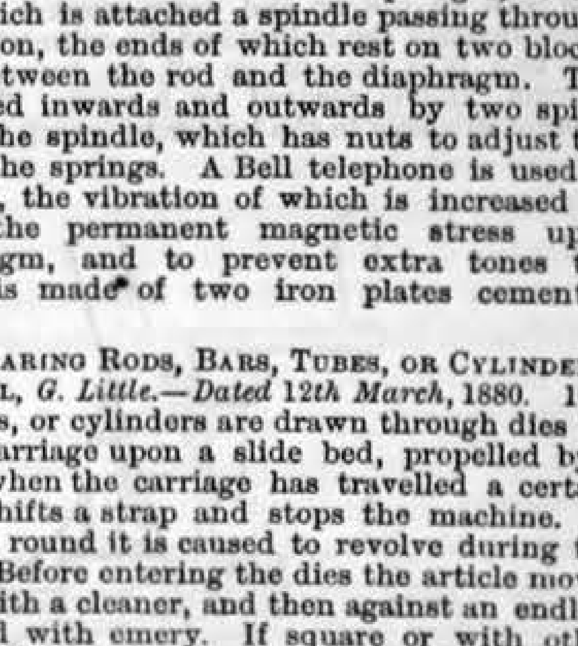
The waste liquor flows from the supply tank through the tubes of a burning off furnace, and being heated therein goes to a donkey pump, which forces it to a steam generator, the steam from which passes to the first of a series of multiple effect vacuum pans, and evaporate the liquor therein. The steam generated in this pan goes to the second pan to evaporate the



liquor therein, and so on through the series of pans. When the liquor has been sufficiently treated it is run into the burning off furnace, where it is ignited and burnt. The vacuum engine is driven by the steam produced in the generator. In the drawing A is the liquor tank, B a surface condenser, C a tank to receive the liquor from the condenser, F is the steam generator, N and R tubes through which the liquor is passed to heat it.

1080. Hand Signal Lamps, *H. Defries.—Dated 12th March*, 1880. 6d.

In order to facilitate the raising and lowering of the coloured discs, E K the thumb pieces or catches are placed above the handles at the back of the lamp, and the



glasses or discs are connected to the thumb-pieces or catches by rods and links passing on either side of the lamp. The discs are shifted by pressing on the thumb-pieces or catches. F joint, G link.

1081. Telephonic Apparatus, *F. H. W. Higgins.—Dated 12th March*, 1880.—(*Not proceeded with.*) 2d.

The transmitter consists of a diaphragm, to the centre of which is attached a spindle passing through a rod of carbon, the ends of which rest on two blocks of carbon between the rod and the diaphragm. The rod is pressed inwards and outwards by two spiral springs on the spindle, which has nuts to adjust the pressure of the springs. A Bell telephone is used as the receiver, the vibration of which is increased by increasing the permanent magnetic stress upon the diaphragm, and to prevent extra tones the diaphragm is made of two iron plates cemented together.

1082. Preparing Rods, Bars, Tubes, or Cylinders, of Metal, *G. Little.—Dated 12th March*, 1880. 10d.

Bars, tubes, or cylinders are drawn through dies by means of a carriage upon a slide bed, propelled by a screw, and when the carriage has travelled a certain distance it shifts a strap and stops the machine. If the article is round it is caused to revolve during the operation. Before entering the dies the article moves in contact with a cleaner, and then against an endless band covered with emery. If square or with other number of sides the article requires turning so that each face may be operated upon. The dies are formed by making several apertures in the same plate, which on being turned will bring any required aperture to the operating position.

1083. Taps or Apparatus for Drawing-off Liquids from Casks, Bottles, &c., *R. Schomburg.—Dated 12th March*, 1880.—(*Not proceeded with.*)—(*A communication.*) 2d.

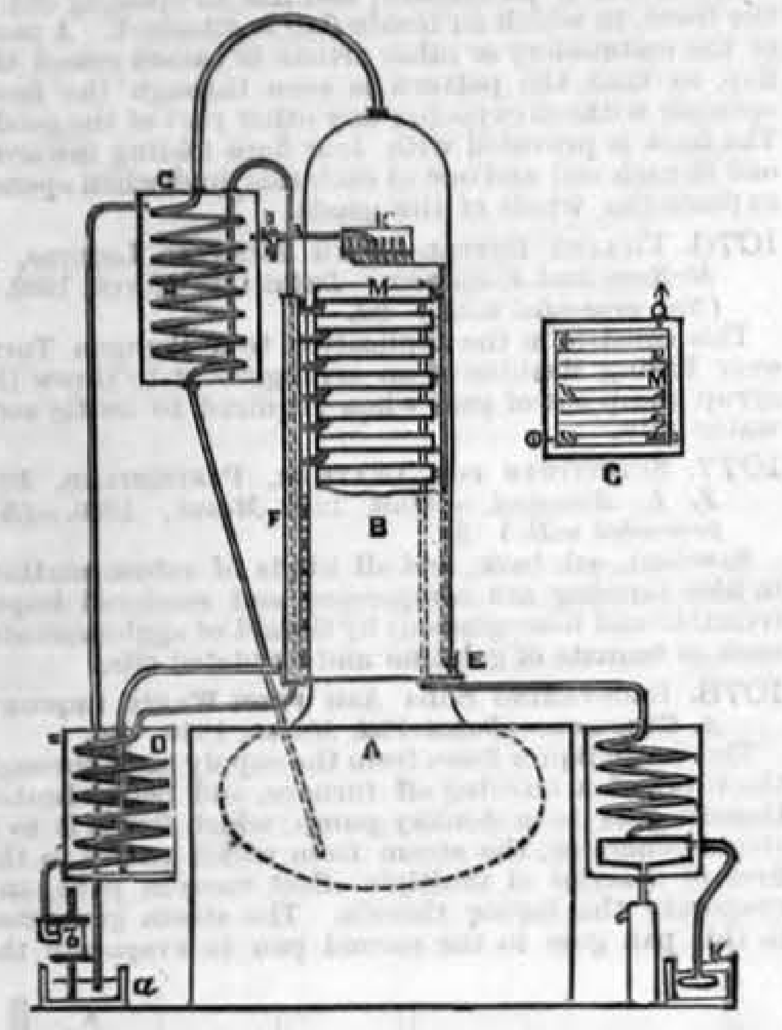
A metal tube curved at one end passes with its other end through a central hole in a stopper fitted in the bunghole of a cask or mouth of a bottle. At a certain distance from its open inner end is a partition, and on each side are holes. The cork has a lateral recess, which by turning the tube opens or shuts communication with the interior of the cork or bottle.

1084. Ecraseur, *W. H. Beach.—Dated 12th March*, 1880. 6d.

The handle is fixed on a spindle separate from but in line with the screw, and the two are geared together by multiplying gear, whereby the motion or the power may be multiplied at will. Longitudinal ribs or shoulders are formed along the frame of the instrument, forming a groove between them for the two parts of the chain to lie in, and prevent any lateral displacement of this part of the chain which would tend to drag the loop or bight of the chain out of the slot in the head of the frame.

1086. Obtaining Ammonia and Ammoniacal Salts from Urine, &c., *J. H. Johnson.—Dated 13th March*, 1880.—(*A communication.*) 6d.

The ammoniacal liquid is drawn from the reservoir *a* by the pump *b*, and passes through the worm D and pipe C, where it is heated, and then enters the vessel G, where it is still further heated by the worm H supplied with steam from the boiler A by the pipe H, the condensed water returning to the boiler by a pipe. The liquid then passes through the pipe K to the cistern, whence it is distributed to the chambers M by pipes, the chambers also being heated by steam from the boiler A, with which the dome B, in which they are placed, communicates. These chambers are slightly inclined, so that the liquid flows along the heated bottoms in a thin sheet towards their lower extremity, being caused to flow in a zig-zag direction, passing alternately from one side to the other by means of partitions acting as baffle plates. At the same time a current of air is caused to pass through the chambers M from a fan



or blower in the opposite direction to the course of the liquid. The ammonia is absorbed by the air, which then passes into the worm in the refrigerator. A portion of the steam is thereby condensed in the worm, and the water and vapours then pass into chamber, the water escaping whilst the air with the uncondensed steam and ammonia passes through tube and perforated bulb into the sulphuric acid in the vessel K, where the acid absorbs the ammonia.

1087. Glove Springs, *J. Hinks and T. Hooper.—Dated 13th March, 1880. 4d.*

To reduce the friction of the two arms forming the spring, the washer which secures the rivet in front is sunk or dished at its back, so as to afford space for a grease pad in the form of a ring, which surrounds the rivet. The washer at the back of which it is enclosed is countersunk on its face, so that the head of the rivet is flush with the face of the washer.

1088. Treating Cane Juice, &c., for Evaporating Purposes, *F. G. Harvey.—Dated 13th March, 1880. 6d.*

This consists in the use of steam pipes or tubes formed and arranged so as to prolong the action of the heat on the juice or liquor in its course along the trough or tray.

1089. Washing Machines, *W. T. Brown.—Dated 13th March, 1880.—(Not proceeded with.) 2d.*

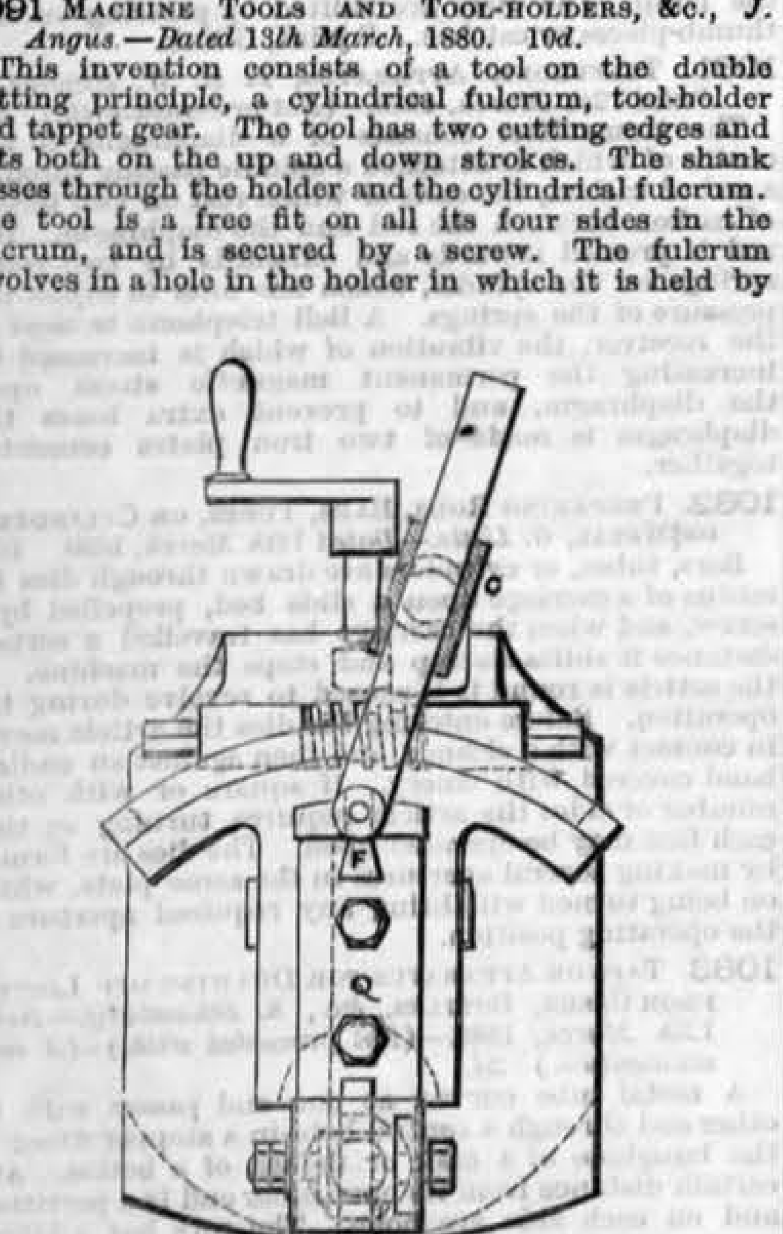
This consists essentially of a suitable flexible agent allowed to hang vertically or nearly so from a carrier or carriers, so as to have a free end or bight in the liquid of the wash tub or container. The articles to be washed are placed within the free end or bight, and a continuous alternating or rising and falling motion, or a combination of such motions is imparted to the flexible agent.

1090. Converting Skins into Leather, *R. Brown.—Dated 13th March, 1880.—(Not proceeded with.) 2d.*

The skins after being unhaired and subjected to the usual preliminary treatment are steeped in a weak solution of sulphuric, hydrochloric, oxalic or acetic acid, and then in a solution of 5 to 10 parts bichromate of potash or of soda in 100 parts water, which is maintained at 80 to 100 deg. Fah. They are then steeped from twenty-four to forty-eight hours in a solution of 5 to 10 parts acetate or nitrate of lead in 100 parts water at 80 to 100 deg. Fah., after which they are treated with a very weak solution of a salt of iron.

1091 Machine Tools and Tool-holders, &c., *J. Angus.—Dated 13th March, 1880. 10d.*

This invention consists of a tool on the double cutting principle, a cylindrical fulcrum, tool-holder and tappet gear. The tool has two cutting edges and cuts both on the up and down strokes. The shank passes through the holder and the cylindrical fulcrum. The tool is a free fit on all its four sides in the fulcrum, and is secured by a screw. The fulcrum revolves in a hole in the holder in which it is held by



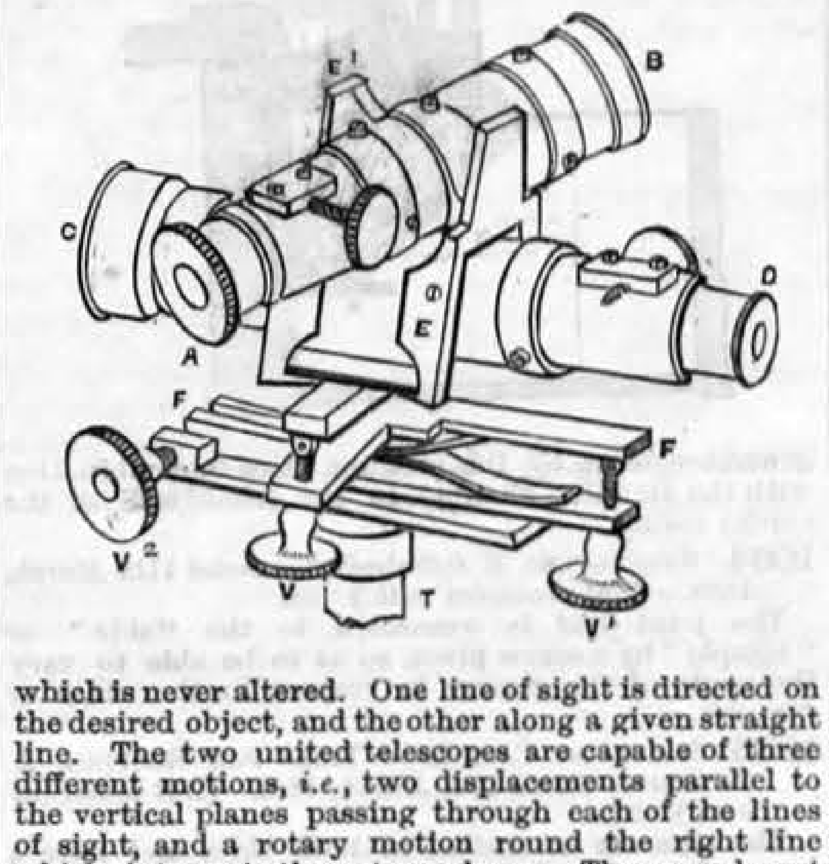
a tail pin; and it is provided with a flange to which the bent end of a tappet or fulcrum rod is attached, by which a vibrating motion is imparted to the fulcrum and tool. The tappet rod is carried from the side to the centre, and out at the top end of a holder by a sliding block arrangement to enable the holder and tool to be set to cut at back or front, right or left side, or at any angle in a horizontal plane. In slotting or shaping machines the tappet and gear are actuated by a stationary bracket provided with a slot to allow the holder, tappet rods, and tool straps to be moved across the face of the machine ram, so as to draw the tool towards the work. A round tool-holder is fixed to the slotting machine ram by two pairs of gripping blocks.

1094. Coke Ovens, *W. O. Wood.—Dated 13th March, 1880.—(Not proceeded with.) 2d.*

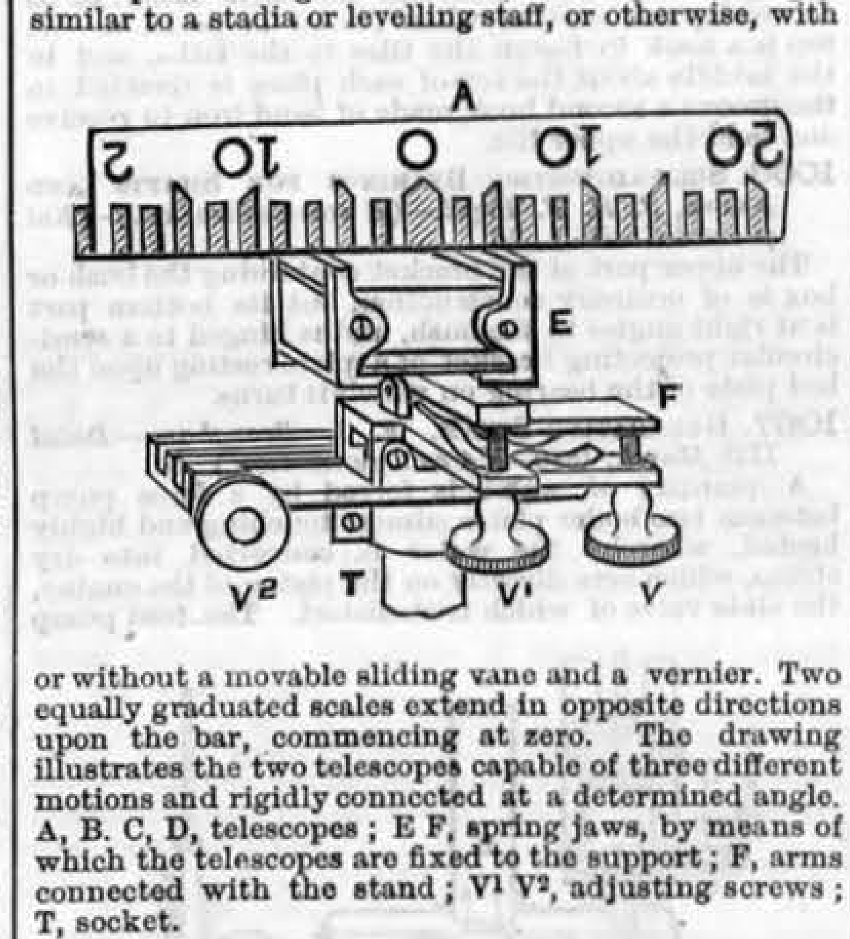
The blocks of which the arch of the oven is formed have a longitudinal canal extending from front to back and inclined upward from the lower half of the front face to the upper half of the rear face, so as to direct a current of air upward from the burning mass. This canal is traversed near each end by a cross perforation, so that the different longitudinal canals communicate by the cross perforations. By inserting plugs into the canals the entrance of air may be regulated, or the air may be made to traverse the whole or any number of the arch blocks, and become heated before entering the oven.

1095. Range Finders, *T. Morgan.—Dated 13th March, 1880.—(A communication.) 6d.*

The apparatus consists of two parts to be placed alternately at the two extremities of a determined base line. The first consists of two sighting lines—telescopes B and C or pinules on any suitable system—rigidly connected together and arranged at an angle



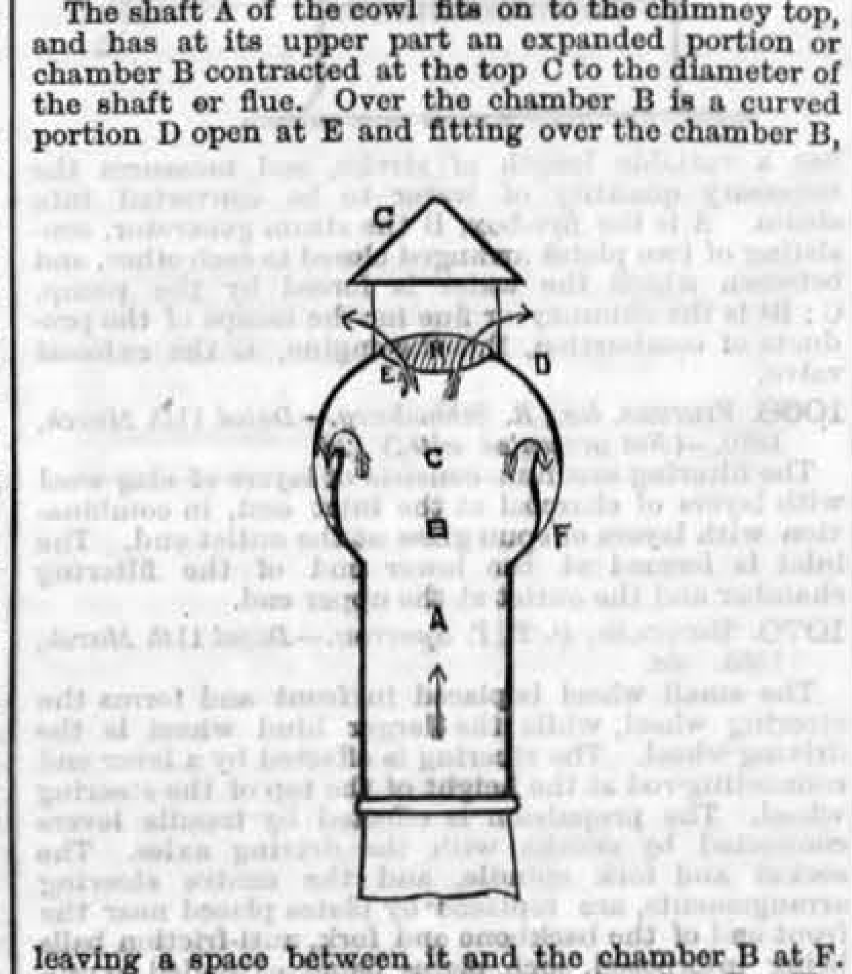
which is never altered. One line of sight is directed on the desired object, and the other along a given straight line. The two united telescopes are capable of three different motions, *i.e.*, two displacements parallel to the vertical planes passing through each of the lines of sight, and a rotary motion round the right line which intersects these two planes. The second part is composed of a graduated bar, and may be arranged similar to a stadia or levelling staff, or otherwise, with



or without a movable sliding vane and a vernier. Two equally graduated scales extend in opposite directions upon the bar, commencing at zero. The drawing illustrates the two telescopes capable of three different motions and rigidly connected at a determined angle. A, B, C, D, telescopes; E F, spring jaws, by means of which the telescopes are fixed to the support; F, arms connected with the stand; V^1 V^2, adjusting screws; T, socket.

1096. Chimney Cowls and Ventilators, *A. Hancock and H. S. Heath.—Dated 13th March, 1880. 6d.*

The shaft A of the cowl fits on to the chimney top, and has at its upper part an expanded portion or chamber B contracted at the top C to the diameter of the shaft or flue. Over the chamber B is a curved portion D open at E and fitting over the chamber B,



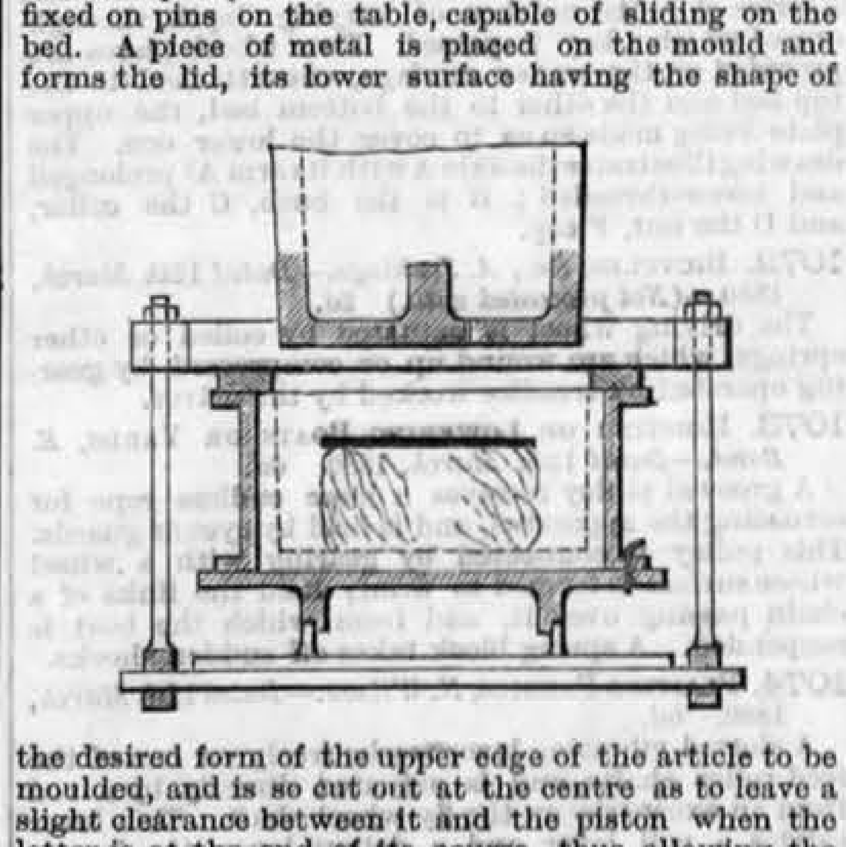
leaving a space between it and the chamber B at F. A dome or cover G is fixed over the chamber D. The two chambers on two sides of the cowl are curved, the other sides being flat, as shown, and on the outside of the flat surfaces are fixed parts H which bulge outwards, leaving a space between same and the flat surfaces. The arrows show the direction of the currents.

1097. Weighing and Measuring, *M. B. Tetley.—Dated 13th March, 1880.—(Not proceeded with.) 2d.*

A scoop-shaped receptacle with a scale of standard measures of capacity extending from top to bottom on the inside has fixed to the bottom a handle containing a spring, the handle being in two parts sliding telescopically one within the other, and enclosing a spiral spring interposed between the two, so as to be compressed by the weight of the contents of the receptacle.

1098. Crucibles, Retorts, &c., *W. R. Lake.—Dated 13th March, 1880.—(A communication.) 6d.*

The clay is placed in the mould without a bottom fixed on pins on the table, capable of sliding on the bed. A piece of metal is placed on the mould and forms the lid, its lower surface having the shape of



the desired form of the upper edge of the article to be moulded, and is so cut out at the centre as to leave a slight clearance between it and the piston when the latter is at the end of its course, thus allowing the escape of superfluous clay. The casing, the table, and lid are firmly connected during the descent of the piston by the bars and bolts.

PRICES CURRENT.

The following prices are corrected up to last night, but it should be borne in mind that in many cases makers are prepared to quote different terms for special contracts. It is obviously impossible to specify these cases and terms, or to give more than the market quotations and makers' prices. Readers should also refer to our correspondents' letters.

PIG IRON AND PUDDLED BARS.

Scotland—	£ s. d.
G.m.b.—No. 1	2 12 0
No. 3	2 9 6
Gartsherrie—	
No. 1	3 0 6
No. 3	2 12 0
Coltness—No. 1	3 0 6
No. 2	2 13 0
Summerlee—	
No. 1	2 17 6
No. 3	2 10 0
Monkland—No. 1	2 12 0
No. 3	2 9 6
Clyde—No. 1	2 13 0
No. 3	2 9 6
Govan—No. 1	2 12 0
No. 3	2 9 6
At Broomielaw.	
Calder—No. 1	2 18 0
No. 3	2 10 0
At Port Dundas.	

Scotland—	£ s. d.
Glengarnock—	
No. 1	2 15 0
No. 3	2 12 0
Dalmellington—	
No. 1	2 12 0
No. 3	2 9 6
At Ardrossan.	
Shotts—No. 1	3 0 0
No. 3	2 13 6
At Leith.	
Cleveland—	
No. 1	2 3 0
No. 2	2 1 0
No. 3	1 19 0
No. 4, foundry	1 18 0
No. 4, forge	1 18 0
Mottled or white	1 17 6
Thornaby hematite	3 17 6

Tredegar—Monmouthshire—No. 3 tin-plate pig iron, 75s. at works.
" " No. 3 foundry pig iron, 60s. 0d. at works.

	£ s. d.		£ s. d.
Wales—Iron rails, f.o.b.	6 10 0	to	6 17 6
Iron bars, f.o.b.	6 10 0	to	6 15 0
Derbyshire—Grey forge, at Sheffield	2 7 6	to	0 0 0
No. 3	2 10 0	to	0 0 0
Lancashire, in Manchester—No. 3	2 7 6	to	0 0 0
No. 4	2 6 6	to	0 0 0
Hematite, at works, Millom "Bessemer"—			
No. 1 to No. 3	3 10 0	to	3 15 0
Forge, mottled and white	..	..	3 15 0
Maryport Hematite—No. 1 to No. 3	3 10 0	to	3 15 0
Puddled Bar—			
Wales—Rail quality, at works	3 17 6	to	4 0 0
Cleveland, delivered on trucks	3 10 0	to	3 12 6
Middlesbrough 16in., plate quality, per ton	3 12 6	to	0 0 0
Lancashire, delivered at Manchester	4 5 0	to	4 7 6

MANUFACTURED IRON.

	£ s. d.		£ s. d.
Ship, Bridge, and Mast Plates—			
Glasgow, f.o.b., per ton	7 10 0	to	8 10 0
Wales—At works, net	7 5 0	to	8 0 0
Middlesbrough, in trucks, at works	6 5 0	to	8 10 0
Boiler Plates—			
Welsh	10 0 0	to	10 10 6
Lancashire, to 5 cwt. each plate	8 0 0	to	8 5 0
Sheffield	10 10 0	to	11 10 0
Bowling and Low Moor—			
Under 2½ cwt. each, up to 4 cwt. per cwt.	1 2 0	to	1 7 0
4 cwt. up to 7 cwt. and upwards	1 10 0	to	1 19 0
Staffordshire, per ton	9 0 0	to	12 10 0
Middlesbrough, free on trucks	7 0 0	to	9 0 0
Glasgow, f.o.b., per ton	7 10 0	to	8 10 0
Angle Iron—			
Bowling and Low Moor, per cwt.	..	..	1 2 0
Staffordshire, per ton	8 0 0	to	9 0 0
Lancashire	6 2 6	to	6 5 0
Stockton	5 10 0	to	0 0 0
Round Oak	8 12 6	to	13 10 0
Cleveland	5 7 6	to	6 0 0
Welsh	6 5 0	to	6 15 0
Glasgow, f.o.b., per ton	6 0 0	to	7 0 0
Bar Iron—			
Low Moor and Bowling, per cwt.	0 19 0	to	1 4 0
Staffordshire, per ton	6 10 0	to	10 0 0
Round Oak	8 2 6	to	13 0 0
Merchant Bars—			
Stockton	6 0 0	to	6 10 0
Welsh	5 7 6	to	0 0 0
Lancashire	6 0 0	to	6 2 6
Glasgow, f.o.b.	6 10 0	to	7 0 0
Sheffield—Bars from warehouse	6 10 0	to	7 0 0
" Hoops	7 10 0	to	8 0 0
" Sheets	9 0 0	to	0 0 0
Nail Rods.—Glasgow, f.o.b., per ton	6 10 0	to	7 0 0
Rails—Glasgow, f.o.b., per ton	7 10 0	to	8 0 0
Cleveland	5 0 0	to	6 0 0
Wales	5 2 6	to	5 5 0
Railway Chairs—Glasgow, f.o.b., per ton	0 4 10	0 to	5 0
Pipes—Glasgow, f.o.b., per ton	5 0 0	to	6 0 0
Sheets—Glasgow (singles), per ton	7 10 0	to	8 0 0
Hoops—Manchester	6 12 6	to	7 0 0

STEEL.

Sheffield—At works—	£ s. d.		£ s. d.
Spring steel	13 0 0	to	21 0 0
Ordinary cast rods	17 0 0	to	24 0 0
Fair average steel	28 0 0	to	36 0 0
Sheet, crucible	24 0 0	to	64 0 0
Sheets, Bessemer	16 0 0	to	22 0 0
Second-class tool	32 0 0	to	48 0 0
Best special steels	50 0 0	to	76 0 0
Best tool	52 0 0	to	76 0 0
Special tool	76 0 0	to	112 0 0
Rails	6 15 0	to	7 10 0
Sheffield steel ship plates	13 0 0	to	14 10 0
Sheffield steel boiler plates	14 0 0	to	16 0 0
Wales—Rails	6 2 6	to	6 7 6
Bessemer pig iron	3 7 6	to	0 0 0

MISCELLANEOUS METALS.

	£ s. d.		£ s. d.
Copper—Chili bars per ton	60 10 0	to	60 12 6
British cake and ingots	64 10 0	to	65 10 0
Best selected	66 0 0	to	67 0 0
British sheets, strong	70 10 0	to	71 0 0
Tin—Straits	85 0 6	to	86 0 0
British blocks, refined	91 0 0	to	92 0 0
" bars	90 0 0	to	91 0 0
Lead—Spanish pig	14 17 6	to	15 0 0
Sheet	16 0 0	to	16 10 0
Red lead	19 0 0	to	0 0 0
White lead	22 10 0	to	0 0 0
Spelter—Silesian	16 15 9	to	17 0 0
Zinc English sheet	22 10 0	to	23 10 0
Phosphor Bronze—per ton—			
Bearing metal XI	0 0 0	to	112 0 0
Other alloys	120 0 0	to	135 0 0

Nickel, per lb., 2s. 6d. to 3s.

COAL, COKE, OIL, &c.

	£ s. d.		£ s. d.
Coke—			
Durham	0 10 0	to	0 12 0
Derbyshire	0 12 0	to	0 13 0
Sheffield, melting	0 16 0	to	0 17 0
Tredegar	0 0 0	to	0 12 6
Wales—Rhondda	0 11 0	to	0 13 6
Coals, best, per ton—			
South Yorkshire—At the pits—			
Branch	0 11 2	to	0 13 11
Silkstone, house	0 10 4	to	0 11 6
Converting	0 7 6	to	0 9 0
Steam coal *	0 5 6	to	0 6 0
Slack	0 3 6	to	0 4 0
Wales, through	0 8 6	to	0 8 9
Steam, less 2½	0 8 3	to	0 10 6
House, at port	0 7 9	to	0 9 3
Small steam	0 2 3	to	0 3 6
Small house	0 7 0	to	0 7 6
Glasgow—Per ton, f.o.b.—			
Main	0 6 9	to	0 7 0
Splint	0 7 0	to	0 7 3
Smithy	0 12 0	to	0 13 6
South Durham	0 6 6	to	0 13 0
Derbyshire—			
Best at pits	0 8 0	to	0 11 0
Converting	0 7 6	to	0 9 0
Slack	0 3 3	to	0 6 0
Lancashire—Wigan pit prices—			
Arley	0 8 0	to	0 8 6
Pemberton 4ft.	0 6 6	to	0 7 0
Forge coal	0 4 9	to	0 5 6
Burgy	0 3 9	to	0 4 6
Slack	0 3 0	to	0 3 6
Oils, tun—			
Lard oil	44 0 0	to	44 10 0
Linseed	28 10 0	to	28 15 6
Rapeseed, brown	29 10 0	to	29 15 0
" Engl. pale	31 10 0	to	31 15 0
Petroleum, refined (per gal.)	0 0 9¾	to	0 0 9⅞
Tallow, cwt	1 16 9	to	1 18 6

* Supplied to railway companies and large works.

PRICES CURRENT OF TIMBER.

	£ s. d.		£ s. d.
Teak, load	13 0 0	to	15 10 0
Quebec pine, red	3 0 0	to	4 5 0
yellow	3 5 0	to	5 0 0
pitch	3 5 0	to	4 10 0
Oak	6 0 0	to	7 0 0
Birch	3 10 0	to	4 15 0
Elm	4 10 0	to	5 0 0
Ash	3 5 0	to	4 10 0
Dantsic & Meml. oak	3 10 0	to	5 0 0
Fir	2 5 0	to	4 10 0
" undersized	1 10 0	to	2 0 0
" Riga	3 10 0	to	4 5 0
" Swedish	1 10 0	to	2 5 0
Wainscot, Riga, log	3 0 0	to	5 0 0
Lath, Dantsic, fathom	4 10 0	to	5 10 0
St. Petersburg	6 0 0	to	7 0 0
Deals, per C, 12ft. by 3 by 9in.:—			
Quebec pine, 1st	17 0 0	to	23 0 0
" 2nd	10 0 0	to	16 10 0
" 3rd	8 0 0	to	10 10 0
Canada, spruce 1st	10 0 0	to	12 0 0
3rd and 2nd	8 0 0	to	9 10 0
New Brunswick	6 10 0	to	9 0 0
Archangel	10 0 0	to	19 0 0
St. Petersburg	13 0 0	to	16 0 0
Finland	10 10 0	to	11 10 0
Wyburg	8 10 0	to	11 0 0
Battens, all sorts	6 0 0	to	8 10 0
Flooring bds. sq. of 1in.—			
First yellow	0 10 0	to	0 15 0
" white	0 8 6	to	0 10 0
Second quality	0 7 6	to	0 11 0
Mahogany, Cuba super. foot.	0 0 4½	to	0 0 7
Mexican, do.	0 0 4½	to	0 0 5
Honduras, do.	0 0 4¾	to	0 0 5½

CONTENTS.

The Engineer, October 15th, 1880.