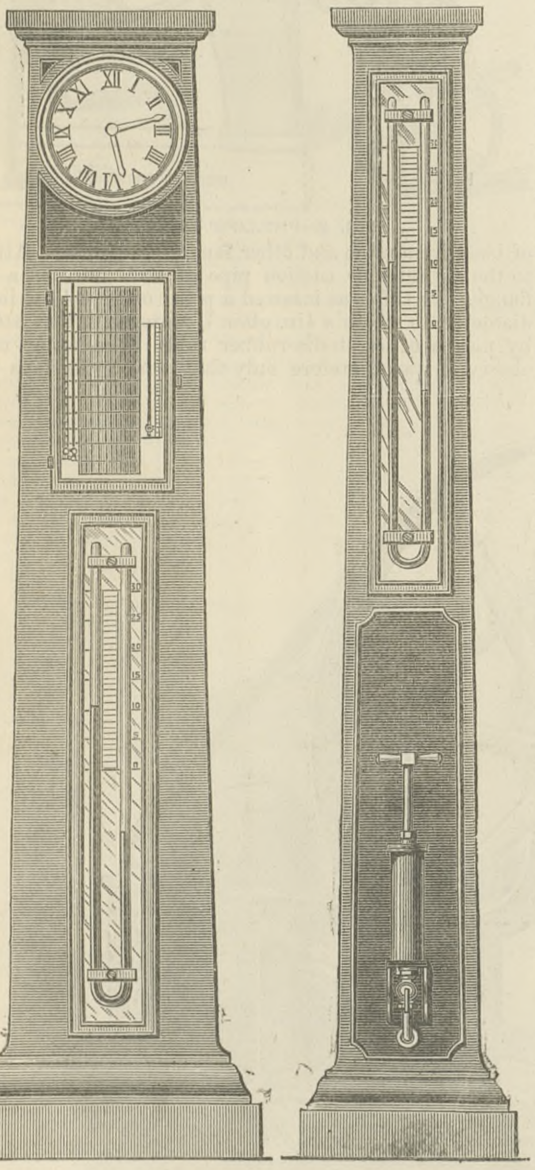
VISITS IN THE PROVINCES.

MESSRS. HATHORNE, DAVEY, AND CO.'S WORKS, LEEDS.

In the Sun Foundry, Leeds, the speciality is the construction of pumping machinery for mines, waterworks, and sewerage works, most of this being constructed on Mr. Davey's now well known differential cut-off gear system. Engines of this kind are now in use all over Great Britain, and they are also in use from China to Peru. Of a set working in the Kai-Ping Colliery in China, together with the winding plant, we gave some account in our impression of the 18th of March, 1881, and we have from time to time described them as employed in mines and waterworks in various places, either of the horizontal, direct-acting, or vertical, beam, and double beam types. Of the direct-acting type, the members of the Institution of Mechanical Engineers will see several in course of construction, as well as the pumping gear connected therewith, including the tee and angle rocking beams, which also are made in numbers at the Sun Foundry. These are built of timber, plated strongly and tied; and for cutting out the holes in the wrought iron side plates, a machine, specially made by Messrs. Joshua Buckton and Co., is employed, the cutter head being annular in form, and thus cutting out circular plates of the metal, or, when the machine is used for the heavy crossheads of large pumping engines, large cylindrical blocks. The cutter head is supplied with a constant stream of water, by which the cuttings are driven back through holes on the back of the cutter head. The bed plates or girders of the direct-acting pumping engines are often of great length, and too great a length for safe transport; it is therefore necessary to send them away in two pieces. They are, however, cast in one length with



separating core plates, which leave only a small thickness of metal continuous on the outer face of the girder. When cold these are broken in the ordinary way, and upon bolting the two parts together again in place the joint is perfect and cannot very well be seen.

Amongst the machine tools in these works is a boring machine by Buckton and Co., chiefly used for boring blowing cylinders, which it will take up to 80in. in diameter and 10ft. stroke. The machine is of the simplest kind, consisting simply of a boring bar, driving shaft with a long bearing in a heavy headstock, and having one large worm wheel on the shaft driven direct by a worm with large rubbing surface. This simple machine seems to have been made in considerable numbers by Messrs. Buckton and Co., for they are noticeable in several places in Leeds, and several of small size were to be seen in one large shop temporarily fixed, just where it might be most convenient to do so, on the bed-plate of a very large vertical planing machine with movable head, similar to that described in our impression of the 21st October, 1881. A large cast iron plate planed and provided with plenty of holes for holding anything, and commanded by a line of shafting, is a valuable tool in any shop where a variety of work is carried on. Among the machinery in course of construction is a fine tandem compound engine with 18in. and 34in. cylinders, of 3ft. stroke, and to run at sixty-five revolutions per minute, or a piston speed of 390ft. per minute. This engine is to be connected by gearing to a large centrifugal pump, which is intended to raise 100 tons of water per minute 16ft. high, the pump being for a Cambridgeshire fen. The pump has a vertical shaft, and will be placed so that the water is forced the 16ft. A number of the differential pumping engines have been sent to Germany, and another for underground work in the Mansfield salt mines is in course of erection. This is of large size, the total length being 46ft. The pump valves are of special form, and are arranged so that the opening of the one pair and the closing of the other are perfectly simultaneous, and by this means the slip which takes place when the suction valves close late, or when the percussion delivery valves close late, are avoided. These horizontal valves we shall illustrate in another impression.

The visitors will also see Mr. Davey's small steam motors with flashing boilers, in course of construction. These we illustrated in our impression of the 30th of June last. This engine has now been under trial a considerable time, and seems likely to be largely employed where small powers are required, and where skilled attention is not to be had. The engine makes about 200 revolutions per minute, water being injected into the boiler once per revolution. Steam is cut off at 0·62 of the stroke, and as showing that the water injected is instantaneously converted into steam, it may be noticed that it is found that the pressure is slightly greater on the first than on the second stroke.

Mention should be made also of Mr. Davey's new pumping engine recorder for Cornish and other direct-acting pumping engines. This comprises a well gauge, and stroke recorder, or a counter, or a well gauge alone, as shown by the engravings in the preceding column. The well gauge consists of an ordinary U water column pressure gauge, attached to an empty pipe, except of air which dips into the well. The pressure upon the air, of course, varies with the height of the water in the well, and the gauge is more trustworthy than the usual float and wire or cord over pulleys, especially when the wire has to pass round several corners. The recorder consists of a barrel, upon which is placed a sheet of paper to show the quantity of water pumped through in twenty-four hours. The barrel is worked by a clock in the upper part of an ornamental case, and the pencil which makes the record on the paper is actuated by gearing which receives its motion directly from the piston rod. The performance of the engine is thus recorded, and short or full strokes or stops registered. The exact quantity of water pumped is thus recorded, and not simply the number of strokes, whether short or long. A small pump is attached to the well gauge pipe, so that by a stroke of this the air in the pipe may be renewed to make up for any loss.

MESSRS. TANNETT, WALKER, AND CO.'S WORKS, HUNSLET, LEEDS.

Steel-making and iron-making plant, and especially ingot and converter ladle cranes and other hydraulic cranes, chiefly occupy these works. Centre pillar cranes have received particular attention, and for casting these vertically up to about 40ft. in length there is in the foundry a very deep tank, or well, as someone has called it, made, we believe, of one or two large old boiler shells. When we visited the works one of these columns, 35ft. in length, 32in. diameter, and perfectly sound, was in the yard ready to go into the turnery. It need hardly be said that with such a head as this the smaller part of the column, which is at the bottom of the mould, is a sound casting, and by casting upward and with a good feeding head the whole casting is solid. Light hydraulic jib cranes, made on Mr. Walker's system, with telescopic piston plungers, so that when lifting light loads the quantity of water used is automatically reduced in quantity, are made in large numbers, and the same arrangement is adopted in the five cranes of one of the foundries. In another foundry are two powerful steam jib cranes commanding the whole floor, jib cranes being almost everywhere in Leeds preferred to travellers for this purpose, as men cannot stand the work in the roof of a busy foundry. Hydraulic capstans with underneath engines are also being made in considerable numbers, twelve, to exert a hauling pull of 16 tons, being now made for Chatham. The pressure generally used in the hydraulic plant made at the work is 750 lb., 720 lb. being used in the works to actuate the cranes and furnace hoist. The latter has a lift of about 15ft., the column being only a 3in. steel bar. The platform, however, is not large, and is well guided, so that the 3in. column does not whip under the load. In the erecting shop we found a pair of compound engines with 34in. and 60in. cylinders and surface condensers with separate circulating pumps for a rolling and cogging mill. This is the fourth set from these patterns, one having recently been fixed in an extension of the Leeds Forge Company's works to drive a large mill for corrugating Fox's corrugated flues. In one of the lathes, at the time of our visit, was one of the rolls for this corrugating mill. It was of crucible steel, cast by Messrs. Naylor, Vickers, and Co., the corrugated part being about 7ft. 6in. in length and 2ft. in diameter, the steel casting alone costing £425. Some very large basic process plant is in course of construction in the works, including 15-ton converters, for which the trunnion belts, 10ft. 8in. in diameter. were being bored out, and others for 10-ton converters. The plant includes 15-ton casting pit cranes and a 20-ton hydraulic wrought iron gantry traveller.

MESSRS. SMITH, BEACOCK, AND TANNETT, VICTORIA FOUNDRY, LEEDS.

In the Victoria Foundry a lot of fine machine tools are in course of construction, including some excellent machines for France, more especially for marine engineering works. One immense lathe will be advancing towards completion in the middle of August. The bed of this lathe is 75ft. in length, and has three surfaces, the width across the outer surface sbeing 9ft. It has 5ft. centres, and the rest saddles are carried on the three surfaces and receive motion from two 5in. screws. This lathe is for heavy ordnance and marine shaft work, and weighs about 80 tons. One part of the bed of this lathe was, when we visited the works, on a large two-way cut planing machine of the maker's own construction. The machine is over 64ft. in length, and will plane 42ft. 6in. at a time.

In the works are also some small planing machines, constructed for the Indian State Railway shops, and from the specification of the engineer of the works. The bed is not more than about 5ft. or 6ft., and yet these machines are fitted with double tool boxes to cut both ways—which is a little absurd. Visitors will see in course of construction a large travelling crane, to lift 50 tons, also for France. Large screwing machines—or, rather, machines for screwing large bolts, *i.e.*, up to 6in. diameter are made under Barrows' patent, and have been chiefly sent to marine engineering works; one for cutting 6in. bolts being in course of completion for Messrs. Caird, of Greenock. These machines we illustrated in our impression of the 14th October, 1881. In these machines there is some very nice fitting, and the construction of the dies is a work of time. The taps and hubs are made by Mr. T. Widdowson, of Salford, Manchester; and it is curious to learn that this maker attributes a good deal of his success in the difficult work of hardening these large tools to the composition of the water which he uses, the quality of the water and its specific virtue being gradually acquired by continual use. Messrs. Smith, Beacock, and Tannett have a large quantity of fine tools for their own use, and the travelling crane in their erecting shop will attract attention. The crane at Monk Bridge Ironworks, which we illustrated in general outline last week and in detail this week, was made by this firm, and the movable bearing for the square driving shaft is of peculiar construction. The inclined plane seen at one end of the lower part of the ends of the crane releases a catch, and the bearing is let go, and in descent follows the inner inclined plane. The wheel passes, and the inclined plane at the other end of the crane end plates raises the bearing, and it there stops until the crane comes back.

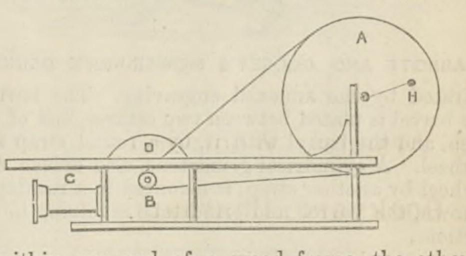
The crane is provided with wrought iron box girders and end carriages. Span, 29ft. 2in. centre to centre of rails; height from rail to roof of shop, 3ft.; speed of lift 9½ft., of longitudinal travel 50ft., and of cross travel 40ft. per minute. The attendant is placed in a cage at one end under the girders, and has all the handles within reach. The driving motion is given to the crane from 2½in. square shaft supported every 10ft. by bearings, the two end bearings being fixed, and those intermediate rising and lowering, as shown in detail, to allow the crane driving wheel to travel along. A small engine is fixed to each end of square shaft. To the crane is fixed a casting with two series of inclined planes—one acting on the locking lever and the other raising and lowering the bearing. The crane is provided with a friction brake, and all or any of the motions may be at work at the same time, and expansion clutches are employed for starting and stopping the various motions.

MISCELLANEOUS EXHIBITS AT THE READING SHOW.

Amongst the new implements which we have not yet described was a new potato digger, by Messrs. Davey, Sleep, and Co., of St. Germans, Cornwall. This consists of a plough body mounted on a frame running on two land wheels about 3ft. in diameter, and provided with a seat like a gang plough. Behind, and as a continuation of, the turnfurrow-shaped digger breast, is a strong grid of round iron bars, to which a shaking motion is given by means of an arm which comes into contact with large cog-shaped pieces in the rim of one of the land wheels. This breaks and shakes the dirt from the potatoes, most of which are delivered behind the grid. This potato raiser promises well, is handy as well as lighter than most others.

Messrs. Penney and Co., of Lincoln, exhibit the model of Clark's new potato raiser which they are now making, and which is exhibited on another stand by the inventor. Its construction is such that on the forward motion of the horses, a long plate iron spade-shaped scoop at the front part of the machine, which can be adjusted by a screw and hand wheel above it to suit the depth of the potato, is forced beneath the rows; and the potatoes, dirt, and everything are conveyed up the wrought iron trough by means of a web platform, into the revolving cylinder at the hinder part of the machine, and the meshes of which separate the soil from the potatoes. The potatoes can either roll out of the separator in a stream upon the ground, ready for being collected by the pickers, or are deposited in a basket hung at rear of the cylinder. The exclusive advantages claimed for this potato raiser are that the tubers are all completely raised without injury to any, and as the soil is separated before the potatoes leave the cylinder, there is no danger of their being buried again, so that the operation of harrowing the land for stray potatoes may be dispensed with. The machine is strong and well made, but we should imagine that as it is mounted upon two rigid parallel axles, it is very difficult to turn on the narrow headlands of potato fields.

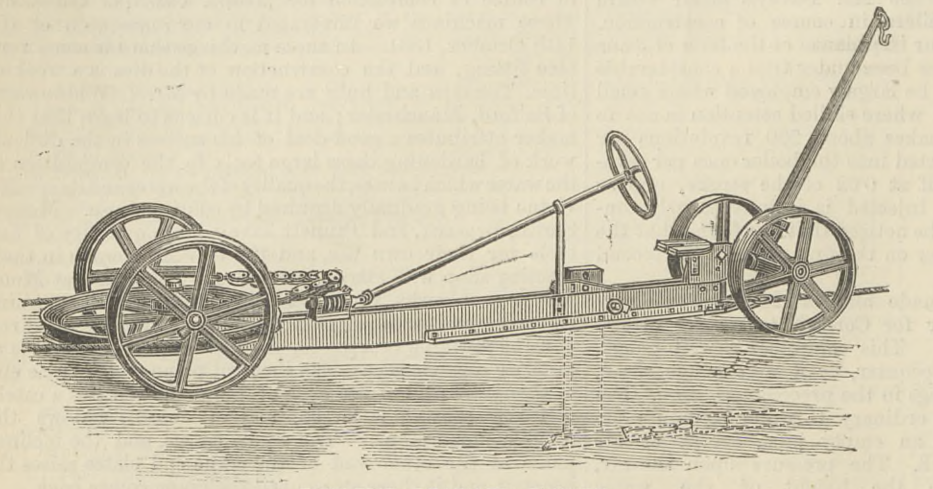
A fan for hay rick drying purposes was exhibited by Messrs. Wallis and Steevens, Basingstoke. Its general form is shown in the annexed woodcut. The fan case D is



placed within one end of a wood frame, the other end carrying a hand-wheel A with handles H, driving the fan by a strap from the wheel A to the fan pulley B. The pipe C from the rick is of leather with iron connecting flange. The hand-wheel is 30in. diameter and the pulley about 2in., though the speed of the fan was said to be 18½ to one of the hand-wheel. The fan is 26in. diameter, apparently in the centre of the case, and the blades 6in. wide. The handles have a length of about 9½in.

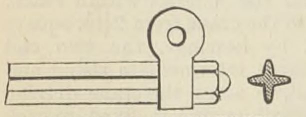
Messrs. E. H. Bentall and Co. showed an assortment of finished nuts and screws made of Siemens steel. Besides nuts, studs, and screws for engineers' use, all of good machine finish, they showed parts of Jacquard looms for Nottingham manufacturers, special screws for manufacturers still further north, and nuts of special sizes, shapes, and threads for bicycle manufacturers. Messrs. Bentall and Co. have some special machinery with which they make these things, and this enables them to compete with makers in the steel and fuel districts. Siemens steel is used as being more uniform than Bessemer steel, which was tried for the purpose.

The mole draining plough entered by Messrs. Fowler and Co. for trial, but which was withdrawn, is shown by the annexed woodcut, which explains itself.



FOWLER'S DRAINAGE PLOUGH.

Messrs. Picksley, Sims, and Co. showed a horse-rake with teeth of the section, and fastened into the heasd, by which they are strung on, and are movable on a rod across the rake, as shown herewith. This method of fastening is simple and permanent; the section of the steel employed may give flexibility, but it is not so good as the section sometimes used, like that of a double-headed railway rail.



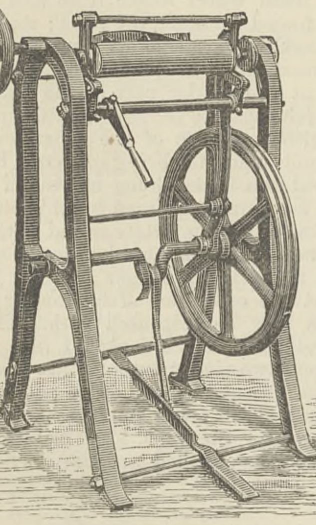
PICKSLEY'S RAKE TOOTH.

Messrs. John Crowley and Co., of Meadowhall, near Sheffield, exhibited a large number of chaff-cutters and food-preparing machines; but attention may be drawn to the collection of malleable iron castings and goods which formed a prominent feature of their stand. A great many of the castings there shown were of articles which, when finished, get the credit of being wrought iron, and even in some cases steel—bicycle forks, stocks for stocks and dies, and others may be mentioned. Some very light castings for machinery, such as loom beam flanges, also showed the quality of the work now done in malleable iron, and the confidence placed in the material, which, at a cost of about 4d. per lb., replaces, without any disadvantage, forgings at three times the cost at least.

Messrs. Doughty and Bradley showed a winnowing machine, with a fan placed at the lower part of the frame, and provided with a side pipe inlet, so that it may be used as an exhaust fan for rick drying purposes.

Messrs. T. Burbidge and Co., of Melksham, Wilts, showed amongst other things a collection of engine fittings electro and nickel plated by them, and a collection of Burbidge's beer and wine taps, in which the fitting surfaces consist of two small pieces of flat glass, one having a hole through it, the other being moved as a slide valve.

Messrs. Abbott and Goosey, of Stamford, showed the little treadle machine for grinding lawn-mower knives, as illustrated by the annexed engraving. The lawn-mower knife barrel is placed between two centres, one of which is driven, and the barrel with it, by a round strap from the fly-wheel. A cylindrical grindstone, also driven from the fly-wheel by another strap, is mounted in a rocking frame, as shown, the barrel and grindstone revolving in opposite directions.



ABBOTT AND GOOSEY'S MOWER-KNIFE GRINDER.

THE VELOMETER.—An action at law has been pending for some months between Mr. Durham, the inventor of the now well-known velometer, and Mr. Churchill, the inventor of a very similar governor. It is now announced that the litigants have entered into an agreement by which all actions then pending in relation to the governors were arranged to be discontinued, and the assets and liabilities of the firm of Durham and Co. to be transferred to the firm of Churchill and Co. In pursuance of that arrangement Mr. Durham joins Messrs. Churchill and Co., and now, and in future, the business will be carried on under the style of Durham, Churchill, and Co., 23, Leadenhall-street.

TRIAL OF HAY DRYING APPARATUS AND FANS AT READING.

THE trials of hay drying apparatus at Reading under the direction of the Royal Agricultural Society have proceeded very slowly, chiefly because the weather during the week preceding the show and the first days of the show week was so very wet that it was impossible to build stacks of the grass that had been cut and fully withered, but was so sodden with rain. As we have already stated, a rick was made on the 8th of July of hay dried by the Gibbs hot air drying machine, but after that very little was done for nearly a week. A rick was then made of wet hay and treated by the Coultas steam fan, which was briefly described in our impression of the 7th inst. This rick has been completed since, but as to the quality of the product we shall say nothing until further on. The quality of the hay can never be high, for most of the grass was very rank, long, and tough. Ricks were subsequently made for the trial of the Phillips' and Bamlett fans, but to these we shall refer later on. On the 19th inst. some tests of the fans exhibited and entered for trial by (1) Mr. Gibbs; (2) and (3) Mr. C. Phillips, Newport, Mon.; (4) Mr. C. A. Lister, of Dursley; (5) Mr. Coultas, of Grantham; (6) and (7) the Agricultural and Horticultural Co., Greening's fan; (8) T. C. Bamlett, of Thirsk.

The trials of these fans have afforded some figures which are not without interest and some value, though the trials were far from complete, and none of the fans gave evidence of any special knowledge of the principles on which the construction of a fan should be based. Owing to the courtesy of the judges we were enabled to take the figures obtained as the trials went on, and to afford some assistance in obtaining them. These figures we have embodied in a table which will be found on page 61, and before making any further reference to them a brief description must be given of the fans. They are all exhaust fans, and are used as described in our impression of the 7th inst.

The blades are radial and the fan is in the centre of the case, and not excentric thereto as indicated in the diagram, Fig. 1. It need hardly be said that this cannot be an economical fan, though it is of small cost.

The dynamometer employed was the rotary hand dynamometer described in the *Proceedings* of the Institution of Mechanical Engineers, page 219, in a paper by Mr. W. E. Rich; but the hand-wheel was removed, and a 31in. pulley affixed in its place. A 4-horse power vertical engine, by Mr. Hindley, of Bourton, Dorset, with a 12in. pulley on its shaft, drove the dynamometer, and from the dynamometer the fan was driven by a strap on an 18in. pulley attached to the hand-wheel of the fan. When the tests commenced it was proposed to take only the water column which the fan would support and the power necessary to drive the fan, as indicated by the dynamometer, the length of the weight-lever of which is 50in., and the circumfenence of the circle of which it is the radius was taken at 26·2ft. Only these figures were therefore taken from this fan, and the fan was removed; the man in attendance, concluding that nothing more was to be done, went away, and taking the pulley from the fan with him, removed the possibility of the further observation which was subsequently decided upon, namely, taking the velocity of the air entering or leaving the fan by means of one of Messrs. Elliott Bros.' small air meters, as made by them for taking the velocity of blast from mine and other fans, air ways, &c. Attached to the air inlet or suction pipe of each fan was a blank flange. In this was inserted a piece of pipe $\frac{13}{16}$in. internal diameter, to which a $\frac{1}{2}$in. glass U water tube was attached by means of an india-rubber tube. The water column observed was therefore only that which the fans would support when drawing no air, or doing no real work, and though of comparative value, it affords no indication of the column which would be supported by the fans when at work. The fan next tested was the hand fan of Mr. Phillips, as illustrated by Fig. 3. The blades in this fan are rectangular and run in the centre of a circular case, the fan being thus of the same type as that of Mr. Gibbs. The blank flange being removed, the velocity of the air from this fan was taken at the outlet, and the discharge D[1] is taken in our table as that of the velocity in feet per minute recorded by the air meter, by the sectional area in square feet of the outlet at which it was taken. The hypothetic discharge D in the table is not inserted in the table as any direct indication of the discharge, but merely for comparison with the discharge D[1] obtained with the anemometer. This fan was, like Gibbs's, at first tried at forty revolutions of the hand wheel, that being supposed to be a fair feed for a man to turn, but Mr. Phillips' representative insisted that sixty revolutions was nearer the mark, and hence it was tried at that speed also. The pulley put on the hand-wheel shaft for the purposes of the trial was of the same diameter as those on the dynamometer, namely, 31in. The foot-pounds of work done on the fan per minute was thus W × C × R, W being the

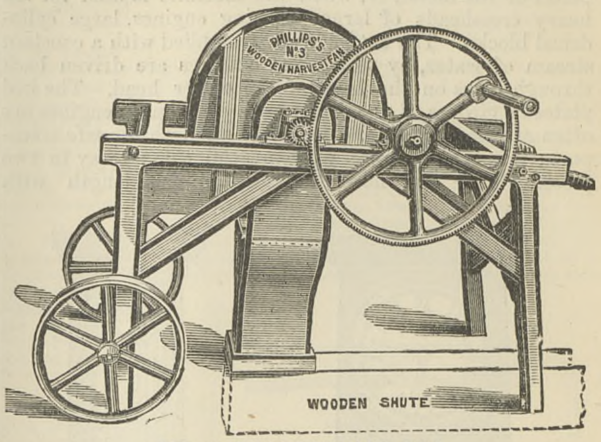


FIG. 3—PHILLIPS' HAND FAN.

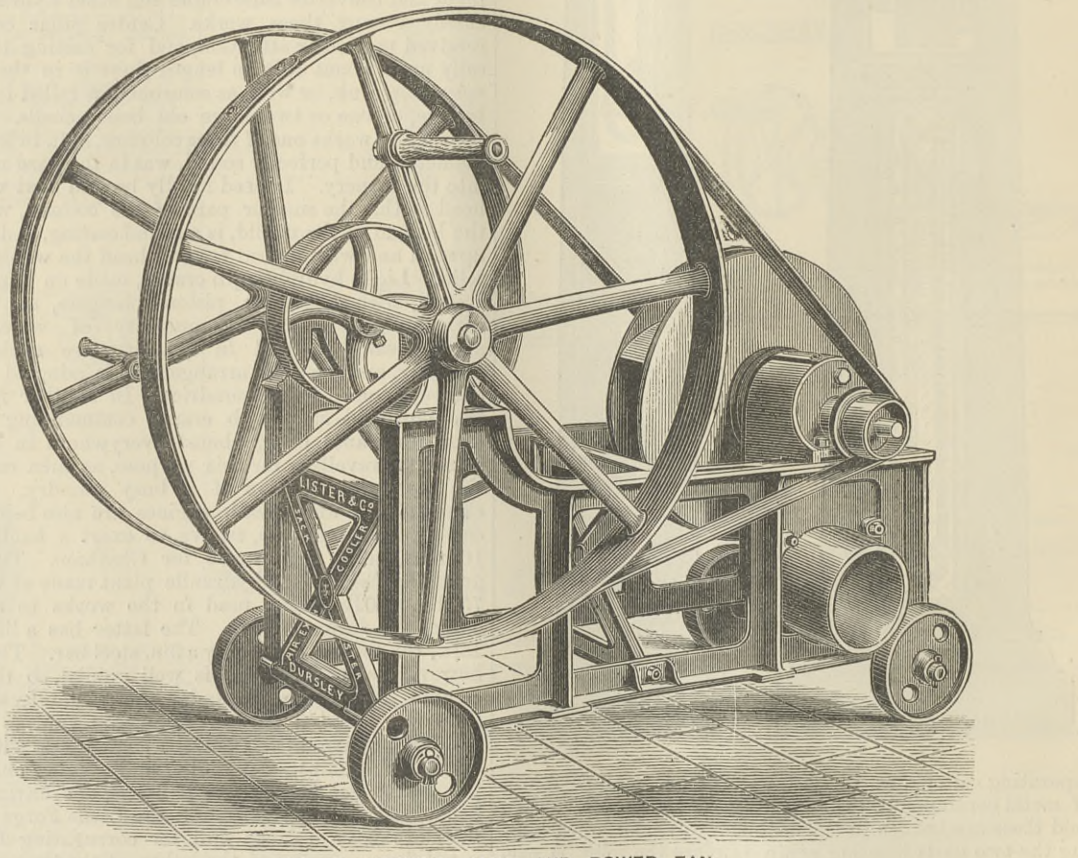


FIG. 5—LISTER'S HAND AND POWER FAN.

The first fan tested was that of Mr. W. A. Gibbs. This fan is intended to be used as described in our impression just referred to, or to cool a stack of hay dried by the hot-air machine, and to this purpose one was applied to the stack made in the hay meadows on the 8th. The form of the fan is indicated in the diagram, Fig. 2. It consists of a sheet iron case with side entrance tube and tangential exhaust, the bearings for the hand cog-wheel indicated by dotted lines and for the pinion on the fan spindle being attached to pieces of angle iron rivetted to the fan case.

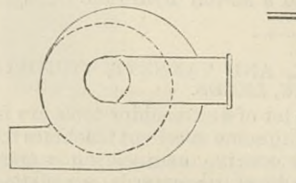


FIG. 1.

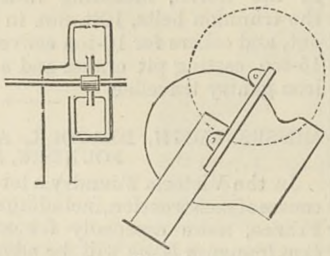


FIG. 2.

RAILWAY MATTERS.

Messrs. T. and J. Bradley, of the Caponfield Furnaces, Bilston, have just executed a contract for a supply of cast iron carriage blocks, for railway brake-vans, now being constructed by the Metropolitan Carriage Company, Birmingham.

An agreement has been made with the Lancashire and Yorkshire and London and North-Western Companies, giving the latter company running powers between Penistone and Huddersfield, including the use of the Huddersfield Station for all traffic south and east of Penistone, with power for the company to fix their own rates.

The increase in the production of steel both in Europe and America has steadily continued. For rails the output capacity in England is now equal to 1¼ million tons per annum, and in America it is even slightly higher, with this notable difference also, that all the rails made there are consumed in the country, with the addition of about one-fifth part of rails imported from England.

At the half-yearly meeting of the Railway Rolling Stock Company, Wolverhampton, on Tuesday, a summary of whose report we published last week, the chairman said that he believed they had seen, so far as that company was concerned, the end of the bad trade. For the first time during several years there was an excess of revenue over the corresponding period of 1881, and also over half year's account preceding the one he had before him.

The London, Chatham, and Dover Railway accounts for the past half year have been submitted to and approved by the Board, and subject to final audit they show an available balance sufficient to pay a dividend of £2 per cent. on the Arbitration Preference Stock for the past half-year. This amount, added to the dividend of £2 5s. per cent. paid in respect of the half-year ending the 31st of December last, will make a dividend of £4 5s. for the year ending the 30th of June last, as against £3 17s. 6d. for the previous year.

A pamphlet entitled "Hints on Tramways" has been published by Mr. C. S. Pain, of North John-street, Liverpool, the object of the pamphlet being to explain a system of tramway permanent way by Mr. Pain, consisting of a grooved rail, generally a central groove, attached to a cast iron or to combined cast and wrought iron sleepers, or to a longitudinal wood sleeper resting on cast iron supports and held down by bolts through rail, sleeper, and chair. The rails are of V form, and the sleepers are made to fit them.

The South Staffordshire and Birmingham Steam Tramways' Company "broke ground" on Wednesday. The scheme embraces the towns of Wednesbury, Westbromwich, Walsall, Dudley, and intermediate places, and at both the two first-mentioned towns ground was broken by Mr. Richard Williams, chairman of the Wednesbury Local Board, who was presented by the company with a silver crowbar. It is understood that the line will now be vigorously proceeded with. There have been 10,945 shares allotted in the company, and of the present issue between £40,000 and £50,000 has been taken up.

The *Railroad Gazette* gives the number and nature of the accidents on American roads for May last. Amongst the derailments, the following were given as the causes:—Broken frog, 1; loose frog, 1; loose rail, 1; broken bridge, 2; broken wheel, 4; broken axle, 8; wash-out, 3; land-slide, 2; accidental obstruction, 5; cattle, 4; runaway train, 1; open draw, 1; misplaced switch, 4; unexplained, 25; total, 62. From this it will be seen that the unexplained derailments were, as usual, a large part of the whole; and this still points to the danger of running very long and very heavy cars at any speed into or round curves.

The Dewsbury, Batley, and Birstall tramway has now been open sufficient time to give reliable data as to cost of working steam motors. The line is a single one about four miles in length, and there are nine engines, six being in constant use; these machines are of Merryweather and Sons' make, and are fitted with their air condensers. This line has been worked by horses four to five years, and by steam about three years, therefore the imformation thereon is amongst the more valuable. Horse traction, we are informed, cost 6·95 pence per mile, whilst steam only shows 3·92 pence per mile, or a saving by adoption of the latter of 2·93 per mile. The rails are of steel of an excellent section, and about 70 lb. to the yard.

The coalowners of South and West Yorkshire have at last heard from one of the leading railway companies—the Great Northern—in reply to their application for a reduction in railway rates to London. The Great Northern states that it cannot reduce its charges for carriage because it had to pay the Manchester, Sheffield, and Lincolnshire Railway 1s. 4d. per ton for taking the coal a few miles from Barnsley to Doncaster, leaving only 5s. 11d. a ton for carrying it a distance of about 160 miles. The question of water carriage was talked about, special importance being attached to the prospect of sending coal from the South Yorkshire district by the way of Rotherham and the proposed canal to the Trent. Expectations were indulged in regarding the Great Eastern's new running powers to Doncaster, which give the company access to the South Yorkshire coal-field, but it appears that the directors of the line are thoroughly powerless to make a reduction, however willing they might be to do so. Any attempt in that direction would be easily frustrated by the Midland and Great Northern, which have the chief interest in Derbyshire and Notts, and could at once arrange so as to keep up the present difference in rates.

In this column of our impression of the 14th inst. a description was given of a tramcar axle, recently patented by a Dane. Messrs. West and Co., of Devon's-road, Bromley-by-Bow, write to say that the invention is theirs, and that for it they took out provisional protection in June, 1874, No. 1914, which reads as follows:—"In our improved system of wheels and axles, the axle is made in two half-lengths, and the wheels are fixed fast on the one end of each half-length, thus forming a pair of wheels and axle, the axle being in two half-lengths, instead of one piece as is now the case. The two portions are carried in journals or bearings fixed in a straight line to the vehicle or carriage, and as each wheel and the portion of axle to which it is attached revolves separately from the other wheel and its portion of axle, the sharpest curves can be turned with more facility than even with a fixed axle and revolving wheels; whilst at the same time the bearing surface being distributed along the whole length of the revolving axle, much less friction and wear and tear is the result." If Messrs. West and Co. only received provisional protection for this invention, anyone is, of course, free to use it, and a modification of it may be protected by the Dane, previously referred to.

In their *Engineering Trades' Report* for the half-year Messrs. Matheson and Grant say:—"New railways of considerable importance are projected. In London the Outer Circle Railway and the Regent's Canal Railway are almost certain to go on, while the East London Line through the Thames Tunnel, which since its completion a few years ago has failed in the anticipation of its promoters, is to be taken in hand by some of the leading lines and its important position utilised. The Lincoln and Spalding Railway, now nearly completed, will give a new route from Yorkshire to London, while the Hull and Barnsley Line and the docks at Hull will stimulate the whole export trade of the Midlands and the East Coast. The new docks at Tilbury have been commenced this month, and are not only important in themselves, but will lead to the construction of new railway lines in that direction, as well as to the enlargement of the existing accommodation of the London, Tilbury, and Southend Railway. On the Continent new lines of importance are under contract in Austria, Italy, and Spain, and though Russia, for the while, is unable even to utilise profitably her existing railways, the approaching completion of the Trans-Caucasian line from the Caspian to the Black Sea, and the exploration of the oil wells at Baku thus rendered possible, is but the beginning of new enterprise in Central Asia, which the new railway brings into direct communication with the Mediterranean and Europe."

NOTES AND MEMORANDA.

To obtain luminous photographs a film is made of perchloride of iron and tartaric acid on a surface of softened glass; when it has been exposed, sulphide of calcium, rubbed to a very fine powder through a sieve, is dusted over it. The image is formed in the same way as if it had been dusted with any other powder, and the *Scientific American* says it can then be transferred to paper.

As the result of carefully conducted analyses, Professor Ledebur, of the Freiberg School of Mines, gives the following examples of the quantity of oxygen in various samples of iron and steel:—Oberhausen open-hearth steel, 0·035 per cent. oxygen; bochum Bessemer steel, 0·047 per cent. oxygen; basic steel, previous to complete dephosphorisation, 0·068 per cent. oxygen; basic steel, after complete dephosphorisation, previous to addition of spiegeleisen, 0·111 per cent. oxygen; Gute Hoffnungshütte wrought iron, 0·515 per cent. oxygen.

The Secretary of the Treasury has transmitted to Congress the report of the Director of the Mint upon the production of gold and silver in the United States in 1881. The total product of gold for the year was 34,700,000 dols., £6,940,000; of silver, 43,000,000 dols., £8,600,000. Colorado takes the first place among the producing States, with a yield of more than 20,000,000 dols., £4,000,000; California follows with a yield of nearly 19,000,000 dols., and Nevada, which at one time ranked first, is now third, with a product of less than 9,000,000 dols.

An American paper says the New York Custom House records furnish the following figures, which show the growth of arrivals of steam and sailing vessels at New York, during the years named:—1865, steamers, 455, sailing vessels, 4291; 1866, 623 and 4284; 1879, 1591 and 6486; 1880, 1895 and 5922; 1881, 1953 and 4976. Although there has been a decrease of 1510 sailing vessels since 1879, and the number last year was only 685 more than in 1865, the increase in the arrival of steamers has been considerable. In commenting on these figures, an exchange says that the steamers, however, have not increased in number to this extent, as the majority of them arrive at short intervals.

The rainfall of Ceylon, which for six months in the year is very heavy, commences in the hill country usually at the end of February or beginning of March. The burst of the monsoon is very severe, and is accompanied by thunder and lightning, and the streams rise with wonderful rapidity and sweep away bridges, breach roads, and do a great deal of damage. Mr. H. F. A. Robinson, in a paper recently read before the Institute Civil Engineers, Ireland, says, "I find by an old diary, that on the 14th May, 1877, my official rainfall return showed 7·80in., on the 15th it showed 8·76in., and on the 16th 8·35in., or a total for the three days of 24·91in. This was an exceptionally heavy burst."

The following measurements of the great lakes of America have been taken by the Government surveyors:—The greatest length of Lake Superior is 335 miles; its greatest breadth is 160 miles; mean depth, 688ft.; elevation, 627ft.; area, 82,000 square miles. The greatest length of Lake Michigan is 300 miles; its greatest breadth, 108 miles; mean depth, 690ft.; elevation, 506ft.; area, 23,000 square miles. The greatest length of Lake Huron is 300 miles; its greatest breadth is 60 miles; mean depth, 600ft.; elevation, 274ft.; area, 20,000 square miles. The greatest length of Lake Erie is 250 miles; its breadth is 80 miles; its mean depth is 84ft.; its elevation, 26ft.; area, 6000 square miles. The greatest length of Lake Ontario is 180 miles; it greatest breadth, 65 miles; its mean depth is 500ft.; elevation, 261ft.; area, 6000 square miles. The total of all five is 1265 miles, covering an area of upwards of 315,600 square miles.

The statement that grain absorbs enough moisture on a sea voyage to pay the freight charges has been to some extent confirmed by experiments made at the California Agricultural College. Various kinds of grain were placed in a moist atmosphere and the increase in weight was noted. The greatest increase was during the first twenty-four hours, the absorption being nearly 33 per cent. of the total absorbed during the fifteen days' exposure. The following table shows the figures:—

	First 24 hours.	Total in 15 days.
Oats	2·79 per cent.	7·70 per cent.
Barley	1·45 per cent.	7·00 per cent.
Wheat	2·45 per cent.	6·56 per cent.

From the results obtained it was computed that perfectly dry grain at 65 deg. Fah. would absorb as follows:—Oats, 29·08 per cent.; barley, 28·17 per cent.; wheat, 25·02 per cent. Under ordinary conditions, the *Scientific American* says, the percentage is perhaps not so high, 15 to 16 per cent. probably being the average.

In their sixth annual report, Colonel Majendie and Major A. Ford, the Inspectors of Explosives, say: "Experiments conducted by us appear to establish very satisfactorily that the effect of small charges of dynamite, and similar explosives, upon masonry structures is essentially local. Were the charge is in contact with an external portion of the structure, any effect which may be produced is almost entirely confined to a complete or partial penetration of the structure at the spot where such contact occurs; while if the charge be not in contact with any part of the structure, the result in the case of an external explosion is either wholly or nearly negative, while if occurring in the interior of a building any effect which may be produced is limited to the more or less complete demolition of the chamber or portion of the structure in, or in the immediate neighbourhood of which the explosion was effected. General or even partial destruction of a public building, or of a substantial dwelling house could not be accomplished except by the use of very much larger charges of dynamite and similar substances than could usually be brought to bear without attracting observation, and the effect of a single 'Infernal Machine,' containing a few pounds of explosive would be structurally insignificant."

M. De Villiers has invented a metallic alloy for silvering. It consists of 80 parts of tin, 18 parts of lead, and 2 parts of silver, or 90 parts of tin, 9 parts of lead, and 1 part of silver. The tin is melted first, and when the bath is of a brilliant white the lead is added in grains, and the mixture stirred with a stick of pine wood, the partially-melted silver is added, and the mixture stirred again. The fire is then increased for a little while, until the surface of the bath assumes a light yellow colour, when it is thoroughly stirred up and the alloy cast in bars. The operation is then carried out in the following manner:—The article, a knife-blade for example, is dipped in a solution of hydrochloric or sulphuric acid, rinsed with clean water, dried and rubbed with a piece of soft leather or dry sponge, and finally exposed to a temperature of 70 deg. or 80 deg. Cent.—158 deg. to 176 deg. Fah.—for five minutes in a muffle, to prepare the iron or steel to receive the alloy, by making the surface porous. If the iron is not very good these holes are much larger, and frequently flaws and bad places are disclosed, which make the silvering more difficult. With steel the process goes on very regularly. The article, warmed to, say, 140 deg. Fah., is dipped in the bath, melted in a crucible over a gentle fire. The bath must be perfectly fluid, and is stirred with a stick of pine or poplar; the surface of the bath must have a fine white silver colour. For a knife-blade an immersion of one or two minutes is sufficient to cover it; larger articles require five minutes' immersion. After taking it out of the bath it is dipped in cold water, or treated so as to temper it, if necessary. If left too long in cold water it frequently becomes brittle. It is then only necessary to rub it off dry and polish without heating it. Articles treated in this manner look like silver, and ring like it too, and withstand the oxidising action of the air. To protect them from the effect of acid liquids like vinegar, they are dipped in a bath of amalgam, composed of 60 parts mercury, 39 parts of tin, and 1 part of silver; then dipped warm into melted silver, or electro-plated with silver to give them the silvery look. This kind of silvering is said to be very durable, and the cost comparatively small. If this method is as good as the inventor represents it, the *Scientific American* thinks it will be preferred to nickel plating.

MISCELLANEA.

Messrs. Currall and Lewis, of Birmingham, have this week secured from the Walsall Corporation the contract for executing new sewerage works at Brockhurst Farm, at a cost of £12,395. The highest tender was £28,000, and the borough surveyor's estimate had been £12,107.

The Corporation of Bridgnorth has just completed a negotiation for the necessary loan of £16,000, to enable them to complete the purchase of the Bridgnorth Gasworks. The interest will be at the rate of £3 17s. 6d. per cent. per annum, and the principal and interest together is repayable in fifty equal annual instalments.

A company entitled the European, American, Canadian, and Asiatic Cable Company, Limited, with a capital of £1,500,000, in 150,000 shares of £10 each, is being formed with a guarantee against amalgamation with any of the existing cable companies. The company proposes to establish international telegraphy upon a system of mutual profits, and to work at a much lower word rate than the existing cable companies offer to the public. The offices are at 4, Coleman-street, Bank, E.C.

The activity of the last two years in iron and steel shipbuilding is still maintained, the English, Scotch, and Irish yards being all fully occupied. Prices steadily advanced during the two years ending last January, so that while at the beginning of 1880 the price of passenger steamers ranged from £21 to £25 per ton, and of cargo steamers from £18 to £19 per ton, prices £3 to £4 above these rates have been paid on recent contracts; and even at these advanced prices it has been difficult to obtain early completion.

We have received a copy of a newly published catalogue from E. R. and F. Turner, of Ipswich. It contains many new engravings, and several novelties and improvements are illustrated and described, the catalogue being in this edition considerably enlarged. Some very useful information is given, the description of the various specialities being clear and concise, and illustrated by sectional drawings. The catalogue is intended more particularly for circulation amongst exporting houses, and Messrs. Turner know that buyers are not satisfied with mere exterior views.

A statement of all the moneys hitherto expended and received on the alteration of streets in Wolverhampton under the Artisans' Dwellings Scheme, shows that, up to the present, the net expenditure has been £245,000. Supposing the debt to be wiped off all at once, a rate of 1s. 7d. in the pound would be needed. The Artisans' Dwellings Improvement Committee propose to pay off the interest by itself as soon as possible, and to this end they recommend that, during the ensuing year, additions shall be made to the improvement rate which will amount to 9d. in the pound. This will raise the town's improvement rate to 4s. in the pound.

The first of the French shipbuilding yards established under the new bounty system commenced operations last month at Nantes, with an equipment of hydraulic and other tools made principally in this country. Four other shipbuilding yards are being prepared at Bordeaux, Havre, and elsewhere, and though some supposed national advantage may be gained, the cost of vessels can hardly be brought within 25 per cent. of that which the better workmen and experienced organisation of English and Scotch builders allow, and, therefore, the success of the French undertakings, subsidised as they are, is, Messrs. Matheson and Grant consider, extremely doubtful.

The death rate of Nantes is singularly low, and, as a contemporary remarks, appears to upset all sanitary theories. Nantes is probably the dirtiest large city within the limits of Christianity. No pen, no language, can describe the state of filth in which the town is allowed to remain; not an angle, not a corner, not a dead wall which is not defiled by abomination of the foulest description. The stench which arises under certain atmospheric conditions can be imagined, but not described. Yet, as before stated, the death rate is only a fraction over 23 per 1000; the population seem happy and contented with their filthy lot, and no pressure seems to be put on the municipality to establish a better order of things.

Messrs. Chubb and Sons, the patent lock and safe makers, are about to transfer their lockmaking factory from Wolverhampton to the large Patent Safe Works, which they built at Glengall-road, Old Kent-road, London, a few years ago. At their London works they have room for a thousand workmen, and, in addition, already possess extensive boiler and engine power and a quantity of heavy machinery. They propose to add special machines for making certain parts of their patent locks, leaving the more complicated and delicate work to be done, as now, by hand. Messrs. Chubb have made about one million locks, and many thousands of safes since commencing business sixty-four years ago. The average length of time their workmen, including boys, have been in their employ, is seventeen years.

The Egyptian crisis, Messrs. Matheson and Grant say in their half-yearly report, has occurred at a most inopportune time for the engineering interests in that country. After a long period of depression, there has been during the last two years an unprecedented activity, and the large quantity of irrigating, agricultural, and other machinery exported from Europe has not only been profitable to merchants and manufacturers, but has extended greatly the various industries in Egypt. The peasants, freed from the rapacity of the pachas, have enjoyed a freedom of which they had had no previous conception, and the consequent stimulus to agriculture in this, one of the most fertile countries of the world, was already showing results in a general growth of national prosperity. This has all been rudely stopped by the military leaders who have usurped authority, and the English, French, Italian, and Austrian engineers who directed industrial enterprises will have difficulty in reconstructing the various undertakings thus broken.

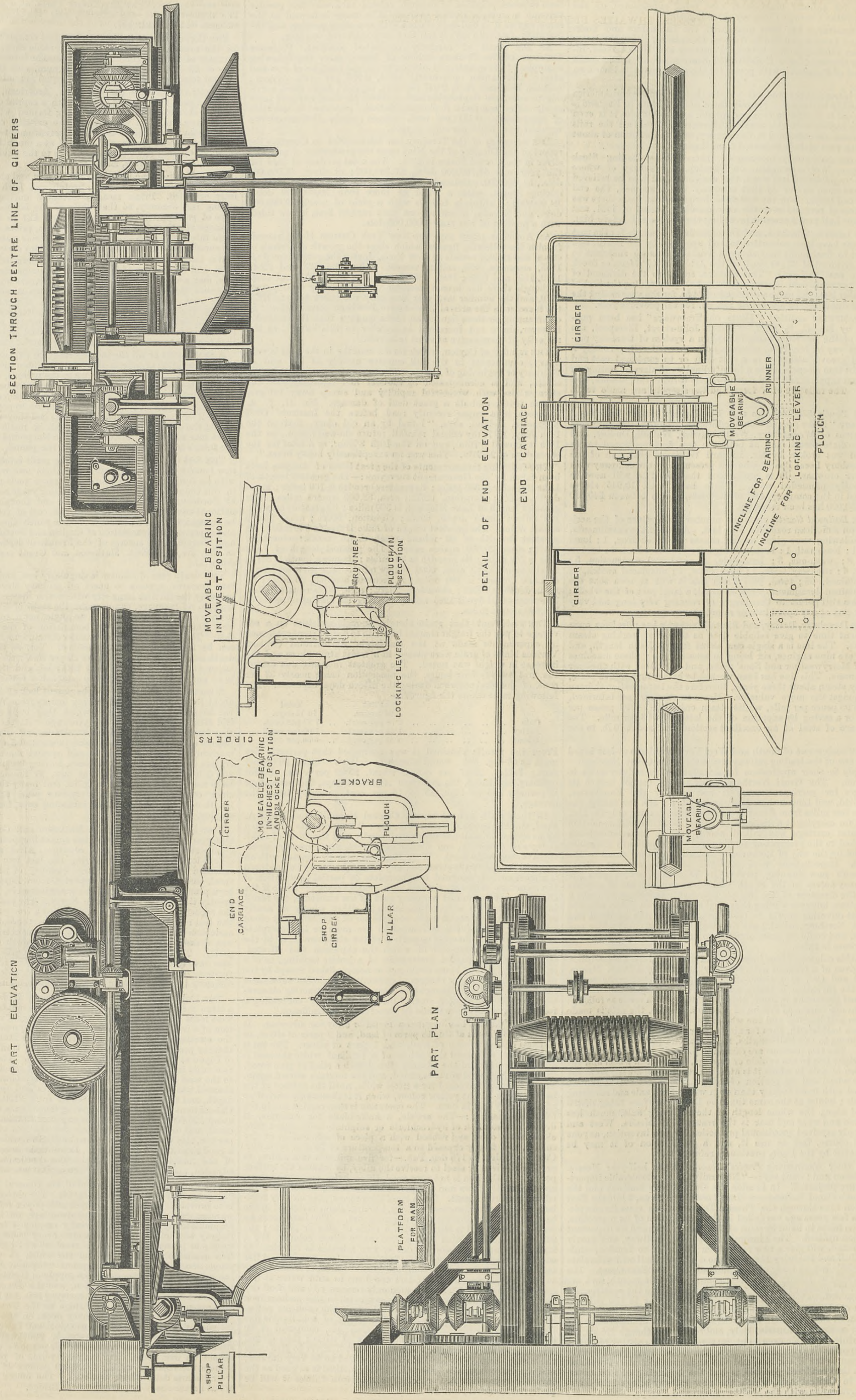
The Duke of Argyll was present on the 25th inst. at Glasgow at a large meeting favourable to the improvements of the east and west lochs of Tarbert, in the county of Argyll, and to the formation of a canal between the two lochs. The proposal submitted to the meeting is to form a canal through the Mull of Kintyre, and thereby provide a direct outlet for shipping traffic from the Firth of Clyde to the west and north of Scotland. The canal would be two miles in length, and the saving it would effect for vessels going to the west and north of Scotland would be about 115 miles. The channel was proposed to be 50ft. in width and upwards of 18ft. in depth, and the cost was estimated at from £150,000 to £200,000. Calculations had been made showing that vessels to the amount of about 500,000 tons a year will be expected to take advantage of the canal, and, estimating the charge for the use of the canal at 6d. per ton, this would give a revenue of £12,000, which was considered a good return upon the outlay. Resolutions were passed in favour of the formation of the canal. The preliminary details were adjusted, and a large portion of the capital was subscribed.

The prospectus has been issued of the General Hydraulic Power Company, Limited; capital £200,000. The object of the company is to provide large towns with hydraulic power for use in wharves, warehouses, factories, hotels, and dwellings, on the high-pressure accumulator system now universally employed in the docks and railway termini, by means of which every consumer will have a supply of power of the most convenient and economical description available at all times, and for which he will pay only in proportion to his actual consumption. A special Act of Parliament has been obtained authorising the supply of hydraulic power over a large area in the centre of London, and the directors of this company have acquired the right of carrying this Act into effect. The area extends from Blackfriars Bridge to the Tower on the north side of the river, and to the Surrey docks on the south side, and includes such important streets as Upper and Lower Thames-street, Queen Victoria-street, Cannon-street, Southwark-street, Tooley-street, &c., the value of which, for the purposes of the company, cannot be over-rated. For nominal terms of payment the Act confers the right of taking 1,000,000 gallons of water from the river Thames daily within this area. The offices of the company are at Palace-chambers, Westminster Bridge.

FIVE-TON TRAVELLING CRANE, MONKBRIDGE IRONWORKS

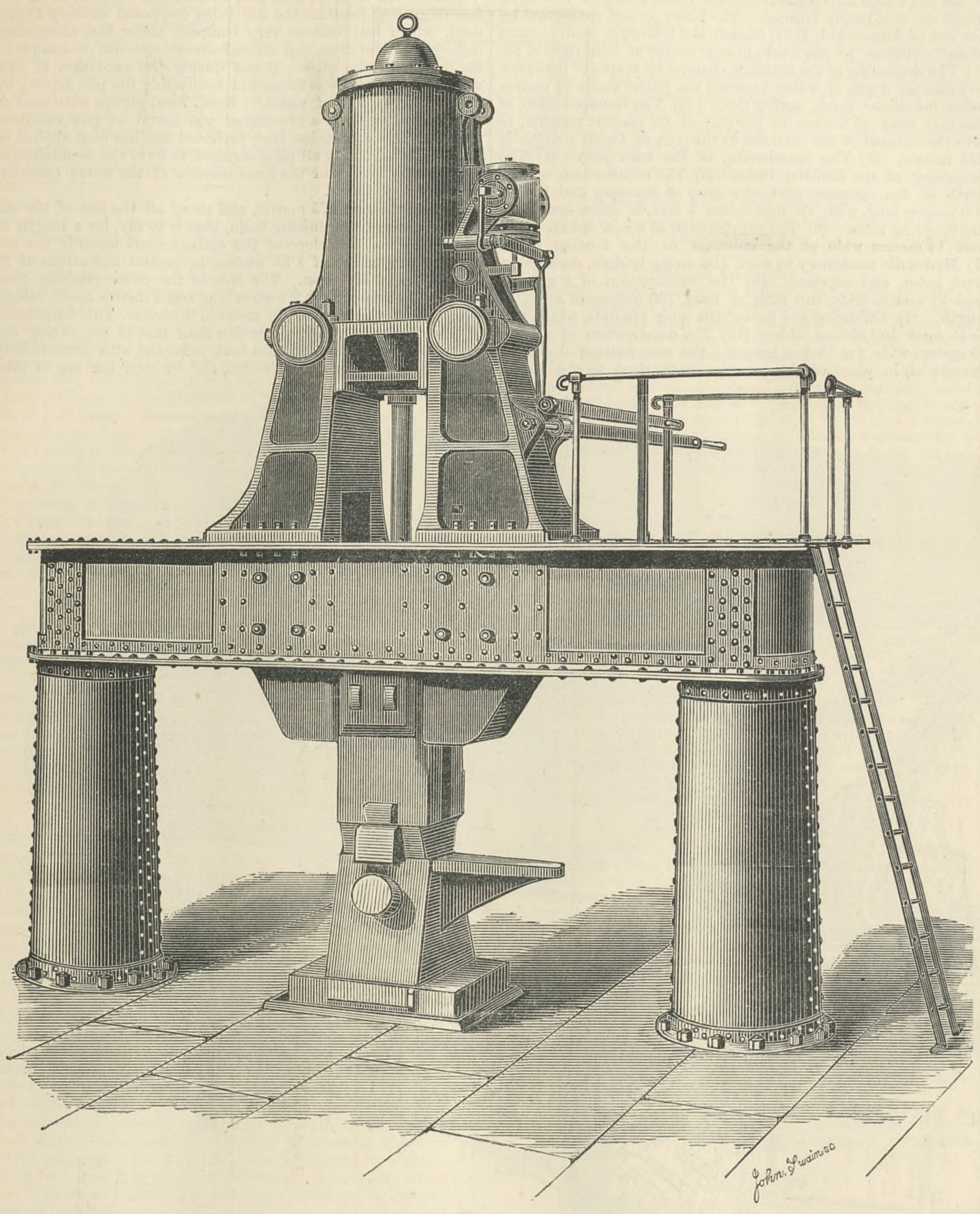
MESSRS. SMITH, BEACOCK, AND TANNETT, LEEDS, ENGINEERS.

(*For description see page 59.*)



WROUGHT IRON FRAMED STEAM HAMMER.

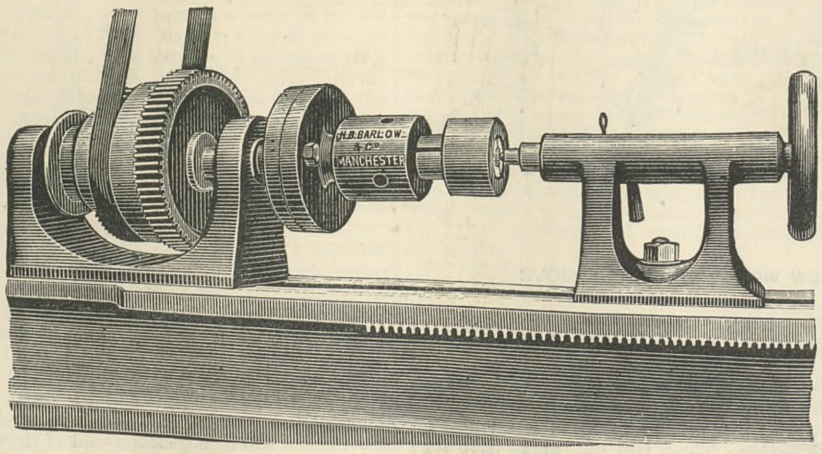
MESSRS. THWAITES BROTHERS, BRADFORD, ENGINEERS.



THE accompanying engraving illustrates a new type of steam hammer now being introduced by Messrs. Thwaites Brothers, of Bradford, in compliance with the growing demand for hammers with wrought iron frames. The hammer cylinder is supported on a wrought iron box girder strongly reinforced where the opening for the piston rod is made in the top and bottom flange. The ends of the girder are carried on boiler-plate cylinders, which, if necessary, may be filled with concrete. In this way a very solid and durable tool is produced. The hammer we illustrate is of comparatively moderate size, and is well adapted for the production of "uses" and special forgings.

BARLOW'S EXPANDING MANDREL.

FIG. I.



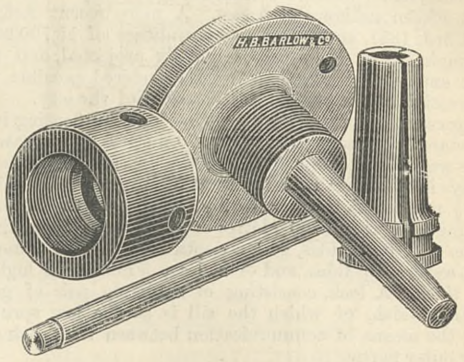
THE time lost in driving or forcing solid mandrels into pulleys, collars, bushes, and other articles which have to be held on mandrels to be turned or worked in a lathe, and the breakages and waste of time arising from this operation, were the subject of an amusing article by an American contemporary and reprinted by us on the 9th January, 1880, and are frequently the cause of serious loss and inconvenience in all machine works. To get over these difficulties various mandrels have been brought forward, but the expanding mandrel herewith illustrated possesses several points of novelty, and must save a great deal of time in a turnery.

In Fig. 1 the mandrel is shown bolted to the face plate of a lathe. Fig. 2 shows the several parts of the mandrel. For turning brass work and other light pieces when thus fastened in the lathe, the end of mandrel need not be supported as shown. It will be seen that the mandrel consists of a taper mandrel core ending in a screw by a running collar, on which the split mandrel itself with taper bore is drawn upon the mandrel core and expanded. The screw being a fine pitch and the taper small, the mandrel is very powerfully pressed against the interior of anything put upon it, so that it holds more firmly than a solid driven mandrel. In many cases such articles as pulleys, wheels, and collars can, by putting them on the end of the split mandrel, be bossed with a round nosed turning tool, which tool is then ready for facing and turning the periphery of the article in the lathe. Knife-edge tools may thus in some cases be dispensed with, and some of the time occupied in changing tools is saved.

Each mandrel has a considerable range of sizes, viz., a 1in. mandrel can by simply changing the split sections be converted into 1½in. in diameter, or to an intermediate size; and a 2in. mandrel, by the use of extra split bushes, and extra collar, will hold from 2in. to 3in. or 3½in. For brass work, especially small light work, they will be found of great assistance, as in turning tubes, however thin, they can be finished and removed without any force, and much time saved.

An advantage that will commend itself to practical turners is that the mandrel will remove the trouble sometimes attaching to articles bored above template sizes, such as loose pulleys, glands, and bushes, as the mandrel will take these just as well as others bored to standard size, and the usual lead lapping is dispensed with. The mandrels and parts are made of steel, and are now in extensive use in Leeds, Manchester, and elsewhere, with great success. This mandrel is one of the most useful time economising

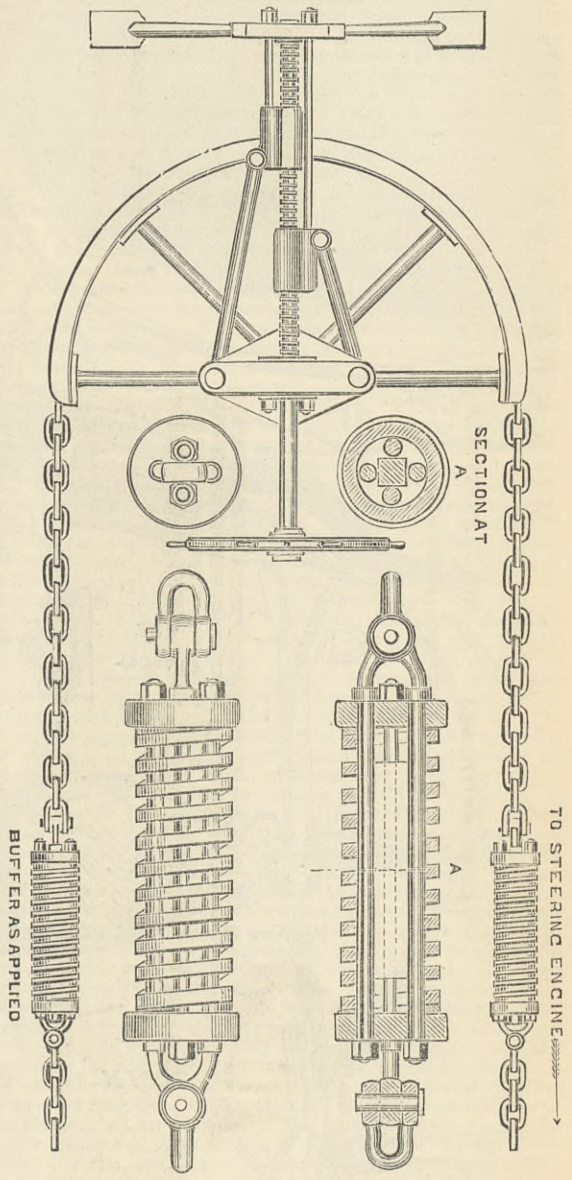
FIG. 2.



tools that have been introduced into the turnery for a long time. It is made by Messrs. H. B. Barlow, jun., and Co., of Combrook Works, Chester-road, Manchester.

WOTHERSPOON'S SPRING BUFFERS FOR STEERING GEAR.

THE accompanying drawing explains itself. It shows the application of spring buffers to take up slack in rudder chains. It will be seen that the four pulley rods which compress the spring also act as effective guides. The link consists, in fact, of a shackle with two stems firmly attached to the discs at the ends;



each pair of stems passes through holes in the discs of the other, facing opposite ways, the two pairs of stems forming a cross with each other in section. The spring is spiral, coiled round the four stems between the two discs, and pressing against the discs, serves to keep them apart. The buffers are being introduced by Messrs. A. and R. Brown, Engineers, Waterloo-road, Liverpool.

THE DRAINAGE OF RIPON AND SHAROW.—The Ripon Rural Sanitary Authority have decided to make application to the Local Government Board for a provisional order forming the township of Sharow and the Ripon Urban District into a united district for the purposes of drainage.

SOLDER FOR METAL, GLASS, AND PORCELAIN.—A soft alloy, which will adhere so firmly to metallic, glass, and porcelain surfaces that it can be used as a solder, and which is invaluable when the articles to be soldered are of such a nature that they cannot bear a high degree of temperature, consists of finely pulverised copper or copper dust, which is obtained by shaking a solution of sulphate of copper with granulated zinc. The temperature of the solution rises considerably, and the metallic copper is precipitated in the form of a fine brownish powder. Twenty, thirty, or thirty-six parts of this copper dust, according to the hardness desired, are placed in a cast iron or porcelain-lined mortar, and well mixed with some sulphuric acid having a specific gravity of 1·85. Add to the paste thus formed seventy parts by weight of mercury, constantly stirring. When thoroughly mixed the amalgam must be carefully rinsed in warm water to remove the acid, and then set aside to cool. In ten or twelve hours it will be hard enough to scratch tin. When it is to be used it should be heated to a temperature of 375 deg. Cent., when it becomes as soft as wax by kneading it in an iron mortar. In this ductile state, the *Scientific American* says, it can be spread upon any surface, to which, as it cools and hardens, it adheres very tenaciously.

NEW WORKS AT CALAIS HARBOUR.

No. I.

The works for the improvement of the port of Calais were commenced in 1877 by authority of an Act of the French Legislature, dated December 14th, 1875, and they were estimated to cost fifteen millions of francs. A more recent Act, dated August 3rd, 1881, authorised an expenditure of 18,700,000f. for the completion of the works originally projected, and for the further extension of the new works, rendered possible by the condemnation of the ancient fortifications of the city.

The present port of Calais consists—(1) Of a floating basin of two hectares superficial area, with 590 metres of quay walls to the low-water level of spring tides; the depth of water alongside the quays is 4½ metres to 5 metres at high-water neap tide, and 6 to 6½ metres high-water spring tides. (2) Of an outer or grounding port with, 1700 metres of quay walls from the low-water level of neap tides, with a depth of water of 3 metres 70 at high-water neap tides, and of at least 5 metres at high-water spring tides. A lock, consisting of a simple pair of gates of 17 metres width, of which the sill is at the low spring tide level, is the means of communication between the floating basin and the outer port.

The depth of water in the entrance channel between the two timber-constructed jetties, and over the bar at the entrance, is maintained by sluicing from a basin of 57 hectares superficial area. The Canal de Calais branches off from a double-gated lock in the grounding port, and establishes a communication between that part and the navigable canal system of the north of France and the Pas-de-Calais. Despite the inadequacy of these works, the registered tonnage of the ships using the port of Calais, inward and outward united, was more than 70,000 tons in 1875. In 1880 it had increased to 1,500,000 tons, although during this interval no change had been made in the accommodation provided.

The works authorised by the Act of December 14th, 1875, now in course of construction to the east of the present port, are partly on the site of ancient fortifications and partly on the beach. They consist of :—(1) A floating basin of 10 hectares superficial area with 1640 metres of quay walls, founded 2½ metres below the low-water level of spring tides; along the walls the depth of water will be about 7·4 metres during neap tides and 9 metres during spring tides. (2) An outer port of 6 hectares superficial area, opening into the main entrance channel of the port; one of the banks only will be bordered by a quay, with foundations 4 metres below low-water mark spring tides, for the accommodation of passenger steamships and of the mail service between Calais and Dover. (3) A great sluicing basin of nearly 100 hectares superficial area, the sluices of which will be about the centre of the entrance channel of the port.

The floating basin will communicate with the outer port by a lock 21 metres wide and 132½ metres long between the gates, and with the Canal de Calais by a single gate.

After the passing of the Act of Dec. 14th, 1875, the military authorities designed new fortifications to include the suburb of St. Pierre. An Act of April 25th, 1879, ordered the *déclassement* of the old Calais fortifications and the construction of new ones, which are now nearly finished. The latest project authorised by the Act of August 3rd, 1881, include the following modifications of and additions to the works now in course of construction :—(1) The deepening of the entrance channel by means of dredgers, to make the depth of water between the jetties about 3½ metres below low-water mark, spring tides. (2) The reconstruction of the east jetty 25 metres to the east of its present position, to give the channel at the entrance to the port of Calais a width of 125 metres. (3) The lengthening of the west jetty (4) The deepening of the sluicing basin. (5) The construction on the north of the entrance port of a quay of masonry and timber 600 metres long, with its foundation 4 metres below low-water mark, spring tides. (6) The construction of a new double-gated lock 14 metres wide at the entrance to the floating basin. (7) Hydraulic machinery to work the swing bridges, dock gates, flood gates, and capstans. (8) The construction of a graving dock 21 metres wide, and with at least 100 metres of available length. (9) Enlarging and paving the quay grounds, which will be at least 100 metres wide. (10) The construction of a basin 45 metres wide for barges, between the new floating dock and the citadel, in place of the junction authorised by the law of 1875; this basin will have more than 200 metres of quay walls, out of a total embankment of 400 metres accessible to sea-going ships.

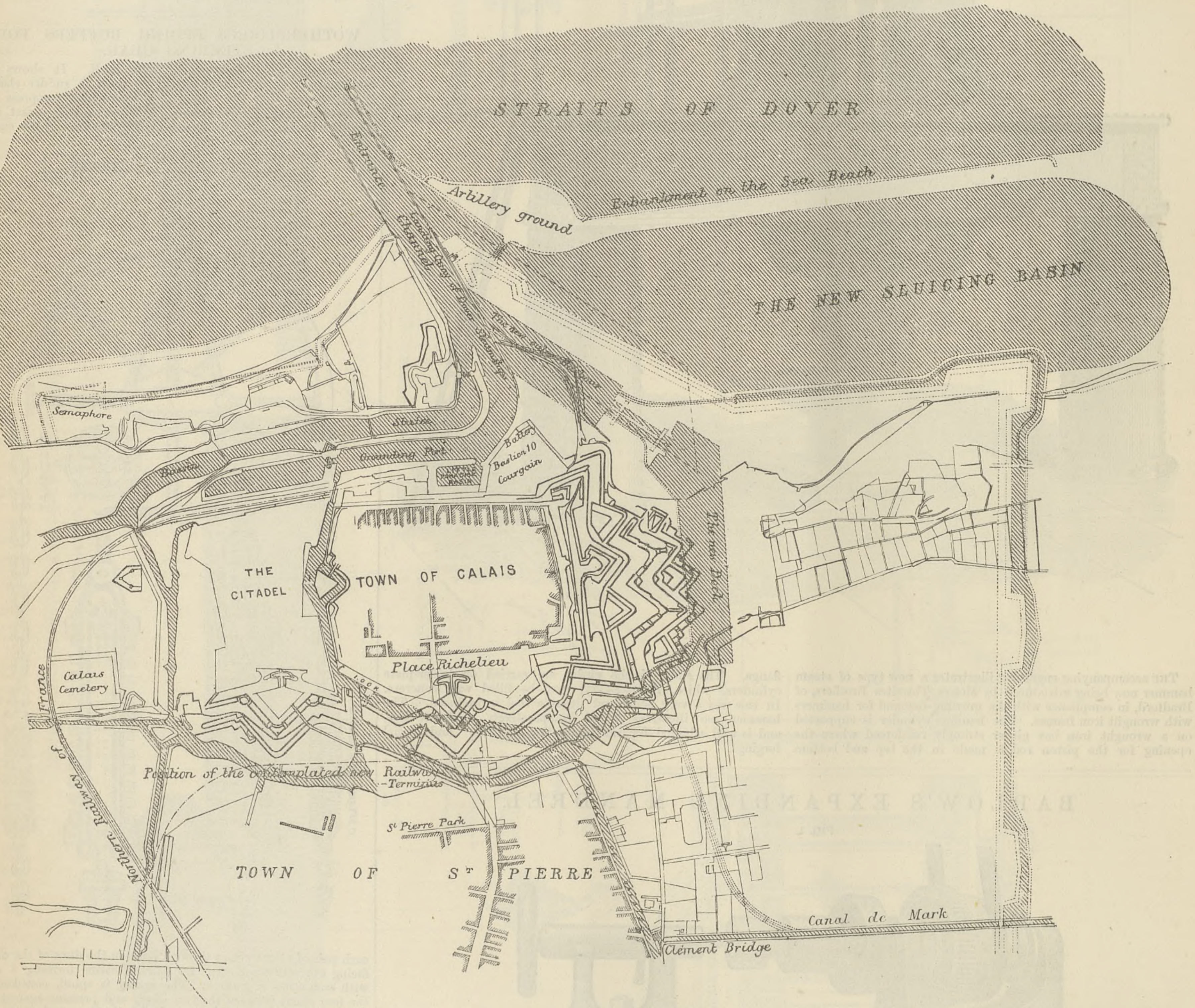
The following will be accessories to these works :—(1) A change in the position of the terminus of the Northern Railway of France. (2) A junction with the Canal de Marck. (3) A junction with the Canal des Pierrettes. These two last works have for their object the securing of the absolute independence of the naval interests, the dock interests, and the canal interests, which interests are often in opposition.

The excavation of the floating basin is completely finished, and that of the sluicing basin is going on rapidly. The excavated earth is used for the formation of the exterior and interior walls or banks of the floating basin, for filling up the quays, for the embankments protecting the excavations from the encroachment of the sea, and for the earthworks of the northern part of the fortifications. The exterior boundary of the sluicing basin is a massive bank of sand, protected on its outer side, next the sea, by a lining made as follows :—Three metres of clayey chalk wetted and beaten down on the slope of the embankment; 2·5 metres of concrete formed of two parts of pebbles to one of mortar. The mortar itself is formed of one part of Portland cement to six of sand—233 kilos. of cement to each cubic metre of sand; 25 metres of rough hewn small stones with mortar of Portland cement—350 kilos. of Portland cement to a cubic metre of sand. For a length of 555 metres alongside the grounds reserved for the establishments of the Experimental Artillery Commission, the bank of the sluice is inclined 2ft. horizontally to each vertical foot; the pitching rests at its foundation upon a row of piles and battens; the piles are driven down to a depth of 3 metres and the battens 2½ metres.

The driving of these piles and battens has been done in the face of great difficulties, the soil being composed entirely of fine sand, which had become very compact under the alternating influence of the tides, and offered almost absolute resistance to the driving of the piles. It was during the execution of this work that the idea was formed of facilitating the pile driving by means of injections of water.* Small hand pumps were used at first, but afterwards a fire-engine was found to give excellent results. This process has been perfected and has been applied to the driving of nearly all piles required to form the foundation of the masonry facings of the most massive of the works executed in the port of Calais.

Beyond the first 555 metres, and along all the rest of the sea embankment of the sluicing basin, that is to say, for a length of 1528·17 metres, the slope of the embankment towards the sea is in the proportion of 1·25 metres horizontal measurement to each metre of elevation. The base of the outer pitching rests on a foundation of piles 2 metres long and 2 metres apart, behind which are simple planks ·034 metre in thickness. This foundation of piles performs no other function than that of supporting the concrete before it sets. It has been executed with great facility by the process of water injection, and without the use of pile-driving machinery. The excavation of the sluicing basin has been executed in the same manner as that of the floating basin, namely, partly by hand labour and partly by an excavator with a chain of scoops invented by M. Couvreux. This apparatus was employed in excavating the Suez Canal, and in widening a mouth of the Danube, and has been used with advantage in removing the fine homogeneous sand of the Calais beach. In one minute a wagon of 6 cubic metres can be filled by means of this machine; a train of thirteen trucks is loaded in about thirteen minutes. Extraordinary rapidity is attained whenever trains can succeed each other without interruption alongside the excavator, but when the sand has to be carried a considerable distance there are proportionately long interruptions to the work. Despite this drawback, the sand dug out and loaded by means of the excavator has amounted to and frequently exceeded 2000 cubic metres a day. In summer about 2400 metres have been excavated in fourteen hours.

The floating basin communicates with the outer port by means of two parallel locks, of which the following are the principal dimensions :—Total length of the work, 191 metres; one of the locks is 21 metres broad and 133½ metres long, measured from mitre sill to mitre sill. The other lock is 14 metres wide and 137·45 metres long between the gates. The lock floor is an inverted arch, with a basket handle curve struck from five centres of 3 metres radius each. The lowest point is 2½ metres below the low-water mark of mean spring tides. The mean high-water mark being 4·95



MAP OF NEW WORKS, CALAIS HARBOUR

* See the note of MM. Stœcklin and Vetillart in *Les Annales des Ponts et Chaussées. Moirde Jaunes*, 1878. Paris.

metres during neap tides and 6·25 metres during spring tides, the depth of water over the base of the lock has a mean of 7·45 metres during neap tides, and 8·75 metres during spring tides. Each lock will have four pairs of gates, namely, one pair of flood gates and two pairs of ebb gates, the latter enclosing a water area large enough for the largest ships; the fourth pair of intermediate ebb gates forming with the pair of gates below them a little lock, and with the pair of gates above them a medium lock, useful for vessels of ordinary dimensions. This arrangement of dock gates has for its object the regulating of the length of lock used to the size of the vessels entering or leaving, whereby the working operations are quickened, and the loss of water every time the lock is used is diminished. The gate platform of the lower gates is deep enough to permit the fixing of shutter gates, which will strengthen the other gates at their junction, and assist them to resist any swell, or if necessary, to prevent the entrance of exceptionally high tides into the basin. At the two heads of the lock are recesses in the masonry, in which caissons can be placed when it is desired to get the lock dry; these caissons will serve also to close the graving dock, according to the authorised plan. A transverse groove is made in the lock floor to permit the passage of gas and water pipes from one side of the basin to the other. The longitudinal culverts are, practically speaking, in the two chamber walls of the locks, and in the wall which divides the two locks. Each of these culverts is put in communication with the corresponding lock by four transverse culverts; the transverse culverts are closed by slip gates which move in grooves; the longitudinal culverts are also closed by slip gates at both ends. These slip gates will be worked by hydraulic power of some type not yet decided upon. At a later stage culverts made at the level of the bottom of the chambers of the dock gates will permit of energetic sluicing to clear the mud out of these chambers.

Two swing bridges will keep up the thoroughfare over each lock; these bridges, formed in a single piece, will be placed at the extreme ends of each lock, so that communication between the two sides need never be interrupted. The foundation of the locks is formed of a solid mass of concrete, of which the surface is sensibly horizontal, and of which the thickness varies from $1\frac{1}{2}$ to 2 metres. At the two ends, and under the chambers of the doors, the concrete forms a solid mass, intended to resist the bursting up of water from below, a danger always to be feared in works of this kind when built upon sea-sand.

Before and behind the lock floor is prolonged by aprons formed of superimposed layers of clay, straw, small blocks of stone, and large blocks of artificial stone made on the spot, deposited between files of piles and battens. The artificial blocks are made of small stones and Portland cement. They have an outer covering of faced and cut stone, at least the lock of 21 metres has. Faced stone is employed only for the crown of the quay walls, the sills of the locks, the quoins, the ends, and for salient angles. It consists for the most part of limestone from Soignies, Belgium, whence it is transported by rail to the works, or of stone from Marquise, Pas-de-Calais.

The concrete used in the bed of the foundations is made of pebbles from the neighbourhood of Calais, and lime made from Tournay chalk, which is eminently hydraulic, added to "trass"—the friable stone of Andernach, and sand. The composition of the mortar is trass, ·35 cubic metre; sand, ·4 cubic metre; lime, ·7 cubic metre. These are mixed under vertical crushing rolls driven by two steam engines, and yield one cubic metre of mortar. The pebbles used in the manufacture of the concrete came from the neighbourhood of Calais; they are not used until they have been washed with great care, either in rotating cylinders, or in barrows with pierced bottoms. The friable stone used at Calais comes from the borders of the Rhine; it is brought in ships, in blocks of a certain dimension, and has to be reduced to powder; this is done by crushing the blocks in one of Blake's machines, and further pulverising them in a Vapart's machine. The powdered trass is carried by a chain of buckets to a sieve into which it is thrown. After being sifted it is put in sacks and carried to the store yards, or deposited by means of an endless screw in a new chain of buckets which transports it to the warehouses. The transportation and distribution in the warehouses is effected by means of an endless band. The quantity of trass thus powdered and mechanically warehoused is 40 tons in twenty-four hours.

The mixers for the concrete used at Calais consist of wooden boxes, 1 metre square and 8 metres high, having in the interior a series of inclined planes. The pebbles are brought in barrows with pierced bottoms in which they have been well washed; the mortar is brought in trucks by Decauville's system; the materials are introduced separately in proper proportions at the same moment into the upper part of the machine, and reach the bottom as a perfectly homogeneous mass, which falls directly into the trucks, and is carried where it is required for use. It is used by maintaining at the bottom of the excavation a layer of water ·5 metre to ·75 metre in depth; the surface of the concrete is kept constantly ·5 metre or 1 metre below the surface of the water, and advance is made in inclined planes, always taking the precaution to deposit the composition behind the crest of the plane, where it is strongly beaten down, thus diminishing as much as possible the formation of slush. The Tournay lime and trass employed for the concrete are not more economical than the mortar cement, which is excellent, but the former is more binding, more waterproof, and better to work with under water.

The sluicing basin was to have been excavated to a depth of about 4·75 metres, or 2 metres lower than the high water of spring tides; the latter project, approved by the law of August 3rd, 1881, includes the deepening of the basin $\frac{1}{2}$ metre more than in the original plan, to facilitate the outflow of water, and to allow a certain margin for sediment. The water in the basin will have a superficial area of 95 hectares, and it has been determined to let it out in such a manner that a slice of water $1\frac{1}{2}$ metre in depth will be discharged during the time that the sluice is really efficacious, that is to say, in three-quarters of an hour; this duration is ascertained from observations made in the Channel ports. It is calculated that a sluicing channel 28 metres wide should secure the emptying to that extent in 43 minutes. This width of 28 metres requires five sluices 6 metres wide, allowance being made for the thickness of the gates, which perhaps can be reduced to ·4 metre, or even less, by the employment of plate iron. This division into five narrow sluicing gates of 6 metres each is advantageous from an economical point of view; the number could not be reduced without augmenting the size, and 6 metres appeared to be the limit imposed consistently with facility in working. It has been ascertained by calculation that the basin can easily be filled in one tide without a more rapid flow than 2·75 metres per minute (?) in the interior of the sluice. The mode of closing the sluices has been decided only in principle, and in that which relates to the position of the masonry; the nature of the gates themselves will be decided hereafter. The basin will be provided also with sluice gates to retain the water in the reservoir, and with caissons intended to prevent the introduction of sea-water from without during the period of sluicing. The sluicing gates will be formed of a slab of iron turning upon a nearly central axis; their positions will be analogous to those of the new sluicing lock at Dunkirk. The caissons will be built up of wood; they are intended to resist, whenever sluicing is not going on, the ebb and flow of currents which might be inconvenient to vessels in the entrance channel of the ports. They will also at other times form rafts, useful to aid in the execution of any repairs necessary in the basin. The position of the sluice gates will be as high up as possible, in order to leave room in the side of the basin for the grooves for the reception of the stop-planks. The caissons will be placed immediately below the sluice gates. The length of the piles and abutments included in the works along the flood-gates, sluicing-gates, caissons, fixed bridge, and stop plank grooves is 21 metres.

LETTERS TO THE EDITOR.

ot hold ourselves responsible for the opinions of our correspondents.]

BRIDGE SUPPORTS.

SIR,—In the *Contract Journal* of the 19th inst. there is given a diagram of "Proposed New Form of Bridge Supports," which is said to be an extract from one of your late issues. If you will refer to plate 73 "Instructions in Military Engineering," 1875, or to page 87 "Elementary Field Engineering," 1877, you will find in both diagrams of bridges or bridge supports of exactly the "proposed new" form, and at page 88 of the above last-mentioned book you will find "Bridges may be supported on weighted brushwood cylinders, on end or horizontally, so as not to stop a watercourse." This form has been known to military engineers for a very long time, and I am astonished to hear it brought out and published by such a journal as yours as "new."

JOHN M. GIBSON.

London, July 24th. Buckley Engineer Volunteers.

THE PIANOGRAPH-METRONOME.

SIR,—I have read with a good deal of interest the description of the pianograph-metronome published in your last impression. I must ask Mr. Hodgson for certain explanations which he has omitted to supply. In the first place he does not state how the metronome is coupled to the apparatus; nor is it easy to see precisely how the reduction is effected. The general principle involved is clear enough. It is that of reading a given set of measures by a different scale from that to which they are drawn, so that what is 3in. long on one sheet becomes $\frac{1}{4}$in. on another sheet; but the way in which the principle is applied has not been made clear.

Again, surely Mr. Hodgson is wrong concerning his notation, especially as regards his inversions; and am I to understand that the composer can only play in either of two keys, F or G?

It is quite possible that I have failed to understand Mr. Hodgson, but I must ask him to help me out of my difficulty.

Brompton, July 26th. MUSICUS.

FOUNDRY TRAVELLERS.

SIR,—Mr. Johnson is evidently doubtful of his foundry traveller. Such travellers, however, as your correspondent describes are commonly used in foundries, and, when properly constructed, give satisfactory results. A safe working load upon a 1in. bolt will not exceed two tons.

The tension rods, as shown in your correspondent's sketch, will certainly give considerable support to the beam supporting the crab, and although these rods will no doubt put the bolts under a shearing stress—such shearing stress being in intensity and direction as may be the angle of the rod to the strut and beam—the bolts will probably be stronger to resist this stress than the tension one.

Considering the rough usage to which foundry travellers are subject, the method of coupling the beams supporting the crab as shown seems to be a weak one. Why not put the girders carrying the crab on the top of the beams to which they are shown to be suspended? This arrangement would be thoroughly safe.

No doubt there is a practical reason for the arrangement as shown—probably want of room overhead. In this case stronger bolts—say $1\frac{3}{8}$in. or $1\frac{1}{2}$in.—will give the arrangement a sufficient margin for safety. M. SILVESTER.

106, Mayall-road, Herne Hill, S.E., July 24th.

GARDNER'S SWING BERTHS.

SIR,—In your issue of 30th June last, on "The Channel Passage," you have honoured me with a notice of my "level berth" in the Louise Dagmar, for which I thank you very much, and I trust you will not reject a few remarks I wish to make, assuming they may interest you. The india-rubber suspenders were not adopted in order to neutralise the effect of pitching—which I will term the vertical motion—but to preserve the berth from tilting by the head or feet when lying in it or leaving, &c. They, however, not only do so, but in addition give a great steadiness to the berth and are invaluable; for their perfect action it is necessary that they work at an angle of 45 deg., which doubtless you observed.

The vertical movement or sinking of the ship does not affect my berth to make the passenger ill, and is neutralised to a great extent in this manner; at least it is the only way I see of solving the problem. In pitching the movement of the berth is a curve, the berth following the support, which may be compared to an ordinary swing on a small scale. The movement of the ship itself is vertical, which is quite another thing, and all the passengers I have questioned on this point agree in this. At all events the result is only about one in twelve or so suffer, and none yet have complained of the sinking feeling. I have crossed about thirty times, the berth then being in the main saloon, and I enclose a few testimonials with remarks as to degree of roll, &c. You will perceive gaps at times, as we had no sea, and many promised to write to me who failed to do so. I may add that with the aid of india-rubber I entirely do away with the vibration of the engines. F. GARDNER.

97, Hereford-road, Bayswater,
July 22nd.

BREWING IN ENGLAND.

SIR,—The letter signed "Brewer's Architect," published by you last week, raises so many interesting technical points requiring lengthened discussion, even to agree upon the terms, that we fear we cannot trespass upon your space sufficiently to say so much as may be deemed necessary.

There are no errors in the dimensions published. The top withering floor is not left open to the roof in construction, it is ceiled flush with the tops of the beams. That the spaces seem cramped is natural, especially to one accustomed to Burton areas. We have simply gone to the very lowest limit possible in this system of working, in order to meet the demand for a malting that combines some novel and desirable improvements upon the recognised English system that can give the largest amount of fair malt at the lowest possible capital expenditure. We understand fully the objections that "Brewer's Architect" urges to such limited working and drying floors. We prefer much more room ourselves, and usually get it. It would, however, interest, if not astonish, him to see what can be done by our plans of steeping, drying, &c. All plans of thick growth upon floors are not failures, although at present some are. Sound theory has often to struggle long with imperfect practice.

We honour him for the frank avowal that "we in Burton are a long way in the rear of the best system," and certainly, so far as the items of drying and steeping are concerned, we can practically prove that our system gives more and better malt at less cost. We are slightly surprised that our adaptation of economical electrical force, labour-saving arrangement of bins, and damaged kernel separators or screens, of conical steeping cisterns suspended in the barley store, and design of steeping and loading kilns every twenty-four hours, do not strike "Brewer's Architect" as novel. We would much like to be informed of an English house having any one of these improvements in use without our present knowledge.

If "Brewer's Architect" were a practical brewer, the advantage of double floors in kilns would at once strike him even more favourably than at present they appear to. There is no longer any doubt about these advantages. A whole season's practical working in a large house, and part of a season in others in this country, and in a number for several seasons abroad, have incontestably proved the benefits to a brewer of drying upon our plan. We even go so far that we assert it is impossible to dry malt properly upon a single open floor in any ordinary kiln, and can prove it to anyone practically understanding the question, who is not already under the delusion that the malt he makes is perfect. We have never yet seen a single sample of perfect malt, and much careful scientific research is needed before it is even possible to make it. We have done something to improve maltings and malt. It is one step only in the right direction, and many more are to be taken.

We must not trespass longer upon your valuable space. To any of your readers taking sufficient interest in the question, we shall be happy to send a pamphlet upon "Drying Malt," upon application covering postage, and this deals more fully with the subject than we now can. H. STOPES and Co.

24A Southwark-street, London, S.E.

LEGAL INTELLIGENCE.

NISI PRIUS COURT, MANCHESTER.

July 25th.

Before MR. JUSTICE NORTH.

PATRICROFT SPINNING COMPANY *v.* THE ENGINE, &C., INSURANCE COMPANY, LIMITED, AND MICHAEL LONGRIDGE.

THE hearing of this case, which was commenced on Monday, was resumed.

The plaintiffs, Messrs. E. S. and Arthur Hargreaves, who trade at the Bridgewater Mill, Patricroft, as the Patricroft Spinning Company, claimed from the Engine, &c., Insurance Company the sum of £101 under a policy of insurance granted by the company on the engines of the plaintiffs. On the 3rd of September last the engineer of the plaintiffs discovered two cracks in the crank shaft, and thereupon reported the matter to his employers. They obtained the opinion of Messrs. Hick and Hargreaves, engineers, Bolton, on the cracks, and were told that it would be dangerous to continue working the engines until the defects in the shaft had been remedied. Mr. Longridge, the engineer for the Engine Insurance Company, did not view the matter in so serious a light, and both he and the company declined to consider it as equivalent to a breakdown of the engine, or to pay the cost of a new shaft which was put in.

Mr. William Inglis, chief engineer at the works of Messrs. Hicks and Hargreaves, and Mr. R. Harwood, of the millwright department in the same works, gave evidence showing the serious nature of one of the fractures when it was first discovered.

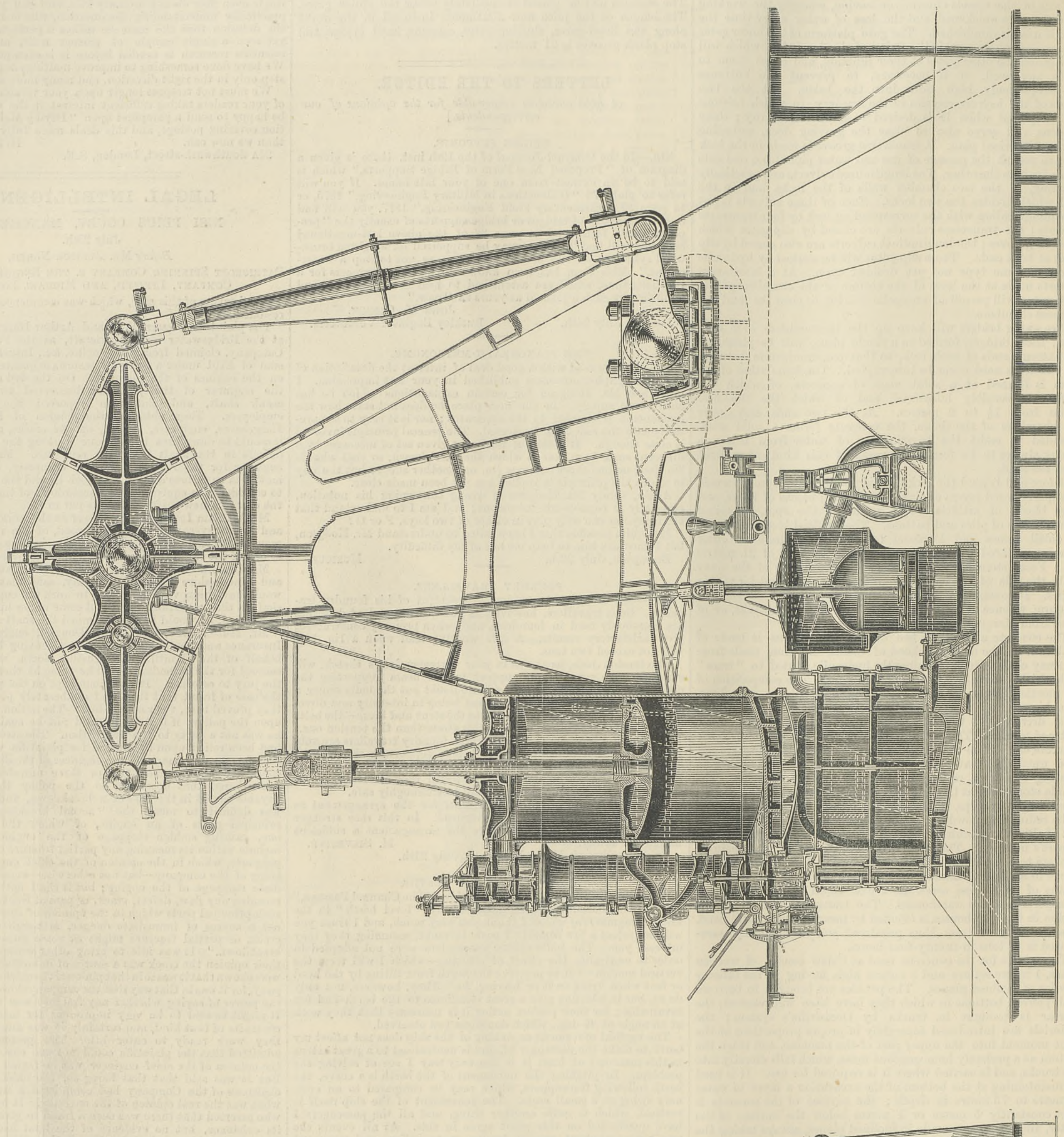
Mr. Charles Sacre, chief engineer to the Manchester, Sheffield, and Lincolnshire Railway Company, said that in his opinion it would have been very dangerous to work the engines with a crank shaft in that condition. If it had come under his notice when first discovered, he would have condemned the shaft at once.

Mr. Hulse, C.E., and Mr. M'Dougall, engineer to the Boiler Insurance and Steam Power Company, having been examined on behalf of the plaintiffs, Mr. Justice North, without calling on counsel for the defendants, said he thought there was nothing for the jury to consider. It was incumbent on the plaintiffs to prove the case of fraud that they had deliberately pleaded, and unless they proved that, their case failed. The action was not an action upon the policy; if it were, it could not be against Longridge, for he was not a party to the transaction. The strongest point which had been relied upon by counsel for plaintiffs was that on a given occasion the chairman and the engineer of the defendant Company consulted together for two or three minutes. It should be remembered that according to the policy there was nothing payable except in the case of a breakdown, and a "breakdown" was defined to mean the "actual breaking of any of the principal parts of an engine, of which the shaft would be one, causing sudden stoppage of the engine, and shall also include within its meaning any partial fracture of any such principal parts, which in the opinion of the chief engineer for the time being of the company—but not otherwise—necessitates the immediate stoppage of the engine; but it shall not include within its meaning any flaw, defect, crack, or partial fracture of or in any of such principal parts which in the opinion of such chief engineer is not a source of immediate danger, although such flaw, defect, crack, or partial fracture might at some future time lead to a breakdown." It was idle to bring other witnesses to say that in their opinion the crack was a source of immediate danger, unless it were shown that it was so in the opinion of the chief engineer of the company, for it was in that way that the company chose to reserve to itself the power of saying whether any fracture was within the policy. It might be said to be very imprudent for insurers to enter into contracts of that kind, and certainly it was amazing to find what they were ready to enter into. The present form of action admitted that the plaintiffs could not sue the Company, because the opinion of the chief engineer was in favour of the Company. But it was said that that being so, the chief engineer and the chairman of the Company had committed a fraud by concealing what was the real opinion of the engineer. It was for the person who asserted that there was such a fraud to give some evidence of its existence, but no evidence of the kind had been given. In fact, the opinions of three or four of the witnesses who had given evidence that day had all gone to show that the shaft might have been used for a certain or uncertain time, though, in their opinion, it would not be a long time.

After some discussion, his Lordship nonsuited the plaintiffs, allowing the defendants their costs.

Mr. S. TAYLOR and Mr. GOULDTHORPE were for the plaintiffs; Mr. ADDISON, Q.C., and Mr. BRADBURY for the defendants.

THE EMPLOYERS' LIABILITY ASSURANCE CORPORATION.—The Employers' Liability Assurance Corporation, who have several clients in the Cleveland district, are endeavouring to introduce a scale of insurance to cover accidents, whether belonging to the class under which employers are liable or not. The risk now attaching to iron manufacturers under the new Act has been assessed by the above corporation at 4s. per cent. on wages paid. It has been found, however, that by far the larger class of accidents from which the workmen suffer cannot be brought home to their employers at all, because there has been contributory negligence on the part of the sufferers, or because the accident has been a pure misadventure and no responsibility can be attributed to anyone. To cover compensation for this larger class of risks, as well as the other, the Insurance Corporation would require 12s. per cent. instead of 4s. Their proposal is, if they can get the employers and workmen both to agree, that the former should pay full 12s. and deduct for each workman every week a sum sufficient to make up the remaining 8s. per cent. The deduction necessary would only be $1\frac{1}{2}$d. per week per man, and for this the Insurance Corporation would undertake to be responsible for a year's wages in case of death and nine months' wages in case of disablement, and proportionate compensation in case of smaller accidents; so that if a workman was injured from any cause whatever, and whether by his own negligence or not, he would be liberally compensated. The difficulty of introducing so estimable a scheme is that it might interfere with provident societies and the provident department of trades unions, and so provoke jealousy and hostility on the part of those it is intended to benefit. However, the Insurance Corporation have wisely determined to consult the governing body of the Middlesbrough Co-operative Stores.



ENGINE OF THE U.S. STEAMBOAT PILGRIM.

MESSRS. JOHN ROACH AND SON, MORGAN IRONWORKS, NEW YORK, ENGINEERS.

(*For description see page 61.*)

SKELDERGATE BRIDGE, YORK, OVER THE RIVER OUSE.

MR. GEO. GORDON PAGE, M.I.C.E., ENGINEER, LONDON.

Sprague & Co. 22 Martins Lane, Cannon St. E.C.

FOREIGN AGENTS FOR THE SALE OF THE ENGINEER.

PARIS.—Madame BOYVEAU, *Rue de la Banque.*
BERLIN.—ASHER and Co., 5, *Unter den Linden.*
VIENNA.—Messrs. GEROLD and Co., *Booksellers.*
LEIPSIC.—A. TWIETMEYER, *Bookseller.*
NEW YORK.—THE WILLMER and ROGERS NEWS COMPANY, 31, *Beekman-street.*

PUBLISHER'S NOTICE.

*** *This week we publish a Double Number of* THE ENGINEER *containing the Index to the Fifty-third Volume. The Index includes a Complete Classified List of Applications for and Grants of Patents during the past six months. Price of the Double Number,* 1s.

*** *With this week's number is issued as a Supplement, an Ink Photograph of Skeldergate Bridge, York. Every copy as issued by the Publisher contains this Supplement, and subscribers are requested to notify the fact should they not receive it.*

TO CORRESPONDENTS.

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

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

CONSTANT READER.—*By making the mouth of your chimney wide as shown in your sketch, yon will gain an infinitesimal advantage. Why not put a steam jet in the bottom of the chimney if you have not draught enough?*

J. B.—*Gun-cotton is made by dipping cotton in a mixture of concentrated nitric and sulphuric acid for about half a minute, and then washing and drying it. It is much more violent in its action than gunpowder. It can be exploded by striking it on an anvil with a hammer. It may be burned when loose without danger, but not when confined in any way. If loose gun-cotton be ignited by exploding a percussion cap in it, the whole will explode violently. We cannot advise you to try any experiments with it, because in unpractised hands it is an extremely dangerous explosive.*

B. AND B.—*We have had no experience with sulphate of soda in boilers as a disincrustant. There are only two really satisfactory methods of dealing with feed-water containing much lime. One is to raise it to boiling point and keep it at that temperature for some time before it is fed into the boiler, when the larger part of the lime will be deposited in the heater; the second plan is to adopt Clarke's lime water softening process, which is very inexpensive and quite effectual—practically it consists in the addition of lime to the water to be softened. You will find an explanation of the process in* THE ENGINEER *for* 18*th February*, 1881.

FELT-MAKING MACHINERY.

(*To the Editor of The Engineer.*)

SIR,—Could any of your readers oblige me with the names and addresses of the makers of machinery for manufacturing felt?

26th July. MACHINERY.

SMELTING COPPER ORES.

(*To the Editor of The Engineer.*)

SIR,—Could any of your correspondents kindly inform me where I can get detailed information about the process of smelting low-grade copper ores at Bergen point? S. D. B.

Córdoba, July 18th.

ESTIMATING THE SPEED OF STEAM LAUNCHES.

(*To the Editor of The Engineer.*)

SIR,—I should be obliged to any reader who could give me through your columns a rule for estimating the speed of small screw steamers, yachts, launches, &c. I mean a rule to be used in designing, so as to get the required indicated horse-power to propel a steamer at a required speed. S. W.

Surbiton, July 26th.

BLOOD DRYING MACHINERY.

(*To the Editor of The Engineer.*)

SIR,—Can any correspondent give me the name of a maker of apparatus for drying large quantities of blood for manure? Such machinery is in existence I know, converting blood into cakes or bricks, much used in vineyards, but I do not know who makes the apparatus. S.

London, July 25th.

THE STRENGTH OF WIRE ROPES.

(*To the Editor of The Engineer.*)

SIR,—In reply to the question in THE ENGINEER of July 21st under the title "The Strength of Wire Ropes," I beg to forward the following:—The greatest strain on the rope is at the points of support. The tension (T) at these points is given by formula—

$$T = W \sqrt{\frac{a^2 + 4\,h^2}{4\,h}}$$ where a is semi-span, h — v. sine, W weight (load and rope) distributed.

∴ In our case we have the following equations for the breaking weight:—

$$41\tfrac{1}{2} = W \sqrt{\frac{(75)^2 + 4 \times (12)^2}{4 \times 12}} = \frac{7875}{4800}$$

$$\therefore W = \frac{4800 \times 83}{7875 \times 2} = 25{\cdot}29 \text{ tons}$$

Weight of rope (length 152·52ft.) = ·16 tons

∴ Breaking weight = 25·13 tons

applied in required manner. C. C. C. C.

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THE ENGINEER.

JULY 28, 1882.

HIGH-SPEED CHANNEL STEAMERS.

THERE is good reason to believe that finality has by no means been reached in the speed of passenger steamers. The voyage to New York has not yet been made in 144 hours, but something very near this has been done. Almost every day a new rumour is set on foot in Liverpool concerning steamers yet to be built. The last is that a couple of vessels, each about 500ft. long, 50ft. beam, and 32ft. deep, are to be built next year. They are each to be propelled by twin screw engines of the collective power of 17,000-horses indicated, and they are to attain a regular ocean speed of 21 knots an hour. The distance from Liverpool to New York is 3016 knots, and at 21 knots the voyage would be made in 144 hours, or six days. We see no reason to doubt that rumour is in this respect accurate enough as regards figures; whether the ships will or will not be built is quite another question. We do not quite see how they could be made to pay. A ship of the kind would burn 12·5 tons of coal per hour, or in 144 hours 1800 tons. Allowing for contingencies, she must stow at least 2300 tons. The space occupied by the boilers and engines would of necessity be very great. The result would be that there would be practically no cargo space left, and it is found by experience that it is not easy to make a ship which crosses the Atlantic in less than seven days pay unless she carries at least 2500 tons of valuable cargo. Such ships as those to which we have referred could not carry more than 1000 tons at the utmost, and they would have to rely on high passenger rates for their profits. But it is very doubtful if, even in the present day, when the desire for great speed transport is intense, passengers would be found willing to pay excessively high rates for the sake of being landed in Liverpool or New York five or six hours sooner than they would be if they voyaged by a slower steamer. For the moment we leave this question of high-speed Atlantic steaming where it is, and turn to quite another problem, which appears to present few difficulties as compared with that which we place on one side. We refer to high speed steamers for short passages, such, for example, as that from England to Ireland *viâ* Holyhead and Dublin, and that between England and France by way of Dover and Calais, Folkestone and Boulogne, or Newhaven and Dieppe. We can see no good reason why the voyage might not in all cases be greatly reduced in length, by putting improved steamers on the service. It is quite true that much is being done in this direction by nearly all the railway companies, but it remains to be seen whether they might not do better yet.

As far back as thirty years ago a little paddle steamer, the Banshee, made the voyage between Holyhead and Kingstown, sixty-four miles, in three and a-half hours, and this not once or twice but frequently. In 1860 the City of Dublin Steam Packet Company put on the Ulster and Munster, which were quickly followed by the Leinster and Connaught, mail steamers, on this route. These four vessels are nearly alike. They are 328ft. long, 35ft. beam, and 21ft. deep, and are propelled by oscillating engines with 96in. cylinders and 7ft. stroke. They have indicated 4100-horse power when making 23 revolutions per minute, the ships then going over 20 miles an hour. Much more recently the London and North-Western Railway Company put on two steamers, the Rose and the Shamrock, which have done very well; but a third vessel, the Violet, which made her first trip about two years ago, may claim to be the fastest steamer carrying passengers afloat, having attained a speed of very nearly 21 knots, and making the run from Dublin to Kingstown, a distance of about 69 miles, in a little over three hours. The Violet and her sisters are large vessels, but not so large as the Leinster, Ulster, Munster, and Connaught. There is no reason to doubt that with a little more boiler-power the Violet could make the run to Dublin in three hours. If we turn to the Channel passage we find that although it is claimed that the run between Dover and Calais can be made in 80 minutes, this result is only attained now and then; yet there is no reason why, by the use of suitable steamers, it should not be made in less than 60 minutes even in rough weather, and in about 50 minutes on fine days. Very important improvements are being made at Calais which will provide ample accommodation for large steamers, but it does not appear to be necessary to use anything much larger than the boats now in the service to secure the required result. A torpedo boat of about 600 indicated horse-power can be made to run for three hours at 20 knots, or 23 statute miles per hour. The displacement of such a boat is about 50 tons, so that for each ton we have 12-horse power indicated. A boat large enough for the intended purpose need not have a displacement of more than 300 tons, and being made of good form, a speed of 23 miles an hour might probably be secured with 6 indicated horse-power per ton. As there would be plenty of room by comparison with a torpedo boat in such a vessel as we speak of, it would be possible to use boilers of much better proportions than can be got into a torpedo boat. Four locomotive boilers, for example, might be employed which would readily generate all the steam needed, the consumption of coal not exceeding about 4 tons per hour. The weight of each boiler with water and fittings may be taken at 12 tons, while that of the engines need not exceed 30 tons, or in all 66 tons. Adding screw propeller, shafting, and flooring plates, fire-bars, &c., the total weight of machinery could be kept down to 80 tons, really durable engines and boilers being obtained. The bunkers need not carry more than 10 tons of coal. It will be seen that there would remain a large margin for providing passenger accommodation forward and aft, the boilers and engines being amidship. As the boat would have to be driven at full speed in all weathers, it would be necessary to fit her with a hurricane deck or turtle back from end to end; on top of this a safe and pleasant promenade might be provided for fair weather, but in rough the passengers would have to content themselves below. But there would be no difficulty in fitting up two spacious saloons with heavy plate glass windows, which windows would stand a good deal of rough usage from the sea. In very rough weather they would be covered with dead lights and the saloon would be illuminated from the deck, and at night by the electric light. As the voyage would occupy in all less than one hour, and every conceivable expedient would be provided to make passengers comfortable, the hardship even of being compelled to remain below would not be great. Of course it is obvious that a craft intended to go straight through the seas which she could not get over, would require special arrangements for housing the look-out and the steersman. In this way an absolutely safe and extremely fast and comfortable steamer might be produced. As her voyage would be of very short duration, the fan blast might be used without risk of clinkering up the tube plates, while the greatest possible facilities would exist for keeping the engines in proper order. In a word, the conditions under which the machinery would be worked would be exactly like those existing in the case of express locomotives.

For voyages of 60 or 70 miles, as, for example, from Newhaven to Dieppe, such boats as these, the general features of whose construction we have indicated, would be unsuitable. The trip could not be made in much less than three hours, and this circumstance would militate against the use of light high-speed machinery. Size would be found indispensable to speed. But it must not be forgotten that if this places difficulties in the way of the naval architect and the engineer in one way, it facilitates his operations in another way. A steamer with a displacement of 1000 tons could probably be made to steam 23 miles an hour with 3000 indicated horse-power. If she was propelled by a screw instead of by paddles, as is now usual in this class of vessel, her machinery could be kept down in weight, unless, indeed, a rather small paddle-wheel were used. Thus, with a 25ft. wheel, about 31 revolutions per minute could be made, and with a 7ft. stroke this corresponds to 434ft. of piston per minute; but with a screw propeller 120 revolutions might easily be made with a 3ft. stroke, corresponding to 720ft. of piston. It is to be remembered that in this case we should have a screw steamer under weigh for only about three hours at a time, so that a special type of comparatively light high-speed machinery might be used in her, midway between the torpedo boat on the one hand, and the ocean steamer on the other. Under such conditions ample space would be left in a vessel of 1000 tons for providing passenger accommodation of the best class.

All the passenger steamers now crossing the Channel, with the exception of the Dover and Calais mail boats, carry more or less cargo. In the high-speed vessels, concerning which we are writing, no cargo could be carried, and in consequence space would be available for the fitting up of berths and the providing of saloons and private cabins to an extent unknown now. It will be said, of course, that the cargo pays better than the passengers; but this has nothing to do with the matter. The vessels concerning which we write would be by far the fastest craft in the world, if we except torpedo boats and certain American river steamers. Such a result can only be obtained by employing very high powers, but large powers require that the ship shall be strong, yet she must be light at the same time; and it follows when all these considerations are put together that her materials and workmanship must be the best possible. Therefore, high-speed Channel steamers must be costly. It is probable that no direct profit could be made out of them unless they carried cargo, but the moment provision was made for this, elements would be introduced fatal, in our opinion, to the whole scheme. We contend that it is possible to produce Channel steamers which will be capable of running as fast as an average excursion train at all events, and providing ample room and hitherto unknown luxuries for passengers; but this cannot be done in the case of steamships of moderate size, unless the whole of the available space is given up to passengers. It may be argued that space will always exist on the floor of a ship that cannot be utilised for passenger accommodation. We can assure our readers that the space thus available in a boat of 1000 tons displacement intended to steam at 20 knots an hour, or a little over, would be very small indeed after boilers and engines were provided for; but even if this were not the case, the carriage of cargo of any kind is in many respects inimical to the comfort of passengers. Large baggage rooms must be provided, with special means of filling and emptying them with great celerity. A mail room would also be wanted. In a word, the carriage of cargo, even cheese, butter, silk, and wine, is not to be thought of. The comfort of passengers must be the first and last consideration. To this end high speed is given to the steamer, and for it everything must be sacrificed. It follows that fast Channel steamers can only be run by the railway companies, the profit to be derived from them being indirect instead of direct. Up to the present moment nothing whatever has been done by any railway company to fully realise the object which ought to be kept in view. We say this with the full knowledge that the London, Chatham, and Dover, the South-Eastern, and the London and Brighton Companies are all putting on new steamers, and better, faster, and more comfortable steamers than have ever before been used to carry passengers across the Channel; but every one of the new boats is but an improved copy of some other Channel steamer. A new departure is wanted. The naval architect and the engineer have alike much in their favour, and we believe that nothing is wanted but a display of energy and inventive genius to supply the travelling public with boats whose speed, comfort, and elegance will rob the Channel of its horrors, and leave Sir Edward Watkin without an excuse for making the Channel Tunnel.

FAITH IN SMELLS.

IN all ages of the world mankind manifested faith in smells. This faith has recently undergone several modifications as regards the deductions to be drawn from them. That a savoury odour indicated the existence of a good dinner somewhere was probably invariably held from the period when man first knew what a dinner was until this moment; but it is not with savoury odours that we have now to do. Not so many years have elapsed since the scent of ambergris was held to be a sovereign remedy against the plague, and ambergris did not stand alone. Not a few plants owed their supposed virtue as prophylactics to their scent and to nothing else. But we have no old record that an unsavoury smell was to be regarded as evidence of eminent peril to life. That is a modification of faith in smells of recent date, but it is none the less potent. In the present day every educated householder is supposed to know that the smell of drains is evidence of the presence of sewer gas, typhoid and scarlatina germs, and a host of evil influences whose very vagueness adds to the fear which their supposed presence inspires. A bad smell is sufficient to condemn a sea-side town to isolation; a whiff of sewer gas may pull down the revenue of a railway, and place a ban on a heretofore prosperous community. A leading article in a recent impression of the *Times*, which article, it is an open secret, was written by an eminently scientific member of the medical profession, will, it is to be hoped, do something to counteract a very mischievous and mistaken impression. We are by no means disposed to underrate the evils which result from bad drainage; but as our contemporary has clearly pointed out, there is really no necessary connection whatever between the smell of drains and sewer gas poison. If anything is certain in sanitary science —which is doubtful—it is that unless the excretæ of cholera or typhoid patients be poured into a sewer, the gas from that sewer is entirely incapable of communicating either typhoid or cholera to those who inhale it. As for diphtheria and scarlatina, there is absolutely not one scrap of evidence that they can under any possible circumstances be communicated by sewer gas to any living being. If, indeed, water contaminated with the excretæ of patients suffering from either of these diseases be taken into the system in even the minutest quantity, mixed with milk or otherwise, infection is almost certain to follow; but the imbibition of a poison into the stomach and its inhalation into the lungs are two very different things. Carbonic oxide gas is, for example, a deadly poison when inhaled. In very small quantities it produces intense headache, and constitutional disturbance; but a considerable quantity might be introduced into the stomach without doing harm. On the other hand, the mere inhalation of the germs of diphtheria as they exist in sewer gas is apparently of no consequence—or else sewer gas never holds them in suspension—while the contrary is true of typhoid and cholera germs. No fixed rule can be laid down concerning the bad effects of sewer gas; but it is at least probable that its influence for evil is in the present day very much exaggerated. If this were not the case, it would be impossible for men to live who spend their lives in clearing sewers; and the engineers and others at our great pumping stations would have to be replaced continually, as persistent mortality swept away staff after staff. The most that can be said is that sewer gas may do harm. That it deserves to be regarded as considerably more dangerous than strychnine or prussic acid is a complete delusion. That the smell of it is any evidence of its toxological energy is quite as great an error. Indeed, so far as can be ascertained, the gas which is really most dangerous has no smell whatever.

While faith in smells has, on the one hand, lent a new terror to the holiday maker at this season of the year, the same faith leads him into another and more dangerous a delusion. As soon as sanitarians convinced the world that bad smells were dangerous, to use popular language, certain other gentlemen came forward with disinfectants, not a few of which smell quite as badly as the sewer gas itself. Indeed, we have heard of one case in which a hotel keeper, in his anxiety for the health of his customers, used a disinfectant so evil-smelling that no one would remain in his house. As a rule disinfectants are simply useless, except in so far as they tend to reassure the timid. Our ancestors smothered evil smells with perfumes, and concluded that all was well with them; we smother sewer gas smells with other smells which are not perfumes, and flatter ourselves with the thought that we have secured safety. We could name several disinfectants which have made a name for themselves which are just about as useful in destroying typhoid fever germs, for example, as ambergris was in stopping the spread of the plague. It is well known that disinfectants when they act at all, do so by oxidising the noxious matters in the air; but the oxidising agents which can be thus used are not numerous, nor is their employment easy. Permanganate of iron is a good disinfectant if it is properly used; but to put a saucer containing it in dilute form on a table and fancy that disease germs floating in a room will kindly find their way to the saucer, is to draw a great deal on the imagination. The two most efficient disinfectants known are sulphurous acid and chlorine. But in order that either may act efficiently, time must be given for their operation; and the room in which they are liberated becomes uninhabitable for some hours. All the chinks should be stopped, the chimney closed, and about half a pound of brimstone burned slowly in the apartment to be disinfected, which must be left shut up for twenty-four hours. The gas does its work effectually. Chloride of lime in solution is an excellent disinfectant for clothes placed in it, or as a wash for walls and floors; but the mere sprinkling of it about a place is of little value. Faith in smells errs on both sides. It attaches an exaggerated importance to the contents of our sewers on the one hand, and, on the other, to the disinfectants which are supposed to be able to counteract the evils which spring from them.

We do not wish it for a moment to be supposed that we underrate the value of sanitary arrangements. On the contrary, all should be done that can be done to keep sewer gas out of our houses and our streets; but when reasonable precautions are taken, the householder may lie down in his bed with an easy mind, although he does get a whiff of sewer gas now and then when passing a street grating. The ventilation of sewers at one time constituted a battle-ground over which sanitarians and borough engineers fought furiously. Recent events in connection with Brighton have again called attention to a subject which has long ceased to receive much consideration. It is obviously quite impossible to prevent the formation of gas in sewers and street drains. The question is, what is to be done with it? The sewers being, as a rule, warmer than the external air, especially at night, the gas tends to rise and escape from them. But as the houses are all fitted with traps, it cannot get back into them, at least it ought not; then it finds its way into the outer air by means of the street gulleys. Then those who walk and drive in the streets complain that they are being poisoned. If the street ventilators are closed, the householder at once writes to the authorities to say that the pressure in the drains is so great that the seals of his traps are being broken. Various methods of getting over the difficulty have been proposed; one plan which enjoyed great favour for some time consisted in putting charcoal baskets in the ventilators. We need hardly say that, so far as typhoid and cholera germs were concerned, the charcoal might have been buried in the nearest garden, and the result would be the same. Smells were arrested, however, and so something was gained, though not quite what was anticipated. The charcoal cost a good deal of money, and as soon as it got wet it was useless. We cannot now name a single town of any importance in which the charcoal ventilator is used. Immunity from bad smells may be bought too dearly. The true remedy for the evil appears to lie in the use of ventilating pipes which will carry the sewer gas up to a considerable height. In certain cases, as we suggested last week concerning Brighton, fires may be maintained at the foot of the upcast stack to maintain a draught; but such an expedient can only be adopted under very special circumstances with any advantage, as when the sewers are steeply inclined, so that the gas naturally finds its way to a high level. In other cases the number of ventilating chimneys must be very great, because their influence ceases after a certain limited number of street gulleys or other openings come within their range, and the use of a great number is out of the question. The most commonly applicable system is to provide for the free communication of the rain-water down pipes, or stack pipes, as they are sometimes called, of every house with the street sewer, and then to trap all the street gulleys. The sewer gas will then rise through the stack pipes, and escape at too high a level to do mischief. Care must, of course, be taken that upper windows do not open in close proximity to the mouths of the pipes, or the consequences may be inconvenient; but this really presents no difficulty of any importance.

SOMETHING LIKE GAS.

WHILE gas shareholders look with mingled dread and aversion at the electric light, and gas managers tardily endeavour to improve what they make and reduce its cost, a Mr. John Dixon, of Richmond, Victoria, has come to the front, and patented in every country where an invention can be patented, a process for producing illuminating gas which cannot, we should think, fail to revolutionise an enormous industry. It would be impossible within limited space to do full justice to this invention. We are compelled to restrict ourselves to the reproduction here of the claims appended to Mr. Dixon's United States specification. Claim.—(1) The process substantially herein described of manufacturing illuminating gas, which process consists of first charging a retort with a mixture consisting of black oxide of manganese, muriatic acid, nitric acid, water, bismuth, iron filings, zinc, mercury, and sodium, previously united and treated as described; of then injecting intermittently upon such mixture, while in a heated state, a flux mixture consisting of bismuth dissolved in nitric acid, antimony dissolved in hydrochloric acid, sodium held in kerosene, tin dissolved in nitric acid, mixed and dried as described, and augmented by kerosene and by nine-tenths of stock No. 1, consisting of copper, muriatic acid, water, zinc, bismuth, mercury, kerosene, sodium, and nitric acid, prepared as described, and six-sevenths of the united stocks of 2 and 3, consisting of bismuth, mercury, kerosene, and sodium united and treated substantially as described. (2) The method substantially herein described of making an illuminating gas yielding a white light, which method consists of generating and combining, in a retort of suitable construction, the gases resulting from the decomposition of the herein described metals, salts, acids, carbons, and hydrocarbons, consisting substantially of black oxide of manganese, muriatic acid, nitric acid, bismuth, iron, zinc, mercury, antimony, copper, charcoal, sodium, and kerosene, combined and treated substantially as described. (3) The means substantially herein described of intermittently supplying a flux mixture to a previously supplied retort charge in the manufacture of a combination of gases for the purpose of producing an illuminating gas yielding a white light, which means consist of the combination of a retort, a flux chamber, connecting and injecting pipes, and fitted with suitable valves, and a shaft fitted with cams and cog gearing, substantially as described. We fear that this must be held to be a combination patent, and Mr. Dixon may perhaps be infringed. Thus, for instance, a patent for producing gas from a mixture of charcoal, irridium, nitroglycerine, and formic acid, would not be held as an infringement; while it is possible that anyone making gas from a combination of saltpetre, sulphur, dynamite, cast iron borings, water, and fulminate of mercury, could hardly be held to invade Mr. Dixon's rights. We commend Mr. Dixon's process to the attention of chemists, as the nature of the combinations promises to be interesting. To write the formulæ of combination would constitute an admirable examination question for young chemical students. Perhaps Mr. Dixon knows what takes place, though it is possible that he treats his ingredients shut up in the retort much as Mr. *Punch's* heavy supper eater dealt with pickled salmon, lobster salad, cucumber, and Welsh rabbit—goes to sleep and leaves his ingredients "to fight it out among themselves."

YORKSHIRE COLLIERIES ABANDONED SINCE THE YEAR 1874.

ONE of the most instructive portions of the report presented by Mr. F. N. Wardel, inspector for Yorkshire, is that relating to the closing of collieries in that county since 1874. The list is all the more suggestive and important when it is remembered that in the year 1873 no fewer than thirty collieries were opened out, and coal drawn from them, whilst notices were served upon the inspector relating to ninety-seven about to be commenced in the same year. The coal famine caused a vast sum of money to be invested in the trade, and numerous limited companies to be floated, many of which have either since come to grief or have paid little or no dividends. Since the year 1874 it would appear that no fewer than one hundred and twenty-six seams and collieries have been abandoned. Many of these have, it is true, been thin seam pits, but in the list there are several large and unfortunate concerns in which needy shareholders were largely involved. A careful analysis shows that four pits were abandoned in 1874; fourteen in 1875; twenty-one in 1876; thirty in 1877; twenty-one in 1878; nine in 1879; fifteen in 1880; and twelve last year. It would appear that the Leeds district has suffered most from the stoppages, forty-four pits having been closed since 1874. Wakefield holds the next place with twelve; whilst Barnsley and Huddersfield—equal—have swelled the list with nine each. In the Halifax district six were closed, and a like number in the Dewsbury coalfield. Last year five pits were closed in the Leeds district, two in Huddersfield, two in Dewsbury, one in Bradford, one in Halifax, and one in Wakefield coal inspection area. Although the list gives the names and numbers of the collieries which have been actually abandoned, it does not furnish those which are set down owing to the depressed state of trade and the failure of the shareholders to find capital to keep the concerns at work. Under this head must be included some very large places. The collieries belonging to the Dodworth and Silkstone Iron and Coal Company, Limited, at Dodworth and Higham, which formerly gave employment to about 1000 hands, have been set down for a long time. The company was started with a capital of £300,000 in 6000 shares of £50 each. The Thorpe Gawber Hall Collieries, Limited, which, when at work, employed fully 800 men and boys, have been set down for about two years, but it is reported are likely to be restarted shortly. This company commenced with a share capital of £100,000. The Holmes Colliery, near Rotherham, started with a large capital, and other concerns in the district, although not actually abandoned, are idle, and serve as reminders of the reckless way in which speculators embarked in the time of the never-to-be forgotten coal famine.

CHEAP OCEAN TELEGRAPHY.

THE reports of the great cable companies for the period ending with the month of June show that the attempt to cable messages from Europe to the United States at the rate of one shilling per word had not resulted in a success that was adequate, and the rate before the end of the half year had been raised to double that amount. It is thus impossible to state exactly the result of the working under the shilling tariff, because it was for a period for which there are not full returns; but it may be taken as fully proved that it developed an enormous amount of traffic. Over the great bulk of the past half-year that rate was charged, and the receipts of the Direct United States Cable Company were £65,082. These receipts were, it is to be assumed, the proportion as fixed between the three cable companies before the recent modification, and they include a period of rather over a month in which the higher tariff was charged. But there would be a proportion of messages which would be charged at lower rates—those of the press—and thus it may not be unfair to assume that the receipts represent a revenue at the rate of one shilling per word. Thus it is evident that the number of words carried was about 1,400,000 for the six months. The total revenue of the company for the half year was £61,000—a sum having been paid out of that stated as received for messages—and the expenses were over £24,000. The capital of the company—including debentures—is £1,314,000, so that it will be seen that the results of the working at the shilling rate, and under the arrangement of joint-purse and division, would not have paid the rate that the company has of late been paying—five per cent. Four cable companies have now united and divided the receipts, and there is in consequence a higher charge for messages. Such a higher charge rather restricts traffic, but it yields a fuller return, and it is to be expected that the transatlantic cable companies are now doing a good business, and that the results of the two shilling per word tariff will be to give a larger dividend in the future. These companies have struggled through difficulties and through great opposition, and for some time to come it is evident that there can be no opposition, if at all. There is, therefore, a tolerable certainty of a good return to the owners, but it is to be hoped that they will look forward to a reduction of the charges. They have now large reserve funds, they have at the present time no fear of competition, and there is every probability of increased dividends, so that when these come it is to be hoped that they may look to a permanent increase of the traffic by the sure process of lowering the charges.

LONDON'S COAL SUPPLY.

THE return of the registrar of the London Coal Market for the first half of the year shows that there has been a diminution in the consumption of coal in the metropolitan district, when compared with that for the corresponding half of the past year. In the coal brought into the district by sea—some 1,845,463 tons for the six months—there is an increase of 5740 tons over the quantity for the corresponding half of the previous year. But in the larger quantity of railway-borne coal—over 3,000,000 tons for the half year—there is a decrease of more than 176,000 tons from the higher figures of the preceding corresponding half. Hence, much less coal has been received in the metropolitan district in the six months. To a very large extent this is due to the much milder winter that has been passed through—a fact reflecting itself in lessened household consumption, lessened consumption for gas and allied uses. But it is still shown that close upon five million tons of coal were received in the metropolitan district in the first half of the year, and allowing for the quantity sent out of the district, there remains an enormous consumption of fuel in the metropolis, the largest part of which is brought in by rail. The Midland and the London and North-Western Railways are at the head of those that bring in the rail-borne coal. From north-east ports the great bulk of the sea-borne coals are brought, Newcastle, Sunderland, and West Hartlepool sending in together much more than two-thirds of the whole of the sea-borne coal, whilst Seaham and one or two other coal-shipping ports in the North add to the quantity that is sent from the coalfields of Northumberland and Durham; and as the present tendency of freights is downward, there is a probability that sea-borne coal will be still cheaper in the London market, and if so the competition with the rail-borne coal will grow. There are improvements being introduced into the method of carrying coal cargoes, and these methods may give the older form of coal carriage an impetus of which it has long stood in need.

INSULATION FOR TELEGRAPHIC AND TELEPHONIC PURPOSES.

VISITORS to the late Paris Electrical Exhibition will remember a system of insulation devised by David Brooks, of Philadelphia, and exhibited by the Silvertown Works of Charlton. The system has been pretty severely tried by our Postal Telegraph Department, with the result that last year they extended its use very considerably. The system briefly is to place a large number of wires in a containing iron tube, and then pour in a cheap mineral oil. Details of the system provide that the tube shall always be filled with the insulating material. Quite recently we hear of a successful trial of 9¼ miles of cable insulated on this system at New York. Thirty wires in a tube 1¼in. diameter are laid between Jersey City and New York. Experiments have shown that with a wire working duplex with a current supplied from a dynamo of 185 volts electro-motive force, or by 60 Calland cells, telephony could without inconvenience be carried on by means of the other wires. We may here say that theory would tend to show that duplex working would cause less inconvenience than simplex, and we shall be glad to hear of further experiments both with simplex and duplex. Ordinary Bell telephones were tried alone and in conjunction with Blake transmitters, but in neither case was there any difficulty in hearing, nor did the interruptions from the dynamo cause inconvenience. It will be absolutely necessary before long to abolish the overhead wires in large towns. Already accidents have occurred, and more are likely to happen, and especially so as the work and fastenings deteriorate by the action of weather during a length of time. The Brooks system of insulating seems to provide a cheap and good method for telephonic requirements, and it should be tried more extensively. Mr. Brooks argues that the inconveniences of induction will be less when using a large number of wires in a tube, as in his system, than when a smaller number of wires are used on the ordinary system.

LITERATURE.

A Treatise on Elementary Trigonometry. By the Rev. J. B. LOCK. Macmillan and Co. 1882.

A Treatise on Mathematics as Applied to the Constructive Arts. By FRANCIS CAMPIN, C.E. Crosby Lockwood and Co. 1882.

An Elementary Treatise on Conic Sections. By CHAS. SMITH, M.A. Macmillan and Co. 1882.

A Treatise on the Theory of Determinants. By THOMAS MUIR, M.A. Macmillan and Co. 1882.

THESE four books deal with various branches of mathematics, and each has probably been written with a fairly definite object. It may, however, be the idea of most people who have but a casual acquaintance with the subject that we have already too many books on the simpler portions of mathematics. The treatises on trigonometry and conic sections above-mentioned are intended for school use, and it must be confessed that almost every mathematical master seems to think that there is not one among the number of books treating the subject exactly as it should be treated. Hence a constant stream of "Arithmetics," "Algebras," and "Trigonometries" issue from the publishers, differing when closely examined only in immaterial points. Almost all may be said to be good; only the few are utterly bad. The work of Mr. Lock contains a large number of examples which seem to be well graduated, and this feature alone would make it valuable as a school textbook; but to this must be added a clear exposition of the definition and principles of the subject. The reference lines in the diagrams are made thick and thin, so as to be seen at a glance.

Mr. Campin's work is written from a different standpoint. It is intended as a work for practical men, and has come to the distinction of a second edition, thus showing that such a book is appreciated. We are not quite sure, however, that such books as this sell, because of their intrinsic merits, or because of their title—which is, we believe, taking, though we might consider it misleading and defective. The practical man must have a fair knowledge of the subjects prior to his studying this work, if he is to benefit greatly by such study. If he has such prior knowledge, he will here see how to apply the scholastic information obtained by the study of works on pure mathematics. The man who tries to make a short cut, and to obtain a kind of rule-of-thumb method of using formulæ, has no broad ideas on the subject. His mind is cramped, and incapable of original work. The whole must be done thoroughly, if mathematical training is to tell, and not in a perfunctory manner. If we must have books for practical men, let us not try to do too much. Instead of attempting to teach both the pure and applied science within two covers, would it not be better to at once assume the knowledge of a modicum of the pure science, state clearly and concisely the laws upon which certain formulæ are based, give worked-out examples of these formulæ, and a series of questions the solutions of which involve the working out of the formulæ? We imagine the rule-of-thumb method would be gained as well by such a system as by more pretentious methods.

Mr. Smith's book on "Conic Sections," like that of Mr. Lock on "Trigonometry," seems eminently suited for school work. The study of Conics is one of the most fascinating in mathematics, and there is little doubt but that the English works on the subject are better than those in any other language; yet the practical man, as a rule, hardly knows what is meant by a work on "Conics." He does not see the application so easily as in the case of trigonometry. In the latter the measurement of heights and distances appeals to him at once, but he sees nothing of a similar kind in the former, and hence the neglect. We must, however, resume and say that the method followed by Mr. Smith is the ordinary method, commencing with the definition, &c., of co-ordinates, then discussing the "straight line," "circle," "parabola," &c. His examples are very numerous, and so far as a general glance shows are well selected. There can hardly be too many examples, or too carefully graduated in a work of this kind. It might be well to adopt one system of nomenclature. Todhunter, for example, speaks of equations *to* a straight line, &c. Mr. Smith uses equations *of* a straight line, &c.

The "Theory of Determinants," by Mr. Muir, is a good book on a special subject. Hitherto the subject has been treated for the learner by means of a chapter or two in books on algebra, and some even of the best books have scarcely mentioned it at all, while the separate treatises have been for the proficient rather than the student. Mr. Muir is to be congratulated upon rendering the subject in such a manner that in future it may commend itself to the schoolmaster, and take its place in the ordinary routine of school work. Roughly speaking, the subject explains a convenient method of simplifying a symbolic notation, and whatever tends towards clearness and simplicity must necessarily be useful.

THE MECHANICAL REFRIGERATION OF AIR.

By T. B. LIGHTFOOT, M. Inst. C.E., M. Inst. M.E.

No. I.

As the applications of air-refrigerating machines are every day becoming wider and more important, it is proposed to give in this and the following articles some concise and simple statements of the laws as at present understood, relating to the production of cold by the successive compression, cooling, and expansion of ordinary atmospheric air, together with some general remarks respecting the construction of machinery for carrying out these several processes in an economical and efficient manner.

Ordinary atmospheric air chiefly consists of two gases, oxygen and nitrogen, in the proportion of 1 part by weight of the former to 3⅜ parts of the latter, or, by volumes, 79 of nitrogen to 21 of oxygen, the mixture being a purely mechanical one, and including varying quantities of carbonic acid gas, ammonia vapour, nitric acid, and aqueous vapour, as well as occasionally water itself in the state of mechanical suspension.

Though oxygen and nitrogen, in common with other substances exhibited to us as gases at usual atmospheric pressures and temperatures, are generally considered and treated as permanent gases, it may be well to point out that in all probability they exist as very highly superheated vapours or steam gases of fluids, liquefaction only taking place at an immense reduction in temperature, and a still greater degree of cold producing the solid form. Within the comparatively small ranges of temperature considered in these articles, the behaviour of both oxygen and nitrogen is, however, so uniform, and follows so nearly the well-known law of Boyle and Mariotte, that they will be dealt with as perfect gases.

As regards the carbonic acid gas, ammonia vapour, nitric acid, and aqueous vapour, all of which are more or less easily condensable, the case is somewhat different. But as the quantities of the three first-named substances are as a general rule so trifling, and do not nearly approach the point of saturation, it is proposed to disregard their effect entirely, and treat them as obeying the same laws as the oxygen and nitrogen, only considering separately the aqueous vapour, which often exists in amount sufficient to fully saturate the air for its ordinary temperature and pressure, and which, as will be seen later, exercises a considerable influence upon the action and efficiency of the machinery for producing the effects we are about to examine.

The elastic force, or, as it is generally called, the pressure, exerted by aqueous vapour or steam in contact with its own liquid, is entirely a function of its temperature, and is the same whether a given volume is occupied entirely by vapour or by vapour mechanically mixed with a gas such as air. The pressures exerted against the sides of a containing vessel are, however, different; in the first case being that from the elastic force of vapour alone, while in the second it is the sum of the vapour pressure and that due to the air. With the atmosphere fully saturated with moisture, we can therefore immediately ascertain the actual pressure exerted by the air itself, by deducting the elastic force of vapour for the given temperature from the total pressure as indicated by the barometer. If the air be not fully saturated, it is necessary to first find out by a hygrometer the actual percentage of saturation, then to reduce the full elastic force in this proportion, and deduct the result from the barometric pressure, instead of taking off the full elastic force.

A complete set of tables of elastic forces of aqueous vapour, down to a temperature of 30 deg. below zero. Fah., is given in Balfour Stewart's "Treatise on Heat," as well as in many other text-books. For lower temperatures, it will generally be sufficiently accurate to reduce the lowest tabular amount in direct proportion to the absolute temperatures.

The air in nature is never quite dry; indeed, in this country, with the greatest dryness on record, it still retained about 23 per cent. of the aqueous vapour that would saturate it. In winter it is frequently quite saturated, and at other seasons of the year the amount of vapour varies from 25 per cent.—extremely dry—to 85 per cent.—damp—of saturation. The simplest and most convenient method of estimating dryness of the air for ordinary purposes is by the dry and wet bulb hygrometer. This instrument consists of two thermometers placed side by side in a frame, the bulb of one tube being kept dry in the usual way, and that of the other being covered with muslin continually wetted by a wick leading to a small reservoir of water. The evaporation from the wet bulb reduces its temperature, so giving a lower reading than that of the dry bulb thermometer; and as the evaporation and amount of cold produced by it varies according as the surrounding air contains more or less vapour, the difference in the indications of the two thermometers shows the dryness of the air.

Table I. gives weight of aqueous vapour held in suspension by 100 lb. of air, when saturated, at temperatures from 50 deg. below zero to 212 deg. Fah., and under the ordinary atmospheric pressure of 29·9in. of mercury.

TABLE I.

Temp. in deg. Fah.	Weight of vapour in pounds.	Temp. in deg. Fah.	Weight of vapour in pounds.	Temp. in deg. Fah.	Weight of vapour in pounds.
—50	·0193	42	·561	132	11·76
—40	·0198	52	·819	142	16·17
—30	·0206	62	1·179	152	22·45
—20	·035	72	1·68	162	31·73
—10	·057	82	2·36	172	46·25
0	·091	92	3·28	182	71·3
10	·142	102	4·54	192	122·3
20	·225	112	6·25	202	277·6
32	·379	122	8·58	212	Infinite.

Table II. gives the percentages of saturation of the air for from 1 deg. to 24 deg. difference in temperature between the dry and wet bulb thermometers, and for a range of from 32 deg. Fah. to 92 deg. Fah.

TABLE II.

Temperature in deg. Fah. as shown by dry bulb.	Degrees difference between dry and wet bulb.																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	Percentages of humidity—Saturation being 100.																							
32	87	75	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
42	92	85	78	72	66	60	54	49	44	40	36	33	30	27	—	—	—	—	—	—	—	—	—	—
52	93	86	80	74	69	64	59	54	50	46	42	39	36	33	30	27	25	—	—	—	—	—	—	—
62	94	88	82	77	72	67	62	58	54	50	47	44	41	38	35	32	30	28	26	24	—	—	—	—
72	94	89	84	79	74	69	65	61	57	54	51	48	45	42	39	36	34	32	30	28	26	24	23	22
82	95	90	85	80	76	72	68	64	60	57	54	51	48	45	42	40	38	35	33	31	29	27	26	25
92	95	90	85	81	77	73	70	66	62	59	56	53	50	47	45	43	41	38	36	34	32	30	28	26

It will be seen from Table I. that under constant pressure the capacity of air for holding moisture in solution in creases very rapidly with its temperature; thus at 92 deg. Fah. saturated air contains about six times the weight of water that would saturate it at 42 deg. Fah. By reducing the temperature of partially saturated air therefore, relative humidity is increased. For example, if air at 92 deg. Fah. containing moisture to one-sixth the amount of saturations be cooled under constant presure to 42 deg. Fah., it will then be fully saturated for its new temperature, and if cooling be still further extended below this point, the whole of the moisture will no longer be held in solution, but a portion of it will be condensed and deposited as dew upon surrounding objects or float in the air as mist. This temperature of saturation is called the dew point, and varies for any body of air according to the amount of vapour it contains. Under constant temperature an increase of pressure decreases the capacity of a given weight of air for holding moisture in solution. For as the elastic force of the vapour is entirely dependent upon its temperature, a given volume of a mixture of air and aqueous vapour at constant temperature can, when saturated, contain only one definite amount of moisture, no matter what the pressure exerted by the mixture may be. With higher pressures, the weight of air increases, while that of the vapour remains constant, that is to say, the relative humidity of the air weight for weight decreases, but is constant, volume for volume, at all pressures so long as saturation is maintained.

The weight of aqueous vapour in pounds required to saturate one-hundred pounds of air at any given temperature and pressure is found by the formula

$$\frac{62\cdot3\,E}{29\cdot9 - E} \times \frac{29\cdot9}{p} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

where E is the elastic force of the vapour at the given temperature in inches of mercury, to be taken from a table, and p the absolute pressure per square inch of the mixture also in inches of mercury.

The capacity of a body for heat is called its specific heat, and it may be defined as the number of thermal units necessary to raise the temperature of one pound of that body 1 deg. Fah. The specific heat of a perfect gas does not alter with change of temperature, nor yet with variations in pressure and density; 1 lb. of air therefore contains the same quantity of heat, whether its pressure be 15 lb. or 75 lb. per square inch, so long as its temperature is constant.

For expansive gases, however, the quantity of heat necessary to effect a given change in temperature varies according to the condition of the experiment. Heated in a closed vessel, volume being constant, pressure is increased, while on the contrary, if free expansion be allowed, pressure may remain constant. In the first case, all the heat communicated is absorbed in increasing the sensible temperature of the air; while in the second, not only has the air to be heated to a similar extent, but in addition, external work is performed during expansion against atmospheric pressure. With the initial temperature in each case at 32 deg. Fah., it is found that under constant volume it takes 0·1686 of a thermal unit to raise 1 lb. of air 1 deg. Fah., and under constant pressure 0·2379 of a unit. These figures therefore represent the specific heat of air under the two stated conditions, but it must be observed that the values may be much modified by extraneous circumstances of pressure when volume varies. The specific heat under any such conditions can, however, always be found by adding to the normal specific heat the extra amount due to the mechanical work performed during change of volume, but in speaking of the specific heat of an expansive gas it is always necessary to mention the conditions under which it was determined.

One pound of air at the usual barometric pressure of 29·9in. of mercury, and at a temperature of 32 deg. Fah., occupies a space of 12·387 cubic feet. If there is a change in pressure the new volume may be calculated according to the law of Boyle and Mariotte, which is, that the volume of any gas varies in the inverse ratio of the pressure, temperature remaining constant. Thus, if v and p are the volume and pressure in one case, and v_1 and p_1 the volume and pressure in another—

$$v_1 = \frac{v\,p}{p_1} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

Under constant pressure volume varies directly as the temperature, reckoned from absolute zero of 460 deg. below zero of Fahrenheit's scale, so that v and t being the volume and temperature in one case, and v_1 and t_1 the volume and temperature in another,

$$v_1 = \frac{v\,(460 + t_1)}{460 + t} \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

When both pressure and temperature change, the formula becomes—

$$v_1 = v \times \frac{p}{p_1} \times \frac{460 + t_1}{460 + t} \quad . \quad . \quad . \quad . \quad (4)$$

Air at all temperatures and pressures, in virtue of the energy or heat it possesses, is capable of expanding or enlarging its volume so long as the external resisting pressure is not greater than its elastic force. If a volume of air be enclosed in a perfectly heat-proof cylinder fitted with a freely moving piston, loaded so that the external resistance exactly counterbalances the total internal pressure, and if this external load be then gradually removed so as to allow the air to expand, it is evident that during expansion a certain amount of energy must be taken from the air in the form of external mechanical work performed in raising the gradually decreasing load, and the total heat of the air must therefore be reduced to an extent measured by the thermal equivalent of this external work. The series of changes so described can be represented graphically by a curve, and this curve is called an adiabatic.

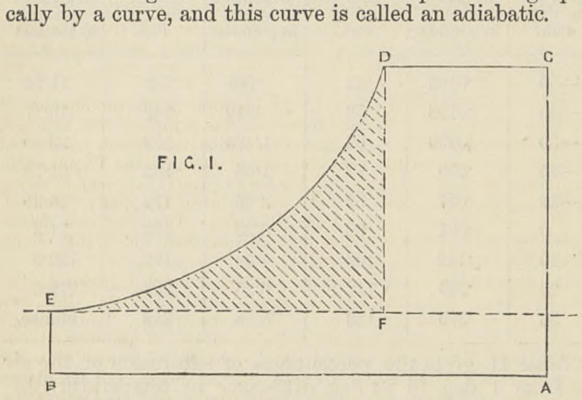


Fig. 1 is a diagram in which C D is an initial volume of air at absolute pressure A C, and A B the terminal volume at pressure B E, after expansion against a piston. The work done during expansion is shown by the shaded part D E F, and this work in foot-pounds divided by Joule's equivalent of 772, gives the heat lost in thermal units.

It may be stated that a perfect gas is capable of performing during adiabatic expansion a certain definite amount of mechanical work which is entirely measured by its initial absolute temperature, and the amount of power of doing work is called its intrinsic energy. Increase of pressure without gain in heat being simply the result of diminished volume, gives no addition to the total power of doing work, though in practice, when expansion is to be effected, it is generally convenient to commence at a pressure more or less above that of the atmosphere. If, during expansion, the resistance is at any time less than the total internal pressure, the conversion of heat into work is less than if the greatest possible resistance had been overcome. In all cases the external work performed is the measure of the loss in heat, and Dr. Joule proved experimentally that in expansion, without doing external work at all, temperature remains unaltered.

The ratio of specific heat of air under constant pressure being to that with constant volume as 1·41 to 1, the relations between temperature, volume, and pressure of any two points on the same adiabatic are—

$$\frac{460 + t}{460 + t_1} = \left(\frac{v_1}{v}\right)^{1·41 - 1} = \left(\frac{p}{p_1}\right)^{\frac{1·41 - 1}{1·41}}$$

$$= \left(\frac{v^1}{v}\right)^{·41} = \left(\frac{p}{p_1}\right)^{·29} \quad . \quad . \quad . \quad . \quad . \quad (5)$$

t, v, and p being temperature, volume, and pressure before expansion, and t_1, v_1, and p_1 those after expansion.

During adiabatic compression changes occur the exact converse of those just described as taking place during expansion. The mechanical work performed during compression is converted into heat, the air receiving the thermal equivalent of the work done. The same diagram—Fig. 1—is applicable as in the case of expansion, the operation being reversed, and the same relations, as given in formula (5), hold good between temperature, volume, and pressure at any two points in the curve, t_1, v_1, and p_1 being temperature, volume, and pressure before compression, and t, v, and p those after compression.

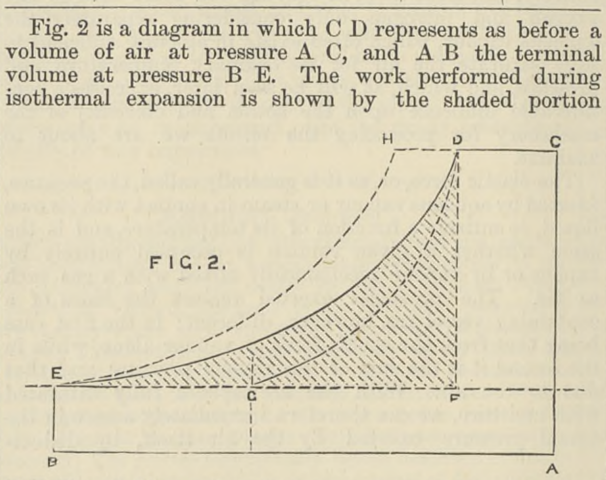
The following Table III. taken from D. K. Clark's "Rules, &c., for Mechanical Engineers," gives the numerical relations between pressure, temperature, and volume for adiabatic compression and expansion of air.

Isothermal expansion and compression differs from that which is called adiabatic, inasmuch as the temperature of the air is the same at all points of the operation. The intrinsic energy, therefore, does not vary, and it is clear that to maintain this condition during expansion there must be an addition of heat to the air equal in amount to the external mechanical work performed, whilst during compression there must be an abstraction of heat to the same extent.

TABLE III.

Absolute pressure.		Absolute temperature.		Volume.	
Ratio of greater to less. Expansion	Ratio of less to greater. Compression.	Ratio of greater to less. Expansion	Ratio of less to greater. Compression.	Ratio of greater to less. Compression.	Ratio of less to greater. Expansion
1·2	·833	1·054	·948	1·138	·879
1·4	·714	1·102	·907	1·270	·788
1·6	·625	1·146	·873	1·396	·716
1·8	·556	1·186	·843	1·518	·659
2·0	·500	1·222	·818	1·636	·611
2·2	·454	1·257	·796	1·750	·571
2·4	·417	1·289	·776	1·862	·537
2·6	·385	1·319	·758	1·971	·507
2·8	·357	1·348	·742	2·077	·481
3·0	·333	1·375	·727	2·182	·458
3·2	·312	1·401	·714	2·284	·438
3·4	·294	1·426	·701	2·384	·419
3·6	·278	1·450	·690	2·483	·403
3·8	·263	1·473	·679	2·580	·388
4·0	·250	1·495	·669	2·676	·374
4·2	·238	1·516	·660	2·770	·361
4·4	·227	1·537	·651	2·863	·349
4·6	·217	1·557	·642	2·955	·338
4·8	·208	1·576	·635	3·046	·328
5·0	·200	1·595	·627	3·135	·319
6·0	·167	1·681	·595	3·569	·280
7·0	·143	1·758	·569	3·981	·251
8·0	·125	1·828	·547	4·377	·228
9·0	·111	1·891	·529	4·759	·210
10·0	·100	1·950	·513	5·129	·195

Fig. 2 is a diagram in which C D represents as before a volume of air at pressure A C, and A B the terminal volume at pressure B E. The work performed during isothermal expansion is shown by the shaded portion



D E F, and this work in foot-pounds divided by 772 gives the thermal units which must have been communicated to the air during its expansion. D G is the adiabatic line given for comparison, and the terminal volume A B bears the same relation to the terminal volume after adiabatic expansion, as do the absolute temperatures of those volumes.

On the same diagram E D is also the line of isothermal compression, and the shaded portion D E F represents the mechanical equivalent of the heat required to be abstracted to keep the intrinsic energy constant. E H is the line of adiabatic compression, the final volumes being, of course, proportional to their absolute temperatures. The relations between pressures and volumes in isothermal expansion and compression are given by Boyle and Mariotte's law, any $p\ v$ being always equal to any other $p_1\ v_1$. The isothermal curve is a hyperbola, and the area and mean pressure can, therefore, be conveniently calculated by the formula in use for the expansion of steam.

In elucidation of the effects just set forth, a short consideration of the actual state of the gaseous molecules under the several conditions of temperature and pressure, expansion, and compression, will now be entered upon.

From considerable evidence it is conceived that the constituent molecules of matter, as it exists in any state, are not at rest, but have a definite motion or vibration. In solids this motion is controlled by what is called the force of cohesion, and the vibration is about certain fixed positions, so that the rigidity or form of the body is not interfered with. In liquids these fixed points do not exist, and the molecules may have any motion of translation, or may rotate about themselves; while in gaseous matter the molecules seem to be totally devoid of mutual attraction, and follow the ordinary laws of bodies in motion, traversing space with a definite velocity. Enclosed within the walls of a vessel, the molecules striking the containing surfaces exert what we call pressure, which under certain conditions may be calculated, and in all cases is a function of velocity, and frequency of impact.

Molecular motion is caused by heat, the addition or subtraction of which increases or decreases the velocity of vibration. In the solid form molecular vibration is comparatively slow, but as heat is applied the velocity is increased until the force of cohesion is overcome and the liquid form is reached. After this the further addition of heat at first increases the sensible temperature, and this goes on till the motion of the molecules at the surface is sufficient to propel them forward into space beyond the control of their mutual attraction, and so evaporation takes place. This is the form of vapour, beyond which the addition of heat generally induces the gaseous state, in which the oxygen and nitrogen composing our atmosphere exist, and substances so affected may, within certain limits of temperature, for all practical purposes be taken as obeying the laws relating to perfect gases shortly defined in these articles. Beyond the gaseous state it is probable that the molecules themselves are subject to change.

With these connections in view, it is now apparent how a gas heated under constant volume acquires pressure or with increasing volume is enabled to exert a constant pressure, and how under constant temperature the pressure—due to molecular impacts—must vary inversely as the volume.

Passing to a consideration of the effects which have been described as taking place during compression and expansion of a gas, it may shortly be stated that they are all brought about either by the transference of motion from the piston to the molecules, or from the molecules to the piston. In the one case molecular velocity is increased—as in adiabatic compression—unless the motion be again imparted to some other body—as in isothermal compression, and in the other it is decreased—as in adiabatic expansion—unless by the addition of heat—as in isothermal expansion—just so much energy is restored to the molecules as they themselves impart to the piston. During compression, energy is given to the molecules at the expense of that of the piston, and the gas not only exerts increased pressure due to diminution in volume, but having greater molecular velocity, becomes what we call heated, while in expansion the piston receives motion at the expense of that of the molecules, and the gas is thereby not only reduced in pressure but also lowered in temperature.

EXHIBITION OF LIFE-SAVING APPLIANCES.—ALEXANDRA PALACE.

AMONG the many exhibitions—and their name has been legion—which have been held during the past twelve months, few deserved a larger measure of success than this, and none were inaugurated with brighter prospects. Everything indeed seemed to favour it before its opening. Its class was one which claims in a marked degree the interest of Englishmen of all grades of society. It had on its list of patrons a prince of the blood, the two archbishops, three bishops, and a number of dukes and earls; while amongst the names of the hundred and forty-four gentlemen who formed the honorary committee were to be found those of some of the most famous Royal engineers, civil engineers, electricians, physicians, members of Parliament, railway managers, military and naval officers, chemists, Fellows of the Royal Society, &c. &c., and yet with all these aids and helps to success the Exhibition must be pronounced a complete failure. The exhibits themselves are most interesting and most instructive, and there can be no doubt that had the promoters ever so little an idea of managing the affair it could have been made the success it deserved to be. As a matter of fact, however, the management has been first irretrievably muddled and then left to take care of itself; and the exhibitors have held indignation meeting after indignation meeting in protest against their treatment, their chief complaint being that the public has not been advised of the existence of the Exhibition, and that no vigorous means have been taken to advertise the matter. Advertising is a most essential minister towards the success of any Exhibition; it must be done profusely, but with much judgment, and it is to be hoped that the management of this Exhibition will, before holding another of a similar kind, take the trouble to have it thoroughly and fully made known. If it is worth while to hold an Exhibition at all, it is well worth while to advertise it well and to manage it well. Almost weekly, Exhibitions of one kind or another are held in London, and wonderful success attends upon the most worthless and uninteresting if it be well managed; while in some cases those which are really the best fail from no other cause than the incapacity of the managers.

On arriving at the Alexandra Palace the visitor will naturally first look about him in the hope of finding an attendant who can supply him with a catalogue which he may fancy will help to make clear the incongruous muddle of exhibits. Happy indeed is the man of gentle habit who does not weary himself in looking far for this book, and much is that bold and determined man to be pitied who has succeeded in obtaining a catalogue, for then his troubles begin. It is difficult to imagine for what purpose the catalogue was intended, as being destitute of any map, of any reference numbers, or of any instructions as to where exhibits may be found, it altogether fails to accomplish the ordinary duties which one naturally expects of a catalogue, and makes confusion worse confounded. Well managed, well advertised, well catalogued, and well arranged, this exhibition would beyond question have been successful, for the exhibits are really good, and the exhibitors until they lost heart, strove their utmost to ensure its success; but mismanaged, unadvertised, badly catalogued, and muddled and mixed in arrangement, any exhibition, however deserving of success, would be wrecked.

The exhibits have been placed in the catalogue under six heads, and these are:—(1) Apparatus and models of railway signalling and safety appliances. (2) Apparatus for marine emergencies. (3) Apparatus for the prevention and extinction of fires, and appliances for rescuing human life. (4) Mining safety appliances. (5) Surgical and sanitary; and (6) Engineering and miscellaneous safety appliances. The first of these classes, which relates to railway signalling and safety appliances, is the only one in which any attempt at order has been made, and in this class, *mirabile dictu*, the numbers do run consecutively, and the exhibits are placed as near to their proper position as could be desired. The chief exhibit of the class, if not of the entire Exhibition, is that of Messrs. Saxby and Farmer, who make an imposing display at the south end of the great central hall. Here are to be seen models, some of them full size, showing the union of the block and interlocking systems under Hodgson's patent, and the electric slot signal, Farmer and Tyer's patent, which has been adopted on the Tunbridge Wells and Eastbourne section of the London, Brighton, and South Coast Railway. The full-sized exhibit which shows these inventions consists of an interlocking apparatus of levers for working points and signals, and telegraphic block signalling instruments for the exchange of train telegraph signals with stations on either side for up and down lines respectively, and also a lever fitted with the "electric slot" arrangement.

The block telegraph instruments and the points and signal levers are so combined that it is impossible to work them in a contradictory manner, and the signalmen at both ends of a section must absolutely agree in their action before the points or signals can be moved, the various levers in one box being locked and interlocked from the other. With this system in use accidents can only happen in two ways: First, by the engine-driver disregarding signals altogether; and, secondly, by conspiracy between the signalmen. This firm also show their patent duplex facing point lock, which is designed to meet the possible contingency of the breakage of a connecting rod between the points and the locking apparatus in the signalman's cabin. Many accidents have happened through the breaking of this rod, and Messrs. Saxby and Farmer now introduce a double connecting rod with a double set of levers, &c. &c. The plan is certainly open to the charge of multiplication of parts and clumsiness, but it absolutely secures the safe working of the points; for should one of the connecting rods break, the other is made sufficiently strong to do the entire work efficiently, and the breaking of both rods is too distant a contingency to be considered. In this stand is also to be seen a beautiful and complete model of a railway junction, which shows the harmonious working of the interlocked points and signals, with patent facing point locks, and level crossing gates interlocked with the signals. By means of this combination the safety of working railway traffic over common roads, or road traffic over railways, is ensured. The gates cannot be opened to allow of road traffic across the lines unless the railway signals be in such a position as to prevent the approach of any train. Nor will the signals fall to allow of the passage of a train until the gates have been securely locked against road traffic. Amongst the exhibitors in this class are Messrs. Cheesewright, Kelday—patent electric fog signal—C. H. Lea, Midland Railway, Allin, Dalton, London, Brighton, and South Coast Railway (Stroudley, Bannister, and Annett's appliances, Annett's patent apparatus for extending the interlocking system to outlying points, Stroudley's communicators between passengers and guard). Mr. Holden. of Nelson, Lancashire, exhibits a simple and ingenious railway chair key and spring, which he has extensively patented. This invention is designed to provide against the danger of railway keys dropping out when they contract, as they will of necessity do in dry weather. The chair is so constructed that on the inside of one or both of its sides it has a recess without rough edges. When the ordinary key is being driven in, it has to pass a narrow aperture, and when it finally reaches its proper position, the wood which has been compressed to pass the narrow space, naturally swells into the recess of the chair-jaw, and so locks itself. Mr. Holden, however, paying judicious regard to the fact that many millions of railway chairs are in use in this country without the recess, and recognising the difficulty of having all these chairs taken up, has designed a combination of key and spring which should effectually overcome the difficulty and danger of loose keys. He forms a longitudinal groove in the surface of the key, which is to be next the jaw of the chair, and between the jaw and the key a bowstring spring has been introduced, the body of which fits the key, and the ends are bent to embrace the ends of the chair jaw. The spring is made of Bessemer steel, and is of considerable strength, say 300 lb. The invention has been worked on two of the principal railways in England, and appears to give complete satisfaction, its simplicity is great, and its efficiency can be very readily understood. Mr. Barrow shows some good patent fog-signal apparatus for preventing collisions when shunting in fog tunnels, junctions, level crossings, and facing points. Messrs. Brear and Hudson show some clever electrical railway signals and signal repeaters. Mr. Heberlein exhibits his well-known automatic friction brake, which is in rapidly extending use on the Continent, especially in Germany and Switzerland, and has been described in our pages.

The Great Eastern Railway Co. shows a model illustrating a new buffer stop on Langley's patent recently illustrated in our pages. The object of this stop is to prevent the severe shock which a train would receive when running at high speed into a terminus or siding if the brakes failed to act, on coming violently into collision with the ordinary dead spring buffer. Each buffer on this principle sends its spindle into a hydraulic cylinder. When the collision takes place the water is driven out of the cylinder through a comparatively narrow orifice, and the vehicle is brought to rest quietly and is not allowed to recoil. The piston of the hydraulic cylinder is brought back to its original position by means of a chain and weight, or by a head of water, which is, of course, a much better arrangement.

Further systems of signalling are exhibited by the Lancashire and Yorkshire Railway—electric block signalling instruments—Whiteman—automatic check system of railway signalling—Kettering, and J. White. Messrs. the Eames Brake Company show their patent duplex automatic continuous brake, and down in the railway station, in such a position that few people not previously advised of its presence could find it or know anything of it, this company have on view an American locomotive, about which a good deal has been said, from Baldwin's Works, Philadelphia, which is fitted with this well-known brake.

In another impression we shall have something to say concerning the remaining exhibits in the other classes which we have named.

SKELDERGATE BRIDGE, YORK.

WE give this week as a supplement a permanent photograph of Skeldergate Bridge, which has already been noticed in our columns, The Act for the making of Skeldergate Bridge received the Royal assent on June 14th, 1875. This empowered the Corporation to construct the bridge and the approaches. The style of the bridge is Gothic or mediæval, and is consonant with the ancient remains of the city. Circumstances have made the Skeldergate Bridge different in outline and structure to that at Lendal, but a similar style of architecture has been adopted, and except in the standards of the lamps, every detail is dissimilar. The style is of an earlier period and more castellated. The lodge represents the ancient chatelet or small castle, which in the middle ages was always placed at the head of a bridge for defence at the bascule or drawbridge. The similarity of Westminster Bridge, the Victoria and Albert Bridges at Windsor, Lendal Bridge, and others, proves that the style may be applied as an ornament without detriment to the strength of the structure. The parapet is decorated with alternate suns and roses, the collar of the ancient Knights of the House of York.

The new bridge consists of five arches, three of which cross the river, the two others being land arches for the waterside traffic. The centre arch has a span of 90ft., springing 9ft. 5in. above the summer level of the river. The headway at the crown of the arch above the summer level is 22ft. 6in.; the depth of the ribs carrying the roadway is 2ft. 6in., and the level of the roadway at the apex is 25ft. 7½in., and the level of the footpath next the parapets at the crown of the arch is 25ft. 9in. above summer level. The gradient of the roadway of the bridge is 1 in 108, falling each way from the centre to the abutments. The arch is composed of seven wrought iron ribs springing from cast iron skewbacks bedded in the masonry of the pier. The whole of the ironwork is strongly braced together transversely from one face rib to the other by a system of continuous bracings, nine in number, which, in addition to bracing the bridge, serve as continuous cross girders to distribute the load over all the ribs. The roadways of the bridge, with the exception of the bascule, which is planked, are carried on deep corrugated wrought iron plates, 5in. deep, the corrugations being 1ft. 4in. from centre to centre, and flattened top and bottom to get more metal for increased strength, and is made up with Portland cement concrete to the requisite level for laying the trams and the preserved wood pavement, and the asphalte of the footpaths. The preserved wood pavement is composed of blocks 5in. deep, 6in. to 12in. long, and 3in. wide, with ⅜in. spaces between the rows of blocks, run in with asphalte and small gravel. The whole of the wood pavement is bedded on a layer of sand, and this preserved wood pavement is stated to be more lasting than any other wood pavement yet laid down. The surface of the blocks is so hardened that they are rendered impervious to the action of the weather. The parapets, cornices, bosses, and all the ornamental parts of the bridge over all the arches are of cast iron. The Skeldergate 30ft. river span is carried by seven girders, forming a continuation of the top longitudinals of the centre arch; the facia girder having ribs forming a pointed Tudor arch, with spandrils harmonising with the centre arch and the opening out spandrils and ribs of the bascule bridge. The two land arches are each 24ft. span, and composed of nine cast iron ribs, braced together with cast iron bracings. The bascule or drawbridge next the lodge or chatelet has an available opening for the passage of masted seagoing vessels of 30ft. in the clear, and the depth of water over the invert is 10ft. 6in. below the summer level. The ironwork of the movable portion of the bascule is composed of eight wrought iron girders affixed to a shaft 10in. in diameter, upon which the whole turns. The total length of each of these eight girders is 53ft. 6in. They are strongly secured and braced together by six continuous cross girders extending over the opening. They also assist in carrying the platform of the roadway on rolled joists. The hydraulic machinery for opening and shutting the bridge was manufactured and fixed by Messrs. Sir Wm. Armstrong and Co. It consists of two hydraulic cylinders placed side by side, one for opening and one for closing the bridge. The diameter of each cylinder is 12in., and the stroke 5ft. 6in. The multiplying power is 4 to 1, giving a travel of 22ft. to the chains. The hydraulic force pump, adapted to work up to a pressure of 700 lb. per square inch, is worked directly from the crank shaft of an Otto's silent gas engine. The accumulator has a ram 15in. diameter and 7ft. 6in. stroke, with cast iron weights, &c., and a self-acting apparatus for cutting off the pressure from the pump when fully charged. The machinery is placed in a watertight cellar in the abutment behind the lodge.

The Skeldergate bascule bridge is the largest of its kind in the world. The area of the whole surface of the bridge in front of the axis is 1484·3 square feet; the area of the Copenhagen Bridge, the next largest, being 1155 square feet, or 329·3ft. super less than the Skeldergate bascule flap. There is one great point in this bascule bridge which is an innovation in advance of nearly all opening and movable bridges. This is that it has been so designed and arranged that the whole character of the design is not marred by unsightly girders, &c., as is usually the case with opening bridges.

The foundations of the Castlegate pier, invert, and abutments were put in by means of a coffer-dam, so constructed that the lower portion formed part of the structure. The foundations of the piers are 63ft. long by 15ft. 4in. wide, giving an area of foundation for each pier of 812ft. super. The area of the foundations of invert is 1290ft., being 30ft. by 43ft. The aggregate area of the Castlegate abutment, invert, and pier amounts to 3870ft., or a square, the side of which is a little over 62ft. Owing to the treacherous nature of the bottom it was found necessary to pile over a total area of 2850ft. super. The interstices between the main piles were all excavated and dredged out until a good bottom was found, and the whole filled in with Portland cement concrete. The piles of the Castlegate pier and abutment were cut off about 10ft. 3in. below the summer level of the river. The Skeldergate pier and abutments are very similar to those on the Castlegate side. The invert, however, has only 6ft. 6in. of water over it at centre below the summer level.

There are six approaches to the river bridge—two on the Castlegate side having an inclination of about 1 in 40—the first commencing from Tower-place with a sweep of 140ft. radius, joining the second from the entrance to the new baths, near Castlemill Bridge, with a sweep of about 340ft. radius, at a point 90ft. from the centre of the St. George's under-bridge. On the Skeldergate side, one from Bishopgate-street, one from Skeldergate, one from Baile-hill, and one from the down-stream riverside property, have the respective gradients of 1 in 40, 1 in 30, 1 in 50, and 1 in 25. The ruling width of the approaches is 40ft., with the exception of the riverside approach, which is 20ft. wide. All the retaining walls of the approaches are faced with Bramley Fall stone ashlar, with a cornice running along the same, surmounted by a solid stone parapet, which has small pedestals growing out of it at distances along its length, and four bold octagonal terminal pedestals, on which are placed the lamp-standards and lamps.

In addition to the approaches there are three flights of approach stairs, viz., the St. George's-fields footpath flight, the flight adjoining the St. George's under-bridge, and those adjoining the Skeldergate under-bridge. There is also a flight of stairs to the new terminal bastion, making in all four flights. The tollhouse has a ground floor about one foot above the flood level, which comprises kitchen, scullery, larder, bedroom, large cellar, coal cellar, &c., and a passage leading to the hydraulic machinery cellar. On the first floor is the tollhouse proper, bedroom, &c., also steps to the open look-out tower or lantern, the floor of which has a lead flat, and the roof of which is surmounted by a lead flat, flag-pole, and chimney. The river wall and deep-water channel upstream have a length of about 72ft. and downstream 270ft. The wall is composed of about forty main piles, 33ft. long and 13in. square. These piles are driven at distances of 10ft., with sheet piling between, secured by a continuous waling at the summer level, a top waling at the level of the quay, and top rail for the protection of the piles. The whole is securely bolted together, and tied back with long wrought iron tie rods fixed into counter piles driven about 20ft. inland. The foundations of the wall are of concrete, and are carried out down 10ft. 6in. below the summer level. Above this level the wall is faced with Bramley Fall ashlar backed with concrete. In order to keep the navigation in its proper course, and to protect the cut-waters of the stone piers from collision, a set of dolphin piles and guide booms have been placed up and down stream.

The total length of the bridge, including the abutments of the land arches, is 308ft. 8in., and the total length from the end of one retaining wall to another is 861ft. 8in. The outlay on the bridge, approaches, lodge, river wall, deep water channel, land, &c., has amounted to £56,000. The foundation stone was laid on the 12th June, 1878. The bridge was opened to the public on the 10th March, 1881. The bridge was designed and carried out under Mr. George Gordon Page, M. Inst. C.E., London, Mr. Robert Nunn being the resident engineer. The Corporation originally invited tenders for the construction of the bridge, but ultimately decided to divide the work, entrusting the ironwork of the superstructure to Messrs. Handyside and Co., and doing the foundations and all the other works by its own workmen, under the direction of Mr. Styan, the city surveyor.

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

(*From our own Correspondent.*)

THE meetings of the iron trade in Wolverhampton yesterday, and in Birmingham this afternoon, had about them as good a tone as last week. The commencement of the war in Egypt made merchants cautious in placing orders for Eastern markets; but beyond this the effect of the hostilities was not much felt. Indeed, sheets for India and Russia were still in capital call. Makers reported having refused numerous inquiries of this class. The refusals arise out of the fact that the mills are already well engaged in executing contracts for the galvanisers, and are likely to be for some time to come, and that the gauges which are sought are not generally favourites with producers. The sizes run largely upon 29 w.g. and 30 w.g., whereas "lattens," which, together with "doubles," are the sizes which manufacturers most like, terminate at 27 w.g. The minimum prices for sheets for the galvanisers this afternoon were: Singles, £8 5s; doubles, about £9; and lattens, £10.

Prices of sheets in the galvanised state gathered some strength from the circumstance that 10s. of the recent 17s. 6d. drop in New South Wales—Australia—has been recovered. The representatives in this district of the Birkenhead Galvanising Company quoted prices up this afternoon 10s. per ton, making their minimum for 24 w.g. in bundles, delivered Liverpool, £14 5s. per ton. The market assumed that this rise was a manifestation of sympathy with the action of the Staffordshire galvanisers a fortnight ago in declaring a 10s. advance. The prices of these makers to-day were £14 10s. to £15 delivered Liverpool.

Plate makers again complained of the competition from North Staffordshire houses. Not only have these latter a great advantage in the matter of railway freightage to Manchester and Liverpool—two of the most important consuming centres—but some of them also manufacture their own pigs, which places them in a further favourable position. South Staffordshire prices range from £8 to £9 per ton, according to brand. The quietude of the plate makers is a matter of concern to the vendors of hematite pigs, who formerly found good customers in the plate producers.

Hoop makers are rather quieter. Yet they refuse to give way in price, preferring lessened activity to lessened rates. Prices are £6 15s. to £7 and £7 2s. 6d. per ton, according to the purposes for which they are required. United States inquiries are not reaching the generality of hoop makers, but are confined to a rather limited circle. The competition of Warrington makers for the orders is keen.

Bar makers are fairly active. Large quantities are going away to Australia, South America, and other export markets. Medium and common sorts are in the greatest demand. Marked bars remain at £7 10s. to £8 2s. 6d., medium sorts at £6 15s. to £6 10s., and common sorts at £6 5s. to £6.

Tin-plates were announced as in steady request from the East Worcestershire mills. The Antipodes, Germany, and Canada, are all satisfactory buyers. Prices, however, are open to much improvement.

Notwithstanding the diversity of opinion upon the matter of waste, and consequent commercial success, which exists amongst certain members of the syndicate of ironmasters which conducted the recent experimental manufacture of steel on the Thomas-Gilchrist process from common Staffordshire pigs, it is a very cheering indication that the Patent Shaft and Axletree Company, Limited, of Wednesbury, are continuing the process. They are now manufacturing by it soft steel ingots, and rolling them down into slabs, billets, bars, &c.

The business of merchanting iron in this district is growing. The Shaws Brow Iron Company, of London and Liverpool, has now opened a warehouse and offices in Wolverhampton. The company has been engaged this week in laying in stock. I understand that of bar iron alone they contemplate stocking no fewer than 236 sizes, and they will also stock hoops, plates, sheets, and tin-plates.

Pig iron of foreign part-mine descriptions, such as Derbyshire, Northampton, and Leicestershire, is still in brisk inquiry from some agents, notwithstanding recent heavy sales. Prices, therefore, remain firm at 47s. 6d. per ton at railway stations. Lincolnshire mine pigs are quoted 50s. Hematites are too high to encourage much business. Blaina sorts are 62s. 6d., and Tredegar and Barrow sorts 67s. 6d. per ton.

Native pig makers report that the current make is going steadily away from the furnaces, but that new orders are rather scarce. From the Spring Vale furnaces of Messrs. A. Hickman and Son, between 1000 and 1200 tons are going away weekly. Best native pigs are 65s. to 67s. 6d.; second qualities, 50s. to 57s. 6d.; and common sorts about 40s.

It was positively announced this week, at a number of the chain and nail warehouses, that a large majority of the employers had consented definitely to pay their operatives in the future by the 4s. 6d. list.

The brass and copper wire trade held their quarterly meeting in Birmingham on Tuesday, and resolved to make no alteration in prices.

Some of the colliers in the neighbourhood of Oldbury and West Bromwich complain that their masters are compelling them to join the Insurance Society established under the Employers' Liability Act. At a meeting that has just been held they have been in effect told by their leaders that they are themselves to blame. Certain of the masters having insured themselves against risk by joining the society, and finding that the men are indifferent to joining either the Insurance or their own Permanent Provident Society, wish to put an end to the tiresome uncertainty. The advice of the colliers' leaders is that the men should at once form branches of the Provident Society, and to do their utmost, in conjunction with the masters, to spread that system.

The Federation of Miners for the Midland Counties discussed on Tuesday at a meeting in Wolverhampton, at which 52,000 men were said to be represented, the notice which the North Staffordshire coalmasters have given for a 5 per cent. drop in wages. The notice expires at the close of this week. The meeting passed a resolution asking the masters to withdraw the notice, and they appointed a deputation to attend any interview which might take place between the North Staffordshire masters and men with view to a settlement.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—Generally a steady tone prevails throughout the iron market, with an absence of speculation. Both pig and manufactured iron, however, have been meeting with comparatively only a slow sale, consumers being mostly tolerably well covered and not anxious to place out further orders at present, whilst producers on the other hand, with good deliveries being made on account of recent contracts, are under no necessity just now to press sales.

There was only a quiet market at Manchester on Tuesday, and sellers generally report not more than a moderate business doing for the last few days. For Lancashire pig iron the demand has scarcely been so active as last week, but local makers are firm at 45s. 6d. to 46s., less 2½ for forge and foundry qualities delivered equal to Manchester, and are realising these figures on the sales made. For district brands the prices quoted for delivery here remain at about 47s. 6d. to 48s. 6d. and 49s., less 2½ for Lincolnshire and Derbyshire qualities, but some makers are so fully sold that they are practically not offering at present in this market, and the business being done altogether is not large. North Staffordshire iron has been offering here at a little under the above brands, but does not appear to have led to orders of importance being secured. Middlesbrough makers are quoting about 52s. 4d. to 52s. 10d. per ton net cash for g.m.b.'s. delivered equal to Manchester, which are simply prohibitive prices so far as this market is concerned, and even where sellers are willing to take less, no business of any moment can be done.

Finished iron makers as a rule are fairly well off for orders, although complaints here and there are made of slackness. The demand for home consumption is not very brisk just at present, requirements having been largely anticipated by purchases made a short time back, and any activity in the market is chiefly in the direction of shipments, for which there are fair inquiries for sheets, bars, and light rails. Prices steady, and for delivery equal to Manchester or Liverpool, average about £6 7s. 6d. to £6 10s. for bars and light rails, £6 12s. 6d. to £6 15s. for hoops, and £8 7s. 6d. to £8 10s. for sheets.

There is still plenty of activity throughout the various branches of the engineering trade in this district, but the present state of affairs in Egypt is inducing a less hopeful feeling with regard to the future, and I hear numerous complaints that already there is a marked falling off in the number of new inquiries coming in.

During the week I paid a visit to the new Salford sewage works in the outskirts of the borough, which are rapidly approaching completion, and will, it is expected, be in working order within the next four or five months. The system adopted by the Salford Corporation for dealing with the sewage, which at present is discharged direct into the river Irwell, is by precipitation, and for this purpose extensive works, designed by Mr. A. Jacob, the borough engineer, and built by Messrs. S. W. Pilling and Co., contractors, of Manchester and Bolton, have been constructed at the present outfall of the sewers. The process adopted may be briefly described as follows:—The sewage, instead of, as now, passing direct into the river, will flow into a large receiving chamber, and passing through a screen, which will detain materials of a large size, will be pumped into a mixing tower, where it will receive a certain proportion of lime, and then be conveyed through pipes to the extreme end of a series of tanks, through which it will slowly flow backwards, gradually depositing all solid matter on the bottom of the tanks until it is discharged comparatively pure into the river. With regard to the details of the process, I may mention that the works are constructed to deal with 27 million gallons of sewage daily, although the present quantity under ordinary circumstances does not exceed 6 million gallons. In the receiving chamber, into which the sewage first enters, there are two valves. One of these, 7ft. 6in. by 8ft. 9in., of the flat-ended egg shape, will only be brought into requisition to prevent any overflow from the river when any exceptionally large quantity of surface flood water has to be dealt with, without passing through the tanks. The other valve, which is of 3ft. 9in. diameter, opens into the screen chamber and passes the sewage on to the pumps. These pumps, which are constructed to lift 27 million gallons per day, and will be driven by two high and low-pressure engines of 150-horse power, and have been supplied by Messrs. James Watt and Co., of Birmingham, are at present being erected. The pumps are contained in a chamber 37ft. deep under the engine-house floor; the engines will be carried on cast iron beams 1ft. 9in. deep, and will be supplied with steam by four boilers, 30ft. long by 7ft. diameter, of the ordinary Lancashire type with "Galloway" tubes. For mixing the sewage with the lime for the precipitating process, a tower 46ft. high has been erected, which will contain at the top a reserve tank to be utilised for hydraulic purposes when required. Here the sewage is forced upwards into a tank through a bell-mouthed pipe; as it overflows into the tank the lime precipitate is dropped into it from a tank above, and it is then passed to a couple of mixers worked by turbines, and then flows on to the tanks. Of these there are twelve placed in two parallel lines divided by an overflow channel, provided to meet any exceptional emergency. Each tank has a superficial area of 1200 square yards, and can be shut off from the others, as required, for the removal of the sludge, which is conveyed to earth pits adjoining, and the two lines of tanks work in duplicate. The flow of the water from the tanks is utilised before passing into the river for turning the turbines, of which there are two of 25-horse power, supplied by the Low Moor Foundry Company, Oldham, which work the mixers, and for this purpose a collecting tank 40ft. by 30ft. and 15ft. deep has been provided in which the turbines are placed, whilst in addition the two end precipitating tanks are constructed as reserves in case of need. The whole of the works have been excellently managed, and the various buildings are of a neat architectural style which gives a pleasing and effective appearance.

The condition of the coal trade shows but little change. In the Manchester district a reduction of 10d. per ton is being made on the delivery rates for house coal to consumers, but this does not affect the pit rates, and generally quoted prices may be said to be without alteration, with, however, a good deal of low selling. Supplies all round plentiful, and pits as a rule not working more than about four days a week.

The shipping trade has shown a little more activity, which has enabled sellers to move away some of their stocks; but prices are without improvement, and at the Garston Docks on the High Level, Liverpool, Lancashire steam coal can still be bought at 6s. 6d. to 7s. per ton, with good seconds house coal offering at 8s. 3d. to 8s. 6d. per ton.

Coke in good demand, and prices are firm at 9s. for common up to 11s. and 12s. per ton for the best qualities at the ovens.

The strike in the St. Helen's district continues, and, as I anticipated, is likely to lead to a protracted struggle between the masters and the men, but the stoppage of the pits has no appreciable effect upon the market.

Barrow.—A very steady improvement is still going on in the hematite pig iron trade of this district, and from what I can learn a very good winter's trade will be done. Orders are being taken up pretty freely, and the inquiries which are coming to hand would seem to show that the wants of users are on the increase. This is especially the case as regards America; the inquiries from that quarter are steadily increasing week by week, and if nothing unusual occurs there can be no doubt but ere long we shall be doing a heavy business with American users. Continental and home consumers are using largely, and the demand is very well maintained. New furnaces are being put into blast to meet the heavy outgo, as the present output is not sufficient to meet the demand, and a consequent falling of stocks is taking place. The shipments to America are heavy, and will continue to be on an active scale till the close of the shipping season. Prices are better by 1s. per ton all round. Mixed numbers of Bessemer are quoted at 57s. 6d. per ton net at works. No. 1 Bessemer, 58s. 6d.; No. 2, 57s. 6d.; No. 3, 56s. 6d. per net. f.o.b. Orders held for steel are sufficient to keep the mills in regular employment for a considerable time. New orders, especially for rails, are being secured. Iron ore in good request, from 14s. 6d. to 16s. per ton at the mines being quoted. Iron shipbuilders are not very busy with regard to new contracts; several inquiries and new orders are being negotiated. Boilermakers, engineers, ironfounders, and others in steady work. Coal and coke unchanged. Shipping active.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

In North Notts and North Derbyshire a considerable business is doing at the leading ironworks, the works being fairly well employed on recent orders for both pig and finished iron. In South Yorkshire there is less activity, and though prices are reported to be firmer in the North, there is no sympathetic firmness for local makes of iron here.

In the coal trade there is a slight improvement in the demand for hard coal, but no advance has taken place in prices. The local pits are mainly working two and three days a week.

A somewhat serious breakdown of machinery is reported from Thorncliffe, at the Norfolk Colliery of Messrs. Newton, Chambers, and Co., Limited. About a year ago the firm decided to adopt the endless rope system of drawing coal out of the workings, and for this purpose erected new machinery on the pit bank near the engine course. The whole of the necessary apparatus had been fixed, and the new system came into operation on the 17th. It worked well until Saturday morning, when the shaft—about 10in. in diameter—connecting the engine and the pulley wheels over which the rope works, broke in two places. The engine tenter at once stopped his engines and gave the alarm. Work ceased, and the men were drawn out of the pit. No one was injured, but the accident entailed a considerable loss in labour and capital.

The Liverpool ivory sales turned out as anticipated. There were only 30 tons on offer, and the prices obtained were from 10 to 15 per cent. on last quarter's quotations. Sheffield manufacturers bought very heavily, and the small ivory used for cutlery purposes showed the heaviest advance. Only West Coast of Africa ivory is offered at Liverpool, where the top price paid was £67 10s. per cwt. for Angola, and £56 per cwt. for Niger. At London, on Tuesday and Wednesday, the quantity on offer was the smallest on record, 72 tons in all. Egyptian being exceptionally scarce advanced £3 to £6, and several soft and good lots even more; West Coast African, £2 to £8 higher for ordinary qualities; East India showed an average advance of £1 to £3, except cores and sea horse teeth, which were difficult to sell.

Messrs. Davy Brothers, Limited, Engineers, Park Ironworks, had their annual general meeting on the 21st. The report and balance-sheet were adopted, and a dividend of 27s. per share declared, making, with the *interim* dividend paid in December last, $8\frac{1}{2}$ per cent. for the year. Mr. W. S. Davy retired from the board of directors in consequence of his engagement with the Barrow Company, and the vacancy thus caused was filled up by the appointment of Mr. William Harmar.

The Manchester, Sheffield, and Lincolnshire Railway Company, in its report, makes the interesting announcement that in consequence of the increase in the number of trains on the main line between Manchester and Sheffield, the directors are considering the construction of an additional tunnel at Woodhead, and the widening of the viaducts at Mottram and Dinting. These are great undertakings, the Woodhead tunnel being stated to be the longest in England. The company contemplate building at their works at Gorton new carriage stock, at a cost of about £30,000, during the ensuing twelve months. These additions to rolling stock are required by the opening of new lines and the putting on of additional trains in different districts.

The Tinsley Rolling Mills Company, Limited, in their report, issued on the 25th, state that the year's working has been so favourable that they are able to declare a dividend of 10 per cent., the same as last year.

At the Lancashire Agricultural Show, on the 20th, 21st, and 22nd, the farmers inspected with unusual interest a new machine manufactured by Mr. Coultas, Grantham, for drying stacks, a machine similar to that inspected by the Prince of Wales at Reading. A farmer stated that by using this machine he had reduced the temperature of his stack from 170 deg. to 80 deg. in two and a-half hours.

The Master Cutler has received from the Board of Trade a statement of the changes introduced into the Russian Custom's Tariff from the 13th of the present month. Very great advances are made in nearly every article exported from foreign countries. Iron and steel were already too heavily taxed to admit of serious advances. Cast iron, in bars, is advanced from $5\frac{1}{2}$ to 6 copecks; iron, in bars, $38\frac{1}{2}$ to 40 copecks; iron rails, $49\frac{1}{2}$ to 50 copecks; steel rails, $38\frac{1}{2}$ to 40 copecks. Tin is greatly advanced.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

THE upward movement, reported last week in the pig iron market, continued last week, until 45s. and even 45s. 3d. was paid for No. 3 g.m.b., f.o.b. Middlesbrough. On Tuesday the Cleveland ironmasters met as usual before 'Change, and compared notes as to the sales they had made and the prices they had realised. They decided not to alter the official minimum from 43s. 6d.; but, as no one would now think of accepting so low a price, their non-interference practically left the market to find its level. The news from Glasgow to the effect that the upward tendency of that market had been checked, and succeeded by a downward movement, had of course a corresponding effect upon Cleveland pig iron. Certain merchants and middlemen, who, by buying, helped to force the price up a week or two since, took fright on Tuesday, and endeavoured to sell in competition with producers. After several oscillations the price settled down to about 44s. 6d. for No. 3, and 1s. less for forge quality. Warrants were to be had at about 44s. per ton. Connal's stores decreased only 849 tons during the week, leaving in stock a residue of 119,563 tons. Shipments, so far, have been below the average for the month, but as the difference between the price of English and Scotch iron has considerably increased, it is hoped that it will soon once again become remunerative to renew the coasting traffic to its former dimensions.

Manufactured iron keeps in steady demand. Everything points to an increased cost of production. Sir J. W. Pease's award will add 9d. per ton from the 1st of August, and 1s. 6d. per ton from the middle of September. The rise in pig iron may be taken already to be equal to another 1s. 4d., so that the manufacturers have to face an immediate diminution in their profits of 2s., to be followed in six weeks by a further 9d. That is, unless their selling prices can be forced up to an equivalent extent. This, however, seems likely to follow. Shipbuilders, bridgebuilders, and boiler-makers, are everywhere busy, and likely to continue so; and it is difficult to supply the material they require with sufficient rapidity. Ship and bridge plates may be had at from £6 15s. to £7 per ton, according to specification and delivery required. Boiler plates are 20s., 40s., and 60s. more, according to quality. Bars and angles are quoted £6 5s. per ton, and steel rails at £5.

The directors of the Consett Iron Company, Limited, have resolved to recommend, at the shareholders' meeting to be held on the 19th prox., the payment of a dividend of 17s. 6d. per share. At the same meeting a dividend of 2s. per share will be declared on the shares of the Consett Spanish Ore Company, Limited, and also an interim dividend of 1s. per share on account of the current year.

Mr. J. W. Hornby, auctioneer, recently offered for sale at Stockton fifteen £100 fully paid-up shares in the Stockton Malleable Iron Company, Limited, and also sixty-one £5 fully paid-up shares in the same company. No bids were forthcoming, and consequently the shares were not sold.

Active preparations are in progress for the North-East Coast Exhibition, to be held at Tynemouth on the 6th of September next, and to remain open for at least three weeks. The Exhibition will include departments for naval architecture, marine engineering, fisheries, life-saving, coast-lighting, submarine engineering, electric light, coal and coal shipping, and models by workmen. Many local gentlemen are working hard for the success of the Exhibition, among whom Mr. F. C. Marshall may be mentioned as chairman, and Mr. Geo. Renwick as hon. secretary of the executive committee. It is to be hoped the Exhibition will attain the success it deserves.

The Boiler Explosions Act, of 1882, is regarded with considerable interest in the Cleveland district, where boilers innumerable are at work day and night, and where several explosions have taken place in times past. As the Act simply compels notice to be given to the Board of Trade immediately after an explosion, and secures that a competent engineer, or engineers, will be sent to make a preliminary investigation, and in important cases a full and public one, there can be no objection to it from any but culpably careless persons. The Act appears to be already in force, and those who buy second-hand boilers of ancient manufacture and set them to work may now expect that they will be brought to account if life or property be injured by their carelessness.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

UP till the close of last week the Glasgow warrant market was very strong, with a larger business done than for a considerable time back. The rapid advance in makers' quotations brought out some good orders from Canada and the Continent. It remains to be seen whether this buying will continue. There is an impression that in some cases buyers have supplied their requirements for a few months ahead. A very large business has been done in warrants, principally by those connected with the trade. On Monday and Tuesday holders were realising to a very considerable extent. Shipments continue very good for the season of the year, those for the past week amounted to 13,763 tons, as compared with 13,136 in the preceding week, and 12,805 in the corresponding week of last year. The arrivals of pig iron from Cleveland have been considerably smaller than in the preceding week, in consequence, it is believed, of the advance in prices at Middlesbrough. The home trade in Scotland continues remarkably good, and the market is altogether in a very satisfactory state. In the course of the week the stock in Messrs. Connal and Co.'s Glasgow stores decreased by 1200 tons, and now amounts to 634,000 tons in the aggregate.

Business was done in the warrant market on Friday up to 52s. cash. On Monday transactions took place, in the forenoon at 52s. 1d. to 51s. 8d. cash, and 52s. 2d. to 51s. 9d. one month; the afternoon's quotations being 51s. $6\frac{1}{2}$d. to 55s. 1d. cash, and 51s. $3\frac{1}{2}$d. one month. Business was done on Tuesday morning at 51s. to 50s. 9d., and back to 51s. $0\frac{1}{2}$d. cash, and 51s. 1d. to 50s. 11d., and back to 51s. 3d. one month; in the afternoon business was effected at 51s. $1\frac{1}{2}$d. to 54s. $4\frac{1}{2}$d., and back to 50s. 11d. cash, and 51s. 4d. to 51s. 6d. and 51s. one month. The market was strong on Wednesday, business from 51s. to 51s. 7d. cash, and 51s. 1d. to 51s. $8\frac{1}{2}$d. one month. To-day—Thursday—business was done up to 51s. $9\frac{1}{2}$d. cash, and 51s. 11d. one month.

In consequence of the large and steady demand for makers' iron prices were again advanced during the week all round, although on Tuesday less money was offered and some sales were effected at a slight reaction. On the whole, however, the quotations show an advance of 6d. to 1s. 6d. per ton on No. 1 special brands, No. 3 being also firmer. The figures are as follows:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 63s. 6d.; No. 3, 56s.; Coltness, 66s. 6d. and 56s. 6d.; Langloan, 64s. and 56s. 6d.; Summerlee, 62s. 6d. and 54s. 6d.; Calder, 62s. 6d. and 53s. 6d.; Carnbroe, 55s. 6d. and 52s. 6d.; Monkland, 52s. 6d. and 51s. 6d.; Quarter, 52s. 6d. and 51s. 6d.; Govan, 52s. 6d. and 51s. 6d.; Shotts, at Leith, 63s. 6d. and 56s.; Carron, at Grangemouth, 53s.—specially selected, 56s.—and 52s.; Kenneil, at Bo'ness, 52s. and 51s.; Glengarnock, at Ardrossan, 55s. 6d. and 52s. 6d.; Eglinton, 53s. 6d. and 52s.; Dalmellington, 53s. 6d. and 52s. 6d.

Since the close of the holidays the foundries have been very busy, and in most cases have good orders on hand. The marine engineering department was beginning to be somewhat less active in some of the works, but as a number of very good shipbuilding orders have just been placed, it is expected that this branch will experience a renewal of activity. The prices are firmer in consequence of the advance in pig iron.

The coal trade does not show quite so favourable results in the shipping departments, but this is attributable to the partia disarrangement of business resulting from the holidays, and now greater animation prevails. In a number of cases the gas coal contracts for the twelve months have been arranged, those of Glasgow being included in the number. Although the quantity of Cannel to dispose of has been rather less than usual, contract prices are understood to have been scarcely up to the mark of those of last year. This observation is, however, applicable to the larger contracts; a number of the smaller orders have yet to be placed and the probability is that, as the mineral is scarce, they will be arranged on somewhat higher terms. The domestic inquiry for coals is upon a satisfactory scale for the season, and prices of all sorts are without quotable change.

The Executive Board of the Fife and Clackmannan Miners' Association held a meeting at Dunfermline on Saturday, Mr. James Innes presiding, when it was resolved to send a deputation representing the various colliery districts to the employers, with the object of getting them to concede a uniform tonnage of 20 cwt. for wages purposes. The men are at present all engaged per $22\frac{1}{2}$ and 23 cwt., which are spoken of, therefore, and rated as tons. The secretary was instructed to communicate with all the mining districts of Scotland, with the object of inducing them to co-operate in a movement for a general advance of wages.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

I REGRET to hear that Mr. W. T. Lewis is seriously indisposed, and at a time when the Bute Dock Bill, now before the House of Commons' Committee, requires his directing hand. I hope in my next to record his safe recovery.

There has been a ferment in the ironworks district relative to the Welsh and Irish disturbances, and on Saturday last there was serious fear of an outbreak at Dowlais, but it passed off. I think that the excitement is toning down, and there is some expectation of a return to Tredegar of the Irish labourers who fled away.

The tone of trade is healthy both in iron and coal. A larger quantity of Bilbao ore came to the Welsh ports last week than has been imported for a long time. Foreign ore is now used almost, but not quite to the exclusion of Welsh ore. Dowlais and others, though they do not work their mines, are yet buyers of best qualities "coal balls," and even patch mine.

Prices of pig and manufactured iron and steel are hardening, and a more decided advance again is likely.

The machinery at the Merthyr wireworks is only just arriving. I hear that the start of the works has been delayed two months, and that a penalty is likely to be exacted from the makers of the plant.

Considerable coal speculation is rife in Monmouthshire, consequent to some extent, I imagine, on the fast approaching completion of the Newport, Pontypridd, and Caerphilly Railway. The girders of the new bridge, which will connect the line with the Taff, are now being placed. The Cwmglo Colliery, Bedwas, formerly worked by a London company, is about re-starting under new auspices. It has a large acreage of coal of what is known as the Llantwit seam. In some parts this seam is found associated with a bad top and a great quantity of water. The Llynvi Company have found the 6ft. seam in the upper part of the valley, and the find is a most important one. A short time ago the celebrated 4ft. Aberdare seam was found in the same valley. The whole district promises to figure as the Rhondda of the future.

Large outputs and exports continue to be the order of the day. The coal trade is as firm in tone as I have known it. The trade is vigorous and promising in all quarters, and I expect daily to hear of a distinctive advance in price. Every day there seems more difficulty in placing future business. The total coal sent from the Welsh ports last week, foreign and coastwise, was 206,000 tons.

The Ferndale colliers have resumed work at previous wages.

An improvement has been seen of late in tin-plate, and prices have advanced; but it must not be overlooked that block tin has advanced, and that if prices touched 17s. per box ordinary coke, this would scarcely cover that advance. One large maker of tin-plate has been hit severely within the last few days by a failure, it is rumoured, to the extent of £6000. This is becoming an ordinary event.

The report of the Cardiff and Swansea Smokeless Steam Company has been published, and is not so satisfactory by reason of irregular working at Resolven, and the fact that Pentre coal was sold for future deliveries at a low rate.

A visit by some of the members of the South Wales Engineers' Society took place last week to Treforest, to see the furnace which now turns out the largest make in Wales.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

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

Applications for Letters Patent.

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

18th July, 1882.

3400. Perambulators, J. Aylward, Birmingham.
3401. Peeling Machine, H. J. Gehlsen.—(*H. Baaser and F. Schulte, Germany.*)
3402. Spinning, F. Fox, Burley, & T. Coulthard, Preston.
3403. Steam Jet, E. Pass.—(*E. Körting, Hanover.*)
3404. Grinding Tools, R. Rawlinson, Salford.
3405. Healds, W. Harris and J. Cooper, Manchester.
3406. Securing Handles, H. Bottom and C. Rose, Sheffield.
3407. Scouring Rice, J. H. C. Martin, Walthamstow.
3408. Looms, R. Hattersley and J. Hill, Keighley.
3409. Plates, W. Taylor, Tottenham, and F. King, New Cross.
3410. Tickets, J. A. Francis, Newington Butts.
3411. Power Looms, R. J. Gulcher, London.
3412. Embalming, P. M. Justice.—(*N. T. Shaw, U.S.*)
3413. Pillars, T. Jefferies, Birmingham.
3414. Signalling, H. E. Newton.—(*O. Zadig, Paris.*)
3415. Separating Grain, P. V. Gelder, York.
3416. Chimney Tops, T. J. Baker, Newark.
3417. Water Bottles, J. C. Cook, Cape Town.
3418. Electric Arc Lamps, S. Z. de Ferranti and A. Thompson, London.
3419. Dynamo-electric Machines. S. Z. de Ferranti and A. Thompson, London.
3420. Dynamo-electric Machines, W. P. Thompson.—(*P. Payne and A. Sandron, Roubaix.*)
3421. Railway Carriages, W. P. Thompson.—(*Rev. A. H. Munro, U.S.*)

19th July, 1882.

3422. Purses, G. Macaulay-Cruikshank. — (*F. W. Schwarz, Offenbach-on-the-Main.*)
3423. Fences, G. Vaughan.—(*C. E. Lesur, Paris.*)
3424. Mallets, &c., A. S. Kershaw, Rochdale.
3425. Ball Valves, H. A. Cutler, Upton.
3426. Dust-collecting Flues, H. J. Haddan.—(*The Mechernicher Bergwerks-Actien-Verein, Mechernich.*)
3427. Steam Engine, J. Pinchbeck, London.
3428. Shoes, A. Laird, Essex, & T. Wilson, Southwark.
3429. Conveying Rails, A. Wilson, Dronfield.
3430. Telephones, A. Q. Ross.—(*T. Jefferson, U.S.*)
3431. Safety Locks, H. Thisquen, Russia.
3432. Propellers, E. Brewer.—(*G. Hoper, Germany.*)
3433. Microphones, P. M. Justice.—(*F. V. Rysselberghe, Schaerbeck.*)
3434. Electric Meters, C. V. Boys, Wing.
3435. Engines, C. D. Abel.—(*C. Beissel, Ehrenfeld.*)
3436. Engine Power Meters, C. V. Boys, Wing.
3437. Cocks, &c., D. R. Ashton, Clapton.
3438. Switches, J. Pickering, London.
3439. Grinding Grain, A. Clark.—(*J. Mounie, Paris.*)
3440. Drying Coffee, F. Engel.—(*F. Klée, Hamburg.*)

20th July, 1882.

3441. Regulating Lamps, A and T. Gray, Glasgow.
3442. Gas Fittings, A. Wells & R. Wallwork, Manchester.
3443. Medical Battery, W. R. Warren.—(*G. M. Hopkins, U.S.*)
3444. Artificial Stone, E. L. Ransome, U.S.
3445. Drying, &c., H. J. Haddan.—(*F. Mey, U.S.*)
3446. Governors, H. J. Haddan.—(*F. H. Ball, U.S.*)
3447. Valves, J. Blake, Accrington.
3448. Plane Splint, A. Wormull, Surrey.
3449. Engines, H. P. Holt & F. Crossley, Manchester.
3450. Recording Apparatus, O. Ber, Russia.
3451. Life-saving Apparatus, A. I. Rath, Manchester.
3452. Screw Propellers, R. Duncan, Glasgow.
3453. Beverage, J. Lane, Liverpool.
3454. Covers, &c., of Books, J. H. Linsey, London.
3455. Dynamo Machinery, J. S. Beeman, London.
3456. Closing Bottles, C. E. H. Cheswright, London.
3457. Finding Distant Points, A. J. Boult.—(*J. Wensel, Strassburg.*)
3458. Telephonic Apparatus, J. Chaster, Manchester.
3459. Checking Cords, A. and T. H. Dix, Rock Ferry.
3460. Crank Shafts, D. Purves, London.

21st July, 1882.

3461. Valvular Apparatus, J. Shanks, Barrhead.
3462. Cultivators, A. Simpson, Lhanbryd, N.B.
3463. Corsets, R. Hunting.—(*J. G. Avery, U.S.*)
3464. Batteries, J. Johnson.—(*J. H. Sutton, Ballarat.*)
3465. Electricity, L. H. M. Somzée, Brussels.
3466. Generating Currents, C. Carus-Wilson, London.
3467. Acoustic Instruments, F. Wirth.—(*A. Rettig, Germany.*)
3468. Boot Fasteners, J. N. Aronson, London.
3469. Saddle Bar, M. Macleod, Teignmouth.
3470. Carpets, &c., J. H. Braithwaite, Kendal.
3471. Knives and Forks, H. Fielding, Birmingham.
3472. Preventing Chimneys Smoking, J. Solomon, Knightsbridge.
3473. Generating Currents, A. Reckenzaun, Essex.
3474. Couplings, H. Smith and C. Harrison, London.
3475. Brake Gear, J. M. Haime, Cardiff.
3476. Receptacles, W. Barlow.—(*L. Encausse, Paris.*)
3477. Clay, &c., J. Gillespie, Garnkirk.
3478. Valves, P. R. Allen, Lambeth.
3479. Explosive Compound, W. G. Reeve, Ealing.
3480. Hides, J. H. Johnson.—(*B. Etcheverry, Paris.*)
3481. Printing Machinery, W. C. Kritch, Leeds.
3482. Locks, J. H. Black, Surrey.
3483. Aerated Beverage, J. and R. J. Alabaster and J. E. Sims, London.
3484. Nozzles, J. Norton and J. Sturgeon, London.

22nd July, 1882.

3485. Telegraphing, W. Healey.—(*W. L. Hunt, U.S.*)
3486. Ventilating Appliances, J. Leather, Liverpool.
3487. Draught Apparatus, E. Edward.—(*A. Marques, Bordeaux.*)
3488. Couplings, J. H. Heathman, London.
3489. Brandy, H. Bonneville.—(*D. Cornilliac, Paris.*)
3490. Cutting Wood, J. Rowley & H. Vulliamy, London.
3491. Images, E. G. Colton.—(*W. Kurtz, U.S.*)
3492. Signaling, H. Haddan.—(*A. & E. Webster, U.S.*)
3493. Textile Fabrics, C. Court, Rotherhithe.
3494. Carding Machines, C. Day.—(*J. Barker, U.S.*)
3495. Links, J. Shoebotham & J. James, Birmingham.
3496. Suspenders, E. M. Desprez, Paris.
3497. Sewage, T. H. Cobley, Dunstable.
3498. Metallising, A. J. Boult.—(*J. Hautrive, Lille.*)
3499. Elevators, J. McAuley, Booth.
3500. Shirt Fronts, G. W. von Nawrocki.—(*Messrs. Müller and Sussmann, Berlin.*)
3501. Wool Carding Engines, E. G. Brewer.—(*C. Rüdiger, Germany.*)
3502. Economisers, J. Perkin and J. Scott, Wakefield.
3503. Hammocks, H. Holman & W. Draper, Grantham.

24th July, 1882.

3504. Generating Machine, A. d'Orcli, Greenwich.
3505. Centrifugal Machine, J. H. Johnson.—(*M. Weinrich, Vienna.*)
3506. Transmitting Apparatus, E. O. Greening and H. J. Collins, London.
3507. Railway Chairs, J. Revell, Dukinfield.
3508. Electric Lamps, A. M. Clark.—(*H. J. Müller and A. Levett, New York, U.S.*)
3509. Rollers, A. Boult.—(*C. Jenatzy-Leleux, Belgium.*)
3510. Motive Power, J. Barlow, London.
3511. Flush Cisterns, W. Wright, Plymouth.

Inventions Protected for Six Months on Deposit of Complete Specifications.

3383. Ice Apparatus, H. J. Haddan, London.—A communication from T. S. Rankin, Washington, U.S.—*17th July*, 1882.
3402. Drawing, &c., Fibrous Substances, F. W. Fox, Burley-in-Wharfedale, and T. Coulthard, Preston.—*18th July*, 1882.
3443. Medical Battery, W. R. Warren, Brooklyn, U.S. — A communication from G. M. Hopkins, Brooklyn, U.S.—*20th July*, 1882.
3445. Drying Apparatus, H. J. Haddan, London.—A communication from F. H. C. Mey, Buffalo, U.S.—*20th July*, 1882.
3446. Steam Engine Governors, H. J. Haddan, London.—A communication from F. H. Ball, Erie, U.S.—*20th July*, 1882.

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

2928. Regulating Apparatus, B. Latham and J. T. Way, London.—*18th July*, 1879.
2935. Drying Felts, T. Aitken, Helmshore.—*18th July*, 1879.
3149. Moulding Socketted Pipes, T. H. Adcock and J. Hassall, Woodville.—*5th August*, 1879.
2940. Posts for Signals, J. S. Williams, Riverton, U.S.—*18th July*, 1879.
2958. Aniline Black, T. Holliday, Huddersfield.—*21st July*, 1879.
2943. Ships' Lights, A. M. Clark, London.—*19th July*, 1879.
3003. Sugar Cane, W. L. Wise, Westminster.—*23rd July*, 1879.
3038. Treating Wheat, W. R. Lake, London.—*25th July*, 1879.
2953. Winding, &c., Yarn, J. Boyd, Shettleston.—*21st July*, 1879.
2954. Mincing Meat, W. and T. C. Ovens, London.—*21st July*, 1879.
3094. Loops for Hanging, C. Kesseler, Berlin.—*30th July*, 1879.
3441. Lawn-mowing Machines, W. P. Thompson, London.—*26th August*, 1879.
3079. Sewing Machines, S. Pitt, Sutton.—*29th July*, 1879.
3224. Clack Valves, W. R. Lake, London. —*11th August*, 1879.
2973. Curing Apparatus, J. S. Campbell, North Plainfield, U.S.—*22nd July*, 1879.
2992. Pumps, H. Hodgkinson, Wirksworth. — *23rd July*, 1879.
3013. Flour, W. N. Dack, Patricroft.—*24th July*, 1879.
3042. Mechanical Stokers, J. Hodgkinson, Bolton-le-Moors.—*25th July*, 1879.

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

4053. White Lead, E. Milner, Warrington. — *22nd November*, 1875.
2623. Wadding, &c., J. H. Johnson, London.—*23rd July*, 1875.
2633. Submarine Cables, F. R. Lucas, London.—*24th July*, 1875.
2658. Pressing Bricks, T. Titley, Leeds.—*27th July*, 1875.
2726. Shaping Staves, C. Hewitt and M. H. Heys, Swanscombe.—*3rd August*, 1875.
3056. Printing Machines, E. Anthony, Hereford, and W. W. Taylor, Cambridge.—*31st August*, 1875.

Notices of Intention to Proceed with Applications.

Last day for filing opposition 11th August, 1882.

1252. Spring Clips, W. D. Saull and W. R. Brooks, London.—*15th March*, 1882.
1272. Urine Receivers, C. Rubens, London.—*16th March*, 1882.
1284. Pianofortes, H. Witton, London.—*16th March*, 1882.
1291. Beverages, H. A. Bonneville, London.—A communication from D. Cornilliac.—*17th March*, 1882.
1294. Breech-loading Fire-arms, H. W. Holland, London.—*17th March*, 1882.
1298. Metal Lasts, J. Markie, London.—*17th March*, 1882.
1303. Telephonic Systems, P. M. Justice, London.—A com. from F. van Rysselberge.—*17th March*, 1882.
1305. Purifying Ores, D. Watson, Manchester.—*17th March*, 1882.
1315. Condensed Milk, W. F. Sweetland, Hendon.—*18th March*, 1882.
1321. Indicating Apparatus, F. Dening, Chard.—*18th March*, 1882.
1324. Electric Lamps, J. D. F. Andrews, Glasgow.—*18th March*, 1882.
1325. Drain Pipes, C. Slagg, Leeds.—*18th March*, 1882.
1330. Driving Belts, J. Appleyard, Bradford.—*18th March*, 1882.
1333. Cases, E. G. Brewer, London.—A com. from C. S. Bleton and A. Maleville.—*18th March*, 1882.
1335. Springs, A. J. Boult, London.—A com. from J. D. Thomas and L. F. Requa.—*18th March*, 1882.
1336. Insulated Wire, A. J. Boult, London.—A com. from J. D. Thomas & L. Requa.—*18th March*, 1882.
1361. Breech-loading Small-arms, J. Rigby and L. F. Banks, Dublin.—*21st March*, 1882.
1364. Wheels, J. Taylor, Wigan.—*21st March*, 1882.
1416. Binnacles, W. R. and C. A. Williams, Newport.—*24th March*, 1882.
1427. Variable Expansion Gear, T. English, Hawley.—*24th March*, 1882.
1436. Saving Life, J. Z. Cressy, Glasgow.—*25th March*, 1882.
1438. Stoppers for Bottles, H. Barrett, London.—*25th March*, 1882.
1470. Furnaces, J. Hodgkinson, Bolton.—*27th March*, 1882.
1502. Sewing Fabrics, J. H. Johnson, London.—A com. from S. Borton & C. Willcox.—*28th March*, 1882.
1543. Capsules, C. Cheswright, Holloway.—*30th March*, 1882.
1608. Weighing Machines, C. Reuther, Germany.—*3rd April*, 1882.
1718. Drying Machines, A. M. Clark, London.—A communication from La Compagnie Générale de teinturerie et apprêts "Système Andre Lyon."—*11th April*, 1882.
1752. Sulphuric Acid, W. Weldon, Burstow.—A communication from the Société de la Manufacture de Javel.—*13th April*, 1882.
1863. Pocket Filter, A. M. Clark, London.—A com. from L. L. T. F. d'Autemarche.—*18th April*, 1882.
2385. Hose Couplings, T. L. Daltry, Stretford.—*20th May*, 1882.
2485. Collecting Dust, L. Fiechter, Liverpool.—A com. from Messrs. Kirk and Fender.—*25th May*, 1882.
2615. Preserving Milk, E. Scherff, Prussia.—*3rd June*, 1882.
2654. Electric Lamps, R. J. Hatton and A. L. Paul, London.—*6th June*, 1882.
2699. Harrows, J. Howard and E. T. Bousfield, Bedford.—*8th June*, 1882.
2775. Opening Bottles, D. C. Berthon, London.—*13th June*, 1882.
3008. Telephonic Instruments, J. D. Husbands, London.—*24th June*, 1882.
3112. Removing Bronze, J. Bromley, Hunslet.—*1st July*, 1882.
3126. Side Saddles, G. T. Jenkins, London.—*3rd July*, 1882.

Last day for filing opposition, 15th August, 1882.

1260. Stamping Matrixes, E. A. Brydges, Upton.—A com. from H. Hagemann.—*15th March*, 1882.
1341. Thrust Bearings, J. Wills, Leicester.—*20th March*, 1882.
1347. Electromotors, S. E. Phillips, Charlton.—A com. from W. C. Johnson.—*20th March*, 1882.
1351. Scaffold Binding, J. Rettie, London.—*20th March*, 1882.
1352. Money Receivers, H. T. Davis, Newington.—*20th March*, 1882.
1354. Treating Flour, F. H. F. Engel, Hamburg.—A communication from F. Lange.—*20th March*, 1882.
1357. Securing Door Knobs, J. Thom, Wolverhampton.—*21st March*, 1882.
1366. Working Telegraphs, A. E. Dolbear, London.—*21st March*, 1882.
1367. Circuit Connections, A. E. Dolbear, London.—*21st March*, 1882.
1368. Electrical Cables, A. E. Dolbear, London.—*21st March*, 1882.
1380. Raising Water, B. J. B. Mills, London.—A communication from J. Fangeat.—*22nd March*, 1882.
1384. Tip Wagons, W. Marche, London.—*22nd March*, 1882.
1389. Filtering Liquids, F. A. Bonnefin, London.—*22nd March*, 1882.
1391. Preparing Tablets, F. Rath, London.—A communication from M. Komáromy.—*22nd March*, 1882.
1392. Electric Lamps, D. Graham and H. J. Smith, Glasgow.—*22nd March*, 1882.
1397. Flower-pot Stand, J. F. Grimmo, Leyton.—*22nd March*, 1882.
1398. Crimping Machine, H. Lake, London.—A com. from G. Lenormand-Carpentier.—*22nd March*, 1882.
1407. Preventing Overwinding, W. T. Lewis, Aberdare, and W. H. Massey, Henley-on-Thames.—*23rd March*, 1882.
1417. Excavating, W. Smith, Aberdeen.—*24th March*, 1882.
1424. Trimming Machines, W. R. Lake, London.—A communication from the Tyler Manufacturing Company.—*24th March*, 1882.
1425. Velocipedes, A. Pengelly and R. Day, Highbridge.—*24th March*, 1882.
1429. Raising Acids, C. T. Wordsworth, Leeds, and J. Wolstenholme, Radcliffe.—*24th March*, 1882.
1434. Sewers, E. G. Banner, London.—*24th March*, 1882.
1440. Spreading Manure, R. C. Garvie and H. Skinner, Aberdeen.—*25th March*, 1882.
1454. Raising Water, G. Macaulay-Cruikshank, Glasgow.—A communication from M. E. B. du Marais and P. D. de la Grée.—*27th March*, 1882.
1511. Breech-loading Small-arms, T. W. Webley, Birmingham.—*29th March*, 1882.
1541. Coal Gas, J. A. Kendall, London.—*30th March*, 1882.
1638. Armoured Vessels, J. H. Johnson, London.—A communication from N. B. Clark.—*4th April*, 1882.
1649. Underground Conduits, A. J. Boult, London.—A com. from J. D. Thomas.—*5th April*, 1882.
1656. Wagons, H. J. Barrett, Kingston-upon-Hull.—*5th April*, 1882.
1748. Railway Brakes, F. W. Eames, Leeds.—*12th April*, 1882.
1754. Ignition Apparatus, F. Anderson and F. W. Crossley, Manchester.—*13th April*, 1882.
1864. Transmitting Motion, A. M. Clark, London.—A communication from A. Samper.—*18th April*, 1882.
1868. Gas Engines, H. A. Dufrené, London.—A com. from L. Bénier and A. Lamart.—*19th April*, 1882.
1913. Treating Ores, A. M. Clark, London.—A communication from A. M. G. Sébillot.—*21st April*, 1882.
1925. Treating Fabrics, J. Tuffnell, Manchester.—*22nd April*, 1882.
1929. Socket Slides, W. Randall, Birmingham.—*22nd April*, 1882.
2032. Locks, A. M. Clark, London.—A communication from A. Parise and C. Elandin.—*29th April*, 1882.
2196. Winding Cotton, H. C. Hill and H. H. Brown, Stalybridge.—*10th May*, 1882.
2227. Railway Brakes, F. W. Eames, Leeds.—*11th May*, 1882.
2466. Telegraphic Apparatus, W. R. Lake, London.—A com. from F. van Rysselberghe.—*24th May*, 1882.
2584. Starting Sewing Machines, A. D. Pentz, Glasgow.—*1st June*, 1882.
2588. Combination Garment, F. W. Brewster, Westminster.—*1st June*, 1882.
2903. Measuring Cloth, C. and A. Edmeston.—*20th June*, 1882.
2968. Propelling Vessels, W. C. Cowie, London.—*22nd June*, 1882.
2973. Ventilators, R. Boyle, London.—*22nd June*, 1882.
2978. Gas, G. W. and E. H. Stevenson, London.—*23rd June*, 1882.
3021. Detaching Hooks, J. King, Pinxton.—*27th June*, 1882.
3041. Stoppers for Bottles, W. Froggatt, Nottingham.—*28th June*, 1882.
3049. Artificial Stone, R. Searle, Hackney.—*28th June*, 1882.
3093. Ploughs, J. Howard and E. T. Bousfield, Bedford.—*30th June*, 1882.
3135. Preparing Jelly, L. Hoff, London.—*3rd July*, 1882.
3172. Voltaic Batteries, J. Imray, London.—A communication from P. Jablochkoff.—*5th July*, 1882.
3183. Preparing Cotton, A. M. Clark, London.—A communication from G. A. Risler—*5th July*, 1882.
3291. Musical Instruments, G. Downing, London.—A communication from M. Gally.—*11th July*, 1882.
3292. Fire-boxes, W. R. Lake, London.—A communication from R. L. Walker.—*11th July*, 1882.
3315. Coating Wire, W. R. Lake, London.—A communication from T. Wallace.—*12th July*, 1882.
3319. Treating Hides, W. R. Lake, London.—A com. from J. Rowe, jun., & C. Perkins.—*12th July*, 1882.
3443. Medical Battery, W. R. Warren, Brooklyn.—A communication from G. M. Hopkins.—*20th July*, 1882.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the 21st July*, 1882.)

227. Rangefinder, G. W. Hart, Portsea.—*17th January*, 1882.
341. Hand Stamps, G. K. Cooke, London.—*23rd January*, 1882.
351. Flushing Tanks, J. Holroyd, Leeds.—*24th January*, 1882.
356. Arresting Progress of Ships, A. W. L. Reddie, London.—*24th January*, 1882.
360. Supporting Devices, W. R. Lake, London.—*24th January*, 1882.
362. Gas Engines, F. W. Turner, St. Albans.—*24th January*, 1882.
364. Tablets, W. Carter, Buckhurst Hill.—*24th January*, 1882.
371. Printing Machines, T. G. and J. Dawson, Otley.—*25th January*, 1882.
375. Cattle Food, C. D. Abel, London.—*25th January*, 1882.
377. Electric Lamps, C. T. Bright, London.—*25th January*, 1882.
404. Glass Bottles, T. Wood, Portobello.—*26th January*, 1882.
431. Automatic Lathes, F. Wirth, Frankfort-on-the Main.—*27th January*, 1882.
450. Roughing Horseshoes, H. Turner and E. Price, jun., Birmingham, and H. Olver, Tamworth.—*28th January*, 1882.
483. Liquor Stands, W. Edge, Birmingham.—*31st January*, 1882.
487. Beating Apparatus, W. R. Lake, London.—*31st January*, 1882.
492. Looms, R. S. and E. Collinge, Oldham.—*1st February*, 1882.
495. Sawing Wood, J. Smith, Rochdale.—*1st February*, 1882.
510. Pulling Boots from Lasts, G. Jenkins, Kingswood.—*2nd February*, 1882.
516. Springs, F. Wirth, Frankfort-on-the-Main.—*2nd February*, 1882.
521. Making Cigarettes, R. Wallwork, Manchester.—*3rd February*, 1882.
579. Gas Engines, J. H. Johnson, London.—*7th February*, 1882.
599. Railway Signals, A. Gough, Buckingham.—*7th February*, 1882.
653. Bleaching Compounds, J. Young, Kelly.—*10th February*, 1882.
669. Purifying Alcohol, P. Claes, Brussels.—*11th February*, 1882.
909. Hats, &c., H. Orth, Washington.—*24th February*, 1882.
925. Earth-closets, W. H. Lascelles, London.—*25th February*, 1882.
979. Washing Coal, H. J. Allison, London.—*28th February*, 1882.
983. Washing Machines, J. and W. McNaught, Rochdale.—*1st March*, 1881.
1431. Grinding Copper Plates, T. Smith, Stoke-on-Trent.—*24th March*, 1882.
1531. Glove Fasteners, J. W. Pritchett, Clapton.—*26th March*, 1882.
1673. Circular Knitting, H. Barrett, Nottingham.—*6th April*, 1882.
2027. Fog Signals, T. Whittingham, Rugeley.—*28th April* 1882.
2083. Luggage Labels, C. Keith, Inverness.—*3rd May*, 1882.
2100. Punching Holes, J. Westwood and R. Baillie, Poplar.—*4th May*, 1882.
2145. Cabinets or Cases, A. Black, Paisley.—*6th May*, 1882.
2165. Programme Holders, F. Steitz, London.—*9th May*, 1882.
2178. Colouring Matters, J. A. Dixon, Glasgow.—*9th May*, 1882.
2249. Colouring Matters, J. Erskine, Glasgow.—*12th May*, 1882.
2264. Engraving Copper, T. R. Johnston, Edinburgh.—*13th May*, 1882.
2365. Ceilings, W. R. Lake, London.—*19th May*, 1882.

(*List of Letters Patent which passed the Great Seal on the 25th July*, 1882.)

250. Testing Liquids, H. J. Haddan, London.—*18th January*, 1882.
386. Cores for Cables, W. T. Henley, Plaistow.—*26th January*, 1882.
405. Dredging, C. J. Ball, London.—*26th January*, 1882.
407. Saving Life, W. Fewster, Margate.—*26th January*, 1882.
412. Attaching Buttons, L. A. W. Lund, London.—*27th January*, 1882.
427. Steam Boilers, P. Jensen, London.—*27th January*, 1882.
429. Feeding Wool, W. Cliffe and T. E. Ainley, Golcar, and J. Shaw, Huddersfield.—*27th January*, 1882.
430. Roving Machinery, W. R. Lake, London.—*27th January*, 1882.
432. Trimming Machinery, F. Myers, London.—*28th January*, 1882.
433. Cyanogen Compounds, L. Mond, Northwich.—*28th January*, 1882.
441. Electric Railways, C. F. Varley, Bexley Heath, and W. Judd, Penang.—*28th January*, 1882.
442. Nailing Machines, F. Myers, London.—*28th January*, 1882.
443. Opening Carriage Doors, G. V. Fosberry, Bitton.—*28th January*, 1882.
445. Firegrates, J. Jaffrey, Manchester.—*28th January*, 1882.
456. Crushing Machinery, R. E. Shill, East Dulwich.—*30th January*, 1882.
458. Getting Coal, M. Burnett, sen., and C. Burnett, Spennymoor.—*30th January*, 1882.
489. Electrical Batteries, G. Skrivanoff, London.—*31st January*, 1882.
496. Cartridges, C. S. Bailey, Waltham Abbey.—*1st February*, 1882.
508. Withdrawing Apparatus, F. E. Wood, Workington.—*2nd February*, 1882.
543. Throstle Frames, A. M. Fletcher, Oldham.—*4th February*, 1882.
584. Brake Blocks, J. Heald, Cardiff.—*7th February*, 1882.
595. Boilers, Z. Sugden and E. Bins, Halifax.—*7th February*, 1882.
612. Beverages, R. Carew, Watford.—*8th February*, 1882.
722. Furniture, J. W. Randall, Chatham.—*14th February*, 1882.
891. Projectiles, T. Nordenfeldt, London.—*23rd February*, 1882.
901. Treating Maize, A. G. Fraser, London.—*24th February*, 1882.
903. Boring Rock, G. F. Wynne, Minera.—*24th February*, 1882.
918. Ventilators, H. J. Haddan, London.—*25th February*, 1882.
975. Artificial Stone, J. R. Nottingham, Washington.—*28th February*, 1882.
989. Locking Devices, C. Bolle, Berlin.—*1st March*, 1882.
1027. Liquor Stands, J. Beresford, Birmingham.—*3rd March*, 1882.
1199. Electric Lamp, R. Kennedy, Glasgow.—*13th March*, 1882.
1365. Moving Rollers, F. Asthöwer and T. Bicheroux, Westphalia.—*21st March*, 1882.
1413. Umbrellas, J. Willis, Rosendale.—*23rd March*, 1882.
1426. Valves, W. Jones, Glasgow, and J. McLeod, Birkenhead.—*24th March*, 1882.
1640. Dynamo-electric Machine, R. Kennedy, Glasgow.—*4th April*, 1882.
1803. Incandescent Lamps, A. R. Leask, London.—*15th April*, 1882.
1891. Milling, A. J. Boult, London.—*20th April*, 1882.
2054. Roller Mills, J. A. A. Buchholz, Vauxhall.—*1st May*, 1882.
2177. Purifying Water, P. and F. M. Spence, Manchester.—*9th May*, 1882.
2214. Grinding Grain, W. Korth, Belfast.—*11th May*, 1882.
2216. Supplying Water, T. C. Summers, Portsea.—*11th May*, 1882.
2240. Locks, M. Gilmour, Paisley.—*11th May*, 1882.
2272. Stench Traps, J. M. Hale, London.—*15th May*, 1882.
2300. Preventing Passage of Heat, W. T. Whiteman, London.—*16th May*, 1882.
2479. Stoppers for Bottles, J. S. Davison, Sunderland.—*25th May*, 1882.
2531. Dynamo-electric Machines, W. R. Lake, London.—*27th May*, 1882.
2561. Scouring Leather, F. A. Lockwood, Boston, U.S.—*31st May*, 1882.
2563. Electric Lamps, W. R. Lake, London.—*31st May*, 1882.

List of Specifications published during the week ending July 22nd, 1882.

4679, 2d.; 4789, 2d.; 4791, 2d.; 4978, 2d.; 5062, 6d.; 5075, 6d.; 5232, 4d.; 5310, 6d.; 5402, 2d.; 5423, 4d.; 5424, 8d.; 5425, 6d.; 5426, 6d.; 5456, 8d.; 5465, 6d.; 5473, 4d.; 5493, 6d.; 5504, 8d.; 5519, 8d.; 5520, 6d.; 5533, 2d.; 5536, 6d.; 5538, 8d.; 5539, 6d.; 5542, 6d.; 5545, 2d.; 5546, 2d.; 5547, 2d.; 5549, 2d.; 5550, 6d.; 5553, 4d.; 5554, 6d.; 5555, 2d.; 5556, 6d.; 5557, 2d.; 5558, 4d.; 5559, 4d.; 5560, 2d.; 5561, 6d.; 5562, 6d.; 5564, 6d.; 5565, 2d.; 5566, 2d.; 5567, 6d.; 5568, 2d.; 5571, 6d.; 5572, 2d.; 5573, 8d.; 5574, 2d.; 5575, 8d.; 5576, 4d.; 5581, 2d.; 5582, 6d.; 5583, 2d.; 5585, 6d.; 5587, 6d.; 5588, 2d.; 5591, 6d.; 5592, 6d.; 5593, 6d.; 5595, 6d.; 5597, 4d.; 5598, 2d.; 5599, 2d.; 5603, 2d.; 5604, 6d.; 5605, 2d.; 5606, 2d.; 5607, 2d.; 5608, 6d.; 5609, 2d.; 5610, 2d.; 5612, 2d.; 5614, 8d.; 5615, 6d.; 5616, 6d.; 5617, 4d.; 5622, 6d.; 5623, 4d.; 5625, 6d.; 5627, 2d.; 5628, 10d.; 5631, 2d.; 5634, 2d.; 5635, 2d.; 5636, 6d.; 5637, 6d.; 5640, 10d.; 5641, 6d.; 5642, 6d.; 5643, 2d.; 5645, 6d.; 5646, 6d.; 5648, 8d.; 5650, 4d.; 5651, 6d.; 5652, 2d.; 5653, 2d.; 5657, 2d.; 5658, 6d.;

5659, 2d.; 5660, 6d.; 5661, 4d.; 5666, 2d.; 5667, 6d.; 5680, 6d.; 5697, 4d.; 5706, 6d.; 5707, 6d.; 2, 6d.; 12, 6d.; 35, 6d.; 649, 6d.; 1063, 6d.; 1343, 6d.; 1848, 4d.; 1932, 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.*

4679. LIFTING WATER, *J. H. Palmer, Aston.—26th October*, 1881.—(*Provisional protection not allowed.*) 2d.

This relates to the employment of a segment of a screw turning inside the cylinder.

4789. APPARATUS FOR HOLDING AND USING GUM, &c., *H. J. Haddan.—2nd November*, 1881.—(*A communication from A. Rittmeyer, Switzerland.*)—(*Provisional protection not allowed.*) 2d.

The apparatus is composed of a base-plate with a handle, a glass or other vessel, and an appliance for hanging the brush up.

4791. SECURING THE LEATHER TABS OF BRACE-ENDS, *G. C. Reddick, London.—2nd November*, 1881.—(*Provisional protection not allowed.*) 2d.

This relates to the employment of metal studs and eyelets.

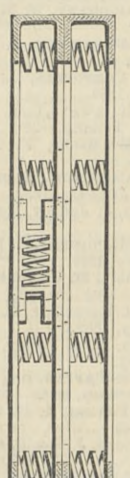
4973. INSTRUMENT FOR TESTING WINE, *H. J. Haddan, London.—14th November*, 1881.—(*A communication from A. C. Woschnagg, Vienna.*)—(*Provisional protection not allowed.*) 2d.

The invention consists of a liquid meter, without graduation, provided with a mark, said mark being determined by means of a solution of salt having a specific weight of 1·001 at a temperature of 15 deg. Cent., said specific weight being the least, genuine, pure wine can possess.

5062. PISTONS, &c., *J. Hopkinson, Sheffield.—9th November*, 1881. 6d.

The invention consists essentially in forming the piston ring or rings with an internal flange or internal flanges for the purpose of obtaining greater bearing surface on or against the piston block or block and cover, or covers, and in the arrangement of the spring or springs employed in combination therewith.

5062



In carrying the invention into effect two packing rings of L shape can be employed, so placed in the piston block as to form a trough, into which a series of helical or other shaped springs can be inserted for the purpose of tightening the flanges against the piston block or blocks and cover, and so make a steam-tight joint.

5075. SLASHERS OR SIZING MACHINES, *A. P. Dickinson and W. Rossetter, Blackburn.—10th November*, 1881. 6d.

The First part consists in an apparatus for pressing or levelling the yarn while being wound on the yarn beam. The second part consists in improvements in driving the side shaft, which communicates the slow motion to the sizing machine. The Third part consists in improved means of stopping the rotation of the yarn beam.

5232. PORTABLE HEATING APPARATUS, *W. Hutchinson, Clapton Park.—30th November*, 1881. 4d.

This relates to apparatus in which a spirit lamp is employed for warming coffee, &c.

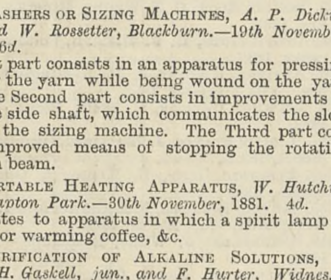
5310. PURIFICATION OF ALKALINE SOLUTIONS, *E. Carey, H. Gaskell, jun., and F. Hurter, Widnes.—5th December*, 1881. 6d.

The inventor claims the system or mode of purifying alkaline solutions by submitting the same to an elevated temperature, in order that the iron they contain may be separated therefrom.

5396. IMPROVEMENTS IN ELECTRIC LAMPS, *C. F. Varley, Bexley Heath, Kent, and F. H. Varley, Mildmay Park, Middlesex.—9th December*, 1881. 6d.

One method by which the inventors construct their lamp is shown in the figure. The upper carbon B is held in hollow cylinder A, being fed forward by spiral spring C or weight C¹; D D are roller clutch contacts by which the current is conveyed to carbon B; E is a swing arm which carries the lower carbon, this latter being fixed. To regulate the arc, regulators J

5396



are provided attached as shown to rods K and K², which run through coils L and L¹. One of these coils is in the main, the other in a shunt circuit. Coil L is constructed so as to counteract the influence of the main circuit coil L¹ when the resistance of the arc has arrived at the proper limits for obtaining the best light; K and K² are jointed to the balance arm K¹, so that when a current flows through L¹ by the circuit being completed through the carbons, K is drawn upwards, forcing K² downwards until J J are forced into the teeth of D D, forcing them back, and with them the upper carbon B, and so establishing the arc. Other methods of constructing the lamp are also described. The inventors claim the roller contact, swing arm, balance rods, and the use of a cylinder and piston with air checks to regulate the carbon feed; also the use of bi-carbonate of soda for coating reflectors, &c.

5402. PACKING MANUFACTURED TOBACCO, *O. W. T. Barnsdale, Nottingham.—10th December*, 1881.—(*Provisional protection not allowed.*) 2d.

This relates to the employment of an india-rubber tube for packing tobacco.

5423. LOOMS FOR WEAVING, *G. Geissler, Kirkburton.—12th December*, 1881. 4d.

This relates to the means or method employed to receive the shuttle when it is sent "home" into the shuttle-box, so as to lessen the concussion occasioned thereby.

5424. GAS STOVES, *E. A. Rippingille, Aston.—12th December*, 1881. 8d.

This relates to the construction of gas stoves for the purpose of effecting an economy in the consumption and more perfect combustion of gas.

5425. PRESERVING OR CURING MEAT, FISH, &c., *H. H. Lake, London.—12th December*, 1881.—(*A communication from A. Fowler, New York.*) 6d.

This relates to the process of preserving meat, &c., by subjecting it simultaneously to the action of salt, saltpetre, salycilic acid, or other suitable preservative substance or agent, and to the action of a current of electricity, the electricity acting simultaneously upon the preservative substance and upon the substance to be preserved.

5426. TWO-WHEELED CABS, &c., *A. Forder, Wolverhampton.—12th December*, 1881. 6d.

This relates to the general construction of the vehicle.

5456. ATMOSPHERIC AIR AND GAS MOTOR ENGINES, *H. Williams, Southport.—14th December*, 1881. 8d.

The invention relates to, First, a system or method of igniting the combustible charge in the cylinder or cylinders of air and gas motor engines; Secondly, a novel construction and arrangement of slide valve for supplying combustible fluid to air and gas motor engines and igniting such fluid; Thirdly, a mechanical motion for actuating the air and gas admission and

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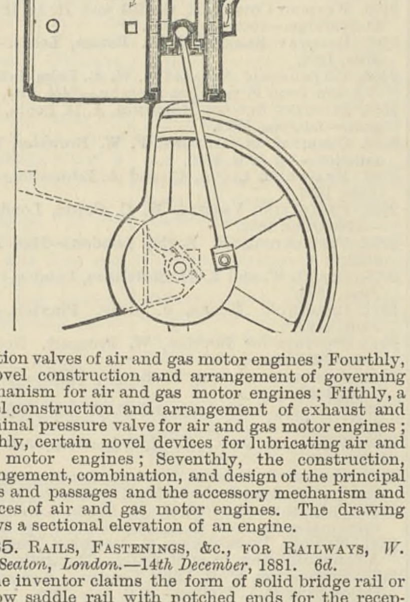


ignition valves of air and gas motor engines; Fourthly, a novel construction and arrangement of governing mechanism for air and gas motor engines; Fifthly, a novel construction and arrangement of exhaust and terminal pressure valve for air and gas motor engines; Sixthly, certain novel devices for lubricating air and gas motor engines; Seventhly, the construction, arrangement, combination, and design of the principal parts and passages and the accessory mechanism and devices of air and gas motor engines. The drawing shows a sectional elevation of an engine.

5465. RAILS, FASTENINGS, &c., FOR RAILWAYS, *W. Seaton, London.—14th December*, 1881. 6d.

The inventor claims the form of solid bridge rail or hollow saddle rail with notched ends for the reception of metal key or keys in combination with, for the purpose of steadying, securing, and fastening the rails, horizontal longitudinal plates or fastenings with curved ends and fang-headed bolts secured or countersunk into the bottom of the sleepers, into which a twin nut-headed screw bolt enters after first passing through the longitudinal plates or fastenings of the rails and the sleepers, by which all the parts can be screwed tightly together, and the rails so jointed together obtain the solidity of a continuous rail.

5473. OPENING AND CLOSING TAPS, *T. G. Sharpe, Huddersfield.—14th December*, 1881. 4d.

This refers to gas taps, and its object is to open taps and partially close them again in a safe and easy manner, and leaves a small light burning.

5493. MAKING BUTTON-HOLES, &c., *A. Helwig and J. Dewdney, London.—15th December*, 1881. 6d.

This relates to the use in combination of a die or cutter and cutter block for cutting the hole, sewing mechanism for sewing the edges of the hole, and a travelling clip or holder that holds the material during the cutting and sewing operations.

5504. LOCKS OF FIRE-ARMS, *E. Bled and E. Richoux, Paris, and J. Warnant, Liege.—16th December*, 1881. 8d.

This refers especially to the locks of revolving fire-arms.

5513. MANUFACTURE OF LONG LENGTHS OF COILED WIRE OR SPIRAL SPRING, *J. Hodson, St. Helens, Lancaster.—16th December*, 1881. 6d.

This consists in the manufacture of long hollow lengths of coiled wire, in causing the drum or bobbin of feed wire to rotate round a short mandrel, or the short mandrel to rotate on its axis while the feed wire drum remains stationary in position, so that the wire shall be continuously coiled on the short mandrel, and bringing the coiled wire to a receiving drum having the same relative speed of rotation, if any, round the axis of the mandrel, so that no twisting or untwisting action shall take place between the mandrel and the drum receiving the coiled wire.

5514. DRIVING TRICYCLES, &c., *W. P. Thompson, Liverpool.—16th December*, 1881.—(*A communication from N. Merrill, New York.*) 6d.

The invention consists in combining with the action of a tricycle or bicycle, or the shaft of a motor, two pedal cranks disposed at an angle with each other of about 120 degrees, and a shorter double crank or a pair of cranks formed to project from the axle or shaft at an angle with the pedal cranks of about 120 degrees, the short double crank being coupled by pitmans or connecting rods with vibrating levers carrying a seat or support for the person operating the machine.

5515. TRAPS FOR SEWERS AND DRAINS, *J. D. Taylor, Halifax.—16th December*, 1881.—(*A communication from W. D. Taylor, Philadelphia, U.S.*)—(*Not proceeded with.*) 2d.

The object is the construction and the employment of mercury in such manner as to entirely prevent the passage of noxious gases from sewers into rooms or streets.

5516. APPARATUS FOR THE USE OF POLICEMEN IN TAKING A PRISONER, &c., *F. Macpherson, Manchester.—16th December*, 1881.—(*Not proceeded with.*) 2d.

This relates to the employment of a ring, round the edges of which a bag is secured. The ring is thrust over the head and secured by springs, the bags serving to blindfold the prisoner.

5519. MECHANICAL PENS FOR PERFORATING, WRITING, DRAWING, &c., *J. H. Johnson, London.—16th December*, 1881.—(*A communication from I. Henestrosa, Paris.*) 8d.

This relates to pens provided with a reciprocating pricker or device for producing perforations, indentations, or marks, and to apparatus for supporting and operating the same.

5520. LOCKS OF FIRE-ARMS, *E. Bled and E. Richoux, Paris, and J. Warnant, Liege.—16th December*, 1881. 6d.

This relates to the general construction of the locks of fire-arms, but specially to revolvers.

5521. IMPROVEMENTS IN SECONDARY OR POLARISATION BATTERIES, &c., *G. Grout and W. H. Jones, Hornsey, Middlesex.—17th December*, 1881. 4d.

The inventors take flour or other vegetable or carbonaceous substances reduced to a powder, and intimately mix it with the oxide or a salt of lead or other metal, and add a sufficient quantity of water, syrup, or other liquid to make it into a plastic mass fit for moulding; the moulded material may then be dried or not before being placed in a closed vessel surrounded with powdered carbon or other substance capable of preventing direct contact with the atmosphere. It is then exposed to a gentle red heat for a sufficient time to carbonise the organic matter with which the oxide is combined, and reduce the oxide to the metallic state within the pores of the carbon. Rods of lead may be inserted before carbonising for affixing the terminals to. A Second portion of the invention consists in taking a combination of lead in sheet or other form, and heaping or piling round it lead mechanically reduced to a dusty or granular state.

5522. OBTAINING VITRIFIABLE MONOCHROME OR POLYCHROME PHOTOGRAPHS, *H. A. Bonneville, London.—17th December*, 1881.—(*A communication from M. G. Wolff, Paris.*)—(*Not proceeded with.*) 2d.

This relates to the compositions for preparing the paper.

5523. SEPARATING AMMONIA FROM BLAST FURNACE AND OTHER GASES, &c., *G. Chapman, Glasgow.—17th December*, 1881. 6d.

The object is to utilise the ammonia existing in blast furnace and other gases or vapours, by separating it by simple apparatus, and it consists in causing the gases to pass through a chamber containing perforated diaphragms, discs, or screens, kept constantly wetted with a solution of sulphuric or other suitable acid.

5526. PLASTIC COMPOSITIONS FOR FIRE-RESISTING PURPOSES, *T. Fletcher, Warrington.—17th December*, 1881.—(*Not proceeded with.*) 2d.

This consists preferably of a mixture of a solution of the silicate of soda of commerce or silicate of potash with ordinary fireclay, ganister, or other fire-resisting material.

5527. COCKS OR VALVES, *J. C. Millard, London.—17th December*, 1881.—(*Not proceeded with.*) 2d.

This relates to a means of preventing waste of water supplied to cisterns, and also to prevent the clogging of the cock or valve by the passage of any solid material.

5528. GAS GLOBE GALLERIES, *J. Challender, Manchester.—17th December*, 1881.—(*Not proceeded with.*) 2d.

This relates to galleries which are intended to be adjustable without the use of screws.

5529. RAISING SUNKEN VESSELS, *R. Hodgson, London.—17th December*, 1881.—(*Not proceeded with.*) 2d.

This relates to the construction of the air chambers or pontoons, by which the raising of the sunken vessel is to be effected.

5530. STERN-POSTS, &c., OF SCREW-PROPELLER STEAM VESSELS, *E. Hayes, Stony Stratford.—17th December*, 1881. 6d.

This consists in a stern-post perforated with peculiarly-formed and arranged apertures, slots, or passages for the entrance and exit of the water, which apertures are connected by a circulating pipe or pipes with the condenser or other apparatus or portion of the vessel.

5531. FLYERS FOR SPINNING FIBRES, *S. Ingham, Luddenden.—17th December*, 1881. 6d.

This consists of a wharve having enlarged disc or head, to which the arms or legs of the flyer are attached, the upper ends of the said arms or legs being coupled or connected by means of a jointed or hinged piece attached to one leg and extending to and over the top of the spindle, and harped or catching upon the end of the other leg.

5533. DRAWING WATER FROM A ROAD TO A GUTTER, *J. C. Bothams, Fisherton, Anger, Wilts.—17th December*, 1881.—(*Provisional protection not allowed.*) 2d.

This relates to the employment of an implement or apparatus to form in the mud, on the surface of the road, cross ruts, or channels, across the direction of the road towards the gutter.

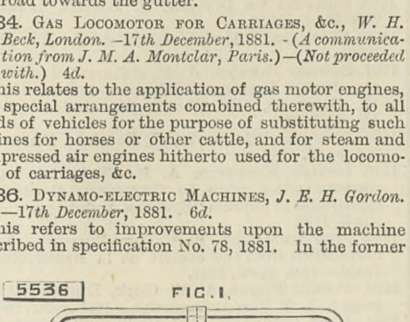
5534. GAS LOCOMOTOR FOR CARRIAGES, &c., *W. H. Beck, London.—17th December*, 1881.—(*A communication from J. M. A. Montclar, Paris.*)—(*Not proceeded with.*) 4d.

This relates to the application of gas motor engines, and special arrangements combined therewith, to all kinds of vehicles for the purpose of substituting such engines for horses or other cattle, and for steam and compressed air engines hitherto used for the locomotion of carriages, &c.

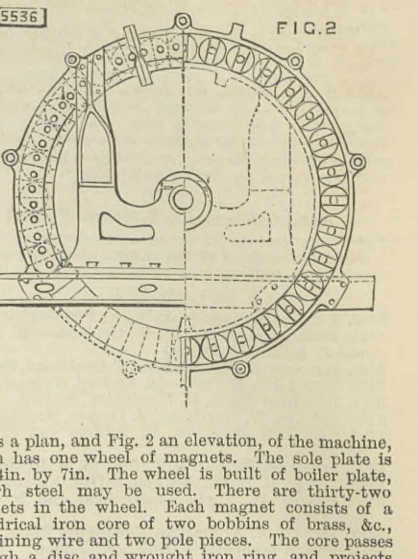
5536. DYNAMO-ELECTRIC MACHINES, *J. E. H. Gordon.—17th December*, 1881. 6d.

This refers to improvements upon the machine described in specification No. 78, 1881. In the former machine inductive action interfered with economical working. In it the number of armature and magnet coils was equal, in the new machine the armature coils are double in number as regards the magnet coils. The fixed coils may be made wedge-shaped to get more wire on the machine and economise space. Fig. 1 shows a plan, and Fig. 2 an elevation, of the machine, which has one wheel of magnets. The sole plate is 13ft. 4in. by 7in. The wheel is built of boiler plate, though steel may be used. There are thirty-two magnets in the wheel. Each magnet consists of a cylindrical iron core of two bobbins of brass, &c., containing wire and two pole pieces. The core passes through a disc and wrought iron ring, and projects equally on either side. The bobbins are slipped on and fixed by the pole pieces. The number of forced coils is sixty-four, fixed to each ring, so that the sixty-four poles facing the magnet wheel are acted on by the thirty-two magnet poles facing them.

5536 FIG. 1.



5536 FIG. 2



5535. MACHINERY FOR SPINNING FIBRES, *C. Morley and H. Jagger, Halifax.—17th December*, 1881.—(*Not proceeded with.*) 2d.

The machines are so constructed that when stopping the machine the action of the drawing rollers is suspended a little time before the spindle ceases to rotate, so that the latter will sufficiently "twist" the length of yarn between the flyer and the drawing rollers, and this sufficiently twisted portion of yarn will resist the strain on restarting the machine, and breakages are avoided, and the snarls usually made or resulting from the stoppage of the machinery are drawn out again and wound on the bobbin.

5537. BREECH-LOADING GUNS, &c., *J. Nordenfelt, London.—17th December*, 1881. 6d.

This relates, First, to the method of securing the breech; Secondly, to the means of preventing premature firing; Thirdly, to the means of operating the breech-block and firing mechanism; Fourthly, to the method of connecting the projectile and powder bag; Fifthly, to the construction of dummy or practice ammunition.

5538. BREECH-LOADING FIRE-ARMS, &c., *T. Nordenfelt, London.—17th December*, 1881. 8d.

The chief objects of the improvements in breech-loading fire-arms, and more especially in single-barrel guns are to make the mechanism specially strong to make it safer, so that the gun cannot be discharged before the breech is closed, either by accidentally touching the trigger or by the breakage of any part of the firing needle, and also to increase the rapidity of fire by supplying cartridges for the mechanism out of a self-acting magazine.

5539. BREECH-LOADING FIRE-ARMS, &c., *T. Nordenfelt, London.—17th December*, 1881. 6d.

The object of this invention is to make a strong mechanism and carriage for a quick-firing gun.

5540. SLIDE RULES, &c., *J. H. Thomson, Shoeburyness.—17th December*, 1881. 2d.

One scale of the slide rule is so divided that the distances from a fixed point are proportional to the logarithm of the number marked on the scale. The other scale, which moves in contact with this, is a logarithmic scale, divided similarly to an ordinary slide rule.

5541. TIP VANS OR WAGONS, *W. Bowen, Southwark.—17th December*, 1881. 6d.

This relates to the tipping van or wagon, in which the body tips or works on hinges fixed directly beneath to its underside, and to a main or bed frame.

5542. AN IMPROVED GALVANIC BATTERY, *W. R. Lake, London.—17th December*, 1881.—(*A communication from La Société Universelle d'Electricité Tommasi, Paris.*) 6d.

This consists in improvements on the Daniell cell as follow:—The zinc and copper are in form of wires from five to seven millimetres in diameter, twisted spirally, or arranged in parallel lines joined by curves. One end of each of these wires protrudes for use as a terminal. The porous cell is replaced by a sheet of parchment or dialised paper arranged horizontally, and the edges of which are plaited or folded and rise above the level of the liquid. The arrangement of the cell is, first, sulphate of copper crystals, then copper wire, then parchment paper, in the interior of which is arranged a circular piece of cord, on which is placed the zinc coil. The vessel is then filled with dilute sulphuric acid.

5544. TREATING ALKALINE LIME MUD, *J. Simpson, Liverpool, and E. W. Parnell, Widnes.—19th December*, 1881. 6d.

Steam is caused to pass down through alkaline lime mud, so as to consolidate the said mud and remove the alkali and moisture. The lime mud during treatment rests on a filter bed, and the steam is passed therethrough at a pressure suitable to the thickness of the mass under treatment. The temperature may be raised by superheating.

5545. LAING'S OVERHEAD SEWING MACHINE, *J. Graham, Dundee.—19th December*, 1881.—(*Not proceeded with.*) 2d.

This relates to details connected with the part of such machines which is known as the thread barrel.

5546. SOFTENING HARD YARN, &c., *L. A. Groth, London.—19th December*, 1881.—(*A communication from J. Balster, Chemnitz.*—*Not proceeded with.*) 2d.

The object is to effect the softening of the yarn in a quicker, safer, and more regular manner than heretofore.

5547. CUTTING THE LEAVES OF STITCHED BOOKS, *L. A. Groth, London.—19th December*, 1881.—(*A communication from R. Söderstrom, Sweden.*—(*Not proceeded with.*) 2d.

Two posts or standards are connected together by a guide and base plate. On the guide is mounted a movable slide, to which is fixed a cutting instrument, consisting of a round sharp-edged knife or plate.

5548. VACUUM PUMPS, *L. A. Groth, London.—19th December*, 1881.—(*A communication from H. Goebel and J. W. Kulenkamp, New York.*) 6d.

This relates to the combination of a Geissler vacuum pump, having a discharge valve at the upper part and an evacuating tube connected thereto below the valve, with an oscillating supporting frame and a vertically movable mercury reservoir.

5549. THROWING DICE, *A. G. Labottière, London.—19th December*, 1881.—(*Not proceeded with.*) 2d.

This relates to dice boxes in which the dice are thrown upwards by means of a spring.

5550. ODOMETERS AND REGISTERS, *W. P. Thompson, London.—19th December*, 1881.—(*A communication from P. E. McDonnell, Chicago.*) 6d.

This relates to the general construction of odometers or registers for recording the number of revolutions or miles.

5553. PACKING FOR STEAM ENGINES, *J. H. Chapman, Forest-gate, and R. H. Harper, London.—19th December*, 1881. 4*d*.

This consists in the forming of tubular or hollow packing with holes, perforations, or apertures in the same.

5554. FASTENING, RELEASING, AND PREVENTING THE RATTLING OF WINDOW SASHES, *B. C. Cross, Dewsbury.—19th December*, 1881. 6*d*.

The inventor claims the combination of a plate fixed to the window frame, and carrying a spring or hinged plate having a knob or projection, a sliding bar working in guides, and regulating the position of the knob or projection, springs or a weight drawing up the sliding bar, and the holes in the edge of the window sash.

5555. FILLING VESSELS WITH LIQUIDS, *E. Rouse, Manchester.—19th December*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to an apparatus for filling vessels with liquids in such a manner as to provide an automatic stopping of the flow of such liquids when the vessel has become filled.

5556. TRAMWAYS, *R. S. Cunningham, C. A. F. Vinkeles-Houssart, and W. May, London.—19th December*, 1881. 6*d*.

This relates to constructing tramrails in two parts, the one consisting of the head and vertical rib, and the other formed of a tee iron inverted, the vertical ribs of the two parts abutting edge to edge.

5557. CHEQUES, &c., *A. W. P. Reddie, London.—19th December*, 1881.—(*A communication from M. F. Berry, Brooklyn.*—(*Provisional protection not allowed.*) 2*d*.

This relates to means of preventing the fraudulent alteration of cheques.

5558. CRANK SHAFTS, *J. Dickinson, Sunderland.—19th December*, 1881. 4*d*.

The invention consists in the construction of crank shafts with each crank pin D cast in one piece with its crank arms C and with a recess made in the outer side

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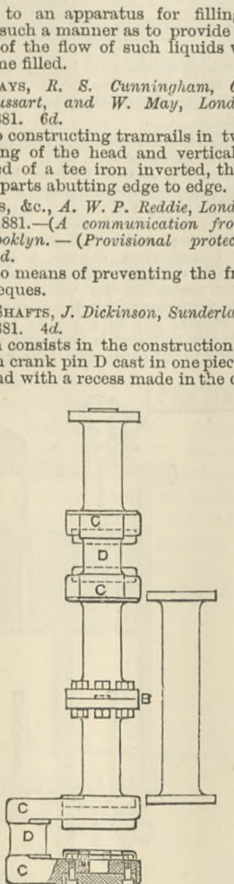

of each arm for disc enlargements or couplings B at the ends of the lengths of shaft to enter and fit into, such disc enlargements or couplings being secured by bolts to the crank arms.

5559. RENDERING FABRICS AND OTHER MATERIALS WATER REPELLENT, &c., *C. B. Warner, London.—19th December*, 1881.—(*Partly a communication from L. P. Britt, New York.*)—(*Void.*) 4*d*.

This relates to the chemical treatment of the materials.

5560. PRODUCTION OF YEAST FOR BAKING PURPOSES, *E. A. Brock, Stratford.—19th December*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to the process and apparatus for producing yeast.

5561. APPARATUS FOR INCREASING THE HEATING EFFECT OF STEAM BOILER AND OTHER FURNACES, &c., *E. Fair, San Francisco.—19th December*, 1881. 6*d*.

This relates to steam boiler furnaces or other furnaces where superheated steam may be introduced to the frame or most intense heat of the furnace and decomposed, thus liberating the hydrogen and allowing it to come in contact with the waste carbon contained in the smoke as the result of imperfect combustion. The combustion is further augmented by the heated air from air tubes being thrown in at the same point, thereby rendering the combustion complete, and utilising the product of the same to a far greater degree than by any of the methods heretofore known.

5562. MACHINES FOR SEPARATING, CLEANING, AND DECORTICATING GRAIN OR SEED, *W. Burley and J. H. Morgan, Kent.—19th December*, 1881. 6*d*.

This relates to a machine in which a series of blades or vanes mounted adjustably or otherwise upon a shaft or column within a cylinder or casing are so arranged and operated that by their rotation they effect the decortication of the grain or seed.

5564 REVOLVING FIRE-ARMS, *W. Stringfellow, Essex.—20th December*, 1881. 6*d*.

This consists essentially in the combination of a horizontally revolving disc containing the radial chambers for the cartridges, and mounted on a sliding frame with the firing, revolving, locking, and releasing actions.

5565. FLESHING, CUTTING DOWN, SHAVING, AND FINISHING SEALSKINS, &c., *T. H. Potter and G. Rice.—20th December*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to the employment of a cylinder which is covered with emery, emery cloth, powdered glass, or wired leather, or cloth commonly known as carding cloth.

5567. MANUFACTURE OF ELASTIC METAL BANDS TO BE USED AS BRACELETS, &c., *B. W. Fase, London.—20th December*, 1881. 6*d*.

This relates to the manufacture of elastic metal bands from hammered strips of metal.

5568. LOCOMOTIVE AND OTHER STEAM BOILERS, *J. Dickson, jun., Liverpool.—20th December*, 1881.—(*Not proceeded with.*) 2*d*.

A valve is inserted in the exhaust steam pipe for the purpose of splitting up the steam passing to the nozzle of the blast pipe, and directing the whole or a portion of the exhaust steam into a branch pipe out of he exhaust steam pipe leading to a hollow superheating pan under the fire-box. This pan consists of a box with metal sides and bottom, and the top is preferably made of fire-clay or other material which will resist intense heat. On the top is placed the fire.

5571. FLOOR COVERINGS, *A. M. Clark, London.—20th December*, 1881.—(*A communication from C. T. and V. E. Meyer, Jersey City, U.S.*) 6*d*.

The invention consists in a floor covering made of a fabric covered with a coating of a mixture of ground leather or analogous fibre with mineral fibre, and a binding material such as hard varnish. It further consists in a floor covering made of a fabric covered with a coating or mixture of ground wood or other vegetable fibre, either plain or dyed, with mineral fibre and a binding material, such as a copal or other varnish.

5572. ADJUSTABLE SUPPORTS FOR SMALL LOOKING GLASSES, &c., *E. A. Brydges, Berlin.—20th December*, 1881.—(*A communication from N. Wiederer, Bavaria.*)—(*Not proceeded with.*) 2*d*.

The object is to construct the support or stay in such a manner that the looking-glass, photograph frame, or other article is held in any desired position, and so that the same acts likewise as handle to the said article.

5573. IMPROVEMENTS IN AND RELATING TO TELEPHONES AND TELEGRAPHS, *W. R. Lake, London.—20th December*, 1881.—(*A communication from J. H. Rogers, Washington, U.S.*) 8*d*.

The object of this invention is to enable messages to be sent secretly, and consists in the employment of two or more circuits, so that anyone tapping one circuit would only obtain confused and unintelligible signals. The inventor causes the message to pass through the two circuits alternately in rapid succession. The current conveying the signals is thrown first into one and then into the other circuit in regular alternation, by means of a circuit-breaker; so that anyone tapping the one circuit would only obtain confused signals. The inventor also describes apparatus for the transmission and reception of signals on this plan.

5574. MANUFACTURE OF FUEL BLOCKS FROM SLACK, &c., *J. Imray, London.—20th December*, 1881.—(*A communication from G. S. Page, Stanley, U.S.*)—(*Not proceeded with.*) 2*d*.

The invention consists in the manufacture of fuel from the waste slack or culm of bituminous or semi-bituminous or other coking coal by coking the same at the mines, then crushing or grinding and mixing it with about equal proportions of raw coal dust or culm of any kind of coal, with the addition of enough pitch to cause the mass to adhere and be formed into convenient-sized bricks or blocks.

5575. TRAMWAY LOCOMOTIVES, &c., *J. Quick and J. Quick, jun.—20th December*, 1881. 8*d*.

This consists essentially in the combination in a locomotive engine, of a gas reservoir, gas engine, and frictional clutching arrangements, through which to drive the wheels, such combination admitting of the gas engine being maintained at a constant or nearly constant speed, whether the locomotive be running or at rest or starting or stopping.

5576. HEADS AND GRATINGS FOR AIR INLETS, &c., OF SOIL PIPES AND DRAINS, *H. S. Cregeen, Bromley.—20th December*, 1881. 4*d*.

This relates to the form of the heads and gratings for air inlets and for outlets used for the aëration and ventilation of soil pipes and drains.

5581. SEWING MACHINES, *N. Wilson, London.—20th December*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to improvements applicable chiefly to the class of sewing machines used in making the ordinary hand or running stitch, and which machines are also capable of being used for gathering purposes for making gathered or fulled trimmings.

5582. TIPPING WAGONS OR TRUCKS, *H. Grafton, London.—21st December*, 1881. 6*d*.

The object is to enable the truck to be tipped at either side (or end, as the case may be) and to give to the truck body a movement of translation bodily in the direction in which it is to be tipped, as well as an oscillating or tipping movement, whereby to enable it to discharge its load quite clear of the rails to a distance greater than is possible with an ordinary pivotted truck of the same height and form of body.

5583. PRODUCTION, TRANSMISSION, AND DISTRIBUTION OF NATURAL FORCES BY COMPRESSED AIR, *W. E. Gedge, London.—21st December*, 1881.—(*A communication from E. L. Champin, Lyons.*—(*Provisional protection not allowed.*) 2*d*.

The object is the distant transmission and distribution of natural forces, such as waterfalls, &c.

5585. APPARATUS FOR REGULATING THE TRANSMISSION OF MOTIVE POWER, *H. J. Haddan, Kensington.—21st December*, 1881.—(*A communication from B. Roussille, Saverdun, France.*) 6*d*.

The object is to regulate the transmission of power to machines, and it consists chiefly of an escapement wheel and pawl made to gear into the said wheel by a spring, when the latter is not set out of action by an excess of force.

5587. CONSTRUCTION AND MANUFACTURE OF BARBED FENCE WIRE, *E. G. Brewer, London.—21st December*, 1881.—(*T. H. Dodge and C. G. Washburn, Worcester, U.S.*) 6*d*.

This relates to the process of manufacturing four-pointed barbed wire.

5588. APPARATUS FOR TRANSMITTING AND INCREASING THE POWER OF MOTORS, *E. G. Brewer, London.—21st December*, 1881.—(*A communication from G. Grange, Paris.*)—(*Not proceeded with.*) 2*d*.

This relates to gearing for transmitting power from one shaft to another.

5591. CLARIFYING LIQUIDS, *C. N. Roeckner, Newcastle-on-Tyne.—21st December*, 1881. 6*d*.

This consists in gradually forcing liquids (such as sewage, mill refuse, or any liquid requiring clarification in large quantities) upward in a vessel of large area to such heights that sufficient time is allowed for the sediments to fall down before the liquids are discharged.

5592. ENDLESS OR BAND SAWS, *J. H. Johnson, London.—21st December*, 1881.—(*A communication from H. Tuysuzian, Paris.*) 6*d*.

This consists in cutting a band or endless saw and hooking or joining together the two ends in such a manner as to restore it to the form of an endless saw.

5593. IMPROVEMENTS IN DYNAMO-ELECTRIC MACHINES, *L. S. Powell, Notting-hill, Middlesex.—21st December*, 1881.—(*A communication from J. M. A. Gérard-Lescuyer, Paris.*) 6*d*.

This dynamo machine is constructed with a movable inductor formed by a wheel of brass or gun-metal keyed on a shaft. Straight electro-magnets are arranged on the circumference of this wheel so as to present

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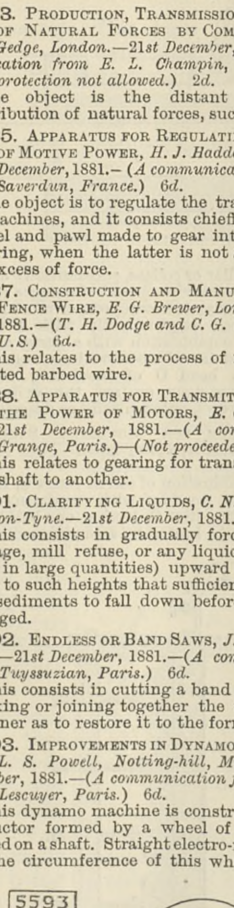

alternate poles on each side of it. These are connected with a commutator. The induced part is fixed, and consists of two series of oval or elliptical coils attached to two annular iron frames placed on each side of the inductor. The wire of these coils is wound as shown in the figure.

5595. IMPROVEMENTS IN ELECTRIC CALLS FOR TELEPHONES AND ANALOGOUS PURPOSES, *A. W. Lake, Addison-gardens North, London.—21st December*, 1881.—(*A communication from W. C. Lockwood, Brooklyn, New York.*) 6*d*.

The inventor employs the power of a weight or spring to ring the gong. The power of the weight is kept ready for use immediately the electrical condition of the line is disturbed. The mechanism for operating the call insures that the weight shall be kept constantly wound up. The call is effected by what may be termed "overwinding" the weight. The same signal is produced at both ends of the line by the overwinding at either end. The apparatus is so arranged in connection with an electro-magnet and connections that the winding of the apparatus by changing the circuit from one condition to another makes the call, and the running down of the apparatus by changing the circuit again to its previous condition discontinues the call.

5597. CALORIC ENGINE, *A. M. Clark, London.—21st December*, 1881.—(*A communication from J. Schweizer, Switzerland.*)—(*Not proceeded with.*) 2*d*.

The engine is based on the employment of a partial vacuum produced by the expansion of air at atmospheric pressure, by the heat of a flame, jet of steam, or other fluid, or by a current of hot air, and its subsequent cooling in a closed chamber.

5598. PHOTOGRAPHIC CAMERAS, *W. Lawley, London, and H. S. Starnes, New Thornton Heath.—21st December*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to improvements in cameras for instantaneous photography, and particularly those used for landscape and other outside work, and it has for its object to dispense with the use of separate focussing and dark slides, to provide closed receptacles within the camera for the sensitised plates both before and after exposure, and to enable the plates to be readily taken in succession from the one receptacle placed in position for exposure and returned to the other receptacle after exposure without the removal from the camera or risk of exposure to light.

5599. INSULATOR CONDUCTOR, *W. Smith.—21st December*, 1881. 2*d*.

Instead of gutta-percha a mixture of gutta-percha and zinc white is used.

5603. FURNACES, &c., FOR THE CONSUMPTION OF SMOKE, *O. Trossin, London.—22nd December*, 1881.—(*Not proceeded with.*) 2*d*.

The coals are shot into a recipient connected with the grate. Out of this recipient the coal is carried by means of an elevator, &c., into a hot chamber, where it is fully freed from gas. The clean coke so produced is now cast into an ordinary grate by means of the same mechanism, and here it is fully consumed.

5604. IMPROVEMENTS IN GALVANIC BATTERIES FOR ELECTRIC LIGHTING, &c., *E. B. Burr, Walthamstow, and W. T. Scott, Stratford, both in Essex.—22nd December*, 1881. 6*d*.

This invention relates to improvements in batteries, whereby they are rendered convenient, efficient, and portable. The battery consists of zinc and carbon plates arranged in wooden cells lined with waterproof cement. The space in the cells surrounding the plates is filled with asbestos fibre or like material, and this is saturated with a mixture of bichromate of potash, phosphoric acid, and sometimes a small quantity of nitric acid.

5605. AMBULANCE STRETCHERS, &c., *A. K. Irvine, Glasgow.—22nd December*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to the general construction of ambulance stretchers or litters, &c.

5606. ILLUMINATING CANDLES, *H. J. Haddan, Kensington.—22nd December*, 1881.—(*A communication from R. F. W. Loper and C. McKeone, Philadelphia.*)—(*Not proceeded with.*) 2*d*.

This relates partly to an illuminating candle which is composed of a broad flat wick or core, surrounded by an inflammable substance, or a compound of such substance, presenting, when taken in cross section, a flattened or elliptical contour.

5607. LOCK FOR DOG COLLARS, &c., *C. Zender, Berlin.—22nd December*, 1881.—(*Not proceeded with.*) 2*d*.

The lock is so constructed that by one pull at a string it is opened, and the collar falls from the neck of the dog, who is instantly free to follow the game.

5608. MANUFACTURE OF BOXES OR CASES FOR CONTAINING JEWELLERY, &c., *W. R. Lake, London.—22nd December*, 1881.—(*A communication from J. M. Douarin.*) 6*d*.

This relates to improvements in the construction of the outer frame or casing and the inner portion or cushion.

5609. PREVENTING RADIATION OF HEAT FROM STEAM BOILERS, &c., *C. Napier and J. Paterson, Aberdeen.—22nd December*, 1881.—(*Not proceeded with.*) 2*d*.

This consists essentially in forming over the boiler, or surrounding it with a hot air space or chamber to retain air heated by radiation from the boiler, and from hot flues connected with the furnace, or with hot flues therefrom.

5610. MANUFACTURE OF BISCUITS, *F. Boucher, Plaistow.—22nd December*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to the employment of mineral waters.

5612. REVOLVING BUOY, *F. M. Duncan, Glasgow.—22nd December*, 1881.—(*Not proceeded with.*) 2*d*.

Upon a spindle is mounted, with capability of revolving, a floating buoy having fins, blades, or screw attached to its sides which are acted upon by the stream or tide to rotate such buoy, or a wheel similar to a paddle-wheel may be employed. As the buoy revolves it communicates motion to a hammer, tongue, or other instrument which will at intervals sound a bell or gong.

5614. BORING ROCKS, *J. T. Jones and J. H. Wild, Leeds.—22nd December*, 1881. 8*d*.

This consists in mounting the boring rod upon an adjustable travelling frame so that the holes may be bored at regular intervals, and it also relates to an improved arrangement of parts for driving and lubricating the boring rod.

5615. IMPROVEMENTS IN THE CONSTRUCTION OF CABLES OR COLLECTIONS OF METALLIC CONDUCTORS FOR TELEPHONIC AND TELEGRAPHIC COMMUNICATION, *J. N. Culbertson, M.D., Antwerp, and J. W. Brown, Upper Kennington-lane, London.—22nd December*, 1881. 6*d*.

This relates to improvements on patent No. 1679, 1881, taken out by the same inventors. Pipes of convenient lengths are employed with perforated insulating discs at each end. The wires are threaded through these discs and strained tight. The pipes are joined together and the joints closed. For above ground work, the inventors employ troughs open on the under side, so as to form a roof to protect the wires.

5616. PRODUCTION OF REFINED SUGAR IN SLABS, &c., *J. H. Johnson, London.—22nd December*, 1881.—(*A communication from M. Weinrich, Vienna.*) 6*d*.

This relates to the production of refined sugar in the shape of slabs or plates, bars or sticks, or other similar forms with facility and economy, and in large quantities, and it has for its object enabling the refiners, by employing the same claying rooms as heretofore, to produce sugar of excellent quality, and capable of being readily reduced to the form of cubes without incurring any greater expense for labour than is required in the manufacture of ordinary loaf sugar.

5617. PRODUCTION OF CYANIDES OF THE METALS OF THE ALKALIES AND ALKALINE EARTHS, *J. H. Johnson, London.—22nd December*, 1881.—(*A communication from V. Alder, Vienna.*) 4*d*.

This consists partly in the conversion of the carbonates, oxides, hydrates, sulphates, or sulphides of the metals of the alkalies and alkaline earths into cyanides or cyanurets by the employment of nitrogen gas of the air, in combination with carbonising gases (oxide of carbon, carburetted hydrogen, and the like) in closed apparatus, with or without the use of suitable carbonising metals, or of caustic, or of carbonate of lime, or of a mixture of same.

5622. AUTOMATIC HARMONICA, *W. P. Thompson, Liverpool.—22nd December*, 1881.—(*A communication from M. Harris, New York.*) 6*d*.

The invention consists in the combination of a perforated strip of paper or music sheet and a flexible wind chest or air compression pump with an ordinary harmonica or similar instrument, whereby the latter is made to execute tunes automatically.

5625. MECHANICALLY COOLING AIR FOR PRESERVATIVE PURPOSES, &c., *J. J. Coleman, Glasgow.—23rd December*, 1881. 6*d*.

The inventor claims the combination of apparatus for mechanically cooling air, in which a motor cylinder operating with combustible gas or vapour, and the parts appertaining to such cylinder, are fixed to or carried on the same bed frame as cylinders for the compression and re-expansion of the air.

5627. IMPROVEMENTS IN ELECTRIC CALL SIGNALS, *H. J. Haddan, Kensington, Middlesex.—23rd December* 1881.—(*A communication from G. W. Foster and F. B. Wilson, Paris.*)—(*Not proceeded with.*) 2*d*.

This consists of clockwork provided with an escapement in combination with a double helix furnished with a metallic rod having an armature on one end which is placed directly in front of the helix. The movement of the armature consequent on a break in the current releases the escapement and causes a hammer connected with the clockwork to strike a gong.

5628. KNITTING MACHINES, *L. A. Groth, London.—23rd December*, 1881.—(*A communication from G. T. Grosser, Burgstadt, Germany.*) 10*d*.

This relates to the application of pattern apparatus to knitting machines.

5631. SECONDARY BATTERIES, *J. S. Sellon.—23rd December*, 1881. 2*d*.

The frame upon which the active agent is put is of material not readily subjected to the influence of oxidation.

5634. MAKING SHEAR STEEL, &c., *H. Badon and C. Yeomans, Sheffield.—23rd December*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to the construction of the furnace.

5635. LAMPS FOR VELOCIPEDES, &c., *F. S. Kendrick, Balsall Heath.—23rd December*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to improvements in lamps, so constructed that they can pass the spokes of the whee and be adjusted with security to the axis. Instead of using oil and wick, phosphorescent salts are employed.

5636. KEYLESS WATCHES, &c., *C. H. Errington, Coventry.—23rd December*, 1881. 6*d*.

A double-action spring, when pressed by the button, works a ratchet fixed on the pillar plate, a second spring locks the ratchet, a third spring has a cam on its side and is operated on by every other tooth of the ratchet, causing the end of the said spring to advance and recede from the balance staff.

5637. AUTOMATICALLY CONTROLLING THE ACTION OF MARINE ENGINES, *R. J. Smith, Sunderland.—23rd December*, 1881. 6*d*.

This relates to apparatus for automatically controlling the action of marine engines and their screw propellers by an opening or closing of the throttle valve by rods from an atmospheric cylinder acted upon from the condenser, the cylinder valve being operated by a pendulum while maintaining its vertical position during the varying motions of a vessel.

5640. LETTERPRESS PRINTING MACHINES, *A. Godfrey, Clapton.—23rd December*, 1881. 10*d*.

This relates, First, to the means employed for propelling the travelling bed supporting the lithographic stone or type from which the printed impressions are taken; Secondly, to apparatus for automatically removing the sheets of paper; Thirdly, to the method of inking the type; Fourthly, to the method of damping the stone.

5641. ROTARY ENGINES, *B. J. B. Mills, London.—23rd December*, 1881.—(*A communication from P. Dall'Orto, Genoa.*) 6*d*.

The inventor claims, First, the combination of cylinder A provided with inlet passages J and K and outlet passages F, with pistons B and projections M

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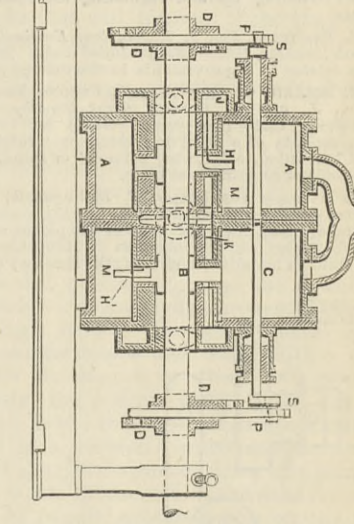


provided with inlet passages H H[1]; Secondly, the combinations with cylinder A, piston B, and projections M, of abutments C operated by cranks S, connecting-rods P and double cams D.

5642. REFRIGERATORS, *G. C. Roberts, New York.—23rd December*, 1881. 6*d*.

The object is to maintain a constant circulation of the whole of the air in the chamber to bring the circulating current of air into contact with the ice, but with the lower portions only, so as to prevent waste by the melting water trickling over the subjacent portions, and to utilise the cooling power of the ice water as completely as possible.

5643. WORKING RAILWAY SIGNALS, *A. Gough, Buckingham.—25th December*, 1881.—(*Not proceeded with.*) 2*d*.

This consists mainly in obtaining the movement necessary for working the signals by the extension produced by the flattening of a curved or bow spring placed in such position as to be acted on by a roller upon one of the carriages of a train, the same motion being applied by means of levers and connections to raise or set one signal upon the passage of the train, and at the same time to lower another signal a given distance in rear of the train which was previously raised in the same way.

5645. SPINNING COTTON, &c., *J. Walker, Hyde.—24th December*, 1881. 6*d*.

The object is to support the top clearing rollers so as to prevent them from rolling off the front rollers, and to keep them always in equal contact with both rollers.

5646. MECHANICAL MUSICAL INSTRUMENTS, *W. P. Thompson, Liverpool.—24th December*, 1881.—(*A communication from M. Harris, New York.*) 6*d*.

This relates to wind instruments which are manually operated upon or are mechanically played or controlled by means of one or more strips or sheets of paper or other suitable material perforated to represent the different notes or sounds it is desired to produce, and caused to automatically pass over air ducts, and thereby control the action of the valves which determine the admission of air to the reeds or pipes of the instrument, whereby said reeds or pipes are made to produce musical sounds.

5648. MANUFACTURE OF CUT WIRE AND WROUGHT NAILS, *J. and J. Grimshaw, Leeds.—24th December,* 1881. 8d.

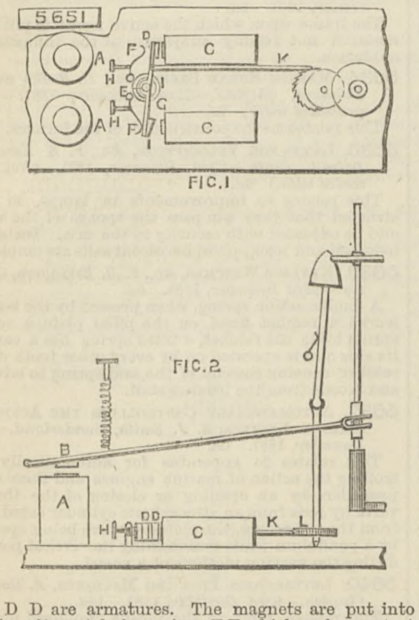
This relates to the general arrangement, construction, and application of the various parts forming the machine for cutting and heading wire nails, and the application of electricity to the same.

5650. MANUFACTURE OF ALUM, *P. and F. M. Spence, Manchester.—24th December,* 1881. 4d.

This consists in mixing cold saturated solutions of alum with stronger solutions of a higher temperature, and so preventing the tendency of such solutions to solidify without crystallisation, or if solidified, to change the solid into the crystalline form by said mixture with the cold solution.

5651. IMPROVEMENTS IN ELECTRIC CURRENT METERS, *St. George Lane-Fox, Westminster.—24th December,* 1881. 6d.

This relates to improvements on the inventor's patent No. 4626, dated 14th November, 1878, in which the position or motion of an armature due to the amount of current passing through a corresponding electro-magnet controls the working of the clockwork of a counting apparatus. Fig. 1 is a plan, and Fig. 2 a side elevation of the apparatus. The inventor employs a magneto-electric motor to give a constant motion to a certain shaft in the meter. C C are the magnets of the motor, G a shaft oscillating about axis



E; D D are armatures. The magnets are put into action alternately by springs F F which make contact according to the position of shaft G. Screws H H limit the time during which the current passes across the contact pieces. A pawl K oscillates with shaft G I, and engages in wheel L so as to move it through a definite angle for every oscillation of G. The motion of L is transferred to another shaft connected with the meter so as to make an annular velocity of this shaft vary with the position of the armature B¹, the position of which is due to the amount of current passing through the electro-magnet A, whose coil forms part of the circuit or a shunted portion of the circuit of the conductor through which the current is passing that requires to be measured.

5652. WINDING AND REGULATING WATCHES, *A. Burdess, Coventry.—24th December,* 1881.—*(Not proceeded with.)* 2d.

This relates to the construction of keyless mechanism for winding up and regulating the hands of watches.

5653. TRICYCLES, &c., *J. Harrington, Kensington.—24th December,* 1881.—*(Not proceeded with.)* 2d.

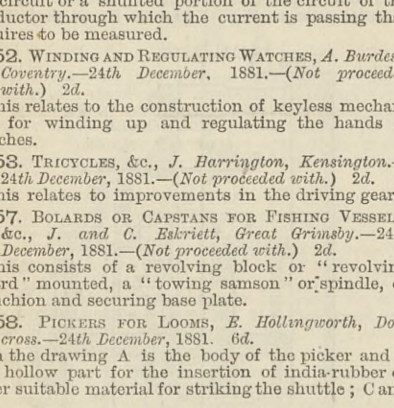
This relates to improvements in the driving gear.

5657. BOLARDS OR CAPSTANS FOR FISHING VESSELS, &c., *J. and C. Eskriett, Great Grimsby.—24th December,* 1881.—*(Not proceeded with.)* 2d.

This consists of a revolving block or "revolving bolard" mounted, a "towing samson" or spindle, or stanchion and securing base plate.

5658. PICKERS FOR LOOMS, *E. Hollingworth, Dobcross.—24th December,* 1881. 6d.

In the drawing A is the body of the picker and B the hollow part for the insertion of india-rubber or other suitable material for striking the shuttle; C and



D are the picker spindles placed one above the other, and on which the picker slides as it is sent backward and forward by the picking stick; E is the horizontal pin or stud for receiving one end of the leather picking arm F and which is prevented from slipping off the end by the lock nuts G.

5659. GAS PRESSURE ACCUMULATORS, *F. H. F. Engel, Hamburg.—24th December,* 1881.—*(A communication from W. Klinkerfues, Gottingen.—(Not proceeded with.)* 2d.

The object is the accumulation of power produced by a number of repeated and momentaneous risings of gas pressure of a circuit of gas, which power may be used for regulating and altering the flow of gas to the burners of lamps and for other purposes.

5660. IMPROVEMENTS IN ELECTRIC LAMPS, *L. S. Powell, Notting Hill, London.—24th December,* 1881. —*(A communication from J. M. A. Gérard-Lescuyer, Paris.)* 6d.

In this lamp the descent of the upper carbon is regulated by its being attached to a piston working in an air cylinder; as the carbon descends a partial vacuum is produced behind the piston, which retards its descent, the admission of air into the cylinder is controlled by a valve. The cylinder is situated in the centre of an electro-magnet in a shunt circuit. The carbons are separated by an armature of this magnet, and a brake worked by the same magnet is provided to arrest the descent of the upper carbon. The weight of the lower carbon and rods is supported by two helical springs attached to the upper part of the lamp.

5661. IMPROVEMENTS IN PIPES OR CONDUITS FOR CONTAINING ELECTRICAL CONDUCTORS OR WIRES, *J. H. Johnson, Lincoln's-inn-fields, Middlesex.—24th December,* 1881.—*(A communication from C. Labye and L. de Locht-Labye, Paris.)—(Not proceeded with.)* 4d.

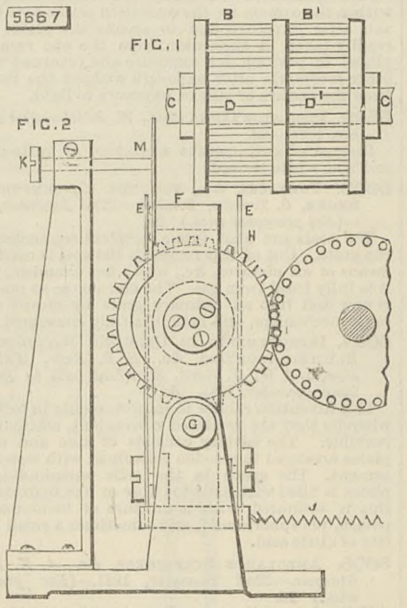
This relates to an improved method of arranging and inclosing conductors in a conduit or chamber constructed with a removable cover.

5666. PROPELLING OR ASSISTING IN THE PROPULSION OF SMALL BOATS, *A. Burdess, Coventry.—24th December,* 1881.—*(Not proceeded with.)* 2d.

This relates to an apparatus for propelling or assisting in the propulsion of small boats, and by the employment of which the use of oars may be entirely dispensed with.

5667. IMPROVEMENTS IN MEANS OR APPARATUS FOR THE COLLECTION AND DISTRIBUTION OF ELECTRIC CURRENTS, *S. A. Varley, Hatfield, Herts.—24th December,* 1881. 6d.

The object of this apparatus is to avoid sparking at the commutators of dynamo machines. The figures explain one form of the inventor's device. Fig. 2 shows only half the apparatus, the other half being a duplicate of that shown. In Fig. 1 the two pinions B B¹ are mounted in shaft C, and have each a set of pins D or D¹, each pin being insulated from the others and the cheeks, and being connected to one of the junctions of the coils of the armature. Pins D are set a distance equal to half their pitch in advance of pins



D¹. Fig. 2 shows the contact wheels, which constitute the poles of the generator H. There are two contact wheels at each side of each pinion; E are for brake springs which keep the teeth of the contact wheels steady. The contact wheels revolve on an axis carried in a frame F pivotted at G. The lower end of this frame is connected to that on the other side by insulated spring J, which tends to draw the contact wheels away from the commutator, while their upper ends carry spring M, adjusted by screw K to force the contact wheels against the commutator.

5680. MIDDLINGS PURIFIERS, *C. D. Abel, London.—27th December,* 1881.—*(A communication from C. Oberdorfer and C. König, Vienna.)* 6d.

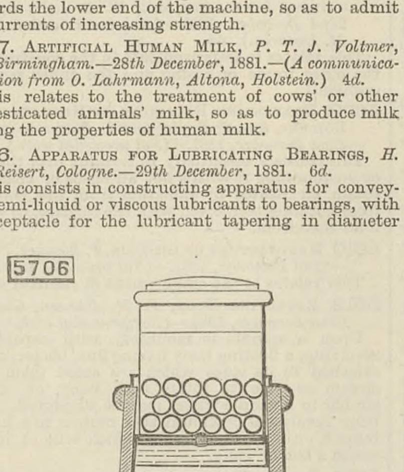
This consists in constructing middlings purifiers with a number of air inlets to the several compartments, such air inlets being made to increase in size towards the lower end of the machine, so as to admit air currents of increasing strength.

5697. ARTIFICIAL HUMAN MILK, *P. T. J. Voltmer, Birmingham.—28th December,* 1881.—*(A communication from O. Lahrmann, Altona, Holstein.)* 4d.

This relates to the treatment of cows' or other domesticated animals' milk, so as to produce milk having the properties of human milk.

5706. APPARATUS FOR LUBRICATING BEARINGS, *H. Reisert, Cologne.—29th December,* 1881. 6d.

This consists in constructing apparatus for conveying semi-liquid or viscous lubricants to bearings, with a receptacle for the lubricant tapering in diameter



from the lower to the upper end, and containing a loaded piston having a cup leather or otherwise expansible packing. A modification is claimed in which the piston is moved downwards from time to time by screw action.

5707. MANUFACTURE OF ROTARY OR ROSE CUTTERS, *C. D. Abel, London.—29th December,* 1881.—*(A communication from W. Lorenz, Carlsruhe.)* 6d.

This relates to the manufacture of rose cutters, produced by pressing in dies.

2. REFRIGERATORS, *P. M. Justice, London.—2nd January,* 1882.—*(A communication from H. C. Goodell, Atchison, U.S.)* 6d.

This consists of a refrigerator or refrigerating room, having an ice box occupying the entire upper part, and suspended from the ceiling, in combination with a series of drainage bars, whereby the water of condensation and of the melting ice is carried.

12. RAILWAY CARRIAGE AXLE-BOXES, &c., *W. Clark, London.—2nd January,* 1882.—*(A communication from C. E. Candee, New York, and A. G. Story, Little Falls, U.S.)* 6d.

The invention consists, First, in an improved construction of boxes; Secondly, in devices for ensuring continuous lubrication; and Thirdly, in an arrangement of packing devices that render the box tight, to exclude dust and prevent escape of oil.

35. BROUGHAM HANSOMS, *J. Marston, Birmingham.—3rd January,* 1882. 6d.

This relates to the general construction of the Hansom. One improvement consists in the employment of two folding doors, capable of opening both outwards and inwards.

44. COMPOUND FOR THE CURE OF NEURALGIA, &c., *H. F. Mills, Notting Hill.—4th January,* 1882. 2d.

Hops and cloves are boiled together in water and then strained, the liquid being mixed with camphor and sal ammoniac, and when cool the mixture is used either internally or externally to cure neuralgia and other analogous complaints.

304. OIL CAP IN WHARVE OF SPINDLE FOR SPINNING AND DOUBLING, *T. Watson, Paisley.—21st January,* 1882. 4d.

This relates to improvements on patent No. 5438, A.D. 1881, and consists in forming a cap in the inside at the top end of the spindle wharve, projecting downward into a recess formed between the top end of the bolster and bush of an ordinary Rabeth spindle. The cap serves to receive the dash of oil, when running at high speeds, and to return it to the reservoir at the bottom of the bolster.

627. COLOURING MATTERS FOR DYEING AND PRINTING, *J. A. Dixon, Glasgow.—9th February,* 1882.—*(A communication Dr. C. Koenig, Germany.)* 2d.

This relates to improvements on patent No. 4531, A.D. 1881, and consists in the use of the neutral sulphite of ammonia instead of the bisulphites of the alkalis for converting alizarine blue into a compound soluble in water.

1983. LIFE-PRESERVING MATTRESSES, *A. A. Young, Boston, U.S.—22nd April,* 1882.—*(Complete.)* 4d.

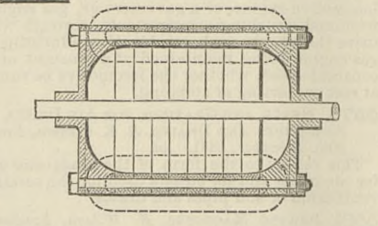
This relates to life-preserving mattresses in which air-filled elastic tubes are employed to buoy the same.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette

260,110. ARMATURE FOR DYNAMO-ELECTRIC MACHINES, *James J. and Thomas J. McTighe, Pittsburg, Pa.—Filed March 28th,* 1882.

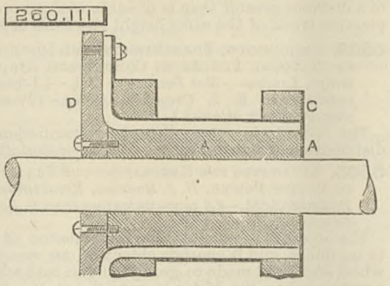
Brief.—The armature core is formed of a number of rings, each provided with a slit of sufficient width to permit a coil to pass therethrough. To place the coils on the core the slits are all brought into line, and after the coils have been placed thereon the rings are



turned so as to bring the slits to different circumferential points. The coils are thus locked into place, and by a proper adjustment of the rings the armature may be balanced. The whole is securely held by end plates and bolts.

260,111. COMMUTATOR FOR DYNAMO-ELECTRIC MACHINES, *James J. and Thomas J. McTighe, Pittsburg, Pa.—Filed May 3rd,* 1882.

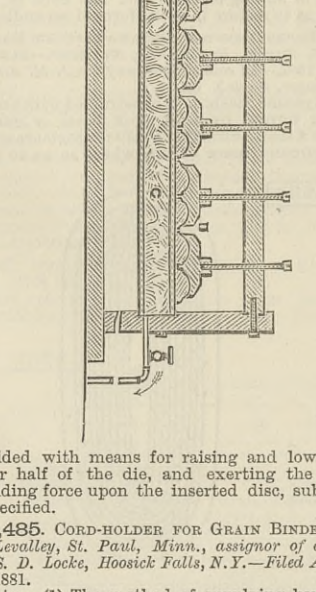
Claim.—(1) A commutator composed of a single cylinder of insulating material, having one or more integral collars C perforated longitudinally with a circular series of holes, in combination with a series of metal rods or bars placed in said perforations and



retained by the collar or collars, substantially as specified. (2) A commutator composed of a single cylinder of insulating material A, having one or more integral collars C perforated longitudinally with a circular series of holes, in combination with a series of metal rods or bars, placed in said perforations, and having the extensions, a head D of insulating material, clamping the extensions against the cylinder A, or collar C, and screws, substantially as described.

260,368. MACHINE FOR MOULDING SAND-PAPER DISCS, *J. G. Buzzell, Lynn, Mass.—Filed February 23rd,* 1882.

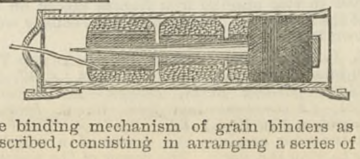
Claim.—The combination of steam-chest C, its inlet and outlet conduits, provided with regulating valves, the divided moulding dies D, having one half secured to and arranged to be heated by said steam-chest, and



provided with means for raising and lowering the upper half of the die, and exerting the requisite moulding force upon the inserted disc, substantially as specified.

260,485. CORD-HOLDER FOR GRAIN BINDERS, *C. W. Levalley, St. Paul, Minn., assignor of one-half to S. D. Locke, Hoosick Falls, N.Y.—Filed April 23rd,* 1881.

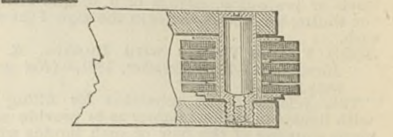
Claim.—(1) The method of supplying band cord to



the binding mechanism of grain binders as herein described, consisting in arranging a series of wound balls of cord within an inclosing case which holds them from disarrangement, and connecting the outer end of the cord of one ball to the inner end of the cord of the adjacent ball, and unwinding them successively by the operation of the machine.

260,541. DYNAMO-ELECTRIC MACHINE, *J. A. I. Craig, Montreal, Quebec, Canada, assignor of two-thirds to E. R. Whitney and C. L. Bossé, both of same place.—Filed October 26th,* 1881.

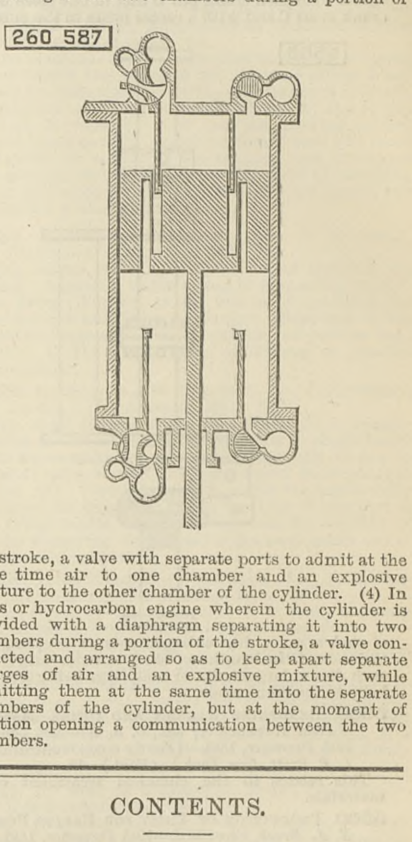
Brief.—The commutator brushes are formed of discs of wire-cloth arranged in groups and the groups separated by washers, the whole clamped upon a



sleeve, which serves as a journal bearing. A hollow spindle upon which the brush rotates is perforated, and serves to distribute lubricating material to the bearing.

260,587. GAS ENGINE, *A. P. Massey, Cleveland, Ohio.—Filed December 12th,* 1881.

Claim.—(1) A gas or hydrocarbon engine wherein separate chambers are maintained inside the cylinder for separate charges of air and an explosive mixture of gas and air until the moment of ignition, when the chambers are placed in free communication. (2) In a gas or hydrocarbon engine, a diaphragm situated within the cylinder, in combination with a corresponding recess in the piston, so as to maintain separate chambers within the cylinder during a portion of the stroke. (3) In a gas or hydrocarbon engine wherein the cylinder is provided with a diaphragm separating it into two chambers during a portion of



the stroke, a valve with separate ports to admit at the same time air to one chamber and an explosive mixture to the other chamber of the cylinder. (4) In a gas or hydrocarbon engine wherein the cylinder is provided with a diaphragm separating it into two chambers during a portion of the stroke, a valve constructed and arranged so as to keep apart separate charges of air and an explosive mixture, while admitting them at the same time into the separate chambers of the cylinder, but at the moment of ignition opening a communication between the two chambers.

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SOUTH KENSINGTON MUSEUM.—Visitors during the week ending July 22nd, 1882:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 9768; mercantile marine, building materials, and other collections, 468. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. till 6 p.m., Museum, 2188; mercantile marine, building materials, and other collections, 681. Total, 17,321. Average of corresponding week in former years, 17,899. Total from the opening of the Museum 21,157,499.