VISITS IN THE PROVINCES.

THE ELSWICK ORDNANCE AND ENGINE WORKS.
No. I.

THE Elswick Engine Works owe their origin to Sir William Armstrong's success in the development of water-pressure machinery; similarly the manufacture of ordnance grew up in consequence of his having brought out his system of ordnance. The former branch of the works preceded the latter by about ten years, and therefore should be first noticed.

In 1836 Sir W. Armstrong conceived the idea of utilising the work due to the descent of water for engineering purposes. His first design was described in the *Mechanics' Magazine* of December 29th, 1838. He made a working model of this in 1839, and tried it in Newcastle, when it acted well, though, as he considered it, in an inconvenient and crude form. In 1840 Sir William wrote a paper to the *Mechanics' Magazine*, in which he investigated the question of the employment of water for storing and distributing the work of a steam engine. He dwelt on its value when raised to a high level as a store of power to be drawn off in its descent, on its suitability for transmitting pressure to a distance, and also for supplying power in small or large quantities, just as might be required. He illustrated his views by the supposed application of a pumping engine and a cistern fixed on a height at St. Katharine Docks, to the performance of loading and unloading ships by means of hoists worked by the pressure of water brought by pipes from the cistern. A hydraulic crane was erected in Newcastle in 1845, whose performances so charmed Mr. Hartley, the engineer of Liverpool Docks, in spite of his having originally entertained a strong prejudice against the idea, that he at once recommended the application of hydraulic power to the Albert Dock at Liverpool. The Elswick Works were then started with a view to the manufacture of hydraulic machinery in 1847, and in 1848 hydraulic cranes were applied to railway purposes in the Trafalgar goods station, now belonging to the North-Eastern Railway, in Newcastle. In 1849 extensive hydraulic machinery for opening and closing docks was erected at Great Grimsby for the late Mr. Rendel, the father of the present partners of that name in the Elswick firm. The same year Sir William proposed to replace the elevated cistern of water by an air vessel, in which the air was brought under pressure. In 1850 the present mode of storing up work by means of a loaded plunger working in a large cast iron cylinder was proposed by Sir William, hydraulic machinery being by this brought into its present condition, having been worked out from first to last by the same mind. It is needless to follow further the introduction of hydraulic machinery, which was adopted in the Paddington Railway Station under Brunel, and quickly came in in many places. The principal steps, then, involving the introduction of fundamental features may be traced as follows :—(1) The general conception of the employment of the work due to the descent of water; (2) the distribution and transfer of work to a distance by an inelastic fluid giving rigidity and power of control with precision; (3) the power of obtaining the mechanical equivalent to multiple gear and lever power without friction; (4) the storing up of the continuous work of a small engine for employment in greater but intermittent efforts such as are commonly required. Lastly, one other property deserves notice, namely, the safety attending the storing up of work in the form of an inelastic liquid, as compared with an elastic gas. This would not be worth consideration practically in ordinary cases, when a little care and calculation would enable steam or air to be employed safely.* It is possible, however, that cases may arise, such as those of exposure of warlike machines to the fire of an enemy, when it is an advantage that the sudden injury of a storehouse of force should be incapable of producing a dangerous explosion. The hydraulic machinery manufactured at the Elswick

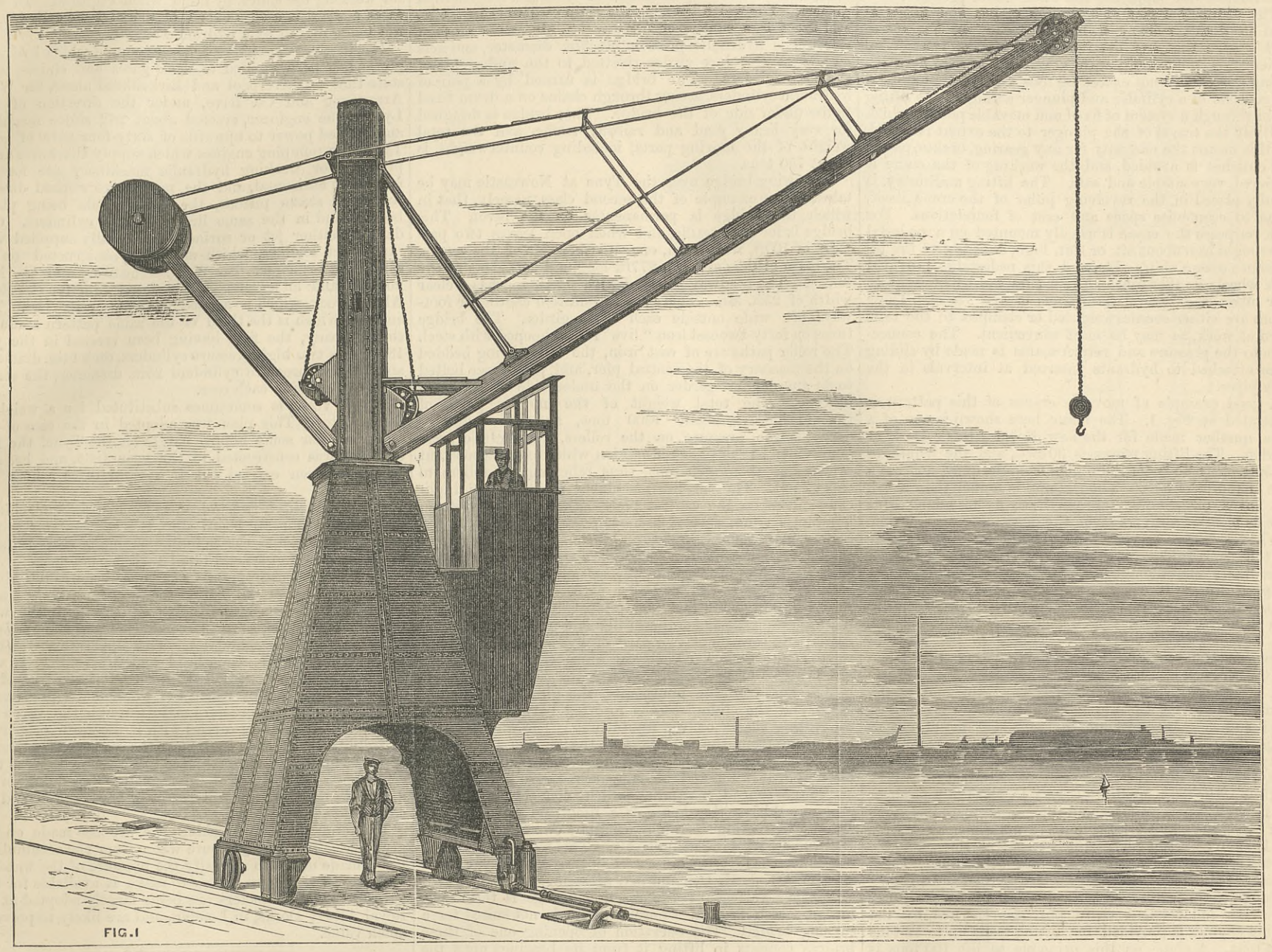
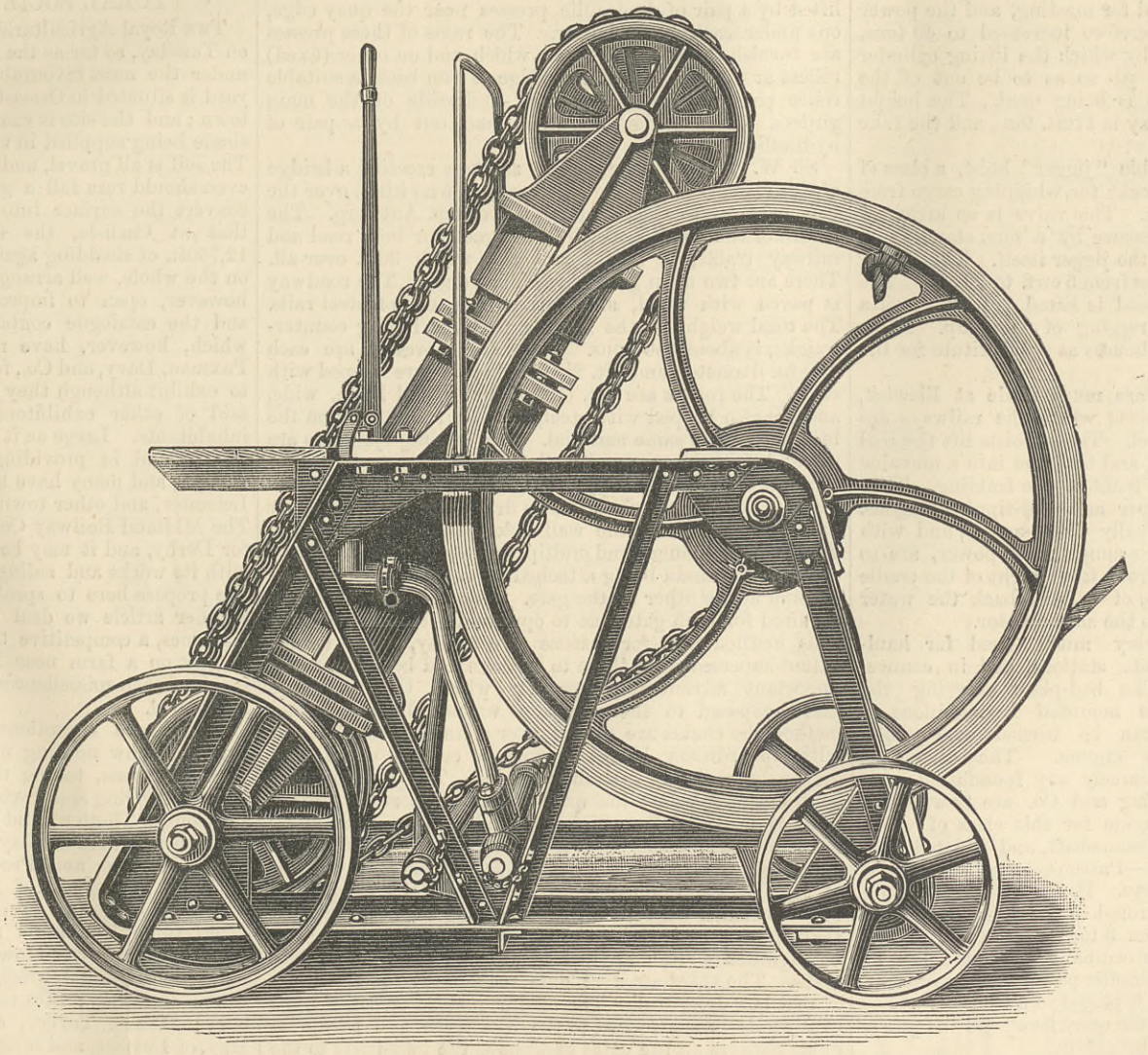


FIG. 1

FIG. 2.



* The partners composing the original Elswick firm were the following :—W. G. Armstrong. George Cruddas, Armorer Donkin, Addison, Langhorn, Potter, and Richard Lambert.

Works consists chiefly of cranes, hoists, capstans for railway stations and docks, rotary engines, pumping engines, opening bridges—swing, draw, and lift—machinery for opening and closing dock gates and sluices, bands and elevators for discharging and storing grain, hydraulic pumps, and winding engines for mines, &c. &c. In addition to these are the steam pumping engines with boilers and accumulators for supplying the water under pressure.

The ordinary forms of hydraulic cranes and hoists as used in docks, railway stations, warehouses, &c., are so well known that any detailed description of the several varieties is unnecessary. In nearly all cases where the lifting power does not exceed 30 tons the hoisting apparatus consists of a cylinder and plunger acting on the lifting chain through a system of fixed and movable pulleys which multiply the travel of the plunger to the extent required. By this means the necessity for any gearing, brakes, pawls, and clutches is avoided, and the working of the crane is rendered very simple and safe. The lifting machinery is usually placed in the revolving pillar of the crane itself, so as to economise space and cost of foundations. For dock purposes the crane is usually mounted on a pedestal of wrought iron about 8ft. or 10ft. high, so as to give the jib clearance over a ship's side, and this pedestal is provided with wheels, so that four or five cranes can be brought to bear upon the several hatchways of one vessel. These cranes are either counterweighted or clamped to the rails when at work, as may be most convenient. The connections to the pressure and return mains is made by sliding pipes attached to hydrants inserted at intervals in the main pipes.

A good example of movable cranes of this pattern is illustrated at Fig. 1. The crane here shown is one of a large number made for the new Royal Albert Dock at London. The lifting power is 30 cwt., and the length of lift 50ft. The jib is 45ft. 3in. high from the quay, and has a rake or radius of 33ft. The pedestal is higher than usual, and has a passage-way through it, so as to interfere as little as possible with traffic on the quay.

When a lifting power of from 30 tons to 80 tons or 100 tons is required, a rotary hydraulic engine acting on an ordinary chain purchase by means of gearing and a "cupped-drum" is usually employed, and the general construction of the crane is modified by a circular roller path with live or fixed rollers being substituted for the iron pedestal. For very heavy cranes to lift loads of 80 tons to 100 tons and upwards, Sir W. G. Armstrong and Co. now use a direct-acting cylinder of from 40ft. to 50ft. stroke, suspended in gimbals from the end of the jib, and fitted with a piston and rod, by which the load is lifted and lowered without the intervention of chains or gearing. The advantages of this plan in regard to safety and simplicity are very great, and the ease and nicety with which the load can be handled are very striking. The first application was to the 120 tons sheer legs in the Elswick Works, and the same plan has since been carried out by the firm in a 160-ton crane erected for the Italian Government at the arsenal at Spezia, and a 100-ton crane at the new Princes Dock at Bombay. These cranes are on "live" rollers, and are turned by a rotary hydraulic engine acting on a rack attached to the roller path. An independent chain purchase worked by the slewing engines is provided for lifting loads up to 12 tons or 14 tons. A crane on this principle to lift 100 tons is now being made for the new Langton Docks at Liverpool, under the direction of the engineer, Mr. Lyster. This crane will occasionally be used for masting, and the power of the chain purchase is therefore increased to 40 tons, and an arrangement is made by which the lifting cylinder can be swung in towards the jib so as to be out of the way when the chain purchase is being used. The height of the jib-head from the quay is 112ft. 9in., and the rake 55ft.

In Fig. 2 is shown a movable "jigger" hoist, a class of machine now much used in docks for whipping cargo from a ship's hold on to the deck. The valve is so arranged that it can be worked at pleasure by a man standing on the deck or on a platform on the jigger itself. The lifting power of these machines varies from 5 cwt. to 20 cwt. The rope or chain, by which the load is lifted, is passed over a pulley suspended from the rigging of the ship. These jiggers are also used in warehouses as a substitute for the ordinary fixed hoist.

Hoists for shipping coal are much made at Elswick, for South Wales and other ports where the railways approach the docks at a low level. These hoists lift the coal trucks to the required height, and tip them into a movable iron shoot carried from the front of the framing. They can be adapted for both hopper and end-tipping wagons. The lifting cylinders are usually direct-acting, and with a view to economy in the consumption of power, are so arranged that on the down stroke the weight of the cradle and empty truck is made use of to force back the water from one of the cylinders into the accumulator.

Hydraulic capstans are very much used for hauling trucks in railway goods stations, and in connection with coal hoists. The bed-plate carrying the capstan-head and engine is mounted in trunnions in a cast iron casing, and can be turned over when access is required to the engine. The casing is bedded in the ground, and scarcely any foundation is required. Sir W. G. Armstrong and Co. are now introducing a new pattern of engine for this class of work, which acts directly on the capstan-shaft, and is fitted with a valve of a peculiar form—Parson's patent—which is common to the three cylinders. Hydraulic capstans are also used for hauling ships through dock entrances, and are made of powers ranging from 3 tons to 11 tons. These machines have heads of the ordinary form, and can be worked by hand in case hydraulic power is not available. The hydraulic driving engine is placed in a chamber alongside the capstan-head, below the quay level, and the power is communicated to the head by gearing.

Swing bridges may be divided into two classes—one in which the bridge is lifted bodily from its bearings by a hydraulic press before being swung round, and the other in which the bridge is permanently on rollers, either fixed or "live." The combined road and railway bridge erected by Sir W. G. Armstrong over the 100ft. entrance to the Queen's Dock at Glasgow, under the direction of Mr. Deas, the engineer to the Clyde Trust, is a good example of the first class. There are two main girders, curved on the top, each 181ft. long and 25ft. deep, over the centre of motion. The roadway is of timber sheathed with iron bars, and is carried by a system of cross and longitudinal girders. The width between the main girders is 23ft. 6in., and there is a cantilever footway 5ft. 3in. wide on each side. The hydraulic press is 5ft. 3in. diameter, and acts on a transverse box girder rivetted to the under side of the main girders. The bridge is turned by a pair of hydraulic cylinders, acting through chains on a drum fixed to the under side of the bridge. This bridge is designed for very heavy road and railway traffic, and the total weight of the moving parts, including counterweight, is about 750 tons.

The swing bridge over the Tyne at Newcastle may be taken as an example of the second class, namely, that in which the bridge is permanently on the pivot. This bridge is for road traffic, and when open leaves two passages of 100ft. wide each, one on either side of the centre. The main girders are each 277ft. long and 24ft. deep at the centre. The roadway is paved with wood, and has a clear width of 23ft. 9in. There are in addition cantilever footways 9ft. wide outside each main girder. The bridge turns on forty-two cast iron "live" rollers hooped with steel. The roller paths are of cast iron, the latter being bedded on the masonry of the central pier, and the upper bolted to an annular box girder on the under side of the main girders. The total weight of the moving parts of the bridge is about 1300 tons, and in order to diminish the pressure on the rollers, a hydraulic press is provided at the centre of motion which exerts a constant pressure of about 800 tons, thus relieving the rollers to this extent. The turning machinery is entirely in duplicate, and is on the central pier. There are two steam pumping engines, each of 20-horse power, two multitubular boilers, and two accumulators which are placed in two of the foundation cylinders. There are two hydraulic rotary engines, each of 60-horse power, acting through gear on a rack bolted to the upper roller path. The teeth of this rack are 13in. wide and 9in. pitch. The apparatus for blocking the nose end of the bridge is worked by hydraulic power, and consists of two pairs of hydraulic presses with rams acting downwards on the abutments and the same number of sliding blocks. When the nose ends of the bridge are over the abutments, the girders are slightly lifted, and the sliding blocks inserted between them and the resting plates on the abutments. The water is then exhausted from the presses, and the ends of the girders rest on the blocks. The valve house, from which all the motions of turning and blocking are controlled, is placed on the overhead platform, which connects the main girders. Above this house is a dioptric light of the 7th order. The bridge is approached by two fixed spans, of 109ft. and 81ft. long respectively. This work was carried out under the direction of the engineers to the Tyne Commission, Mr. J. H. Ure and Mr. Messent.

Another variety of the opening bridge is the drawbridge, which is used where the site is not suited for a turning bridge. The operation of opening one of these bridges consists in lifting it from its bearings until the underside is above the level of the roadway on the quay, and then running it back on this roadway. The bridge is lifted by a pair of hydraulic presses near the quay edge, one under each main girder. The rams of these presses are furnished with rollers, on which and on other (fixed) rollers at the rear end, the bridge is run back, a suitable roller path being fixed to the underside of the main girders. The bridge is run in and out by a pair of hydraulic cylinders.

Sir W. G. Armstrong and Co. are now erecting a bridge of this class, which is a good example of its kind, over the 80ft. entrance to the Kattendyk Basin at Antwerp. The length of this bridge, which is designed for both road and railway traffic, is 159ft., and the width 30ft. over all. There are two main girders, each 9ft. deep. The roadway is paved with wood, and carries one line of steel rails. The total weight of the moving parts, including counterweight, is about 350 tons. The lifting presses are each $31\frac{5}{16}$in. diameter, and 3ft. 2in. stroke, and are hooped with steel. The rollers are 3ft. 6in. diameter, and $12\frac{1}{2}$in. wide, and are also hooped with steel, and the roller path on the bridge is of the same material. The hauling cylinders are placed below the rear end of the bridge.

For opening and closing dock gates three forms of apparatus are commonly used. The first consists of a cylinder fixed at the back of the wall below the quay level, and fitted with a plunger and multiplying sheaves as in a crane or hoist, the chain being attached at one end of the cylinder and at the other to the gate. Two such cylinders are required for each gate, one to open and the other to close. This method has, for reasons of economy, been to some extent superseded by those to be described below, but has important advantages, especially where the gates are much exposed to the action of waves. In the second method the chains are passed over a crab provided either with an ordinary barrel or with a cupped drum, and driven by a rotary hydraulic engine. The machinery is kept entirely below the quay level, and a sunk capstan head is provided by which the crab can be worked by hand in case of emergency, if the hydraulic power is not available. At the new Langton Docks, under the direc- of Mr. Lyster, the machines for closing the gates have been furnished with spiral drums so as to take up the slack chain quickly and without waste of power. Rotary hydraulic engines are often applied to existing hand-power gate crabs. The third class of gate machine is a modification of that last described. The chains, instead of being fixed to the gates, are attached to the lock walls, and pass over guide sheaves on the gates and above the heel-posts to the crab, which is placed in a chamber in the quay as near the heel-post as convenient. By this device the crabs for the opening and closing chains can be placed side by side and worked by one hydraulic engine. The necessity for chainways through the walls is also avoided, and the foundation work is much simplified.

The simplest and best form of hydraulic machine for opening and closing sluices is a cylinder fixed vertically over the paddle or sluice door, and fitted with a piston and piston rod or plunger attached to the paddle. A hand force pump, either fixed or movable, is usually provided for working the sluice by hand when required. In some cases a screw is used instead of a hydraulic cylinder, the nut being driven by a hydraulic engine.

It will give some idea of the extent to which hydraulic power has been applied to dock gates and sluices, if we state that at Liverpool and Birkenhead alone, Sir W. G. Armstrong and Co. have, under the direction of Mr. Lyster, the engineer, erected about 262 sluice machines, and applied power to upwards of sixty-four pairs of gates. The steam pumping engines which supply the water under pressure for working hydraulic machinery are for the most part horizontal, and the pumps are worked directly from the steam pistons, the piston rods being placed behind, and in the same line with the cylinders. Condensers, either jet or surface, are usually supplied with the larger engines, which are often constructed on the compound principle. Sir W. G. Armstrong and Co. have now in hand an engine of this description for the Royal Albert Dock, which is a good example of its class. This engine—which is the third of the same pattern made for the company, the first having been erected in the year 1874—has two high-pressure cylinders, each 14in. diameter, and two low-pressure cylinders 25in. diameter, the stroke being the same in each case.

An air vessel is sometimes substituted for a weighted accumulator. This plan was adopted in the case of the machinery for some hopper barges on the Tyne, the first of which was constructed in the year 1865, and has subsequently been carried out in several cases ashore and afloat.

Under certain circumstances, as for hydraulic machinery for working guns on board ship, the accumulator is now dispensed with, and the pumping engine is designed so as to be capable of great and rapid variations of speed.

Sir W. G. Armstrong and Co. have recently introduced a new method of adjusting the power of a hydraulic machine, such as a crane, hoist, or engine, to the work actually to be done, so as to economise the consumption of water from the accumulator. This apparatus, which is patented by Messrs. Greathead and Martindale, is very simple, and is a description of injector, forming part of the working valve, and by which the water under pressure, as it passes from the pressure main through the valve into the working cylinder, carries with it a certain proportion of water from an open tank near the valve. The amount of water under pressure required to fill the cylinder is thus diminished—the extent of the reduction depending on the difference between the full power of the machine and the actual force it is required to exert.

Hydrants for extinguishing fire are also made on this principle. The high pressure water from the accumulator being made use of to intensify the pressure of the water in ordinary service pipes, so as to make it available for this purpose. These injectors are being largely adopted at the Royal Albert Docks, in London, and are likely to prove of much value.

STEAM ENGINES AT THE ROYAL AGRICULTURAL SOCIETY'S SHOW, DERBY.

The Royal Agricultural Society's Show opened at Derby on Tuesday, so far as the implement yard was concerned, under the most favourable possible auspices. The show-yard is situated in Osmaston Park, about a mile from the town; and the site is exactly what was wanted, admirable shade being supplied in various places by noble beech trees. The soil is all gravel, and the ground stands high, so that even should rain fall a great quantity will be needed to convert the surface into mud. The yard is larger than that at Carlisle, the implement department having 12,750ft. of shedding against 9780ft. at Carlisle, and it is, on the whole, well arranged. The system of numbering is, however, open to improvement. There are 293 stands, and the catalogue contains particulars of 5960 entries, which, however, have not all been filled up; Messrs. Paxman, Davy, and Co., for example, having been too busy to exhibit although they took space, and the same may be said of other exhibitors. Derby is a town of 90,000 inhabitants. Large as it is, however, much difficulty has been found in providing accommodation for a host of visitors, and many have had to find quarters at Matlock, Leicester, and other towns, within easy distances by rail. The Midland Railway Company's works have done much for Derby, and it may be worth stating that the station with its works and sidings occupies no less than 250 acres. We propose here to speak of the engines exhibited. In another article we deal with the sheaf-binding reaping machines, a competitive trial of which will take place in August on a farm near Derby, and next week we shall speak of such miscellaneous exhibits as most deserve to be mentioned.

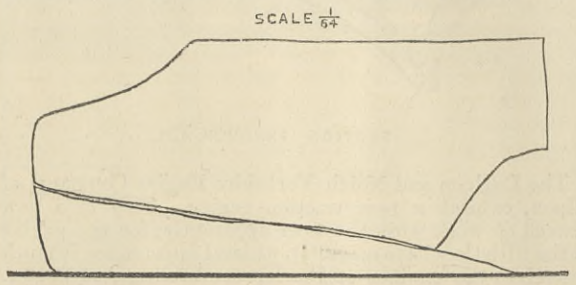
With three exceptions, the agricultural engineers of England show nothing new in steam engines at Derby The exceptions, taking them in alphabetical order, are Messrs. Aveling and Porter, of Rochester; Messrs. Burrell and Sons, of Thetford, and Messrs. Richard Garrett and Sons, of Leicester. Messrs. Clayton and Shuttleworth, Robey and Co., and Ruston and Proctor, all of Lincoln, and Messrs. Marshall and Sons, of Gainsboro', exhibit no engines which present any specially novel features calling for description. The same may be said of the "Farmers' engines, of Messrs. Howard of Bedford; Messrs. Ransomes, Head, and Jeffries, of Ipswich; the Reading Iron-works Company; Messrs. Barrows and Stewart, of Banbury; Messrs. Turner, of Ipswich; Messrs. Brown and May, of Devizes, and several other eminent firms. Messrs. Paxman, Davey, and Co., Mr. Savage, of King's Lynn, and one or two other well-known firms, do not exhibit at all; and it is worth notice that very few firms show engines in motion. If we say that the engines exhibited although

not new are of good workmanship and design, we say nothing more than they deserve. Some makers—notably, for example, Mr. W. Allchin, of Northampton—steadily improve in this respect year by year; firms which we shall not name make no advance. They are either unable or unwilling to take a lesson from others, and so we see crude workmanship and crude design exhibited year after year with much placid contentment on the part of the exhibitor, whose customers probably never find their way into a showyard, or avail themselves of any opportunity of learning what a well-designed, well-made engine is like.

The three firms which we have cited as exceptions to the general rule, exhibit compound engines; and the type of compound engine adopted has obviously been determined by considerations in which the question of economy of fuel does not necessarily play an important part. The compound system for portable and traction engines has not, indeed, been adopted so much to save fuel as to meet a popular fancy. There is a fashion in steam engines just as there is in ladies' dress; and if the public will buy compound and neglect simple engines, the engineer will do well to consult the popular taste; but it is evident that it is highly desirable that each firm should have a compound engine of its own, and so keep clear of rivals. There is a story told of a clockmaker who undertook to invent a new escapement every day for a year, provided they were not all to be good escapements, and it is said that he accomplished his task. When such leading firms as Messrs. Aveling and Porter, Burrell, Garrett, and Marshall have begun, others must follow; and it is quite as easy to invent new methods of compounding as it is to invent new escapements. We see no reason why every agricultural engineer in the kingdom should not exhibit a compound engine of a different type next year. We do no more than bare justice if we add that up to the present moment Messrs. Richard Garrett and Sons are the only makers of compound portable or traction engines who have given us any proof that such engines are more economical than the ordinary simple portable engine. Probably the time has not yet come for other firms to do this, and Messrs. Garrett have perhaps been exceptionally fortunate in being in a position to test a compound engine for economy. But a statement of the work actually got out of compound engines by the firms making them should not in justice to themselves and the public be much longer delayed. Is it hopeless to expect the Royal Agricultural Society to test compound engines next year?

The compound engine exhibited by Messrs. Aveling and Porter we illustrate fully on page 44. It is intended for use on tramways, in chalk pits, and such like, and as a contractor's locomotive. But beyond this it is put forward tentatively as the forerunner of a new type of passenger tram car engine, and it has much to recommend it. It is carried on two spiral springs at the back, and one transverse leaved spring at the front end, so that it is sustained on three points of support. The crank axle and the driving axle are carried in an H frame at the back of the fire-box, which frame is one casting, and slides up and down between angle irons rivetted to the sides of the fire-box, so that the engine can rise and fall without affecting the distance between the driving axle and the crank shaft. As the engine is carried on three points of support, it is not likely that much bending or tendency to distortion will take place in the H frame, more particularly on tram rails. The engine has fifty-six tubes, and the exhaust is taken into a belt round the smoke box, and passing downwards, then rises through a short blast-pipe fixed in the bottom of the box, entering above a petticoat pipe, so as to distribute the draught among the tubes. The object is to render the exhaust silent, and this end is we believe perfectly attained. The engine is compound, Kingdon's patent. The arrangement has we believe been very successfully worked out by a Dartmouth firm—Messrs. Simpson and Denison—for steam launches. We give a section of the cylinders and valve on page 40, which scarcely requires any description. No packing is used between the cylinders. The piston rod has a series of grooves turned in it, as shown, and being made a good fit, the leakage is, we are informed, quite inappreciable in a quick-running engine. It will be seen that the steam has a good deal of travelling to do through ports and passages; as to whether the engine is more or less economical than the well-designed single-cylinder engines which have hitherto been made by Messrs. Aveling and Porter we cannot say. The engine was only finished in time for the show with great difficulty; and its unusual absence of finish bears testimony to the haste with which it was turned out, so that no opportunity for testing it for economy has yet arrived. When the test takes place it ought not to be forgotten that the boiler is of exceptionally good design, and will probably give a high evaporative duty. Messrs. Simpson and Denison state in a circular that "careful analysis of a large number of indicator diagrams—Richards' indicator—taken in trials before referred to, has proved beyond doubt that the engine will give out an indicated horse power for every 16 lb. of water evaporated per hour, and supplied to the engine in steam at 75 lb. pressure, even in small sizes." It is somewhat disheartening to find engineers writing thus in 1881. The analysis of a diagram, however carefully made, supplies no information whatever as to the quantity of steam which actually passes through the cylinder. If 16 lb. of water per horse per hour were accounted for by the indicator, then the engine is very far indeed from being economical. But the water accounted for by the indicator, and that actually used, are two very different quantities.

Messrs. Burrell and Sons, of Thetford, show the most novel engine exhibited at Derby. We shall probably illustrate it at another time; just now the firm do not wish drawings to be published. It is what is called a 10-horse power traction engine, with a Landore steel boiler. It is a compound engine, fitted with Joy's valve gear and a new steam steering gear. It is a curious type of compound engine, but very simple. There are two cylinders, arranged tandem fashion, as in Kingdon's engine just described, but an ingenious conical metallic packing is introduced between the two cylinders, which packing is automatic. The high-pressure cylinder is double-acting in a sense; the low-pressure cylinder is single-acting, and plays the part of guides, the end of the connecting rod being pivotted directly to the centre of the large piston. This piston is fitted with a broad junk ring to take the strain due to the angular thrust and pull of the connecting rod. It is also provided with a trunk running in a bush, to further relieve the piston. There is one slide valve for both cylinders, as in Kingdon's engine; steam is admitted first to one side of the small piston. The engine then, as a Cornish man would say, "comes indoors." At the end of the stroke the steam is exhausted into the opposite end of the small cylinder and into the space behind the large piston. The small piston is then in equilibrio, the same pressure being on both sides, and the engine "goes out of doors." At the next stroke steam is admitted again to the crank end of the small cylinder, while the steam now in the cylinder exhausts, and so the process is repeated. The diagrams



which we annex will serve to make the action clear. There is, it will be seen, no gap between the two, but instead there is the sudden fall of pressure in a vertical line which takes place the moment the exhaust from the small cylinder takes place. At first sight it would appear as though the whole of the steam passing to the opposite side of the small piston did no work on the expansion stroke and was wasted, but this is not the case. In the ordinary compound engine from the total pressure on the large piston has to be deducted the back pressure on the small piston. In this engine, of course, no such deduction has to be made, and the large cylinder is consequently much less in diameter than it would otherwise have to be, which is an important advantage, as it permits the compound engine to be constructed on the same centres as the ordinary simple engine. The arrangement is, we believe, the invention of Mr. Burall, manager to Messrs. Burrell and Sons. Joy's valve gear has already been described and illustrated in our pages. Without drawings it would not be easy to make the mode of its application to this engine intelligible; its action leaves nothing to be desired. We come now, lastly, to the steering gear, also the invention of Mr. Burall. This consists of two small vertical double-acting cylinders, working by the aid of dog links a small crank shaft, the end of which carries a worm which gears in a worm wheel on the end of the chain steerage shaft usually fitted to traction engines. The little steering engine is bolted well forward to the side of the water tank under the engine. The admission to and exhaust of steam from the engine are effected by an ingenious rotary slide valve, which is a long cylindrical bar, fitted with ports and packing, and caused to revolve by the engine. It would be impossible to make the details of construction clear without drawings. It must suffice to explain the principle of the action of this valve:—One end of it works in a nut; this nut is caused to revolve by the steersman on the foot plate by a hand wheel. For each turn given to this hand wheel and to the nut the engine will make one turn; the moment the steersman ceases to turn the nut the slide valve screws itself endways in it and shuts off steam, stopping the steering engines. Thus the engines are always when in motion following the hand of the steersman and trying to overtake him. As the slide valve is double-acting the engines will run in each direction, always following the hand of the steersman. This gear seems to be as well adapted to steering ships as steering engines; and would also be very suitable for operating the link motion of large marine engines. It cannot overrun itself, and when left to itself always stops.

The third firm we have named, Messrs. Richard Garrett and Sons, show a portable engine which is new in its way, as is Messrs. Burrell's traction engine. This is a compound engine, almost identical with that whose performance during a test run on the brake we reported in The Engineer last year. The novel feature about this engine is the boiler, which, with the engine, we illustrate on page 41. The fire-box is of peculiar shape in cross section, as shown by the diagram, page 41. At the tube plate end it is fitted with a vertical tube about 5in. in diameter outside. In this tube is established a rapid circulation when the furnace is alight, preventing the accumulation of cold water under the fire-box. At each side of the tube is fitted a swinging door faced with fire-brick. When these doors are open access can at once be obtained to the fire-box end of the tubes; when closed they make a bridge, and over the top of this bridge all the products of combustion must pass on their way to the flues. Six of the top flue tubes are fitted with prolongations which extend through the smoke-box to the outer air. When the fire is alight there will be a draught up the chimney whether the engine is at work or not, and this draught causes a rush of air in through the tubes in question. This air is heated by traversing the smoke-box and the boiler, and it meets full tilt the products of combustion coming over the top of the bridge. The result is a mixing of these last with air, and consequently the prevention of smoke. A very careful and elaborate series of trials have been carried out with a straw burner fitted with this arrangement, with a result of an increased evaporative duty of nearly 25 per cent. With coal also the results obtained have been highly promising. The use of flue tubes for the admission of air to furnaces was tried years ago by Edward Wilson in locomotives. His arrangement has been described and illustrated by Holley. But Wilson's use of the principle was different from that of Messrs. Garrett, in that he took no precautions to make the entering air encounter the escaping gases and mix with them. The combination of these air tubes with the bridge is, so far as we can see, quite new. The use of bridges, we may add, and deflectors of all kinds is very old, but it is quite possible to make a new combination of old devices which will succeed where they have failed. The diaphragm shown in the smoke-box is movable, and is employed only to distribute the hot air equally through the box, to regulate the draught, and to act as a spark arrester in some degree. The same firm also show a short, externally fired boiler, with tubes, to supply the compound fixed engine which we illustrate. This engine is identical with that on the boiler of the portable engine. A cast iron tank bed-plate is used, which being of just the shape and dimensions of the portable boiler, the engine will fit either independently. This is an ingenious way of making one set of patterns do for two types of engine, and the result is a very good and satisfactory job. Messrs. Garrett also exhibit a tandem compound portable engine. We give sections of the cylinder and valves on page 41. This may, we understand, be regarded as, in some sense, an experimental engine; only a few runs have as yet been made with it, and no decided opinion can be pronounced on its economy. It has not, we understand, as yet equalled the performance of the double-cylinder compound, although it has given very good results.

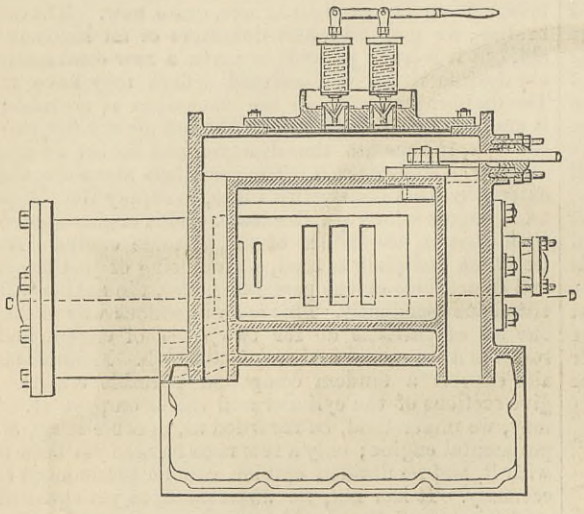
The engines we have thus described and illustrated are the most noteworthy in the showyard. It may be urged that Messrs. Burrell, by introducing steam steering gear, have added to the complexity of the machine and retrograded. This is a weak argument. Those who use engines are becoming in some way better educated, and are quite satisfied with machines which they would not have thought of buying a few years ago. The modern traction engine is all over wheels, and gearing, and pins, and joints, and cocks, and gauges, and lubricators, and nuts, and bolts and cotters, and clutches, but no one objects. Steam steering gear will be found to meet a want. Messrs Burrell have led the way, and the other makers of traction engines will have to follow. Half-a-dozen engines will probably be found fitted with some form of steam steering gear at the Smithfield Club Show in December. To attempt to stop progress because a little extra complication is introduced would, in the present day, be as judicious as trying to keep back the tide with a pitchfork. Messrs. Fowler, of Leeds, exhibited the "Yorkshire" engine at Kilburn for the first time two years ago. Now there are four other important firms, namely, Messrs. Aveling and Porter, Burrell and Sons, Marshall, Sons, and Co., and Richard Garrett and Sons, making compund engines. The sheaf-binding reaper is a complex engine in all conscience. No less than ten sheaf-binding systems are exhibited, to to which we refer in another place. It has come to be understood that farming, to be made to pay, must be conducted on a large scale as a manufacturing operation with the best machinery; and the farmer will no more object now to *necessary* complication than does the cotton spinner. Agricultural engineers have succeeded in inspiring such confidence in their powers that the farmer will not hesitate to take into the field, and to work with success, mechanism which, less well made, would have to be worked, we had almost said under a glass case if it was to be kept in order.

Although no other firms than those named show novelties in engines of a startling character, several engines are to be found in the yard which well deserve notice. For example, horizontal engines of considerable dimensions will be found at the stands of Messrs. Marshall and Sons, of Gainsborough, and Messrs. Ruston, Proctor, and Co., of Lincoln, well worth examination. Messrs. Marshall also show a great 14-horse power compound engine, similar to that which they exhibited at Islington last year. Messrs. Aveling and Porter show a traction engine, new, in that the proportions have been modified, the cost has been reduced by £50, and the weight has been diminished by 1½ tons, without any loss of efficiency. Much of this gain has been obtained by shortening the flues and reducing their diameter, while increasing their number. The road wheels have cast iron rims, 5ft. 6in. diameter instead of 6ft., and the tread-ribs are of chilled cast iron. Another engine, shown by the same firm is principally remarkable for its road wheels, which are 7ft. high. The rim of each wheel was cast in one piece, of steel, by Messrs. Jessop. These are admirable wheels. In several matters of detail the engines made by the Rochester firm are improved year after year. 1881 is no exception to the rule.

Messrs. Fowler and Co., of Leeds, show six engines of various dimensions, but nothing new save one engine, which is different from those built before by the firm in proportion and in some matters of detail, but in nothing else. It has been constructed throughout from new patterns; it is quite unnecessary to say a word in praise of either the workmanship or design of the engines made by this firm. Messrs. Hornsby and Sons, of Grantham, exhibit almost for the first time a traction engine. It is as nearly as possible the same as that which they showed last year at Islington, and it is claimed for it that it is the narrowest engine in the showyard. In order to keep the wheels close in, however, it has been found necessary to reduce the size of the vertical wheels of the jack-in-the-box gear, but as these are made of steel, it is probable that they will be quite competent to bear the strains thrown on them. It is a noteworthy fact that Messrs. Hornsby now make all their own steel castings from the crucible; and with, to judge from the specimens we have seen, uniform success. These castings are, indeed, as sound and clean and free from holes and pits as those of the most eminent steel makers in the kingdom. The great experience which the firm have had in making malleable iron castings no doubt contributes to their success with steel. The steel castings are made from special mixtures, a considerable proportion of old files being used. At first sight it might be imagined that these would be too highly carbonised for the intended purpose, but this is not found to be the case.

COMPOUND ENGINE CYLINDERS.

MESSRS. AVELING AND PORTER, ROCHESTER, ENGINEERS.



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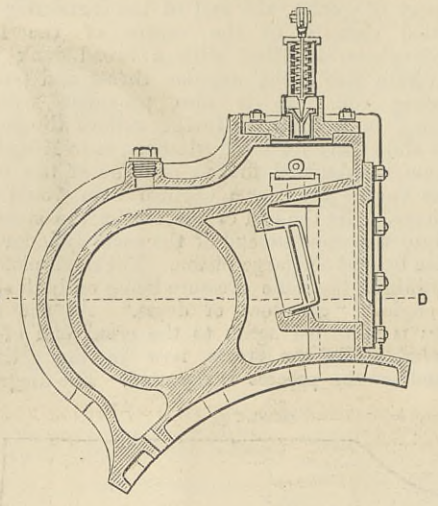
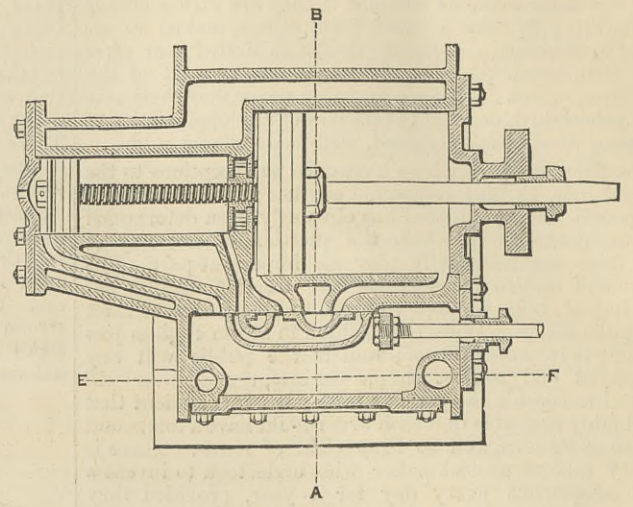


SECTION THROUGH A.B.



SECTION THROUGH C D.

Mr. Darby shows his steam digger, not very dissimilar from that which did such good work at Carlisle last year. There are in this engine certain valuable improvements. It is steered while ploughing from the front now, instead of from the rear. The digging fork frames are no longer connected in any way with the boiler; each has its length of crank shaft set in a separate frame The frames themselves are made of wrought iron instead of steel, which was found to be untrustworthy. India-rubber washers have been introduced, to prevent noise. The throw of the crank has been augmented from 5½in. to 6in., and better work is done; and clutches have been introduced where nuts and bolts were used before, and so the engine can be got to work, or ready for the road, in much less time than has hitherto been necessary. We understand that this digging machine is growing in popularity. Mr. Darby has already done a great deal of work with one, and is full of orders for the ensuing season. Thus the favourable opinions we have already expressed concerning it are justified by the results of experience. As an example of the opinions entertained, it is worth while to quote a letter from Mr. W. J. Beadel, of Springfield Lyons, near Chelmsford, to Mr. Darby:—

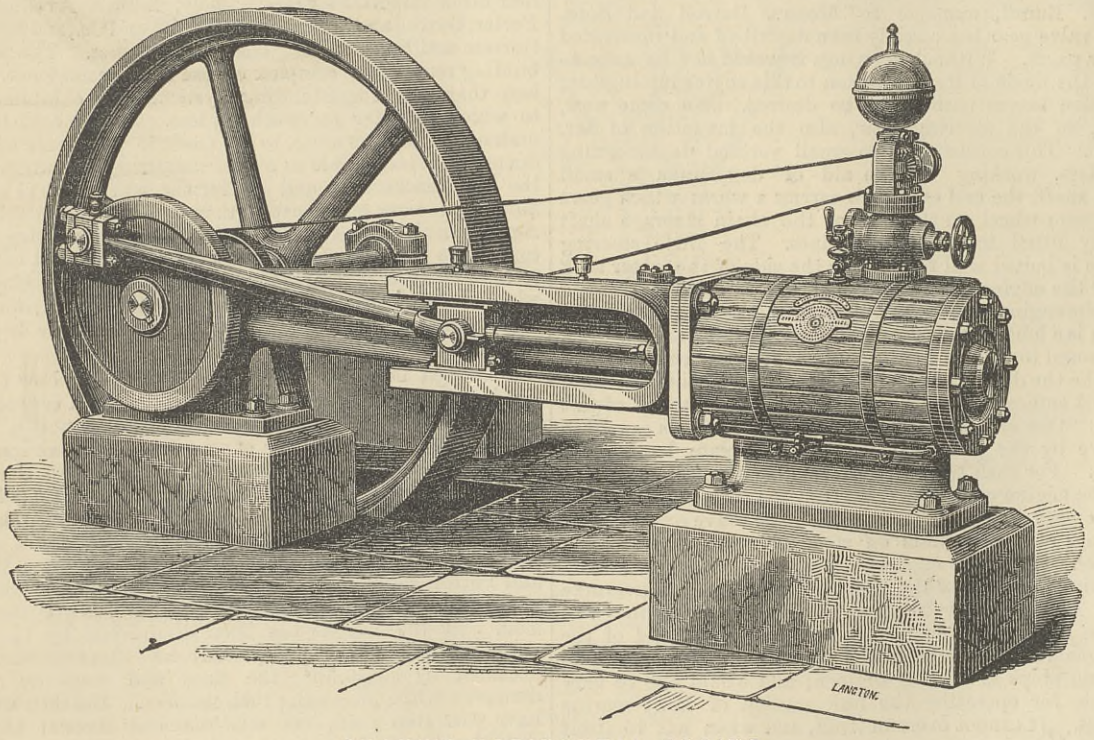
"Inclosed is a cheque for £9 15s., viz., 6½ acres at 30s., which I pay with the greatest satisfaction. The work done upon my farm last week with your Digger is without exception the most perfect piece of steam cultivation I ever witnessed. The small portion of the field (clover fed off) which I attempted to plough with horses, but from the hardness of the ground was obliged to relinquish, is the only part which resists the action of the Bedford harrows and Cambridge roll, and must remain until rain falls to moisten the clods. That portion dug by your machine (twice in a place), I have been able to get pulverised, and in fact prepared for cole seed or swedes. The difference in the appearance of the field now and seven days since is almost incredible."

Mr. Darby publishes the following statement concerning the cost of digging and ploughing. We express no opinion concerning its accuracy, but we may point out that prices vary with the district to some extent. The figures apply to the relative cost of work per day on ten acres:—

DIGGER.	£	s.	d.
Two men ..	0	7	0
Coal..	0	15	0
Oil	0	1	0
Water	0	4	0
Interest of money, depreciation, wear and tear	1	0	0
	£2	7	0

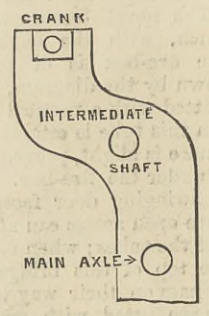
STEAM PLOUGH.	£	s.	d.
Wages of four men at 4s...	0	16	0
Coals	1	10	0
Water	0	8	0
Oil	0	1	0
Interest on capital, wear and tear ..	1	10	0
	£4	5	0

HORSE PLOUGH.	£	s.	d.
Keep of thirty horses at 2s. 6d. ..	3	15	0
Ten men and ten boys' wages.. ..	1	10	0
Interest, wear and tear ..	0	15	0
	£6	0	0

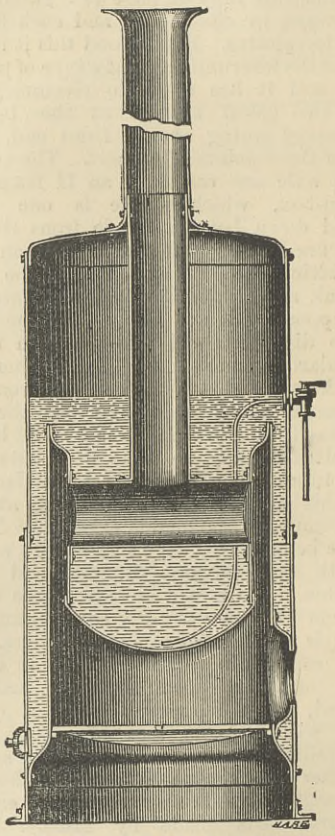


SHANK'S HORIZONTAL ENGINE.

The Durham and North Yorkshire Engine Company, of Ripon, exhibit a new traction engine. This is a new branch of work with the firm apparently, for the engine is the fifth they have made. In general appearance it much resembles the engines of Fowler or Aveling and Porter. The cylinder is on the smoke-box end of the boiler, and the steam, admitted high up, descends through a cylindrical-balanced throttle valve worked by the governor, and is compelled to rise again to get into the cylinder. It is thus a good deal beaten about, and the water is "knocked" out of it on a well-known principle. The cylinder is the only casting bolted to the boiler. The fire-box is enclosed in a species of wrought iron cradle, the top of which forms the cross-bridge for bracing the horn plates together. The engine is carried on coiled springs at the back of the fire-box, very much as Messrs. Aveling and Porter's tramway locomotive—page 44—is carried; but the designer had here three axles to provide for instead of two, and his bearings are fitted in two cheek plates of wrought iron somewhat of the shape shown in the accompanying diagram. Thus all three axes are kept at the same relative distance, the plates with the road wheels following the level of the road, while the boiler rises and falls on the springs.



Time would fail us did we try to do more than allude to the engines of Messrs. Dodman, of King's Lynn; Nicholson, of Newark; Turner, of Ipswich; Bagnall, of Stafford, who show the Tunis, a well designed and finished diminutive locomotive, and a whole host of other makers, who have all earned a first-rate reputation for small steam engines. At the stand of Messrs. Abell, of Derby, will be found some small engines of neat design, and good workmanship. The connecting rods are of cast steel channelled at the side. These engines are sold at a low price. Messrs. Alexander Shanks and Co., of Arbroath, have a very fine display of engines and steam pumps. One of the engines of a new pattern we illustrate above. It has a great many good points to recommend it, as will be seen from the engraving. Of the pumps we shall have more to say. Messrs. Deakin and Parker show a compound engine for the electric light. Two simple engines with distinct bed-plates connected by cross frames drive one crank shaft; externally the cylinders are of the same size, but the high-pressure cylinder is fitted with a liner to reduce its diameter, the space between the liner and cylinder forming a jacket. The fly-wheel has two sets of spokes and one turned rim for a belt; between the spokes works a Hartnell governor, similar to that used by Messrs. Turner, of Ipswich. Both engines are fitted with double excentrics and Mayer's valves. The governor shifts the cut off excentrics round on the crank shaft. This is a very well-made engine and should give very equable turning. At the stand of Messrs. Priestman Brothers is shown Keable's patent boiler, a section of which we give in the accompanying engraving. This boiler is made with an inverted fire-box, forming a water space, having a single cross tube through which the hot air is conducted into the chimney. By means of the scum cock shown, a very ready and simple method of cleaning out the boiler is provided without drawing off the water.



KEABLE'S VERTICAL BOILER.

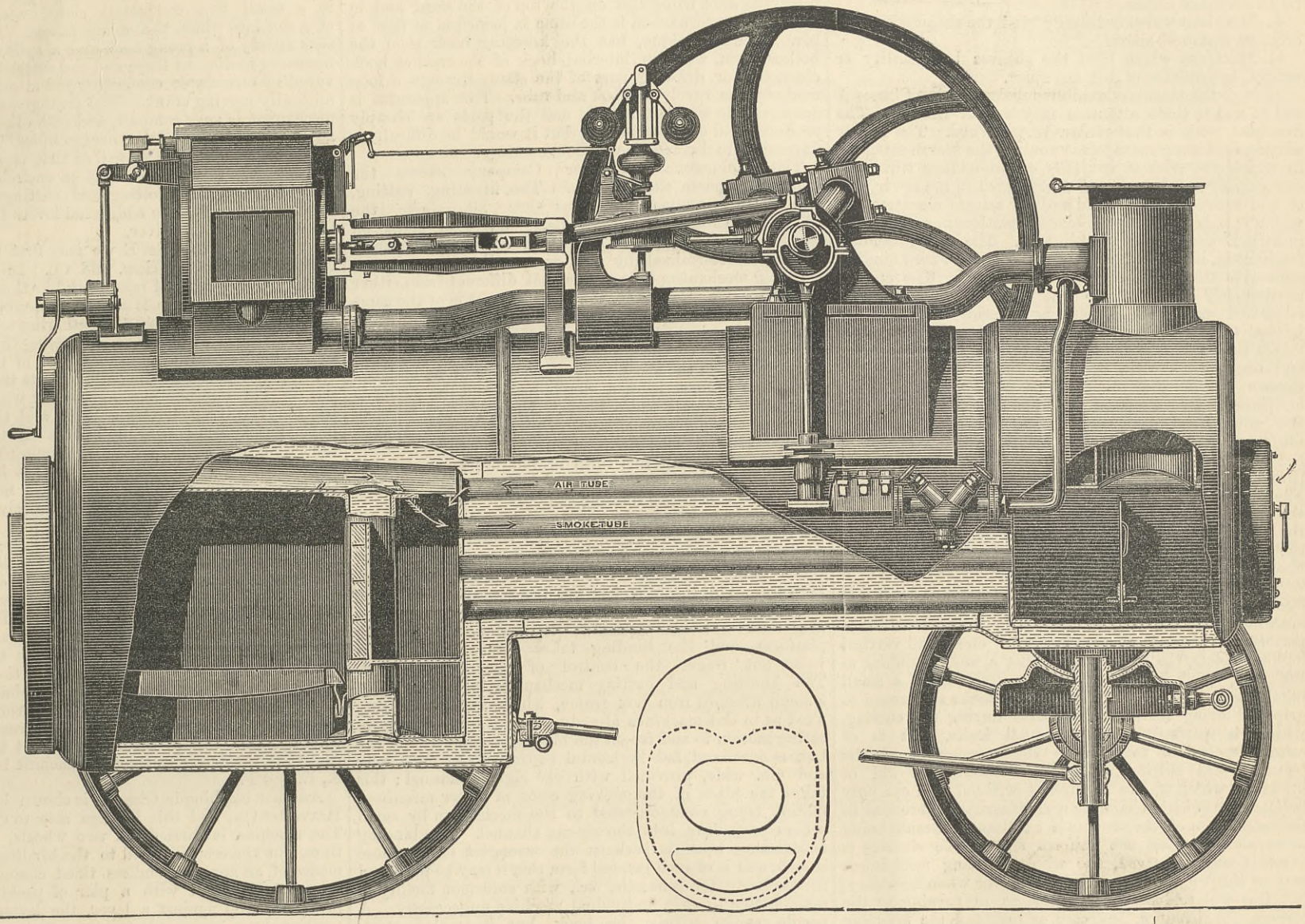
We have now, we believe, noticed all the engines which call for special remark. We have said nothing, nor is it necessary that we should, of a great many other engines, more or less good in design and workmanship. We have seldom visited a Royal Agricultural Society's show in which less rubbish in the shape of steam engines was to be seen. It was a noteworthy circumstance that comparatively a small number of firms showed engines in motion. An explanation of this fact may perhaps be found in the uncertain character of the weather. This is the first fine-weather show held in three years. Kilburn was disastrous, and at Carlisle the showyard was little better than a sea of mud on the second day. A high price is paid for stands, and little is to be gained by showing engines under steam which have to be reached by perilous and divergent paths across narrow planks, a false step from which means destruction. It is gratifying to be able to add that nearly all the exhibitors can say that they are very busy and full of orders.

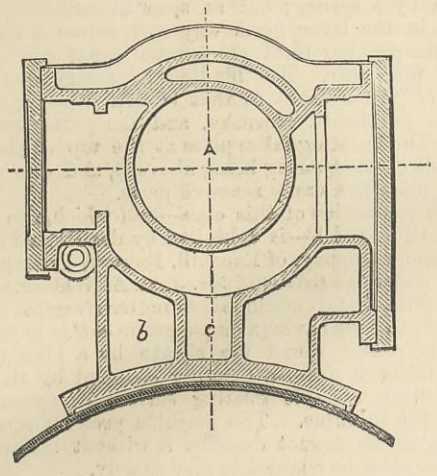
SHEAF-BINDING MACHINES AT THE ROYAL AGRICULTURAL SOCIETY'S SHOW, DERBY.

In 1876 the Royal Agricultural Society offered a gold medal for an efficient sheaf-binding machine either attached to a reaper or otherwise, and at the Liverpool Show in 1877 eight exhibitors entered machines for trial. Three of these makers did not, however, send machines

COMPOUND PORTABLE ENGINE, R.A.S. SHOW, DERBY.

MESSRS. RICHARD GARRETT AND SONS, LEISTON, ENGINEERS





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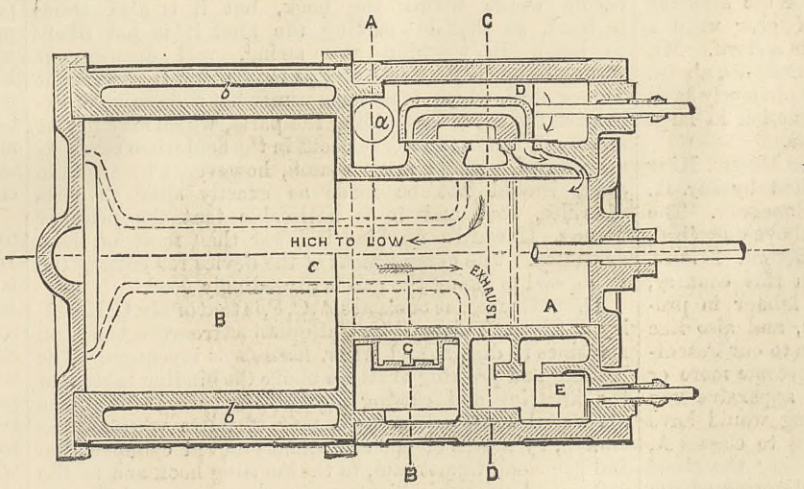
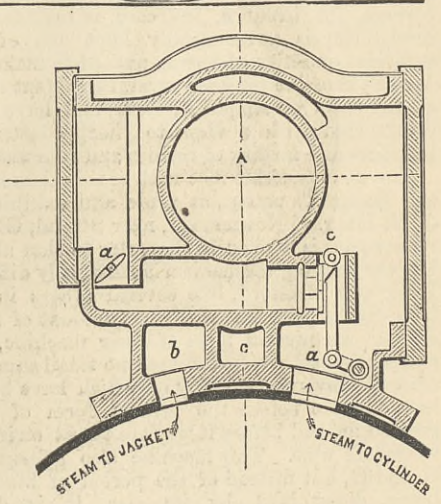
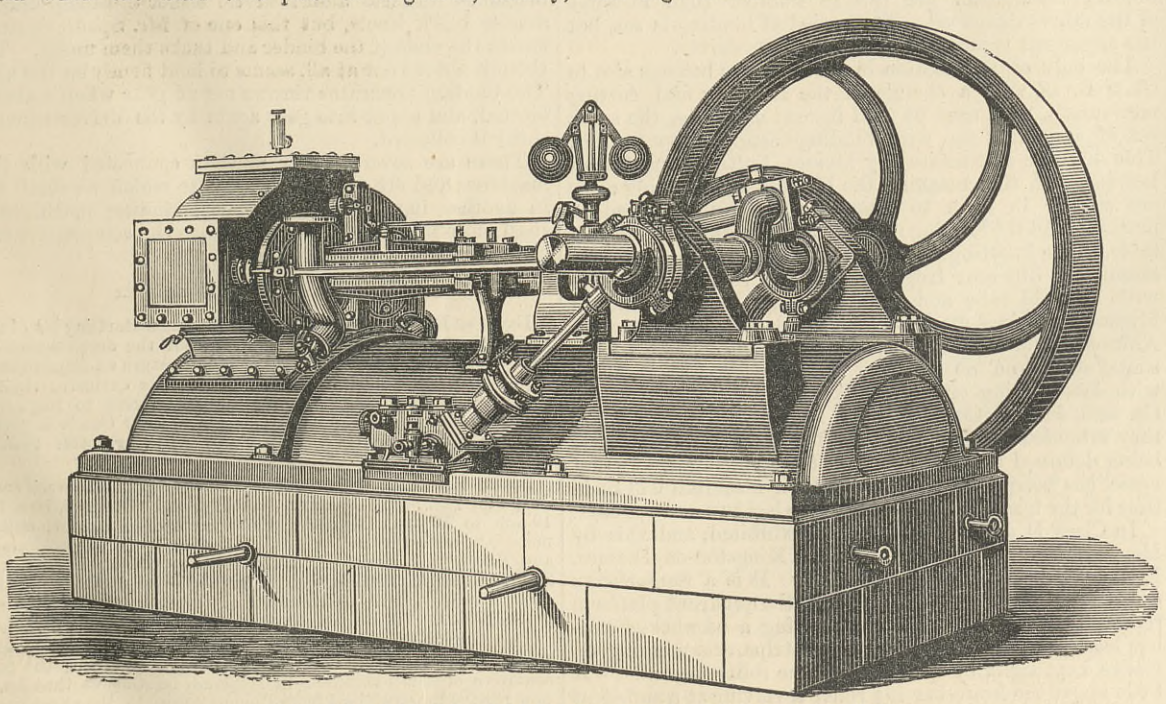


SECTIONAL PLAN



SECTION THROUGH A.B.

even for exhibition, and two others who had made machines for binding with string, withdrew from the competition. There were thus only three machines in the field when the trials took place at Aigburth, namely, those of Mr. C. H. McCormick, Mr. W. A. Wood, and Messrs. D. M. Osborne and Co. Some fair work was done on clean standing barley and oats, but the gold medal was not awarded, on the ground that a sufficient degree of perfection had not been arrived at to suit English requirements. A silver medal was, however, awarded to Mr. W. A. Wood as a recognition of progress, and high commendation was bestowed on the binding mechanism of Messrs. Osborne and Co.'s machine. The offer of a gold medal was, however, repeated by the society, and renewed competition took place in August, 1878, at Abbots Leigh, Bristol. Ten machines were entered for exhibition, eight being intended for competition, but only three went through the trials. These were the machines of Messrs. McCormick, W. A. Wood, and Messrs. D. M. Osborne and Co.; the Johnston Harvester Company's machine, a string binder, going through part of the trials. The judge in this case awarded the gold medal to Mr. McCormick, as fulfilling the conditions laid down, and highly commended Mr. Wood's machine.* String-binding machines were hardly better represented than at the previous trial, and it is here that the first great difference is observable in the machines previously shown and those at Derby. The latter are all string-binding machines, though some are so made as to bind with wire, with more or less change of parts. In America it seems that the objection is not now very frequently urged against wire, and the National Millers' Association has withdrawn a resolution previously passed respecting the price to be paid for grain from wire-bound corn. Magnetic machines became necessary to separate the short pieces of wire from the wheat previous to grinding; but it was soon found that these machines extracted so many nails and other pieces of metal besides the wire, all of which were highly injurious to mills, that it was evidently economy to use them for all corn. The objection on the part of the millers thus ceased, and Americans say that animals know better than to eat wire in injurious quantities or forms, and thus, in spite of what has been said about wire in fodder, wire is still largely used in America, though England has decided against it.



GARRETT'S STATIONARY COMPOUND ENGINE.

The machines exhibited at Derby—in response to the repeated offer of the Society of a prize for the machines which shall be proved to be the best at some trials in about a month's time—are divisible into several classes:—

A. Machines which tie with string only.

B. Machines which tie with string or wire.

C. Machines of which the binder forms part of a combined sheaf-binding reaper.

*The knotting and cutting mechanism of this machine was very fully illustrated in THE ENGINEER of the 17th August, 1877.

D. Machines attached to an ordinary sheaf delivery reaper.

E. Machines attached to a form of horse rake or gleaner, and intended to pick up and bind the crop after cutting by an ordinary reaper.

F. Machines which ordinarily bind the sheaves by time or at set distances apart.

G. Machines which bind the sheaves by quantity or weight, irrespective of distance apart.

Most of the machines exhibited belong to the Classes A and C, and to these attention may be first directed. The first met with is that of Mr. W. A. Wood. The reaper portion is of the general form known as the Marsh machine, in which the crop as cut falls on an endless travelling canvas platform, by which it is delivered to the lower part of and between two inclined endless canvas elevators, by which it is delivered to the binding platform, as illustrated in The Engineer, 8th March, 1878. The string binding mechanism, however, bears no likeness to the wire binding apparatus there and elsewhere illustrated. The crop is continuously delivered to the binding platform, and is packed up against a lever by a series of short tines jointed to a small revolving barrel. The lever against which the packing is done is held in position by a spring, and controls a clutch, by which the packing tines are thrown out of gear as soon as a sufficient quantity is packed for a sheaf of the desired size. By the same movement the binding mechanism is put into gear, and the sheaf tied and ejected. As soon as the ejection has taken place, the packing tines are again thrown into gear, and the binding mechanism out of gear. The whole of the sheaf-binding mechanism is above the sheaf, which is tied at the top, and a peculiar feature of the machine is that, if the string breaks anywhere below the binding arm point, it re-threads itself, and it is only known that the string has broken by the appearance of a very small sheaf. The breaking of the string is thus, it is said, seldom attended with the necessity for stopping the machine. The knotting of the string in this machine is performed by a pair of open hooks on one small vertical hollow spindle, the one hook having a motion similar to the other, which it follows under the resistance of a small friction-grip spring belt, by which the hooks are caused to grip the string for a brief interval during the cutting, which is performed by a small knife. It is of course impossible to describe the mechanism of the knotting and cutting apparatus without the aid of drawings, which we are at present without, and can only indicate the general character and essential differences in the mechanism of the machines exhibited. Beside being so constructed that the uniform size of the sheaves is automatically preserved, the whole binding mechanism may be thrown out of gear by the driver when necessary, but this will seldom be required, as in turning at the corners, for instance, less corn is cut, and the knotting mechanism is automatically kept out of gear until a sufficient quantity of corn is packed to make a sheaf. Mr. Wood's machine presents several excellent features, almost all the parts are simple in form, and have obviously been constructed with a view to cheap construction in large numbers and facility of repairs and renewals.

The next machine met with of this class is Messrs. King and Bomford's patent, as made and exhibited by Mr. H. J. H. King, of Newmarket, near Stroud, Gloucester. The reaper part is similar in character to that above described, but the binding mechanism is essentially different. Messrs. King and Bomford, like several others in this country, have gone through a prodigious amount of labour in producing the present form of their machine, and also like many others, have contributed no small sum to our Patent-office for inventions, many of which have become more or less obsolete before the present form of apparatus was arrived at, and before it was seen that string would have to replace wire. This machine also belongs to classes A, C, and G, but instead of the period of binding the sheaf being determined by its size, it is determined by weight. The crop, as delivered by the elevator, falls upon a number of arms forming a kind of grid platform, a little above the binding platform proper. This grid is kept up by a weighted lever, and as soon as the necessary weight of crop has fallen upon it to depress the grid, the binding and pressing arms and mechanism are thrown into gear, the sheaf bound and ejected, and the binding mechanism thus again thrown out of gear until the necessary weight for the next sheaf has accumulated upon the grid. The knotting and cutting apparatus in this machine is all under the binding platform, and the different parts receive their motion from a compound horizontal slowly-revolving face cam of rather large dimensions. The knotter consists of a revolving hook within a tube, which receives both a revolving and reciprocating motion from the cam. The binding and pressing arms in this machine are of considerable size, but do not necessarily take more power to work than the smaller arms of Wood's and other machines. The machine is well made, and the parts appear to be of sufficient size and strength to perform the work for which they are designed; but it may be suggested that the period of binding the sheaf may possibly be affected by the jolting of the machine as it moves over a field, and which may sometimes cause the sheaf to descend a little earlier than the counterbalance weight would allow when the machine stands still, or the reverse may take place. Possibly a spring may be found more effective in securing uniformity than a weight.

The machines exhibited by Messrs. Hetherington and Co., and one of those by Mr. Bamlett, need no description, as they are constructed under the patent of Messrs. King and Bomford. Mr. Bamlett, however, exhibits a new machine in this same class. The knotting and cutting mechanism is beneath the binding platform, and the binding arm is of the large crane neck form. The cutting of the string is effected by a circular knife, but the knotting apparatus is of the tube and internal hook character. Its exact form cannot be described, as the machine was not completed at the time of our visit, but was in the hands of the fitters in preparation for the trials.

The next machine in this class, or in the three classes A, C, and G, is that of Messrs. Richard Hornsby and Sons. In this machine, as in Mr. W. A. Wood's, the whole of the knotting and cutting gear is above the plat form, the knot being tied on the top of the sheaf and in sight. The mechanism is the same in principle as that of Mr. Wood's machine, but the knotting hook is of the hollow form, with an internal hook of the crochet hook character for drawing part of the string through a loop made by the revolving hook and tube. This apparatus is amongst the simplest shown, and the parts are cheaply produced and easily renewed; but it would be difficult or impossible to describe it without drawings.

The Johnstone Harvester Company shows the other machine in these classes. The knotting, cutting, and sheaf-forming apparatus are all above the binding platform, the knot being made in sight on the top of the sheaf. The period of binding is automatically determined by size or quantity of corn, the knotting mechanism being somewhat different from either of those above referred to, though the knot is of the same form. The binding platform is not horizontal as in the other machines, but inclined to the part at which binding takes place, the edge of the table being fitted with flaps, which fall down when the sheaf is tied and allow of its ejection. The knotting hook is of a simple form, and the string is severed by a simple knife blade. The parts are all such as can be cheaply made and with facility renewed. Messrs. Samuelson and Co., Banbury, exhibit two well-made machines fitted with this form of binding apparatus and one of their low level binding platform machines, also fitted with this string binding gear.

The next machines to be noted are those which comprise the classes A, C, and F, namely, the combined machines which bind with string and by time, instead of by size of sheaf. The first of these is that of Messrs. J. and F. Howard. This machine has not the appearance of being a combination of two American machines. The knotting and cutting apparatus is under the binding platform, and the binding takes place at set intervals, but under the control of the driver's foot. The knotting and cutting mechanism is contained in a small wrought iron box frame, which, instead of being fixed as in the machines already described, has a reciprocating motion to and fro on the binding table. Under the box is one fixed flat horizontal casting, about 24in. long and 4in. wide, provided with one zig-zag channel; this takes the place of the moving cams of other machines, motion being communicated to the mechanism by small rollers projecting into the zig-zag channel. The binding or knotting hook is perhaps the strongest of all those shown, and is of such general form that it may be produced in duplicate for renewals, &c., with sufficient facility to make fitting in each individual machine unnecessary. A needle works within the hook, but it is also strong in form, so that in making the knot it is not likely to break in catching the string, and drawing it through the loop. Most of this mechanism is of wrought iron or steel, which is perhaps somewhat suggestive of expensive fitting, in assembling the parts, which may not be so severely felt in the works as out in the field when renewals are wanted. There is no reason, however, why all these parts should not be made as exactly alike as parts of rifles, &c., and it is noticeable that the price of Messrs. Howard's machine is lower than most of those exhibited. The arrangement of the device for cutting the string and gripping the end is exceedingly good.

The next machine of classes A, C, F, is that of Mr. G. Kearsley, of Ripon. This machine is also distinct from the American machines in design, and is Mr. Kearsley's invention. The binding and pressing arms are above the binding table, and the knotting and cutting mechanism beneath it. One horizontal shaft driven by a pair of mitre wheels gives motion, by means of one compound grooved cylindric cam and one small tappet cam, to the knotting hook and to the cutter and gripper, which are in one piece, and in this case travels up to the knotter as the knot is made, so as to remove unnecessary strain from the knotting hooks. The binding and pressing arms are simple in form and in motion, and the pressing arm acts as the ejector. The machine is less in height than others, and the parts of the binding mechanism are less in number than in some of the others described. The period of binding is set, but the apparatus is under the control of the driver.

The only other machine in these classes belongs also to Class B, as, with a change of the knotting and cutting mechanism, wire may be used instead of string, the extra set of apparatus for wire binding costing a few pounds. This machine is exhibited by Messrs. Aultman and Co., of London. In this machine the binding and pressing arms are similar in form to those of the King and Bomford machine, and the binding mechanism is all below the binding table. The knotting hook and cutting gear are, however, essentially different from any others, though the hook with internal tube and looping needle is also found in Messrs. Hornsby's machine. All the mechanism in Messrs. Aultman's machine is worked by one face cam on a horizontal shaft, and no machine in the show tied its sheaf with less jerking or noise. Messrs. D. M. Osborne and Co. and Mr. McCormick send machines, but not those they intended to show, the machines of both these makers being detained by the stranding of the Britannic. As that vessel has been got off, however, their machines will be in time for the trials if not for show on the last two or three days.

In Class D only one machine is exhibited, and this by Messrs. Kingsford, Fairless, and Co., of Kingston-on-Thames. It belongs also to Classes A and F. It is a Samuelson's ordinary sheaf-delivery reaper with the quadrant platform removed and replaced by one carrying a number of endless leather belts crossed by wood strips, and running on rollers kept tight by springs upon the roller bearings. A little above the knife-bar is a roller revolving at a sufficient speed to carry the crop on to the endless leather belt platform, and another roller is placed close to the knife-bar to carry the straw when short on to the endless platform. The latter delivers the crop to the binding mechanism, which is placed at the rear of the main wheel of the machine. The binding mechanism is the same as that employed in a machine of Class E, and consists of gathering, pressing, and binding arms above and knotting and cutting mechanism below the travelling platform, all fitted in a small box completely closed with the exception of a slot into which the string passes. The knotter consists mainly of a prong hook and a split crochet hook, the necessary motion to these and the cutter knife being conveyed by one simple connecting rod attached to an intermittently moving crank. The arrangement of the small mechanism is very compact, and offers in this respect some advantages not secured by other machines. The tension on the string is automatically varied, so that it runs loose when the string is being drawn out to encircle the sheaf, and is tight when the knotting and cutting are performed. The binder involves no additional levers for the control of the machine by the driver.

Turning now to Class E we may first mention that of Messrs. Kingston, Fairless, and Co. In the front of the machine is a number of rake teeth like those of an ordinary horse rake, and above is a pair of double or tong teeth which take the crop from the gathering teeth and deposit it at the rear of the machine. In passing there it is encircled by the binding string, and one part of the central combined pressing and binding arm, directs the string into the slot in the binding mechanism box where it is caught by the revolving knotting hook and tied. A feature in the mechanism is that the knot is tightened by it from the supply string, so that the tightening does not depend upon the expansion of the sheaf after it is liberated from the cutter. The knotting and cutting mechanism works smoothly, and though it needs to be nicely made, the parts may be made of sufficient strength, and of forms which admit of facility of production and repairs. The little box containing this mechanism can be easily removed from the machine for storage in winter or for repairs, and a duplicate of this box of apparatus might advantageously accompany each machine. The machine is mounted on three wheels in the same line, so that should one wheel be over a furrow the others carry the machine at the proper level. A friction strap-brake is applied to the wheel from which the binding mechanism is driven, so that in case of any obstruction the whole apparatus ceases to operate until the obstruction is removed. The machine ties at set intervals, but this is under the control of the driver, so that the machine belongs to classes A, E, and F.

Another machine in Class E, is shown by the Johnston Harvester Co., and this belongs also to Classes A and G. The machine is carried on two wheels, and collects by tines, but the crop is raised to the binding mechanism by means of an apron of endless tined chains. The binding apparatus is fitted with a pair of packing tines, which press the crop against a lever, the latter being kept in position by a spring; but as soon as sufficient corn is pressed in the lever gives way and moves a clutch, by which the packing tines are thrown out of gear and the knotter into gear. The binding apparatus has several points of resemblance to that of Mr. Wood's, and the new one of Messrs. Hornsby, and the parts are simply made. The knotting takes place at the top of the sheaf, the whole of the gearing being above it, and consisting of cheaply made and easily renewed parts.

Another machine of this class—and which also belongs to Class B, A, and F—is exhibited by the Notts Fork and Implement Company, of Ranskill, Bawtry, Yorkshire, and is made under the patent of Mr. J. G. A. Walker, of Danes Hill, Retford. In this machine the knotter is carried in a tube mounted in a slide having a simple reciprocating motion. The string is passed round the sheave by a binding arm, which takes it from a quantity collected by tines, and passed up a metallic guiding surface or apron at the rear of the machine. The machine presents some good features, but we cannot describe it without the drawings, which we shall be enabled to give shortly.

The remaining machine, which is also of Classes E, A, and F, is exhibited by Mr. G. Spencer, of Duffield, Derby, as made for him by Mr. W. Abell, of Derby. It is a smaller and, perhaps, lighter machine than either of the others, and is intended, like the two first-mentioned, to gather either after swathe or sheaf-delivering machines. All the machines hitherto described tie either tight slip knots or double black knots, but this one of Mr. Spencer's simply twists the ends of the binder and tucks them under. This, though not a knot at all, seems to hold firmly on the sheaf. The binding apparatus throws out of gear when a sheaf is ejected, and is put into gear again by the driver when the sheaf is collected.

There are several other matters connected with these machines and others of their class to which we shall refer in another impression. The sheaf-binding machines we shall more particularly describe when the competitive trials take place in a few weeks time.

English Engines.—In the United States a startling bit of news comes from Connecticut. We hear that the organisation of a joint-stock company in Hartford to manufacture an English engine is proposed. A Hartford capitalist holds the exclusive right for its manufacture in the States, and has sent agents to England to look into the subject. What engine can this be? Can it be possible that an English engine can be made which is better than the native product?

South Kensington Museum.—Visitors during the week ending July 9th, 1881:—On Monday, Tuesday, and Saturday, free, from 10 a.m to 10 p.m., Museum, 8023; mercantile marine, building materials, and other collections, 3357. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. till 6 p.m., Museum, 2232; mercantile marine, building materials, and other collections, 425. Total, 14,037. Average of corresponding week in former years, 17,642. Total from the opening of the Museum, 20,127,806.

The Buenos Ayres International Exhibition of Machinery, &c.—Mr. John Hayes, C.E., of 27, Leadenhall-street, the representative of this exhibition in England, informs us that he has now received instructions from Buenos Ayres to the effect that it is definitely arranged to open the exhibition on February 15th, 1882, a copy of a decree by the Argentine Government granting the use of the Plaza Once de Septiembre in which to hold the machinery section of the exhibition, and which is signed by the President of the Argentine Republic, has also been forwarded to Mr. Hayes by the Commissioners at Buenos Ayres.

RAILWAY MATTERS.

THE length of railroads built in the United States in the year ending April 1st, 1881, was 6113 miles, or twice the mileage of the preceding twelve months.

THE final link of the Darjeeling Steam Tramway was opened on the 4th inst. Calcutta is now in direct communication with its sanatorium. At a banquet given on the occasion, Sir A. Eden congratulated Darjeeling on being the first Himalayan station to connect itself with the railway system, and described the line as one of the most remarkable railways in the world.

THE Select Committee of the House of Lords have refused the application of the Skipton and Kettlewell Railway Company to extend their line to Aysgarth, though the Committee have sanctioned its extension as far as Buckden. At present the promoters only intend to take powers for the construction of the line to Kettlewell, though they have made arrangements with the contractors to commence operations at once in the construction of this portion of the line.

THE Westerham Valley Railway has been opened for traffic. The new line commences at Dunton-green, on the main line of the South-Eastern Company, where it branches off, and goes through or by the villages of Chevening, Chipstead, Sundridge, and Brasted, where there is a station, to Westerham, a market town of Kent, close to the borders of the county of Surrey. The railway, which is nearly five miles long, serve the purpose of connecting the town and the fertile district known as the Westerham Valley, with the metropolis.

WHEN the Bill authorising the abandonment of the Forth Bridge came before the House of Lords' committee last week, it was at once withdrawn, owing to the recent decision of the North-Eastern, Great Northern, Midland, and North British Railway Companies to guarantee a fixed and perpetual dividend of 4 per cent. per annum on the share capital instead of a conditional guarantee on the making of the bridge. The estimated cost of constructing the proposed bridge is over £1,375,000, or less than that designed by the late Sir Thomas Bouch.

A SELECT Committee of the House of Lords have passed that portion of the Guildford, Kingston, and London Railway which, it was agreed, should be constructed by the South-Western Railway, but have refused to sanction the branch line, which was to have crossed Great Bookham-common to join the South-Western Railway at Leatherhead. As the other branches between Surbiton and Guildford were abandoned in the House of Commons in favour of this Leatherhead extension, the Bill as now passed by the Lords only authorises the construction of the main line between those two points. The other portion of the line from Surbiton to Fulham, which is to be constructed by an independent company, has passed unopposed.

THE Lancashire and Yorkshire Railway Company, in order to meet increasing traffic requirements of the engines working the Preston district, have commenced the erection of a large new locomotive shed at Lostock Junction. This shed will be 224ft. long by 140ft. wide, and will provide accommodation for thirty-two engines of the largest type, whilst along one side will run a suite of offices and mechanics' and other workshops for repairing purposes. The roof will be in thirteen spans of 17ft., supported upon cast iron columns, with troughs running the whole length of the shed to carry away the smoke from the engines. The shed is being erected from the designs of the company's architect, and the contractor is Mr. Bridge, of Burscow.

IN addition to the parcels postal facilities in France recently mentioned in this column, the French Minister of Public Works has induced the French railway companies to agree to an arrangement by which packages such as are not admitted to the mails because of dimensions, &c., and up to the weight of 11 lb., will be carried between any two points in France for 10d. when delivered at stations, and for 12·5d. at consignee's address; besides which a Government tax of 2d, on each has to be paid. The very great convenience of these arrangements to the public is evident. A lady on the Russian border of Prussia can have her bonnet sent to her from Paris for 22c. The *Railroad Gazette* thinks that this must greatly stimulate the trade of the large cities at the expense of the smaller towns, especially in France, where it brings the Paris shops virtually to the doors of every house in the Republic.

DURING the month of June a number of experiments on the consumption of naphtha have been made on the Tamboff Saratoff line by the engineer, M. Poretsky. The following points were established :—(1) Steam was got up from cold water to a pressure of 100 lb. on the square inch in two hours, and by burning 4 poods —or 144 lb.—of naphtha. Usually in the same locomotive, with coals aided with wood, three and a-half hours are required, and 26 poods of coals and wood—936 lb. (2) The apparatus can be kept in use forty-eight hours without stoppage for cleaning, after which only two hours required to clean out. (3) In running 1500 versts it was only required to stop the locomotive twenty minutes for fuel, and the driver and stoker have almost nothing to do, except to stop and start, the apparatus simply requiring opening more or less of the feed. (4) The flame is so well thrown over the whole of the fire-box that after running 40,000 versts it is considered only one-half remount is necessary as opposed to coals. (5) Whilst it was found possible to evaporate 13⅛ lb. of water with 1 lb. of naphtha, the absolute result with new men and on the whole runs was 9 lb., or about two and a-half times more than the coals used.

IN the course of the meeting of the Railway Rates Commission on the 1st inst., Mr. George Finlay, general manager of the North-Western Company, stated that immediately before the construction of the railway between London and Birmingham the whole of the traffic by road and canal was 45,400 tons per annum, while the traffic carried by the North-Western alone in 1870 was 56,000 tons, and in 1880, 78,741 tons. This was exclusive of what was carried by the Great Western or the Midland companies or the canals, the latter carrying more than they did at the time he had mentioned. This showed that although the rivalry between the three great companies went on, the traffic was constantly increasing. The traffic between Liverpool and Manchester was carried by canal, at a cost of 15s. per ton, and the time taken was twenty hours. When the railway was opened the charge for the same class of traffic was 10s. per ton. In 1841, Pickford and Co. charged between Manchester and London, for bales and cases, 57s. 6d. per ton, and the railway companies now charged 40s. for the same articles; and there was a similar reduction in other articles. In providing goods station accommodation the North-Western had spent £2,300,000 in London, £812,000 in Manchester, £250,000 in Birmingham, and £1,913,000 in Liverpool. This was exclusive of passenger stations. The sum actually spent in providing goods stations in Liverpool was twice as much as was required originally to construct the Manchester and Liverpool Railway. The cost of landing goods in London—the loading, and the unloading, &c.—was 2s. 11d. per ton, at Manchester 1s. 8d., at Birmingham 1s. 5d., and at Liverpool 1s. 7d. per ton; and if they added interest upon the capital laid out in stations at 4 per cent. per annum, less the amount received in the way of rent, the cost in London would be 4s. 3d. per ton, Manchester 2s. 4d., Birmingham 1s. 9d., Liverpool 2s. 2d. In addition to the expenditure they incurred in the construction of these large stations, they had to provide an enormous mass of sidings for the reception of train loads. At Willesden they had provided twenty miles of sidings, and at Edge-hill, Liverpool, thirty miles; and they had in course of construction at the latter place another eight miles. This showed that so costly was the construction of terminal accommodation, that they ought to be allowed for terminals, and he considered that their right was borne out, not only by their statutory powers, but by the necessities of the case and by the experience of carrying on the business. The average cost of loading and unloading at each station was 9d. per ton.

NOTES AND MEMORANDA.

IN the United States there are 560 cities and towns which have hydrant water supply, adapted to the use of water motors.

THE census returns for South Australia show that the population is 278,000. In 1871 it was 185,626 souls; in 1876, 213,271; and in 1881, about 147,000 males and about 130,000 females. In the last ten years the rate of increase in South Australia has been 49·76 per cent.

IN a letter on the heat in the tropics, to the editor of the *Times*, Mr. G. J. Symons gives the following as the highest point reached by the shade thermometer in the years 1874-80 :—

	Barbados.	Mauritius.	London.	Bombay.
	deg.	deg.	deg.	deg.
Average for the seven years	84·9	87·3	87·4	93·9
Absolute highest	86·0	88·8	92·6	96·3

A TABLE which shows that the wages of thirty-six different trades in France in 1877 averaged 52 per cent. higher than in 1853, has been published by *La Statistique de France*. The lowest increase given is 40 per cent.—colliers' wages—and the highest 74 per cent. —bakers' wages. The compiler of the data notes that the rise in wages has been greatest in those trades in which machinery has come largely into use; and states that the price of bread has remained stationary.

THE Municipal Council of Paris has recently made a great improvement in the arrangements of the Morgue by adopting the refrigerating apparatus of M. Mignon and Rouart at a cost of 53,000f. The bodies on view will thus be enabled to be preserved for any length of time within reason, and the sanitary conditions of the Morgue will be greatly altered for the better, while the longer period of exposure will frequently further the ends of justice and give more frequent opportunities for identification.

A VARIETY of coal, said to be the most highly-carbonised member of the coal series hitherto described, has been found near Schunga, on the western shores of Lake Onega—*Jahrbuch für Mineralogie*—it contains about 91 per cent. carbon, 7 or 8 per cent. water, and 1 per cent. ash. This coal is extremely hard and dense, has an adamantine lustre, is a good conductor of electricity, and has a high specific heat—0·1922. Although containing as much carbon as the best graphites from Ceylon, it is not a true graphite, inasmuch as it is not oxidised by potassium chlorate and nitric acid, but behaves towards those re-agents like an amorphous coal.

THE authorities of the Paris Mint propose to substitute for the present bronze pieces, now almost as familiar in England as in France, a new coinage of a smaller and more elegant kind containing 20 per cent. of nickel. Specimen coins have been struck of the respective values of about a halfpenny (5 centimes), a penny, and twopence-halfpenny. The die used is an old one, cut in the troublous time of 1793. Its device is an allegorical head of the Republic wearing a cap of liberty. It will be well for the Royal Mint to adopt a similar plan so far as the metal is concerned, for the bronze coinage of this country, as it is, is simply disgraceful.

WRITING in answer to a question on cleaning out lime incrusted water pipes, a correspondent of the *American Manufacturer* writes :—"As a sort of 'shop kink' I give you a curious experiment tried on an engine water supply pipe that had become choked up with lime incrustation. After hammering it for an hour or two and kindling a fire all over it, without any result, one end was plugged up, and about a pint of refined coal oil was poured in the other end—all it would hold—leaving it to stand all night. The next morning the entire mass slid out a solid lime core. Before trying this we thought of throwing the pipe away as useless, and getting a new one."

THE summary of the population of the several provinces of the non-Hungarian portion of the Austrian Empire, according to the report of the Central Statistical Commission for taking the census last December, is as follows :—Lower Austria, 2,329,021; Upper Austria, 760,879; Salzburg, 163,566; Styria, 1,212,367; Carinthia, 348,670; Carniola, 481,176; Trieste, Istria, &c., 650,532; Tyrol, 805,326; Vorarlberg, 107,364; Bohemia, 5,577,134; Moravia, 2,151,619; Silesia, 565,772; Galicia, 5,668,170; Bukovina, 569,599; Dalmatia, 474,489. Total for the Austrian Crown Lands, 22,130,684. This gives a total increase for the eleven years, since the census of 1879, of 1,734,054 or 8·5 per cent.

AS a summary of a climatological table for the British Empire for 1880, Mr. G. J. Symons gives the following :—Highest temperature in shade, 106·9 deg., at Cape of Good Hope, on December 28th; lowest temperature in shade, — 44·4 deg., at Winnipeg, on December 28th; greatest range, 134·7 deg., at Winnipeg; greatest mean daily range, 24·8 deg., at Cape of Good Hope; least mean daily range, 7·7 deg., at Barbados; highest mean daily temperature, 81·1 deg., at Ceylon; lowest mean daily temperature, 32·4 deg,, at Winnipeg; driest stations, Melbourne and Mauritius, 72 deg.; dampest station, Cape Breton, Sydney, 83 deg.; highest temperature in sun, 159·5 deg., at Calcutta; greatest rainfall, 77·90m., at Barbados; least rainfall, 17·70in., at Cape of Good Hope; most cloudy station, Barbados, 6·9; least cloudy station, Cape of Good Hope, 3·9.

ONE of the recently introduced substitutes for gold, which has become very popular in some of the jewelry and other manufactories of fine wares in France, is composed as follows :—100 parts, by weight, of copper of the purest quality, fourteen of zinc or tin, six of magnesia, three and six-tenths of sal ammoniac, limestone, and cream of tartar. The copper is first melted, then the magnesia, sal ammoniac, limestone, and cream of tartar in powder are added separately and gradually. The whole mass is kept stirred for half an hour, the zinc or tin being dropped in piece by piece, the stirring being kept up till they melt. Finally, the crucible is covered and the mass kept in fusion thirty-five minutes, and the scum being removed. the metal is poured into moulds and is then ready for use. The alloy thus made is represented as being fine-grained, malleable, takes a high polish, and does not easily oxidise.

HERREN Holetschek and von Hepperger, of the Vienna Observatory, have calculated the comet's path from the data furnished by the various observations taken since it first became visible to European observers, and especially those taken at Kiel, Hamburg, and Leipsic. They estimate that it reached the point of its orbit nearest the sun on the morning of June 17th, at a heliocentric distance of about 14⅜ millions of miles. On June 29th its distance from the earth was 7¾ millions of miles. To-day this distance will haue increased to 12½ millions, by July 23rd to 17½ millions, and by August 4th to 22 millions of miles. As its distance from the sun also has been daily increasing, its brilliancy must speedily disappear. So long as it will be visible, it will occupy a position in the heavens between 8 and 11½ deg. from the North Pole, moving in the direction of the middle star of the Little Bear.

THE German Imperial Statistical Department has set an example which would be advantageously followed by us. It has prepared an "Agricultural Atlas of the German empire"—*Atlas der Bodencultur des Deutschen Reiches*—which will be published during the present month. It will contain fifteen maps, accompanied by explanatory text and tables. This will be the first trustworthy statement for the whole of Germany, based on actual figures and statistical data, of the amount of land under cultivation in the various districts, and the kinds of cultivation. Four maps represent generally the state of the four chief classes of cultivation —tillage, pasturage, meadow, wood. Five maps represent specially the districts growing grain of any kind, two deal with the potato production, two with the growth of agricultural trade, one with the production of fodder of all kinds for cattle, one with land in actual tillage and fallow land. The tables give figures which represent, not only the absolute acreage employed in any particular kind of production, but also its proportion to the total area altogether, and the total area under cultivation, or in tillage. The text gives explanations of the chief results of the figures.

MISCELLANEA.

THE Britannic arrived off Holyhead on Wednesday morning in tow of three tugs.

MESSRS. TANGYE BROS., of Birmingham, have just taken an important Admiralty contract for the supply of pulley blocks. They have had the contract, year by year, for the last six years; it has now been renewed for a definite period of five years.

A PLAN for the construction of sewerage works to deal with the sewage of the Cole Valley district at a cost of £25,000, presented to the Birmingham, Tame, and Rea District Drainage Board by its engineer last Tuesday, has been approved, and steps are being, taken to carry out its recommendations.

MESSRS. I. C. JOHNSON AND CO., Portland cement manufacturers, of London and Gateshead, have received intimation that a medal and diploma have been awarded to them at the Melbourne Exhibition. A medal for superiority of manufacture was awarded to this firm at the Sydney Exhibition last year.

THE Municipal Council of Paris are contemplating taxing telegraph and telephone wires placed in the sewers. The proposed tax is 20f. per kilometre up to 500, 30f. from 500 to 1000, 40f. from 1000 to 1500, and so on, with an increase of 10f. for each 500 kilometres. The *Electrician* says, the number of kilometres of wire placed in the sewers being about 7000, the Compagnie des Téléphones will have to pay something like 59,500f.

WE learn that at the recent Port Elizabeth Show, South Africa, the first prize has been awarded for the "Invincible" Centrifugal Pump, of which Messrs. John and Henry Gwynne, of the Hammersmith Ironworks, are the patentees and manufacturers, as being the best "irrigation" pump. At the Nîmes (South of France) trials, held on the 1st inst., the first prize for the best and most economical irrigation pump was also awarded to the makers for this pump.

WE have received from Mr. W. E. Wood, of Darlaston, a copy of his Chart of the South Staffordshire Iron Trade. The chart is so arranged as to show at a glance the prices and fluctuations therein for the past thirty-nine years, of marked bar iron, common pig iron, coal, slack, and cost of puddling. To all connected with the iron trade the chart has special value, as affording at a glance information which it would take some time to hunt up from different sources.

OUR Birmingham correspondent says that Messrs. J. and S. Roberts, ironfounders, of West Bromwich, have this week secured an order from the Wolverhampton Corporation for 200 tons of iron pipes required for waterworks purposes, "to be delivered as required by the engineer," a period which will probably extend over a couple of years. The price of the 2in. pipe is £4 12s. 6d. per ton, of the 3in. and 4in. £4 7s. 6d., of the 5in. and 6in. £4 5s. per ton, and against the larger sizes, for which special prices are required, £7 15s. per ton is set down.

AT the Chicago Stove Works, on the 10th ult., where the union moulders are on a strike, and where the non-union men are working, as a moulder was about to charge a flask with molten iron he accidentally discovered a package containing two pounds of gunpowder, which had been hidden in the mould by some unknown party. Had the powder not been discovered a terrific explosion would have taken place, and it is fearful to contemplate the loss of life and property that would almost inevitably have ensued. The *American Manufacturer* commenting on this, admits that rattening and trade outrages are not peculiar to England.

ON Wednesday afternoon there was launched from the ship-yard of Messrs. Raylton, Dixon, and Co., the iron screw steamer Lesseps, which has been built to the order of Norwegian owners. Her dimensions are 270ft. long by 34ft. 9in. breadth of beam, and 24ft. 3in. depth of hold. Her gross tonnage will be about 1825, and she will carry about 2500 tons dead weight on 22ft. draught. She is built on the three decked rule, having main and upper decks laid, the latter being of iron; water ballast in the after hold and in a large chamber in main hold forward of the engine-room. She will be fitted with engines of 150-horse power by Messrs. Blair and Co., of Stockton.

THROUGHOUT the most important part of the area in South Staffordshire affected by the operations of the Mines' Drainage Commissioners, the water in the mines is being gradually got under. In the Bilston and Tipton mines during the last few weeks there has been a subsidence of as much as 11ft. These results are mainly due to surface drainage improvements, and to the re-starting of several of the pumping engines of local firms. Messrs. Addenbrooke's Rough Hay engine, at Darlaston, is that which has been most recently set in action, after standing for some years. It contains two 16in. lifts, and can raise close on three million gallons of water per day.

THE truth seems to be coming out about the London water supply. In concluding their report on the water supplied to the inhabitants of the metropolis for June, Mr. Crookes, F.R.S., Professor Odling, and Dr. C. Meymott Tidy, who are acting for the president of the Local Government Board, say :—Judged by our daily examinations, the water supplied to London is in our opinion whether considered as to its efficient filtration, or as to its proper aeration, or as to its purity and wholesomeness, unimpeachable. The result of our six months' work, and the examination during this period of 1127 samples, enable us to state that as an excellent drinking supply it leaves nothing to be desired.

THE Brest-St. Pierre cable, laid in 1869, which was broken on the 12th November last, has been picked up in 1700 fathoms of water, and repaired by the Telegraph Construction and Maintenance Company, with their steamship Scotia, under the superintendence of Mr. F. R. Lucas, engineer to that company, and Mr. H. C. Forde, acting as engineer upon behalf of this company. As a consequence of the repair just effected, telegraphic communication between France and the United States of America, by this company's cable *viâ* Brest has, been restored. The company has now four Atlantic cables at work, *viâ* Valentia, and *viâ* Brest, and their system throughout is in good working order and condition.

THE Cardiff Corporation have had an able report presented to them by Mr. Williams, the engineer appointed to report on the various water schemes that are feasible, and there is now a strong probability, the bias of the engineer being clearly in that direction, that the place selected for a great reservoir to supply Cardiff will be near the Breconshire Beacons, and six miles to the north of Merthyr Tydfil. The rocks are sandstone, and the quality of water admirable. The distance from Cardiff would be about thirty miles, and cost slightly over £200,000. This scheme would not be so great as the Liverpool one, which is to get water from the Verniew, North Wales; but Cardiff will have water of equal purity at a much less cost.

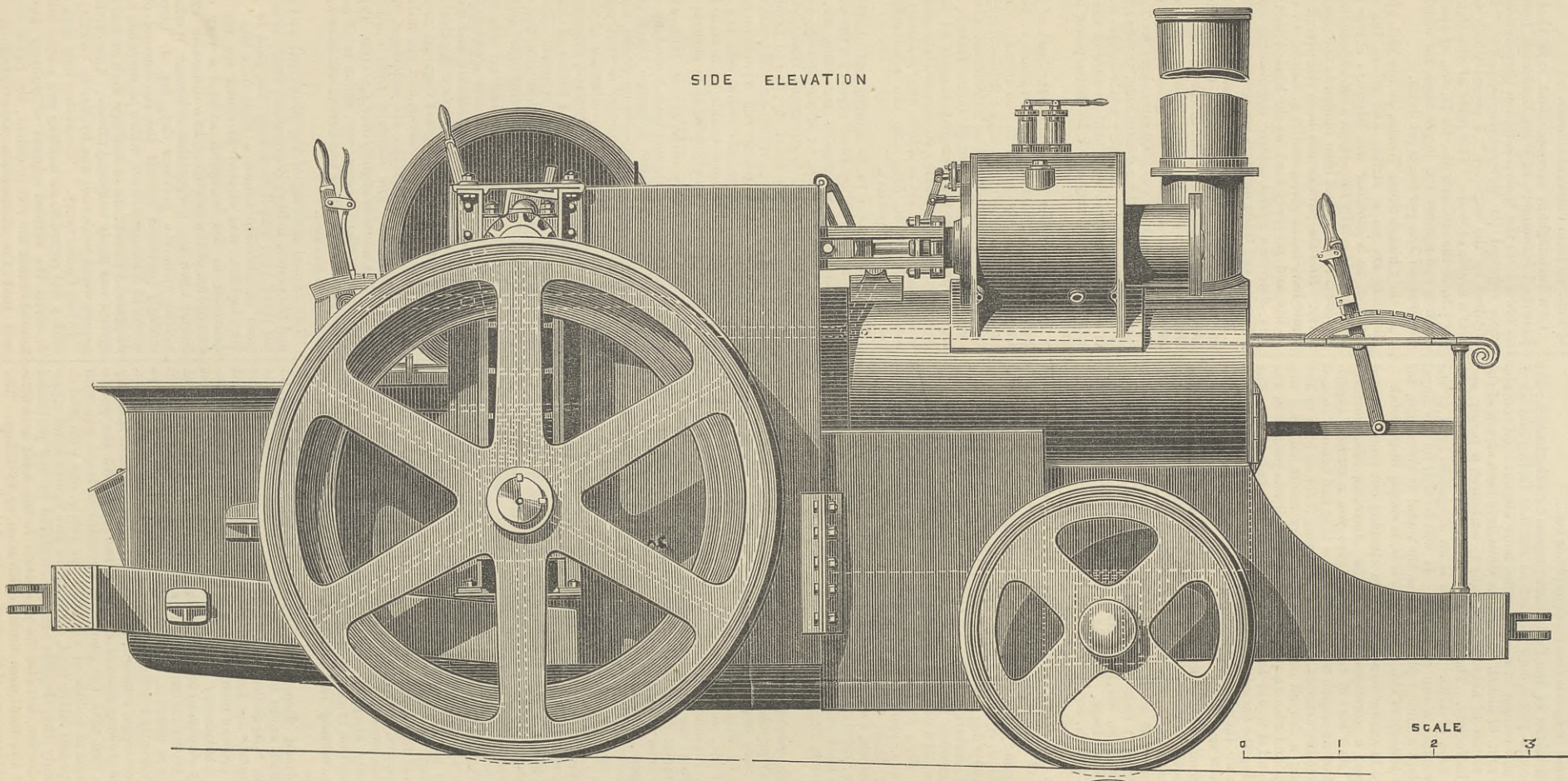
THE annual meeting of the Municipal and Sanitary Engineers and Surveyors, held in Birmingham at the close of last week, was the third visit which that body has paid to Birmingham. The total membership is now a little over 200. Mr. W. S. Till, of Birmingham, was elected president for the ensuing year, and delivered as his inaugural address a very complete summary description of the borough. In a discussion which took place on Friday upon the Corporation Sewerage Works, which had been visited upon the previous day, Mr. J. Lemon, Southampton, strongly protested against the continuance of the intercepting works at Montague-street, which he described as one of the most disgraceful exhibitions of sanitary work he had seen. The present system was likely to spread disease. One of the most interesting papers which were read was by Mr. R. Vawser, of Manchester, on "Rivers Conservancy." The author held that the Bill was drawn with a due regard to all existing and vested interests, and that it deserved the earnest support of sanitary authorities. At the annual dinner the vice-president, Mr. Lewis Angell, of West Ham, said that the Association were extremely gratified with the reception that they had met with from the Birmingham people.

COMPOUND TRAMWAY LOCOMOTIVE.

MESSRS. AVELING AND PORTER, ROCHESTER, ENGINEERS.

(*For description see page* 39.)

SIDE ELEVATION



SCALE

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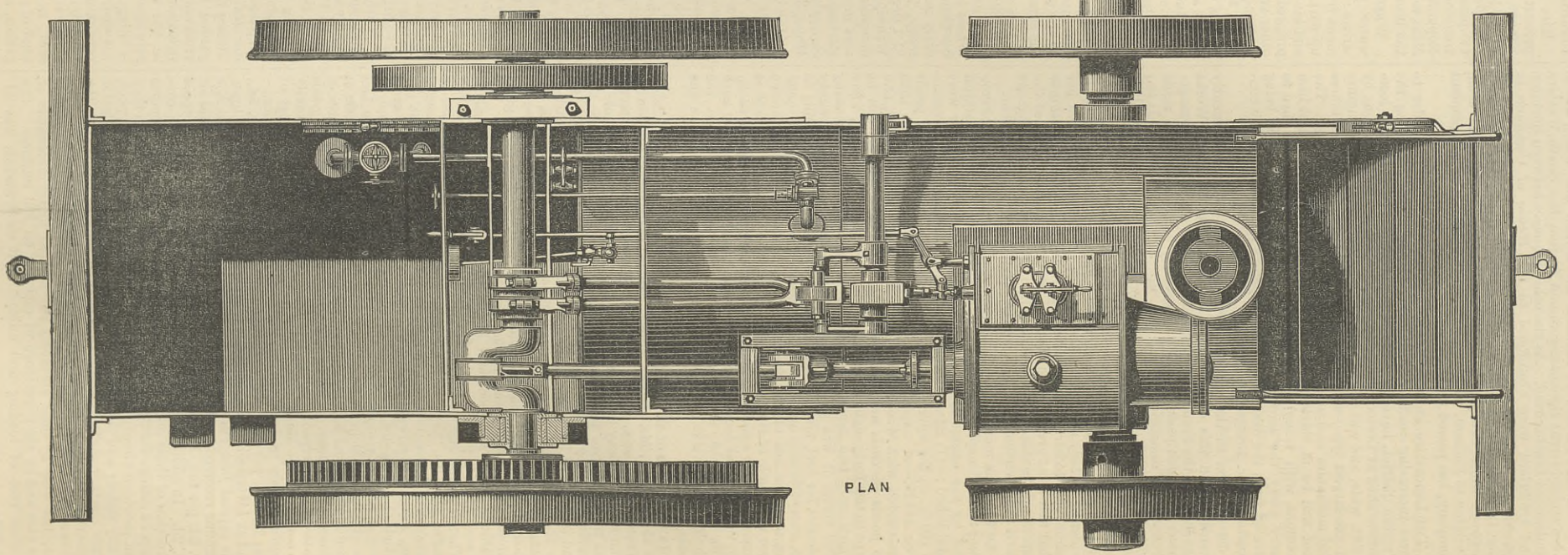

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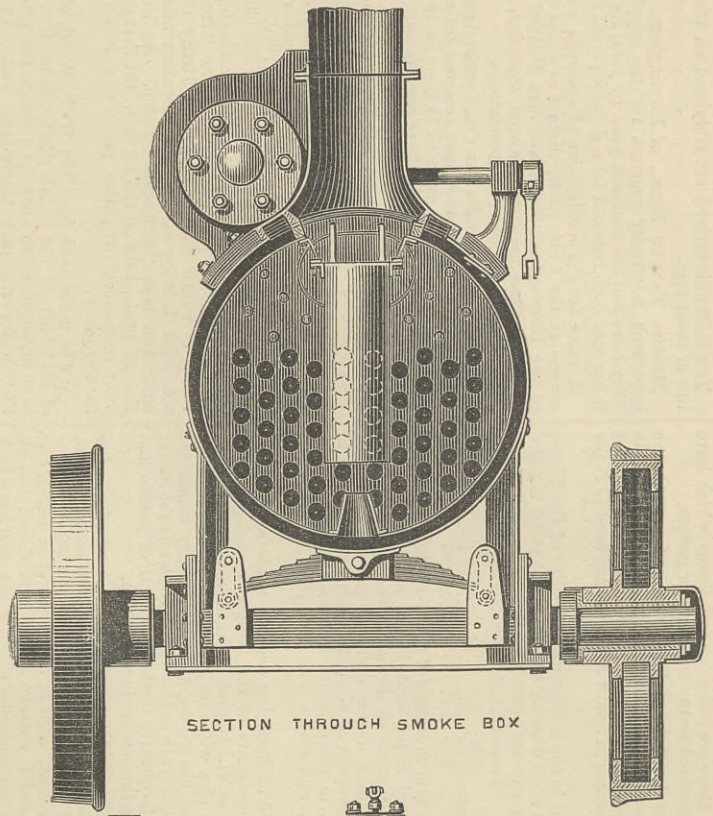
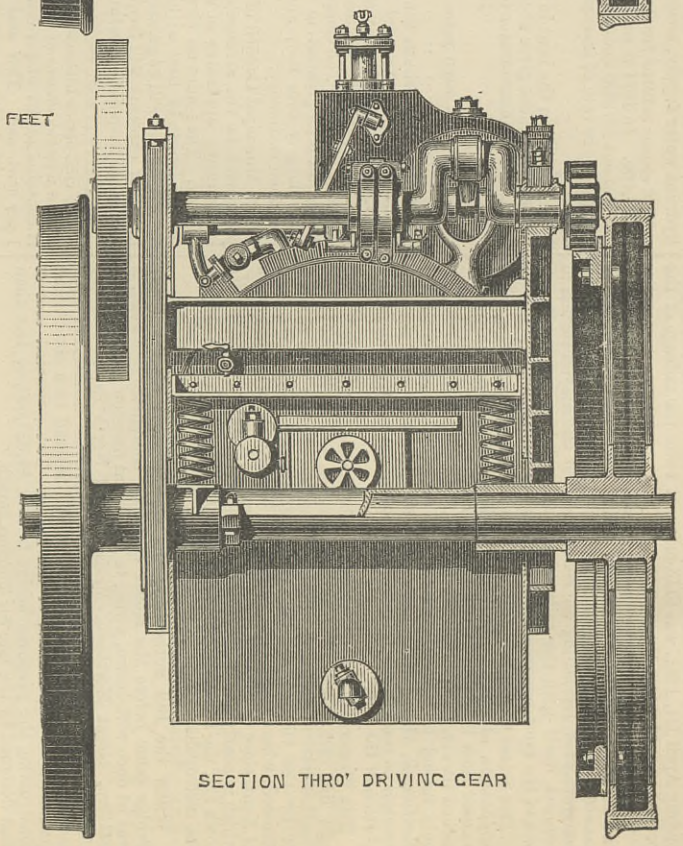


SECTION THROUGH SMOKE BOX



SECTION THRO' DRIVING GEAR

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*** *With this week's number is issued as a Supplement, a Two-page Engraving of No. 3 Winding Engine, Silksworth Colliery. 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 2d. postage stamp, in order that answers received by us may be forwarded to their destination. No notice will be taken of communications which do not comply with these instructions.*

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

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

S. T.—*The Great Eastern was launched without her machinery.*

W. S. AND CO.—*Communications in reply to your inquiry await your application.*

J. H. D.—*So far as we are aware the coupling is new, and would probably work very well.*

C. W. B. C.—*The Grantully Castle was built during the autumn of* 1879. *She has not been illustrated in* THE ENGINEER.

X. Y. Z.—*Friction brakes are now fitted to nearly all omnibuses after a more or less keen opposition based on prejudice. Wagonettes and carriages used in hilly districts are also so fitted. The existing brakes are so simple and efficient that it is not easy to see how any improvement can be effected in their construction.*

LINING TINS.

(*To the Editor of The Engineer.*)

SIR,—I shall be obliged to any of your readers who can give me information about a new lining for preserved meat and fruit cans. I believe it is the invention of a Dunstable firm. TIN CAN.

July 11th.

A NON-CONDUCTOR.

(*To the Editor of The Engineer.*)

SIR,—"Founder" does not say whether there is any space between the dwelling-room wall and that of the drying stove. If there is not a space it would seem difficult to prevent the conduction of the heat. A very thin space would be of little use in any case, either for containing, say, slag wool, or air, but an air space arranged so that a current of air would be maintained in summer and could be stopped in winter, would be the most effective means of preventing the heating of the dwelling-room.

London, July 14th. YBROW.

(*To the Editor of The Engineer.*)

SIR,—I observe "Founder's" letter in THE ENGINEER of last week as to the best means to prevent heat passing through the wall of a dwelling-house from a stove adjoining. If he place a board partition, say 6in. from the wall, in the dwelling-house, and fill the vacancy with common, but clean, garden soil riddled fine, it will prevent the heat being objectionable. If there is room between the stove and the wall of the house this would be the proper place to put the soil, and he will soon ascertain the thickness or depth of soil required. The Cornish engineers cover the tops of their boilers in this manner to retain the heat, and it answers well; so does felt, but the smell of the latter in a sitting-room is very objectionable. Sand is also used, but nothing better than soil. If the wall is not very hot a less thickness than 6in. will suffice.

Birmington Hall, Chesterfield, July 5th. RICHARD G. COKE.

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

DEATH.

On the 29th June, in India, THOS. LANFEAR TANNER, Civil Engineer, eldest son of the late Thomas Tanner, of Welford, Berks, aged 36.

THE ENGINEER.

JULY 15, 1881.

THE ELECTRIC LIGHT IN COLLIERIES.

"THE good old times" is an expression frequently heard, and as frequently misunderstood. If we try to ascertain the particulars in which the "olden times" were so much more favourable than the present we meet with an insurmountable difficulty. Close investigation shows that civilisation has advanced, although the idealistic mind realises that it is even now very imperfect. Certainly, the "olden times" had not ever and anon to deplore the decimation of a village population by a calamitous explosion in a coal-mine, for coal-mining is in reality of no very ancient date. The, to us, all-important mineral has been commonly in use but a few centuries, yet the interest that now concentrates around it is universal. Upon its quantity, quality, and position depend the material resources of empires. Great Britain, without the wonderful development of this material which pertains to her, would be comparatively unknown in the world. America looks to her vast stores of coal as the germ of her present, and still more of her future greatness. But coal is not to be obtained in the large quantities required for modern industries without great labour and frequently great danger. The weight obtainable at a surface outcrop is small, and hence the necessity for deep mining. Over and above the dangers incidental to all mining operations, in this case there exists that arising from the explosion of the gases gradually excluded from the coal as it is hewn, or more rapidly from the holes in which it has been accumulating for ages. The means of obviating this danger has always been an interesting problem to both the practical and the scientific mind.

Chemists have analysed the gases, and tell us that the most dangerous is that called light carburetted hydrogen, or more commonly marsh gas (CH_4), consisting of one atom of carbon combined with four atoms of hydrogen. It is also well known that carbon combines with oxygen to form a very dangerous suffocating gas called carbonic dioxide (CO_2), consisting of one atom of carbon to two atoms of oxygen. Again, hydrogen combines with oxygen to form water H_2O, which consists of two atoms of hydrogen with one of oxygen. Suppose, then, a quantity of marsh gas to exist in a mine, it requires to be mixed with oxygen before an explosive mixture is obtained. If, however, we have a mixture consisting of four volumes of oxygen to every two volumes of marsh gas, and this mixture is brought into contact with matter of a sufficiently high temperature, such as a flame, or white hot metal, an explosion will take place, the resulting compounds being the before-mentioned carbon-dioxide and water. Now carbon-dioxide, whilst having few, if any, active properties upon the human frame, has one negative and deadly one. It is that it cannot be breathed. The marsh gas is the well-known fire-damp; the carbon-dioxide is the choke-damp of the mine. These are the gases which have so often proved fatal to large numbers of men. In the early days of mining the sparks from the primitive flint and steel were used to give a feeble light, it being found that the temperature of these sparks was not high enough to explode the gas. Dr. Henry was, we believe, the first to determine that the fire-damp was principally composed of light curburetted hydrogen, and this was confirmed by the investigations of Davy. The result of Davy's experiments was the well-known safety lamp called after the inventor, the "Davy Lamp." This lamp depends for its efficiency on the good conducting power of metals. Flame is gaseous matter so intensely heated as to be luminous. When the flame comes into contact with a metal surface, it loses much of its heat in consequence of the conducting power of the metal, and the gaseous matter is cooled down to a non-luminous point. It was found that metal perforated with small holes, or wire gauze with small meshes not more than $\frac{1}{20}$in. aperture, were able to cool down the flame to the non-luminous point; and so a lamp surrounded with such wire gauze was made, the rays of light from the flame passing through the small apertures, but the flame itself being unable to do so, except under certain conditions, such as the gauze becoming white hot, a sudden gust of wind, or the enlargement of the holes. At the time Davy was perfecting his lamp, George Stephenson was working in the same direction, and designed a lamp which was satisfactorily tried, and is known as the "Geordy Lamp." Dr. Clanny, Smith, Upton and Roberts, Martin, Ayre, Whitehead, Fyfe, Elsin, Bosy, Glover, and many others have designed lamps more or less perfect, but hitherto no lamp has been invented that is absolutely safe. Various parliamentary committees have met and reported on safety lamps, but the conclusions they have arrived at have necessarily been that almost any one among the large variety of safety lamps would render useful service, provided due care was exercised in its use. The necessary care, however, it is painfully evident, is not always taken; and here, as elsewhere, we so often have to record fatal accidents because familiarity breeds contempt and carelessness.

The introduction of the electric light turned the minds of those interested in mining operations in a new direction, and it was hoped that at last a perfect mining lamp might be obtained. Messrs. Molera and Cerbrian in California suggested a system, which theoretically admits of perfect safety, but its practicability has never been determined. The plan of these gentlemen was to have a brilliant electric light at the pit's mouth, and to direct and divide this light by means of lenses and tubes to the particular points where the light was required. There is no doubt that this could be done on a small scale, but on a large scale the loss by imperfect lenses, and the enormous cost would probably render it useless. Could such a method be perfected, there would be no matter at a high temperature in the pit at all, and all chance of explosion from the light-giving material would be avoided.

The success of Swan's incandescent lamp for lighting interiors of buildings suggested its use for mining operations, and Mr. R. E. Crompton, in conjunction with Mr. Swan and others, has for some time been experimenting with a view to its use in this direction. We recently mentioned the trial of the system at the Pleasley collieries, near Mansfield, under the auspices of the Mines Accidents Commissioners. In these trials two kinds of lamps were used—the ordinary Swan lamp, fitted with wooden sconces, for the main roads, gates, &c., and a lamp of special construction for use by the miners. In these special lamps the globe proper is surrounded by a second globe, there being sufficient air between the two to insure the instantaneous combustion of the carbon should the inner globe be fractured. These lamps are made to withstand a considerable amount of rough usage, and the light-giving power is altogether independent of position. It seems, then, that so long as the external globe is safe, no danger can arise from the ignition of the fire-damp; so, again, should the external globe be broken whilst the internal globe remains intact, and also when the internal globe is broken and the external remains intact; but we doubt whether the accidental breakage of both glasses at once in a fiery mine would not lead to an explosion. Has the use of toughened glass been tried for the globes of these lamps, or is its manufacture still too uncertain to admit of its use in such cases? Is it possible still further to guard against any breakage? For it will be seen that, so long as the globes remain intact, there is no danger from the incandescent carbon. The Davy lamps, and similar lamps, possess one valuable property which the electric lamp has not, inasmuch as they, to a certain extent, enable the miner to tell the state of the mine. The connections to the electric lamps are made by means of insulated cables, and to avoid chance electric contact the leading and return wires are kept far apart; but there still remains the danger of accidental contact by means of a piece of curved metal, and any such contact gives a sufficiently powerful spark to inflame the gas. These details have probably been well considered, and the risk from such an accident as we have just imagined is so infinitely small that the further protection of the insulated wire is unnecessary. At any rate, great progress has been made, and the practical use of the system will suggest many modifications tending to increase its utility and perfectness, and we trust that the able engineer who has put his hands to the plough will not rest contented till he has placed the miner in a far better position as regards safety than he is in at present.

THE METROPOLITAN AND SUBURBAN GAS COMPANIES.

WHILE the metropolitan water companies still continue eight in number, the gas companies have been uniting among themselves until the thirteen companies which existed in 1860, when the Metropolitan Gas Act was passed, are now reduced to four. But while diminished in number, the gas companies have grown in the magnitude of their interests. In 1869 the total capital employed was under £8,000,000. It now exceeds £13,000,000. For several years past it has been the custom of Mr. John Field, who for a lengthened period held the office of acccountant to the Imperial Gas Company, to issue an "Analysis" of the accounts of the various gas undertakings in the metropolis. The disappearance of several of the companies, consequent on the continued process of amalgamation, has from time to time reduced Mr. Field's programme, until at last he finds it necessary to enlarge his range, and to include the suburban gas companies. The "Analysis" just issued includes, therefore, not only the four metropolitan companies which still remain, but thirteen gas companies situated in the suburbs of the metropolis. These employ capital amounting in the aggregate to £1,830,000, the largest being the Brentford, which figures for more than £500,000, the Crystal Palace Company coming next with rather less than £300,000, Colney Hatch being the smallest, with a little under £35,000. All the suburban companies appear to supply 14-candle gas, but the price varies from 5s 9d. per 1000 feet at Barnet and Colney Hatch, to 5s. at Lea Bridge, 4s. 9d. at Mitcham, and lesser prices elsewhere, down to the minimum of 3s. 3d., the final charge of the Woolwich Consumers Company. The accounts of the Woolwich Equitable Company, unfortunately, were not received in time for publication.

The four gas companies belonging to the metropolitan area are now, the Chartered, the Commercial, the London, and the South Metropolitan. The last named has lately grown by absorbing the Phœnix and the Surrey Consumers, the capital employed in the combined undertakings being raised to a sum approaching £2,000,000. The figures we cite are those given in the "Analysis" as appertaining to 1880. The employed capital of the Chartered Company thus appears as nearly £9,500,000. The Commercial and the London do not differ very greatly, the former having £746,000 and the latter £859,000. The price of gas to the consumer last year was 3s. 4d. per 1000ft. in the Chartered district, 3s. 3d. in the Commercial and the London, and 3s. in the district of the South Metropolitan. The lighting power is said to be 12 candles in the London district, and 16 candles elsewhere; but as a different burner is used in the two cases, we may perhaps class the lower power as 14 candles. The gas rental of the Chartered Company is only a trifle short of £2,000,000, while the other three companies take a trifle over £1,000,000, verifying the customary estimate that the Chartered supplies two-thirds of London with gas. The Chartered Company employs 16s. 3d. of capital per 1000ft. of gas sold, being a reduction of tenpence compared with 1876. The London employs 10s. 5d., being a reduction of elevenpence in the same period. At the former date the average of the metropolitan companies was 15s. 9d., dropping last year to 14s. 5d. The gas unaccounted for averages 5·59 per cent on the make, as compared with 6·38 in 1876. In this respect the most economical company now is the Chartered, and the least so the Commercial. The net proceeds of residuals are highest with the South Metropolitan, and lowest with the London. The net profit on 1000ft. of gas sold is highest with the Chartered, and lowest with the London. The gas sold per ton of coals carbonised averages 9529 cubic feet, the Chartered being the highest, and the South Metropolitan the lowest. An interesting fact in these statistics is the immense quantity of coal consumed in the production of the London gas supply, the total last year being nearly 1,900,000 tons, or about 5000 tons per day. The actual gas made averaged 10,220 cubic feet per ton, the Commercial being the highest, with a production of 10,476, and the South Metropolitan the lowest, with 9803. The Commercial used 6·54 per cent. of cannel coal, and the South Metropolitan only 3·14 per cent. The Chartered used 7·68 per cent. of cannel, but supplied 5·55 per cent. of cannel gas, whereas the other companies only supplied common gas. The London used 5·27 per cent. of cannel.

It is to be regretted that we have not the complete

account from Woolwich. If we had the statistics of that town would stand much higher. As it is it only figures with £66,000 of employed capital, and a consumption of coal under 13,000 tons. The total quantity of coal carbonised in the year by the suburban companies appears as 245,000 tons; the entire quantity carbonised by the metropolitan and suburban companies combined being in excess of 2,100,000 tons. In looking at the economical results it would be obviously unfair to the small suburban companies to compare them with the large undertakings in the metropolis. But comparing them among themselves, we find that Barnet employs £2 of capital per 1000ft. of gas sold, and Wandsworth only 10s. 6d., the average of all being 15s. 10d. The gas made ranges from 10,870ft. per ton at Croydon, down to 9500 at Bromley. The gas unaccounted for is as little as 1·77 per cent. at West Ham, and very little more at Bromley, while at Colney Hatch it is as much as 13·45 per cent.; but the make at the last-named place is very small, while West Ham carbonises 27,000 tons of coal in the year. The entire gas rental of the suburban companies is £450,000, Brentford taking the lead with £112,500, the next being the Crystal Palace Company with £84,000. The net profit of the suburban companies is nearly £159,000, that of the metropolitan companies is £1,136,000, the complete aggregate being £1,295,000. These are large amounts, and show how great is the vested interest connected with the production of gas mainly as a lighting agent, though not so exclusively so as in former years.

NEW NORTHERN RAILWAY PROJECTS.

Two new railway schemes of some magnitude have been laid before the public in the last few days, one of which has been suggested to the North-Eastern Railway Company as a supplement to its present accommodation in the north-east, and the other projected independently. The first is the scheme for a line of railway from Bishop Auckland to Spennymoor, and thence to the east of the county of Durham—to the sea-coast near West Hartlepool, in fact. The second is a revival of the ambitious scheme of several years ago, which traversed some of the Yorkshire dales from Skipton, touched Darlington, and ultimately landed at the port of Sunderland. Since this last scheme was before Parliament there have been great railway changes in the North of England; the line which sprang out of the costly parliamentary fight—that traversing Wensleydale—has been made; and in addition there has been a completion of several lines to open out more fully the North Yorkshire part of the district possessed by the North-Eastern Railway, so that in some degree the ground that the Skipton and Sunderland line would have occupied has been filled. Hence, though it may be possible that the project will be laid before Parliament, yet there does not seem much hope, with the decision that has been recently given in the case of the Ayrgarth and Kettlewell project, that it will be carried. But the line from Bishop Auckland—which is the revival of a project of five or six years ago—seems in some degree likely to be carried; for there has been for a score of years no increase of the means of communication between the east and west of South Durham, though in the interval there has been an immense industrial growth, and the planting of towns where a generation or two ago there were solitudes. Between Bishop Auckland and the sea-coast near it there is only a roundabout method of communication, and there are many of the intervening colliery villages, populous and growing, which have no means of communication. The district is wholly in the hands of the North-Eastern Railway, and recognising this, the projectors have drawn the attention of the Board of Directors of the railway to the scheme, and though there has been only a cautious reply, yet there are grounds for the belief that in an early session the North-Eastern will have a proposal to make to increase its service in South Durham. It is evident that when there is so complete a monopoly of the district as that now enjoyed by the company, the claims of the industries, and of the growing population upon it are large, and it may therefore be assumed that if the opposition in its own district which has been long prophecied is to be staved off, the North-Eastern will have to meet the wants of the populace in its territory, and will have to give unity and completeness to its scheme of lines—unity and completeness which could scarcely be looked for in the disjointed and separate lines that were amalgamated to form it.

THE PALLISER GUN PRESSURE GAUGES.

It may be well to note for the information of those who may have missed the fact in the pages of any contemporary, that the pressure gauges employed in the Palliser gun which was tested to destruction at Erith registered 44 tons to 47 tons pressure as estimated from an examination in the Royal Gun Factories, to which department the gauges were submitted. It will probably be allowed by any reasonable man that the gun did well to resist in such a way as to develope this pressure in the act of bursting. We believe we may add that the opinion that the setting up of the shell was the immediate cause of the destruction of the gun is held by good authorities. We think that the character of the Palliser converted guns has been well maintained by this series of experiments. We have always held that the combination of the loose lining of coiled iron with the complete cast iron case, which was well calculated to support it, and to supply the required longitudinal strength, was most happy as a system of conversion. We understand that Sir W. Palliser expects to get much greater results from his new guns with cast steel exteriors. This may probably prove correct. We look upon the question of a new gun, however, as a totally different matter from that of conversion, and we would not at all commit ourselves to the Palliser system for the former. In the competitive trial we advocate it should certainly have a fair opportunity of showing what it is capable of doing.

THE WATER SUPPLY OF MIDDLESBROUGH.

The question how best to increase the supply of water to the district for which the Stockton and Middlesbrough Water Board is responsible, has given rise to several side issues of considerable interest. For instance, in order to afford temporary relief at a comparatively small cost, it has been proposed to sink one or more wells into the magnesian limestone, near the pumping station at Broken Scar. The water thence obtainable has been proved to be heavily charged with the carbonates of lime and magnesia. The steam users of the Cleveland district are strongly opposing this scheme. Working large numbers of boilers night and day as they are, they cannot do with any increase of liability to incrustation. The water at present supplied from the river suits them well. Nevertheless, at the usual periodical scaling of boilers, deposits up to a quarter of an inch in thickness are sometimes removed; and if this evil was aggravated to to ever so slight an extent, inefficiency, loss, and danger would probably result. Three-fifths of the water at present consumed is for boiler purposes, and therefore the views of the steam users are entitled to serious consideration. Not only so, but it has been pointed out that the whole population is indirectly interested in their prosperity; for anything which would be liable to stop the use of steam power, would obviously equally stop the daily bread of multitudes, besides the owners of boilers. The other, or opposite view on the well scheme, is that a little increase of hardness would not seriously affect the working of boilers, and that if it did, manufacturers are able, and ought to meet their own difficulties in their own way, and at their own expense. This view has at the moment most supporters, although, if votes were taken according to the amount of rates paid, it is probable the tables would be turned. This is only another instance of the penny wisdom, which is almost always manifest when a number of provincial ratepayers are summoned to discuss important questions of public policy. The majority go in for keeping the rates down, at any cost, and taking the consequences, if needs be. They want the greatest present advantage, and never mind the future. To be prepared to submit to present self-denial for the sake of a greater future benefit, is the mark of a higher degree of civilization, and must not, we suppose, be expected of every one who can hold up a hand at a municipal meeting.

THE CAUTIOUS SCOTCH.

We once remember to have seen an excitable, loquacious, argumentative, bore, most effectually silenced for the time being, by his victim quietly suggesting that he should put his views into writing, and forward them by post. The Scotch ironmasters seem to have treated somewhat in the same manner, the request of the Cleveland Ironmasters' Association that they should receive an emissary from them, to propose putting out ten per cent. of their blast furnaces. "Put it into writing," say they, "and then we will see if it is worth our while to discuss it." The omen is not a very favourable one for the Clevelanders. It suggests a preliminary private consideration of the written request, and perhaps a virtual decision thereon before the verbal arguments of the emissary are heard at all. Scotchmen are not going to allow themselves to be carried away by enthusiasm, or by the excitement of desperation, or by anything else of an impulsive nature. They want to see what they are going to get by such a move, which they do not now possess; or what loss which they are now suffering they will then avoid. They also want to pry a little into the future. They must be assured that their English competitors will not improve their position in the long run, as compared with themselves, in the close competition which has long been going on as regards certain markets. All these are fair questions for consideration, and especially when they come from competitors who are somewhat differently circumstanced. When, in the fable, the giant asked the dwarf to go forth with him on a fighting expedition, the latter, if he had been similarly wary, might not have come back minus an arm and a leg, whilst his more powerful friend was scatheless. On the whole, we are disposed to commend the policy of the men of Glasgow.

LITERATURE.

Mine Drainage; being a Complete and Practical Treatise on Direct Underground Steam Pumping Machinery. By Stephen Michell. Crosby Lockwood and Co., London. 1881.

We are quite at a loss to understand why Mr. Michell used the words "mine drainage" on the title page of this book. It certainly conveys the idea that the book is what it is not—a treatise on the unwatering of mines. Of its kind, the book is a good book, but then its kind is not very good. It belongs to a low type of literature. It contains little or nothing original; but none the less, it may be consulted and even read by many persons with advantage. There are literally hundreds of steam pumping machines in the market, and all those best known to engineers are very fully described and illustrated by Mr. Michell. The descriptions have been for the most part published before in various ways. Some have been written by the inventors or manufacturers of the pumps described; others by the authors of papers read before various societies, such, for example, as the Institution of Mechanical Engineers. These descriptions are illustrated by engravings, only a few of which seem to have been specially prepared for this book, and all of which are either a good deal worn or badly printed. Messrs. Lockwood get up their books so well in other respects that it is much to be regretted they do not pay more attention to the printing of engravings. As a rule, their woodcuts are worse printed than any others in the trade. Why is it that English publishers will not take a lesson from American printers and publishers, who are half a century in advance of Englishmen in typography and its kindred arts?

Mr. Michell is very candid and quotes his authorities freely, and without any attempt at concealment, and for this he deserves praise; but can it be that he is not capable of better things? Is it possible that he will rest content all his life with compiling? Perhaps so. It is certain that his work in no way supplies a want, namely, a good treatise, not too long, on the principles of mine drainage, combined with practical instructions as to the carrying of these principles into practice. Where, for example, is anything to be found on the erection of pumping plant to take the place of Watt's instructions for the erection of his engines, now nearly a century old?

Those who wish for particulars of almost any steam pump in the market will find them at once in this book. When we have said this we have said all that need be said. It is a dictionary of steam pumps, and a very good dictionary too, but it is not a treatise on the drainage of mines.

THE IRON TRADES EMPLOYERS' ASSOCIATION.

The annual general meeting of the members of this association was held on Friday at the Royal Hotel, Leicester, the president, Mr. Richard Peacock, of Manchester, occupying the chair. There was a large attendance. The secretary, Mr. E. Hutchings, presented the report of the committee of management of the past year. The chief portion of the report is devoted to the question of the Employers' Liability Act, and the best means for protecting members of the Association from claims made upon them by workmen under the provisions and clauses of the Act. The committee have been advised upon high authority, that as all claims made under its provisions must in the first instance be brought into a county court, but could under certain conditions be carried to the higher courts for hearing, it would be of great importance that the first case or cases should be thus removed so as to secure at the outset the clearest and most conclusive interpretation of the new law available. To this end, in November last, the committee passed a resolution calling upon all members to report, without delay, any accident which might arise in their works after January 11th, 1881, so that it might, if approved upon examination, be taken up and defended at the cost of the Association. That resolution was still in force, but up to the present time no case had arisen which had called for the intervention of the committee. Another protective measure had also been adopted. A workmen's complaint book and notice paper in connection therewith had been prepared and sent to all the members of the Association for use in their workshops, and these had met with such cordial approval on all hands that their use would probably become general throughout the leading industries of the country. A closer examination into the details of the certain statistical returns brought out the fact that the ratio of risks was very variable. Eventually it was determined to classify the respective industries in the following order:—Class, A, machinists and light industries in the textile machine trades. Class B, engineers, tool makers, locomotive builders; boiler-makers, founders, millwrights, &c. Class C, shipbuilders and marine engineers. In Class A the returns showed 1 fatal accident to every 10,525 men, and 1 minor accident to every 64 men employed, these figures being based entirely upon returns from manufacturers of cotton, woollen, and lace-making machinery. In Class B the tables showed that there was 1 fatal accident to every 2983 men, and 1 minor accident to every 67 men employed, this division taking in all the leading sections of the engineering trades. In Class C it was found that there was a fatal accident to every 1185 men, and 1 minor accident to every 26 men employed.

The terms upon which the committee had concluded to issue policies of insurance were as follow: Machinists, 2s. per cent. upon the amount of wages paid annually; engineers generally, founders, millwrights, tool makers, locomotive makers, marine engineers, boiler makers, &c., 3s. per cent., and shipbuilders, 4s. per cent. Dealing next with the condition of trade, the committee state that there is nothing very satisfactory which can be reported. Of the iron trades, with which the Association was most distinctly allied, the condition generally had not improved since the last annual meeting.

On the motion of the President, seconded by Mr. John Robinson, of Manchester, it was unanimously resolved that the scheme for the mutual insurance and protection of the members of tbe association against claims made by their workmen under the clauses of the Employers' Liability Act, 1880, as set forth in the committee's report, be hereby accepted and acted upon under the direction of the committee. The general committee of management for the ensuing year were next, in conformity with the nomination of representatives from the several district branch associations, appointed as under: Barrow-in-Furness, Mr. C. J. Copeland; Barnsley, Mr. J. Mitchell; Bradford, Mr. James Cole; Bristol, Mr. J. S. Stothert; Halifax, Mr. John Crossley; Huddersfield, Mr. G. W. Tomlinson; Hull, Messrs. H. S. Brodrick and C. D. Holmes; Keighley, Mr. R. L. Hattersley; Leeds, Messrs. J. Craven, D. Greig, and J. H. Kitson; Leicester, Mr. Joseph Jessop; Liverpool and Birkenhead, Messrs. A. Bower, J. Laird, and H. Shield; London, Messrs. J. Field, J. Simpson, and G. Waller; Manchester, Messrs. B. A. Dobson, R. Peacock, and H. Wren; Nottingham, Mr. G. R. Cowen; Wakefield, Mr. Geo. Rhodes. Immediately after these appointments had been made, Mr. John Robinson, of Manchester, was, on the motion of the President, seconded by Mr. H. Shield, elected by acclamation also a member of the committee. On the motion of the President, seconded by Mr. J. H. Kitson, of Leeds, a vote of thanks was unanimously accorded to the committee specially appointed to investigate the returns showing the ratio of fatal and minor accidents in the workshops of the members of the association, and for the great pains they had taken in the preparation of the scheme for mutual insurance against claims which might be made by workmen under the clauses of the Employers' Liability Act. It was resolved that the next annual meeting of the association should be held at Huddersfield. Mr. David Greig, of Leeds, was elected President of the Association for the ensuing year, and the following gentlemen Vice-Presidents:—Mr. James Cole, Bradford; Mr. C. D. Holmes, Hull; Mr. John Laird, Birkenhead; Mr. R. Peacock, Manchester; Mr. H. Shield, Liverpool; and Mr. John Robinson, Manchester. Mr. J. Field was re-elected to the office of hon. treasurer, a position which he has held since the formation of the Association, and the proceedings were then brought to a close.

WINDING ENGINES—SILKSWORTH COLLIERY.

We publish this week a two-page engraving giving a plan of No. 3 winding engine, Silksworth Colliery. An elevation of one engine appeared in our last impression. Next week we shall complete our notice of these engines, giving further illustrations and descriptive particulars.

TENDERS.

NEWHALL WATER SUPPLY.

Tenders for supplying and laying 5in., 4in., and 3in. water mains, with valves, hydrants, &c., for the water supply of Newhall and Stanton, near Burton-on-Trent. Mr. Charles R. Walker, Cannock and Walsall, engineer.

	£	s.	d.
J. and G. Tomlinson, Derby	5505	3	10
John Harrison, Louth	4627	1	0
De Ville and Forest, London	4626	7	5
James Knight, Loughborough	4625	6	8
George Bell, Gateshead-on-Tyne	4563	19	0
Alfred Palmer, Birmingham	4524	17	2
Fawkes Brothers, Southport	4519	14	2½
Drewitt and Pickering, Stoke-on-Trent	4481	13	2
John Mackay, Stoke-on-Trent	4408	0	0
J. Harrison, Brighton	4310	0	0
May Brothers, Canterbury	4292	18	3½
Thomas Parkes, Birmingham	4284	13	2
John Hill, near Sheffield	4201	5	2
Thomas Colson, Matlock	4182	15	2
Currall and Lewis, Birmingham	4151	10	7
William Holland, Leicester	4015	3	6
J. and S. Roberts, West Bromwich	3996	1	11
Warren Stacey and Co., Swadlincote	3920	10	5
Meak Brothers, Nottingham	3783	16	1
Thomas Kirk, Chester	3776	11	6
Cochrane and Co., Dudley	3759	10	7
George Stevenson, Eckington	3688	19	9
Pontifex and Wood, London—accepted	3559	1	9

THE DUFFIELD BANK RAILWAY.

AT Duffield Bank, not far from Derby, Mr. Percival Haywood, a gentleman of independent fortune, has constructed a narrow gauge railway, which engineers visiting the Royal Agricultural Society's Show will do well to see. The following description of this little line has been prepared by Mr. Haywood, and we illustrate the engines from drawings with which he has supplied us.

Objects of the Railway.—This paper does not pretend to discuss the whole subject of light narrow gauge railways, but is merely a short account of the writer's experimental line, with such notes as may possibly be of use to those interested in gauges of 2ft. or under. It is hardly at the present day necessary, as it would have been when this line was first constructed, to offer an apology for considering such miniature railways as something more than toys. Their quickly increasing popularity during the last few years is sufficient acknowledgment of their utility under suitable conditions. In the year 1874, the writer, after various preliminary trials, determined to construct a model railway of 15in. gauge, no less size appearing to offer sufficient stability for practical use, although a 9in. gauge has been built for some friends as a toy; the wagons being 3ft. by 1½ft. inside, and the passenger carriages admitting one on each seat. The stability of this very small line is perfect enough when unhampered by persons riding upon the wagons, but man being an article of standard size, it is clear that there is a minimum gauge which will with safety resist his attacks in the shape of sitting on the edges of wagons, and so on. Rolling stock properly proportioned to a 15in. gauge seems as small as will ensure safety in this respect; and, indeed, in France, M. Decauville has arrived at nearly similar conclusions in constructing a minimum gauge of 16in. The writer must not be understood to advocate gauges so small as these, except where the traffic is unlikely to increase beyond the capacity of such a line, and where the material to be moved can conveniently be loaded in little wagons; his object in adopting it for experiment was to see how capacious the rolling stock could safely be made on a given gauge, without incurring the expense of large and unwieldy wagons. It was, however, not only to acquire this information that the railway was constructed, but to experiment on various questions connected with friction and resistance, and also on the roadway and appliances necessary for a serviceable Army Field Railway plant. A certain length of line having been finished, a locomotive, carriages, and wagons were built in the writer's amateur workshops, and experiments carried out during several years. Later, the line was extended and developed, and a long timber viaduct erected in connection with a scheme for military railways. The workshops, situated 70ft. below, were connected with a line by a branch having a gradient of 1 in 10; the total length of the whole, including sidings, being at the present time about a mile; of which half is arranged in the form of a pair of spectacles, to admit of a continuous run. The maximum gradients on this part are 1 in 25, and the minimum curves half-a-chain. During the last year a six-coupled locomotive, with radial axles for traversing sharp curves, has been built, and also a closed bogie carriage to hold sixteen persons. The writer is always glad to show the railway to any who are interested in the subject, and also to give information as to experiments that have been carried out, and of the cost of the various modes of construction.

Construction of the Line.—The line, of 15in. gauge, was at first constructed to carry loads of half a ton per axle, and laid with 14 lb. iron rails, without fish-plates, the sleepers being 5in. by 2in., and 2ft. 6in. long, spaced 18in. centre to centre. The whole was carefully laid and ballasted; but the result was not satisfactory, as sleepers frequently required re-packing. A part, and eventually the whole of the main line, was then relaid with various weights of both iron and steel rails, from 9 lb. up to 22 lb. per yard, and sleepers 6in. to 8in. wide, 2½in. deep, and 3ft. long. The sleepers were tried both at 18in. and 2ft. apart, and all rails were fish-jointed, the joints being on a sleeper. In every case the new road proved far better than the old, the improvement being entirely due to the fish-plates and longer sleepers. Part of the road laid with 12 lb. steel rails, and sleepers 2ft. apart, has not been touched since first put down five years ago, although constantly run over. The writer has for some time been of opinion that a sleeper rather more than double the gauge in length will be found to give the best results, if the depth is sufficient to avoid bending. Mr. Spooner has used 4ft. 6in. sleepers on the 2ft. gauge Festiniog Railway with the best results; and if the strain be examined it will easily be seen why this is so. Unless the sleepers are more firmly supported outside the rails than between them, the traffic will cause the ballast to become convex lengthwise of the sleepers, and so make the road unstable; and by a very simple calculation it will be found that a length approximating to two and a-half times the gauge will be required in order to make the sleepers sink evenly. When this is the case, and the packing has been properly done, the road, if the formation be sound, will be long before it works loose. Good fish-plates are a *sine quâ non*, and with the ordinary flat-bottomed rail the joints are best on a good broad sleeper, they should also be as nearly as possible opposite one another, for which object it is a good plan to order a proportion of rails 3in. shorter than the standard length, then, as soon as one one rail lags as much as 1½in. behind, a short rail should be laid on the opposite side. The writer tried "breaking joint," with the most uncomfortable results. The joints will sink, and if opposite one another, the serious jolt which is felt in running over a bad joint on one side only is avoided. The rails are bent before being laid by passing them under a screw which stands between a couple of rollers; but the writer designed a simple form of rail bender, on the principle of a tire bender, for the Royal Engineer Department to use on their field railways, by which the rail was continuously bent while being drawn through the rollers. With a little practice, however, rails may be sprung round sharpish curves without any bending; but great care must be taken to screw up the fish-plates very tight before springing, and to avoid overstraining the joint, which will produce a "dog leg," not to be got rid of without the "jim crow." It is needless to enter into a description of the points and signals, the peculiarities in these having to do rather with full-sized railways than with those of narrow gauge. The timber viaduct, before referred to, is 91ft. long, and varies from 12ft. to 21ft. in height. It is constructed entirely of pitch pine, the trestles being so designed that each member is a multiple of the height. The roadway is carried on four timbers, each 11in. deep by 3in. wide, bolted together in pairs, one pair under each rail, the two being kept parallel by stretchers. In each pair the timbers break joint with one another on alternate trestles, the latter being 15ft. apart and each timber 30ft. long. The advantages of this are twofold, the timbers can be run forward from trestle to trestle as the bridge advances, without scaffolding or lifting tackle, and should one trestle sink out of line, the continuity of the upper work checks it, and obviates the dangerous elbows so common in similar structures. The total cost of the viaduct was £30, or under £1 per yard, the strength being amply sufficient to carry a six ton engine. The details are arranged to require but little skilled labour, the connections being made chiefly with bolts. Two carpenters in five days framed the five trestles, including cutting the timbers to length; and in three more days, with the additional assistance of two labourers, the whole was erected and the rails laid ready for traffic. The viaduct was designed as an improvement on the form adopted for the military railways at Aldershot and Chatham, as being simpler and stronger. The length of the part of the line used for experiments is, as before stated, about half-a-mile, and although there are gradients of 1 in 25, a more trying bit for the engine is a curve of half-a-chain radius, embracing nearly three-quarters of a circle, on a gradient of 1 in 50. A branch about a quarter of a mile long leads down to the workshops, with a gradient of 1 in 10; up this the locomotives haul rather more than half their own weight; this, though fairly good, would be exceeded were it not for two severe curves, which, on so steep a gradient, are formidable obstacles. This part of the line crosses the fences on balks of timber, an excavation being made below to prevent the passage of cattle. The ballast is chiefly ashes, which, when to be had, will be found to remain porous far longer than gravel, and also to produce very little dust, and that less injurious to the engines than ballast containing sand. The sleepers are all elm and Spanish chestnut, fallen and sawn on the premises, and worth from 7d. to 8d. each. Ordinary dog spikes are used, four to each sleeper, in securing the rails; great care requires to be observed in procuring these spikes of first-class quality. With the assistance of two labourers, the writer has usually laid about thirty yards per day, which includes bringing forward rails, sleepers, and ballast; bending, spiking, and fishing rails; packing sleepers, top ballasting, and dressing off; equal to about 5d. per yard for labour. The materials, with 12 lb. steel rails, costing about 4s. 6d. per yard. The line, when laid, costs therefore about 5s. per yard, exclusive of earthworks and bridges, which in this case average about 3s. per yard run. The following estimate gives the cost per yard of a line about 15in. gauge, to carry one ton per axle, allowing an ample margin for emergencies :—

	s.	d.
Earthwork, 2 cube yards, per yard run	2	0
Bridges, and other structural works, say	1	0
Rails, 18 lb. steel, including fish-plates	3	0
Sleepers, 7½in. by 2½in., by 3ft., 2ft. apart	1	0
Ballast, 1 cube yard, per 3 yards run	1	0
Laying (including points) and spikes	1	0
Extras, say	1	0
Cost of 15in. gauge surface line, per yard run	10	0

Locomotives.—The two locomotives now on the line were designed with different objects. The first, an outside cylinder four-wheeled tank engine, put to work in 1875, was intended to be as handy, compact, and cheap as possible. In building it, a good deal of material which happened to be at hand was used rather to the prejudice of appearance to save expense; it has, however, run about 3000 miles with none but trifling repairs, and has proved itself pleasant to handle in every way. This locomotive has four steel-tired wheels, all coupled, 15½in. diameter, with a wheel base of 2ft. 6in., and an overhang at each end of 2ft. 3in. The boiler is a simple cylinder, with ends suitably shaped for attachment to the frame, and contains a cylindrical fire-box, in the form of a short flue, terminating in tubes. The absence of any projecting fire-box admits of the engine being perfectly balanced on the axles, and such a boiler, while capable of making as much steam as is required, is not only cheaper in first cost and repairs, but much safer, when placed in the hands of comparatively inexperienced men, than an ordinary fire-box boiler, and also far easier to clean. The springs are rubber blocks, fitted into the hornblocks above the axle-boxes. It is always asserted that oil destroys india-rubber, but this is not practically true as regards the very best quality. The blocks in question have been moist with oil for six years, and are as good and elastic as when first put in, the sole sign of decay being an almost imperceptible rounding of the edges. The only other peculiarity worth notice is the plan of allowing the connecting rod brasses to turn in their straps. These latter are bored, instead of slotted out, in the direction of the length of the rod, the brasses being shaped circular to fit. This enables the latter to acccommodate themselves to the varying transverse parallelism between the axles and the frames, due to the unequal rise and fall of the springs on opposite sides, thus avoiding all twist on the slide-bars, the cutting of which was a constant source of annoyance till the above plan was tried. The maximum speed attained over a measured course, taken with a stop watch and checked by a revolution indicator, is twenty-three miles an hour, the motion at that speed being perfectly steady. With a tender attached, continuous runs of an hour have frequently been made at an average speed of ten to eleven miles an hour, the rate on the straighter parts of the line being fifteen to eighteen miles an hour, reduced to seven or eight on the sharp curves. The writer considers that on any gauge the maximum speed, if the road be good, may be as many miles an hour as the gauge is inches wide, and half this for goods traffic. The rule, however, does not at present apply to gauges over 5ft. The second locomotive, constructed by the writer, was designed as an engine suitable for military railways, to afford great power on a narrow gauge, and able to take very sharp curves, at the same time avoiding the complication of the double bogie system, without making the weight on each axle too great. This engine has six cast steel wheels, all coupled, each pair of wheels being keyed on a hollow axle, within which are axles coupled at their outer ends by cranks and coupling rods in the usual way, and running in ordinary bearings. The middle hollow axle is capable of sliding laterally on its inner axle, but cannot revolve on it. The leading and trailing hollow axles are internally larger than their inner axles, to which each is connected by a central ball and socket joint, so arranged as to leave the hollow axles free to radiate in any direction, but compelling them to revolve with the inner axles. The middle hollow axle is connected with the leading and trailing hollow axles by iron straps and links, so designed that when it slides laterally, as is the case on entering a curve, the other two hollow axles with their respective wheels are radiated truly to the curve, no matter what may be its radius, providing it is within the limit of the lateral travel of the centre axle. The space between the frames being thus occupied, the valve gearing is necessarily outside; and to avoid overhung excentrics, a modification of Brown's valve gear, designed by the writer, is adopted, the arrangement being somewhat similar to what is known as Joy's gear. One advantage of this type of valve gear is that it gives a constant lead, whatever the travel of the valve, so that when closely notched up the diagram is not distorted by an increased lead, as in the case of the ordinary link motion. To give the minimum strain on this gear, the valves, which are circular, are balanced by a packing ring working against the cover of the steam chest, a pin-hole being drilled through into the exhaust cavity of the valve, by which any leakage of steam past the packing ring, which otherwise would destroy the balance, is passed away with the exhaust. The boiler is similar to that already described. The engine is fitted with only a steam brake. In the first engine the writer found the ordinary screw hand brake so much too slow in action for such sharp curves, that a tender, subsequently built, was fitted with an instantaneous friction brake. From the use of the latter the advantage of quick action was so apparent that a steam brake only was fitted to the engine now under consideration. The safety valve is entirely within the boiler, so that it cannot possibly be tampered with. The draught through the lower rows of tubes is ensured by a petticoat pipe somewhat on the American plan in the smoke-box, which also acts in a measure as a spark arrester. There are various other details of peculiar design, but they are of little practical importance, and will, therefore, not be mentioned. Two exceptions will be taken to this engine. First, that the motion is too near the ground; secondly, that there is too liberal a use of cast iron. The answer to the former is that the engine is almost too large for the gauge, and it was necessary to keep the centre of gravity low; to the latter, that the writer is an indifferent smith, but a fair moulder. He would not, however, advocate this type of engine except for special purposes. Four-wheeled simple engines are the best and cheapest for light lines, and, no doubt, if makers had orders enough, they might turn out these with 4in., 5in., and 6in. cylinders, as low as £200, £300, and £400. Annexed are given the dimensions of the engines above described:—

	No. 1.	No. 2.
Diameter of cylinders	4in.	5in.
Length of stroke	6in.	7in.
Diameter of wheels	15½in.	14in.
Wheel base	2ft. 6in.	4ft. 6in.
No. of wheels	4	6
Length over buffer planks	7ft.	9ft.
Overhang at each end	2ft. 3in.	2ft. 3in.
Width over	2ft. 3in.	3ft. 9in.
Length of boiler	4ft. 6in.	6ft. 6in.
Diameter of ditto	22in.	24in.
Diameter of fire-box flue	11in.	14¼in.
No. of tubes (1¼in.)	23	42
Heating surface	23 sq. ft.	56 sq. ft.
Grate area	1¼ sq. ft.	2 sq. ft.
Weight in working order	1 ton 3 cwt.	2 ton 10 cwt.
Working pressure	125 lb.	150 lb.
Net tractive power	500 lb.	1200 lb.

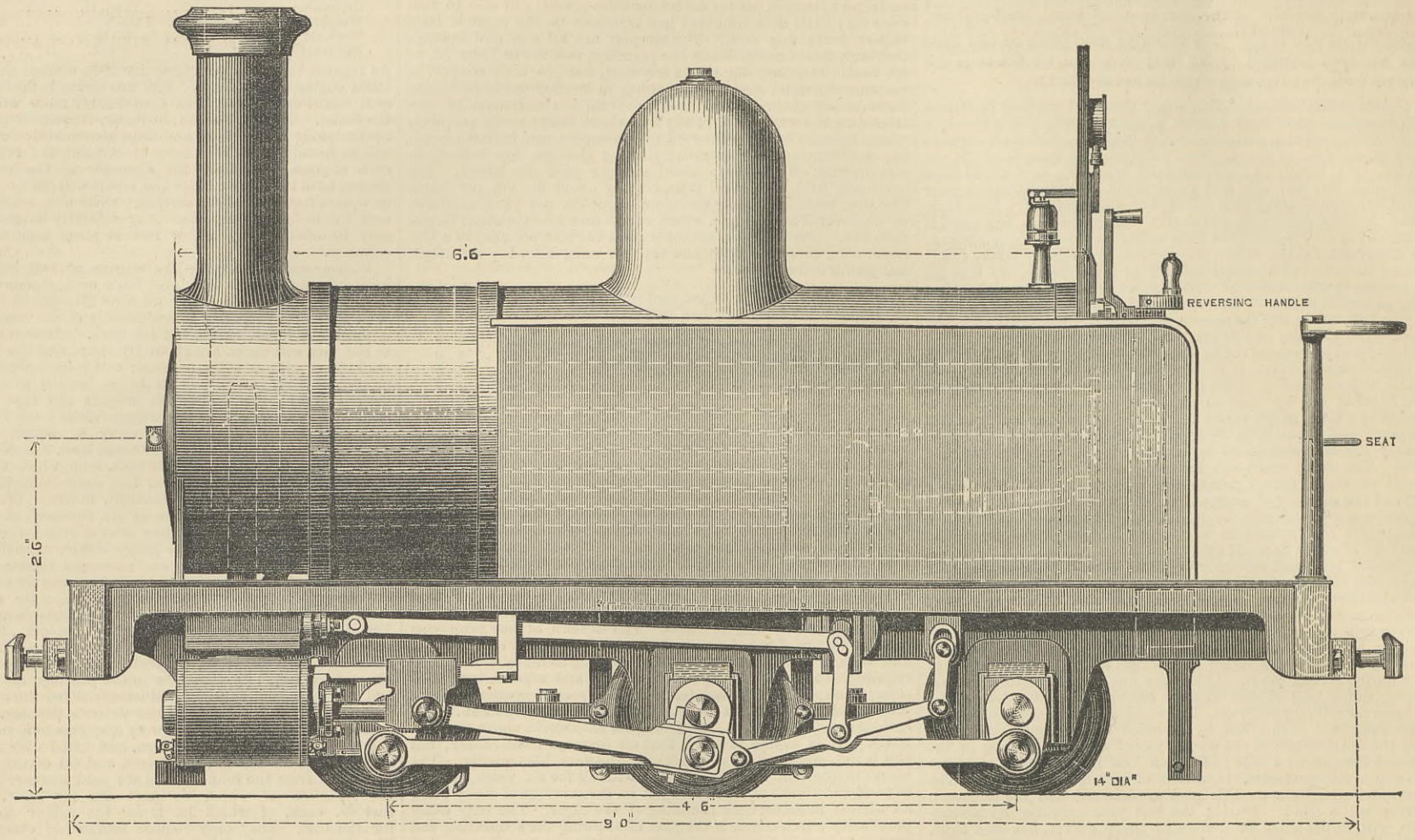
As regards the heating surface, it will be noticed that that of the lesser engine is very small. This was owing to faults in the design, as it might easily have been considerably more without enlarging the boiler. This engine has, however, frequently run for an hour continuously with a train, and kept steam well; but the following will be found a good rule for proportioning the heating surface of such engines:—Multiply the diameter of the cylinder by the stroke, both in inches; twice the result will be an ample number of square feet of heating surface. Once and a-half will do very well for ordinary purposes. Any difficulty in getting up steam may be obviated by a few feet of stove pipe inserted in the chimney.

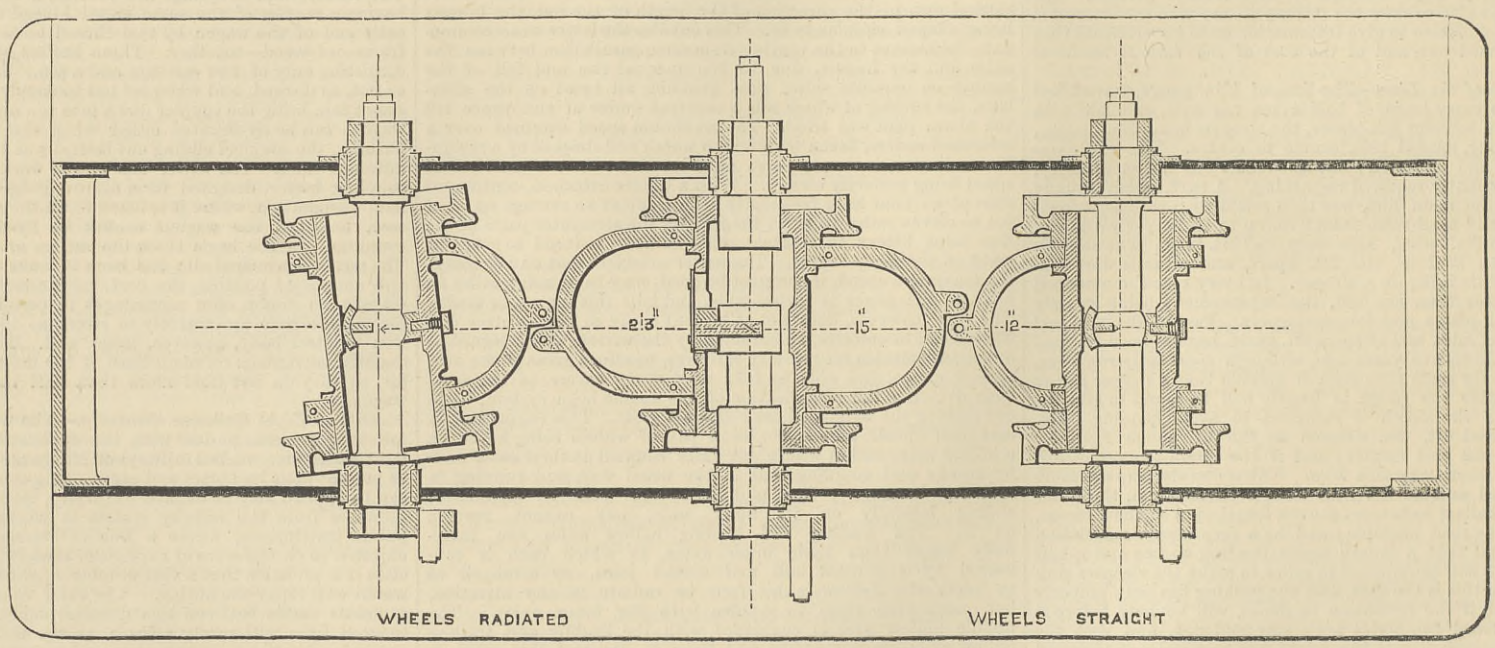
Wagons and Carriages.—The wagons at first built for the line held only eight cubic feet, and have been replaced by others of larger size. The present ones measure 2ft. 6in. by 5ft. inside; the sides are framed together independently of the wagon itself, which is constructed flat, with a rim 1in. high. These sides, or "tops," as the men call them, are about 1ft. deep, and the wagons can be used either with or without them; and being interchangeable, any number of tops can be put on to one wagon to make it of the desired depth. To empty the wagons the tops can be easily removed. The weight of the wagons varies from 4 cwt. to 5 cwt., and they are constructed to carry a maximum weight of 2 tons, 15 cwt. to 1 ton being the usual load. To show the capacity of the gauge, one wagon was built 6ft. long, which will hold 30 cwt. of soil or sand, but it is found less convenient than the smaller ones; so far as stability is concerned, however, 6ft. by 3ft. would be quite admissible. The rule of Mr. Spooner, of the Festiniog, Railway, seems the best for floor area of small wagons viz., twice the gauge by four times the gauge inside. Besides wagons, the writer has built a brake van and passenger carriages; the former being fitted with a powerful and instantaneous foot brake. One of the carriages is open, and holds eight persons; the other is closed, and holds sixteen, twelve inside and four outside over the bogies. The seats are all transverse, seating two abreast. The wheels are mostly 13¾in. in diameter, one wheel on each axle being loose, the other forced on by hydraulic pressure of from five to seven tons. The axles are all 1¾in. diameter in the bearings and wheel bosses, and 2in. where not turned. All wheels fitted during the last two years are chilled iron, cast at the writer's foundry. Most of the axles are lubricated from below by a sponge in a small oil vessel; the axle-box is of peculiar design, and fitted with an india-rubber spring. The hornblocks, axle-boxes, and oil covers fit together as they come from the foundry, and are held together by a bolt, after the insertion of which no part can get loose. These boxes cost 5s. each, of which 1s. is for the rubber spring, and 6d. for the bolt. They only require lubricating every month or so. The buffers and couplings are central, a single cast iron buffer, having a coupler of the same metal hinged to it, being bolted to each end of the wagon by two thread bolts, which also hold the frame—of wood—together. These buffers are extremely simple, consisting only of two castings and a pin. They are self-coupling or not, as desired, and when set not to couple, the driver can, by a smart tap, bring the coupler down into the coupling position. The wagons can be fly-shunted either when the engine is drawing or pushing, the couplers sliding out laterally as the wagons diverge on different lines. The writer has also at work a wrought iron self-coupling buffer, designed for a narrow gauge line of the Birmingham Corporation, where it is fitted to all the rolling stock. In this case, however, the wagons cannot be fly-shunted without uncoupling. In the bogie stock the buffers are fitted to the bogies. The writer's principal aim has been to make the wagons as cheap and simple as possible, the cost being about 25s. per cwt. Iron wagons, no doubt, offer advantages in certain cases; but weight for weight they are scarcely so strong as those of wood; a light iron or steel body, however, wears well. Tipping wagons are of doubtful advantage on small lines, if the material has to be moved far, as they do not hold more than half the load of a good box wagon.

Notes on Light Railways Generally.—The writer proposes in the following remarks to deal with the application in this country of light locomotive worked railways of 2ft. gauge or under, to do work at present done by horses and carts. The cases in which such lines can be applied may be defined as, firstly, isolated lines; secondly, branches from the railway system to works, quarries, farms, or public institutions, where a line of standard gauge would be objected to on the score of expense or unsightliness. Of the latter class it is probable that a vast number might be constructed which would well repay the outlay. The chief condition of success is a sufficient traffic between two definite points, and for this reason isolated lines will rarely answer, as the traffic is generally too varied in direction, except under special circumstances. It is said, however, that they have been made abroad on several large farms with advantage, even where unconnected with the railway system; but the writer himself cannot see how a locomotive line can be profitable for clearing land, or such purposes, where a considerable length of rail must be required, and that continually changing in direction. Light hand trams might answer in this way, but a locomotive essentially requires a good and cleanly-kept road if it is to work to advantage, and where there are bits of line laid down in this direction and that, which are little used, repairs are sure to be neglected. It is, therefore, in cases where a large traffic requires to be delivered on to the railway system, that such locomotive worked lines will be of most service. The small wagons should run right up to where the material requires to be loaded, so as to entail only one transhipment. The line can be carried unfenced over the fields, avoiding arable land as much as possible, and crossing the hedges on two balks of timber, so arranged with a dyke below as to prevent the passage of cattle. Even where the land is not owned, an agreement can usually be come to by paying a rent of 3d. to 6d. per yard run. The transhipment on to the railway should be effected by a raised platform, which will bring the floors of the small and large wagons to the same level, or, where the material is mineral, shoots can be erected. Every variety of such apparatus can be seen at work on the Festiniog Railway. The gradients of these small lines should not, if posssible, be greater than 1 in 40, as difficulty will be experienced in slippery weather, both in hauling anything like a load, and also in braking it down the inclines. The diminution of power on gradients may be thus clearly exemplified: If a locomotive will haul, as it should do, ten times its own weight on the level, it will haul only four times its weight up 1 in 50, twice its weight up 1 in 20, and once its weight up 1 in 12. The weight of the locomotive itself is, of course, not included in the loads hauled. More can be done on an emergency if the adhesion does not fail, but the above give a fair working average. It will thus be seen how important it is to keep the line as level as practicable. The permanent way should be made a thoroughly sound job, as it will then cost but little for repairs. The rails should be fish-jointed, and fully strong enough for the load; say 18 lb. rails for an engine having one ton on each axle, and 26 lb. rails for two tons per axle. The sleepers may be then spaced 2ft. to 2½ft. apart; they should be fully double the gauge in length, or a little more, and amply deep enough not to bend under the load; about one-sixth of the gauge will be right. As to width 7½in. will do for the 18 lb., and 9in. for the 26 lb. rails; no sleepers should be used less than 6in. wide, as the packing soon gets squeezed out. Narrower iron and steel sleepers are in use, and do well where bedded on a road or other unyielding surface; they are preferable to wooden sleepers when the line has to be laid in such places, as the surface requires to be

RADIAL TANK LOCOMOTIVE, DUFFIELD RAILWAY,

(*For description see page 47.*)





SECTIONAL PLAN OF RADIATING GEAR

disturbed to a much less depth. Dog-spikes are sufficient fastening for the rails; they should be long enough to go just through the sleeper, and each sleeper should have four; "ins" and "outs" on alternate sleepers do not answer. Locomotives are infinitely preferable to horses for working these lines; horses knock themselves and the road to pieces, and are very unhandy in shunting, let alone the chances of their getting lamed. A small four-wheel coupled engine is undoubtedly the cheapest and best in all but exceptional cases; but whatever class of engine is employed, all the wheels should most certainly be coupled. Adhesion is a great point, as dirt, grass, or leaves all greatly reduce the grip, and one of the chief difficulties is keeping the rails clean and dry. Having mentioned the basis on which an effective narrow gauge line should be constructed, it remains to show what traffic is required in order that such a line may pay, and this can best be done by giving the relative cost of horse and cart traction on roads, and locomotive traction on rails. Loading and unloading will not be included, being the same in each case. Taking the distance apart of the two points between which haulage is required as one mile, and the smallest and cheapest gauge as 15 in., the cost of the line and rolling stock will be as follows: one mile of 15in. gauge at 10s. per yard run, including the average earthwork required for a surface line, but no fencing,

	£
Say 2000 yards (which allows for points and sidings)	1000
One 4½in. cylinder locomotive, 2 tons	250
12 wagons to hold 1 cube yard, at £8 say	100
Extras, say	150
Total cost of one mile of line complete	1500

The above engine would be capable of hauling a gross load, exclusive of its own weight, of eight tons up 1 in 50, which latter may be taken as a fair ruling gradient for a surface line. A gross load of eight tons would be equal to a paying load of about six tons, so that, supposing the engine to make one trip every hour, 60 tons would be moved in the day; although, with a double set of wagons, 100 tons could easily be managed. If the engine worked one day a week, or, say, fifty days in the year, it would have hauled 3000 tons one mile (goods hauled on return journeys need not be taken into account), and the cost would be as follows:—

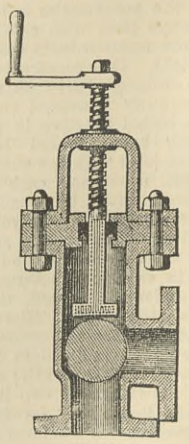
	£
Interest on £1500, at 5 per cent.	76
Driver and boy, 50 days, at 6s.	15
Fuel, oil, and current repairs at 5s., say	13
Renewal of line and rolling stock, at 20 years' life on £900 ..	22
Cost of moving 3000 tons one mile	125

Equal to 10d. per ton.

Now, the same haulage by horses and carts would cost in this country about 1s. per ton, and in this case there is the advantage, especially in agricultural districts, of the horses and cart during harvest time, or for hauling in other directions, which would more than balance the 2d. per ton saved by the railway. It is, therefore, probable that the latter would not pay unless the engine were required to work two days in the week, hauling, say, a minimum of 5000 tons (or a proportionate number of cubic feet of light stuff) per annum. Beyond this amount the railway would pay well, as the outlay remains the same, and the renewal need not be put below twelve years. Working daily such a line will move material at 5d. per ton per mile; the longer the line the cheaper will the haulage be per mile. It will be observed that in the above estimates no allowance is made for way leaves or purchase of land; should these be required, the cost of transport would be increased accordingly. The writer, in drawing these comparisons, is far from wishing to discourage the construction of light railways, for which he believes there is a wide future even in this country, but it must be borne in mind that where machinery takes the place of manual or horse labour, it is in all cases with one or two objects; either to do a larger amount of work than is possible without it, or to do it in a shorter time. Apply the same reasoning to locomotive-worked railways, and it will easily be seen whether they will pay as against horses and carts. The writer has known several ill-considered schemes of this kind which have ended in the whole plant being left to rust away, at considerable loss of capital to the owner, and of credit to the cause of light railways generally. While, therefore, strongly advocating such lines, he would equally strongly urge that the question of expediency be first considered, and lastly, that if made at all, the whole should be as carefully surveyed, laid out, and constructed as a full-sized railway. The question of light railways in foreign countries has never had much of the writer's attention, except in the matter of army transport, in experimenting on which, much of his time has been spent. The use of small lines in sugar plantations and other industries abroad is increasing extraordinarily, and cannot be too highly encouraged. It is often not a question of whether steam is the cheapest means of transport, but whether there is any alternative, and the conditions for success depend so much on local considerations, that it is impossible to offer advice without entering into each individual case under the guidance of those on the spot. The whole subject of light railways is still in its infancy. It is only just beginning to be understood that these cannot be diminutive copies of full-sized lines; the conditions are entirely different, and we have yet to see the miniature railway developed. Year by year, the clumsy old portable engines have changed, till we now have as near perfection, both in simplicity of construction and in economy of working, as it seems possible to attain. So the light railway remains to be developed into a simple easily laid, and enduring roadway, with cheap, but effective locomotives, and wagons of every class carefully designed to carry their loads with the greatest convenience and minimum of dead weight.

COCHRANE'S PATENT ACID VALVE.

THE construction and action of this valve, the invention of Mr. A. H. Cochrane, of Westminster-chambers, will be readily seen from our illustration. It consists of a lead box and cover flange, and specially prepared india-rubber ball valve, the stalk being made of brass or steel, working through a cast iron gland, and the lower half being coated with lead, so that the whole of the inside parts are either lead or rubber, as will be seen from



the illustration. The lead cover flange is recessed and a hydraulic cup rubber inserted, so that the valve may, if required, be used up to a considerable pressure. The construction of the valve is very simple, and will allow its wearing parts to be replaced from time to time without removing its connections. Another great advantage claimed for it is its non-liability of getting choked by straw, grit, &c.

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

(From our own Correspondent.)

THE quarterly meetings of the iron trade of South Staffordshire were begun in Wolverhampton yesterday—Wednesday—and the business done and the tone of the market were improvements upon the corresponding meeting three months ago. Prices generally were without alteration upon those fixed at the earlier date. Consequently marked bars were again declared at £7, and Earl Dudley's bars £7 12s. 6d. Yet £7 10s. was still quoted as the price of the marked bars of the John Bradley and the new British Iron Company's brands. The sheets and plates of all these firms were set down at £1 10s. in advance of bars, and £8 10s. was firmly demanded for "Monmoor" boiler plates. Finished iron of less valuable kinds was generally stronger upon the quarter than the high-class sorts. Medium bars were from £6 5s. to £6 10s. From £6 5s. bars were to be bought, according to quality, down to £5 12s. 6d. for hurdle bars. Gas strip could have been purchased at £5 17s. 6d. Hoops for baling were mostly quoted £6 10s. to £6 12s. 6d. at the works, but were procurable from some makers at £6 7s. 6d.

Sheets of the working-up quality were to be had at £7 7s. 6d., singles gauge; but for galvanisers' singles £7 15s. to £8 were the figures quoted. Doubles of the same quality were named at £8 15s. to £9; and for latens from £9 15s. to £10 had to be given. Sheets in a galvanised state were quoted £14 10s. to £15 upwards for 24 w.g. delivered in London; 26 w.g., £16 10s. to £17; and 28 w.g., £18 10s. to £19. There was an augmented inquiry for export and home use, colonial and foreign orders mixing in the shipments.

Tank plates and girder plates were procurable at from £7 5s. to £7 15s., and common boiler plates were to be had at from £7 15s. to £8. At the latter figure it was possible to buy a branded plate; but of a much less reliable quality than the plate for which nothing under £8 10s. would be accepted.

The finished iron market was mostly remarkable for the pressing appeals made to makers for an earlier and larger delivery of sheets to the galvanisers. The prices sought yesterday for galvanising sheets showed an improvement upon the minimum prices of the quarter to the extent of from 5s. to 15s. per ton. Hoops for baling and for coopers' use were in demand at Wolverhampton, a Liverpool merchant, who is amongst the largest buyers of this commodity for export, being amongst the purchasers, and the prices were better on the quarter from 2s. 6d. to 5s. Inquiries for quotations for the most kinds of iron rolled in South Staffordshire were more numerous than at the Lady Day meeting, and there was more of a business air about the majority of them; but it could not be concealed as to certain of the higher qualities that the growing use of steel exercised a prejudicial influence.

Recent considerable sales of pigs checked the business in raw iron. In this, as in the finished iron department, the ruling quotations were without change upon the quarter. Lillcshall hot blast Shropshire all-mine iron was fixed at £3, and cold blast at £4 per ton. Staffordshire all-mine iron was quoted at from £3 5s. down to £3 2s. 6d. Yet while there were some brands for which £3 7s. 6d. was demanded, there were others—equally all-mine—which were readily procurable at £3. Part mine was generally £2 10s. to £2 15s., and cinder iron £2 down to £1 17s. 6d. Hematites were mostly down upon the quarter from 2s. 6d. to 5s. Alike West Coast and South Wales brands of repute were quoted £3 5s. Derbyshire and Northampton pigs—of which I am assured from 45,000 to 50,000 tons have been sold hereabouts in the past three weeks—were freely quoted £2 2s. 6d. up to £2 5s. Local makes, suitable for mixtures in the forge or for foundry use, were in most sale.

At the Birmingham quarterly meeting to-day—Thursday—the attendance was as numerous as ever, and the improved tone perceptible in Wolverhampton was even more conspicuous. There were some good transactions in sheets and hoops at yesterday's full sale rates—in a few cases which involved immediate delivery even better terms were procurable. All but high-class marked iron was stronger upon the quarter; even ironstone was better by from 1s. to 1s. 6d.

The coal trade keeps dull. Yet no conspicuous change has yet taken place in manufacturing sorts, the crucial quotation remaining at 9s. per ton for best Dudley furnace descriptions.

The number of blast furnaces alight is less than in the previous quarter. In the interval since the April Quarterly Meetings, the Lilleshall Company have put out a hot and also a cold-blast furnace, leaving two of each now blowing out of the nine they possess; the Madely Wood cold-air furnaces are chiefly on slack blast, and this week, in the Dudley district, Messrs. Grazebrook have put out a furnace for repairs, and Earl Dudley is about to do the same.

NOTES FROM LANCASHIRE.

(From our own Correspondent.)

Manchester.—Various circumstances have combined to bring about a lull in the iron trade during the past week. The tolerably heavy buying which has been going on during the past fortnight has, no doubt, for the most part covered any present requirements on the part of buyers, whilst the quarterly meetings held this week are also an inducement to hold off buying for the moment. Apart, however, from these special circumstances to account for the lessened activity, there is a good deal of uncertainty as to the course the market may take. The most varied opinions are expressed; some people are very confident that a decided and permanent improvement is being developed, whilst others, in the face of heavy stocks and a large production, have no faith in any present upward movement of the market. But although there is a very considerable curtailment in the amount of business doing, sellers are still firm and show a determination to hold for the slight advance which has been asked upon late rates, but which buyers have not, as yet, shown much disposition to pay.

Lancashire makers of pig iron, who, during the last two or three weeks have sold sufficient iron to carry them over the next three months, have for the present ceased to offer in the market, and pending the result of the quarterly meetings, their quotations are practically withdrawn. Nominally the quotations for delivery into the Manchester district may be given at about 44s. to 45s. per ton, less 2½ per cent.

So far as outside brands are concerned, any business doing is still confined chiefly to Lincolnshire irons, in which a few sales have been made at prices equal to about 44s. to 45s. per ton, less 2½, delivered into the Manchester district. The prices asked for Derbyshire and Middlesbrough irons still keeps these brands practically out of this market.

A fair amount of business appears to be doing in finished iron, and the principal makers in this district continue well supplied with orders. Bars, hoops, and sheets meet with a tolerably good inquiry, and a considerable shipping trade is being done. With the exception, however, of bars, for which some of the local makers have been asking an advance of 2s. 6d. per ton this week, no materially better prices are being obtained, and the average quotations for delivery into the Manchester district are about £5 17s. 6d. to £6 for bars; £6 7s. 6d. to £6 10s. for hoops; and £7 12s. 6d. to £7 17s. 6d. for sheets.

Amongst founders, engineers, tool makers, and machinists, a better feeling is also generally reported. New work it is true has still to be taken at very low prices, but there is a more confident tone in inquiries, and they result in business more promptly than has been the case of late.

In previous notes I have referred to what is being done in this district by tool makers in the manufacture of American twist drills, and I may now add that there has been recently a considerable development of the local manufacture, not only of American, but of other small foreign inventions generally. The prohibitory tariffs which are being imposed by competing nations abroad seem to have roused manufacturers here into more energetic action in taking prompt advantage of any useful improvement from whatever source, and many small tools and machines which have hitherto been sold largely in this market by representatives of foreign houses are now being made at considerably lower prices by Lancashire manufacturers. As an illustration I may mention that one local manufacturer in the engineering trade, who is a strong free trader, became so annoyed at the "protective" spirit displayed across the Channel, that he determined at any inconvenience to produce himself a speciality which he had hitherto purchased from a French house and sold to his customers. A sample was sent into the workshop to be taken to pieces, and the result is that it is now being made by his own men equally as well, and at 30 per cent. less cost than the price charged by the French firm. This, a method of retaliation, certainly more profitable than reciprocity and the same kind of thing, is going on in the manufacture of the small lathes, slide rests, chucks, &c., of which the Americans have previously practically had a monopoly.

In the coal trade extreme dulness continues, and the pits in most cases are not working more than six to seven days a fortnight. All descriptions of round coal both for house fire, iron making and steam purposes are very bad to sell, and of these heavy stocks are held which are being forced upon the market at very low figures. Engine classes of fuel are in moderate demand, but supplies are much more plentiful than had been anticipated. The average prices at the pit mouth are about as under: Best coal, 8s. to 8s. 6d.; seconds, 6s. to 6s. 6d.; common round coal, 4s. 6d. to 5s. 3d.; burgy, 4s. 3d. to 4s. 9d.; and good slack, 3s. 9d. to 4s. 3d., with inferior about 3s. to 3s. 6d. per ton.

The inferior quality of Lancashire coke, as compared with Durham and other north country makes, has always stood in the way of its adoption for iron-making purposes, but some of the local makers are now endeavouring by improvements in their ovens to produce a coke which shall meet the requirements of iron-masters. In this to some extent they have been successful, samples having already given good results, and for these better qualities of coke from 15s. to 16s. per ton at the ovens is being obtained, the inferior descriptions averaging about 10s. to 12s. per ton.

Barrow.—Appearances of better trade in the hematite pig iron trade are more evident this week than for some time past. The demand continues to show a steady increase, and buyers are coming forward with their orders much more freely. I anticipate a good winter's trade, should the present demand continue, and the likelihood of its doing so appears to be certain. A much better demand is experienced from America and the Continent. Stocks are still very large, in spite of the large deliveries which have recently been made; but as the shipments of metal have only been light, considering that the shipping season has now been open some time, there will in all probability be a very heavy tonnage of metal shipped to America and elsewhere before the season closes. This, I expect will raise the price of pig.

Present qualities of Bessemer are quoted at 59s. per ton No. 1 quality; No. 2, 58s.; and No. 3 at 57s.; No. 3 forge, 56s. to 57s.; other qualities of an inferior kind at 55s. Makers are not altogether disposed to accept these quotations, and holders of large parcels are holding back in anticipation of better values. I expect some little time must elapse ere a fair advance is quoted. The steel mills are in active work, and orders are being placed in the hands of makers which will maintain this activity for some time. They are chiefly employed in the rail trade. Iron ore in fair request at late prices. Iron shipbuilders busy. Engineers and others doing a fair business. Coal and coke unchanged.

THE SHEFFIELD DISTRICT.

(From our own Correspondent.)

THE houses doing an American business are somewhat less actively employed, or, to speak more correctly, there are fewer orders being received from the States. This is nothing unusual, however, July and August being the lightest months of the year, the Americans giving up business as much as possible during "the hot season," and this to an extent scarcely appreciated by those outside the trade. With the recommencement of the cooler weather the American orders again get heavier. At present, fortunately, there is a great deal of work in hand for the United States, both in steel and cutlery, as well as in steel rails. Sheep-shears are also being largely inquired for by American dealers.

Messrs. Spear and Jackson, of the Etna Works, are exceedingly busy on orders for agricultural implements, and for the classes and sections of steel required by the great firms who make farm machinery and specialities, such as reaper and mowing sections. A better and more hopeful feeling evidently pervades the rural districts. During the last ten days I have travelled over a large portion of the Midland counties, and have met both farmers and representatives of the great agricultural firms. The latter tell me that they have not been so busy for five or six years. One implement alone—a sheaf-binding harvester, with automatic action—manufactured by a well-known firm, has already been ordered this year to the extent of over 10,000. Last year, which was considered a heavy year for this particular article, the total number supplied was 4180.

Messrs. John Brown and Co., Limited, have announced the form in which they intend to obtain further capital. Instead of making a call on the ordinary shares, they issue £50,000 of 5 per cent. preference stock, in £10 shares, which will be offered to ordinary shareholders in the proportion of three preference shares for every five ordinary shares. In the event of there being a surplus of shares, those who desire a larger number than are allotted to them will have their holding increased to the extent of the surplus. The company state that the new capital is required to work the new compound iron and steel plates on the patent of Mr. J. D. Ellis, the inventor. The new plates have successfully passed the Admiralty tests, and their manufacture requires considerable alterations and extensions of existing plant. The directors express the greatest confidence in the future prospects of the company. Meanwhile the new issue has caused the ordinary stock to drop to 16½ and 17 dis. on 'Change. There is a great deal of good and remunerative work being done at the Atlas Works at present, and there is no doubt the ordinary stock will promptly recover the present depression.

Messrs. Davy Brothers, Limited, of the Park Ironworks, have issued their report and balance-sheet for the year ending April 30, 1881. The directors state that although the quantity of work turned out has been greater than in the preceding year, the prices obtained have been, through severe competition, less remunerative, and the profits have thus been unfavourably affected. The directors very much regret such unsatisfactory results, but point out that they have been brought about by circumstances over which they have had no control; and they add that with a general improvement in trade, no difficulty would be experienced in realising such prices for their machinery as would again enable fair returns to be made upon the capital invested. The profits of the company after writing of £1400 for depreciation of plant and machinery, amount to £2956; balance of undivided profit from last year, £767; total, £3724. Interest on debentures, mortgage, &c., requires £1848, leaving for disposal £1875, which the directors recommend to be carried forward to next year's account, and no dividend be paid. Mr. David Davy, one of the managing directors, retires this year, but is eligible for re-election.

Dr. Webster, the American consul, in a circular, dated the 12th inst., intimates that in accordance with the decision of the State Department of the United States Officers, a uniform change is henceforth to be made in taking declarations to invoices lodged for verification. This change is made with a view to secure uniformity of charges throughout the United Kingdom. Acting upon the terms of the circular, the officers attached to all the consulates in Great Britain will, on and after 20th July inst., make a uniform statutory charge of 1s. 6d. for each signature.

THE NORTH OF ENGLAND.

(From our own Correspondent.)

TUESDAY being the quarterly meeting of the iron trade at Middlesbrough Exchange, there was an unusually large attendance, including several merchants from distant towns. Notwithstanding the damping effect of the June statistics, the price of pig iron does not appear to have fallen much; or if it did so slightly at the first shock, it has now recovered, and even shows a tendency to advance. The only theory on which this can be accounted for is that the possible damping down of some furnaces here and elsewhere may be acting as a scare, causing some people to buy for future needs, when otherwise they would have waited.

The reply of the Scotch ironmasters to the proposal of their Cleveland competitors is looked for with interest, but many think that nothing is likely to be done. Indeed the question may well be asked, whether the desired curtailment of production is not even now going on in a much sounder and healthier manner than would result from any artificial decision to put out furnaces. It has been shown that there are some thirty to forty fewer furnaces in blast in the United Kingdom now than at the beginning of the year. These furnaces are not either in the Glasgow or the Cleveland district. They belong to outlying localities, and were no doubt previously working at a disadvantage. But it is enough that they have gone out, and that if prices remain as at present, all others in similar circumstances will also have to succumb. In time the production will thus be brought down to the consumption in a natural way, whereby Cleveland and Glasgow will be left masters of the situation. These districts need in that case fear no outside competition for years to come. They will have fought out the battle and won fairly, and the result will be sufficiently discouraging to the fallen to prevent any future resurrection. But if the production be curtailed by voluntarily putting out good and efficient furnaces, then it is certain that on the least rise of prices it will be impossible to restrain the owners from breaking away from the combination and putting them to work again.

The price of No. 3 g.m.b. yesterday was from 37s. to 37s. 3d. f.o.t. Middlesbrough. Forge iron was 1s. per ton less, and warrants 1s. per ton more. Cleveland hematite may be had at 56s. f.o.t. Middlesbrough. The stock in Connal's stores is now 180,975 tons, being an increase of 1142 tons during the week. The finished iron trade continues steady, the new contracts entered into last week more than covering the quantities run off. Ship plates are worth £6 per ton for large and £6 5s. for small lots, free in trucks, Middlesbrough. Best bridge plates are 10s. per ton more, and boiler plates, 20s., 40s., and 60s. extra, according to quality. Bars, angles, and iron rails may be had for £5 12s. 6d. per ton, and puddle bar, £3 15s. for broad, and £3 12s. 6d. for narrow sizes. Old rails are £3 7s. 6d. per ton, c.i.f. Tees. Purple ore is 16s. per ton, also c.i.f. net cash against documents in both cases.

A shocking and unusual accident occurred a day or two since at the Middlesbrough shipyard. It was necessary to paint the inside of an iron mast which was lying on the ground just completed. The ends were both closed in, and access to the inside was obtainable only through a manhole. A lad, aged 16, was sent in to creep through the whole length of the interior. He carried a paint-pot, brush, and naked candle. In order to make himself the more comfortable, he had wrapped his body over with tow. Suddenly screams were heard and smoke was seen issuing from the manhole. The workmen rushed to the spot, only to find the poor boy was on fire. After a time he managed to work himself along to the opening, and was dragged out. He was fearfully burned all over. Everything was done that could be done, but it was of no avail. The poor fellow died shortly after at the infirmary.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

DURING the greater part of the week the Glasgow iron market has been devoid of strength. It began well in consequence of large shipments of pig iron being reported, but other influences coming into play, a feeling of flatness set in. A number of holders showed rather more disposition to part with their iron, which had the effect of weakening the market. The chances of an early reduction of the output of pig iron are still regarded as remote; and so far as can be ascertained, the proposal of the Cleveland iron-masters for a simultaneous damping of a percentage of the furnaces has not met with much favour here. The exports of pigs have been good, last week's amounting to 13,825 tons as compared with 10,158 in the corresponding week of last year; but a large weekly addition continues to be made to stocks, which in Messrs. Connal and Co.'s stores have reached the large aggregate of 570,000 tons. So long as this state of matters continues prices are likely to be moderate. The holidays begin this week, and they will possibly have some little effect upon the trade. At their close, it would not be surprising if those concerned had the question of a curtailment of the production again forced upon them. The imports of Cleveland pig iron are comparatively large, showing an increase for the year to date of no less than 37,745 tons. There are 120 furnaces in blast as against 117 at the same date last year, and six of the number are making hematite.

Business was done in the warrant market on Friday morning at from 46s. 11d. to 47s. 3d. cash and 47s. 1d. to 47s. 5d. one month, the afternoon quotations being 47s. 2d. to 47s. cash, and 47s. 4d. to 47s. 1d. cash. On Monday forenoon transactions took place at 46s. 11½d. to 47s. 3½d. cash, and 47s. 4½d. twenty-one days; whilst in the afternoon the quotations were 47s. 2½d. to 47s. 1d. cash, and 47s. 4d. to 47s. 3d. one month. The market was flat on Tuesday, from 47s. 3½d. to 46s. 10½d. cash. On Wednesday business was done at from 46s. 9d½. to 47s. cash. To-day—Thursday—the market was firmer, at 47s. to 47s. 2d. cash and 47s. 4d. one month. Owing to the Fair holidays the market will be closed till Tuesday.

The demand for makers' iron is quiet, but prices have been pretty steady. Gartsherrie, No. 1, f.o.b. at Glasgow, per ton is quoted at 54s. 6d.; No. 3, 48s. 6d.; Coltness, 56s. 5d. and 49s.; Langloan, 56s. 6d. and 49s.; Summerlee, 54s. 6d. and 47s.; Calder, 54s. 6d. and 48s. 6d.; Carnbroe, 51s. and 47s.; Clyde, 50s. and 46s.; Monkland, 47s. 6d. and 45s. 6d.; Quarter, 47s. 6d. and 45s. 6d.; Govan, at Broomielaw, 47s. 6d. and 45s. 6d.; Shotts, at Leith, 55s. 6d. and 49s.; Carron, at Grangemouth, 52s. 6d. (specially selected, 56s.) Kinneil, at Bo'ness, 47s. 6d. and 45s. 6d.; Glengarnock, at Ardrossan, 51s. 6d. and 47s. 6d.; Eglinton, 47s. 6d. and 44s. 6d.; Dalmellington, 47s. 6d. and 45s.

The malleable iron trade is still fairly active, but from some quarters there are complaints that new orders are not very readily obtained. The marine and general engineering works are busy, especially the latter. For some time the cast iron pipe department has been dull, and in the course of the past few days a much-needed order of upwards of 20,000 tons has been received. There is still abundant room for improvement in this branch. The Sheriff of Hamilton has granted authority to eject from their dwelling-houses a number of men who have been on strike since the 28th May, at the works of the Steel Company of Scotland, at Newton, near Glasgow.

In the coal trade a good business is doing, the shipping department of the trade being particularly satisfactory for the time of the year. The total shipments at the ports, east and west, are fully 1000 tons larger than they were in the preceding week, and 17,000 over those of the corresponding week of last year.

WALES & ADJOINING COUNTIES.

(From our own Correspondent.)

The various engineering works of the district, notably the Clydach Vale Railway and the Pontypridd, Caerphilly, and Newport, are progressing well. As for the first, this will open out a new field for the Taff Vale, whose stock—£100—is already at £270, and holders are confident of its touching £300.

The Glamorgan Agricultural Society are to hold their annual meeting at Merthyr this year, on the first week in August, and preparations are going on energetically already. The show at Cardiff was a great success in implements.

The coal trade of Wales may be fittingly described as in a most satisfactory condition. Prices of best coal are decidedly looking up, and I have heard of business being done at an advanced price and a lengthy period.

The last advance has had a satisfactory effect upon the men. There was a little grumbling previous to the announcement, but the rumour that a strike was meditated is, I am persuaded, incorrect. There is too much high-pressure work going on to allow men time for organisation, and in the Rhondda Valley especially men are scarce.

The exports of iron last week amounted to 6500 tons from all Wales. There is not much movement in iron. Makers of coke bar complain that trade is dull, and that there is not much confidence in present business. A good deal of it is done by bills, and these are occasionally not met. A large maker told me this week that several tin-plate firms are in a doubtful state.

Steel rails are in fair demand, and prices are kept up.

The Treforest Works had an accident to the machinery some little time ago, but are now making up for lost time. Tredegar is going on with its steel plant. Cyfarthfa remains the same, and the men are shifting for themselves as they can.

Tin-plates remain at 15s. f.o.b. Liverpool or London, and even best charcoals are at 18s. Steel rails remain at £5 2s. 6d. ordinary section; wrought scrap £3 to New York.

Cardiff and Newport exhibit in all respects, save that of patent fuel, a remarkable contrast in briskness to that which is shown at Swansea. There is no movement in prices there, and those who quote an advance cannot sell. The great rush unquestionably now is for the best samples obtainable from Newport and Cardiff. Every argument possible is given for Swansea to get connected with the Rhondda Valley, and thus secure a supply of best coals at easy rates.

Seventeen thousand tons of Bilbao and other foreign ore came to hand this week at the several ports.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

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

Applications for Letters Patent.

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

5th July, 1881.

2924. Steering Engines, G. W. Robertson, Glasgow, and I. Beck, Sheffield.
2925. Preventing, &c., Incrustations, H. A. Bonneville.—(*Commander Pasquale Alfieri, Naples.*)
2926. Furnaces, H. Bonneville.—(*W. Moller, U.S.*)
2927. Propelling Vehicles, J. Simmons, Brixton.
2928. Attaching, &c., Harness, C. D. Abel.—(*H. Fleischhauer, Berlin.*)
2929. Bulb Syringes, J. A. Grant, Canada.
2930. Electric Lamps, E. P. Ward, London.
2931. Gas Engines, E. de Pass.—(*E. Körting, Hanover.*)
2932. White Metal, J. C. Mewburn.—(*La Société Raynaud, Paris.*)
2933. Valve-gear, W. Hargreaves & W. Inglis, Bolton.
2934. Rotary Knife, &c., Cleaner, W. Scott, London.
2935. Protecting Apparatus, &c., J. Louis, London.
2936. Tricycles, &c., R. Jones, Liverpool.
2937. Fastenings, A. J. Boult.—(*J. C. Koch, Berlin.*)
2938. Harvesting Machines, W. P. Thompson.—(*H. B. Blakemore, Ohio, U.S.*)
2939. Mincing Meat, &c., H. Dollman, Birmingham.
2940. Churns, C. Slater.—(*I. W. Plewes, Lynedoch.*)
2941. Boxes, &c., C. R. E. Bell, London.
2942. Wagons, G. Redfern.—(*M. V. Wormer, U.S.*)
2943. Motors, S. Pitt.—(*M. G. Farmer, Newport, U.S.*)
2944. Telegraph Wire Ropes, J. P. Hooper, London.
2945. Applying Pictures to Doors, F. D. Harding, London.
2946. Caloric, &c., Engines, L. Wolff, Magdeburg.
2947. Cleaning, &c., Materials, W. R. Lake.—(*C. A. Dresser, U.S.*)
2948. Producing Writings, &c., W. R. Lake.—(*H. Schmitt, Austria.*)

6th July, 1881.

2949. Cotton Ropes, H. Birkmyre, Port Glasgow.
2950. Car Axle Lubricators, H. J. Haddan.—(*C. G. Till and H. R. Randall, Brooklyn, U.S.*)
2951. Trousers, A. W. Adams, Southampton.
2952. Preparing Textile Materials, L. A. Groth.—(*H. R. P. Hosemann, Berlin.*)
2953. Thermometer, M. Immisch, London.
2954. Magneto Engines, P. Jensen.—(*T. Edison, U.S.*)
2955. Lamps, F. R. Baker, Birmingham.
2956. Surveying Instrument, E. A. Brydges.—*W. Hamburger, Copenhagen.*)
2957. Caustic Holders, G. F. Redfern.—(*Monsieur A. B. Clarin, Paris.*)
2958. Looms, E. and S. Tweedale, Accrington.
2959. Steel, J. C. Ramsden, Gristhorpe Hall, York.
2960. Markers, W. Douglas and E. Collis, Stourbridge.
2961. Gas Motor Engines, C. G. Beechey, Liverpool.
2962. Railway Vehicles, W. R. Lake.—(*W. Robinson, Boston, Massachusetts, U.S.*)
2963. Cooling Apparatus, J. T. King.—(*T. Rose, San Antonio Texas, U.S.*)
2964. Burnishing Apparatus, P. M. Justice.—(*W. F. Hutchinson, Lynn, Essex, U.S.*)
2965. Weavers' Heddles, W. R. Lake.—(*L. Borgognon, Basle, Switzerland.*)

7th July, 1881.

2966. Grain Binding Machines, G. E. Vaughan.—(*M. A. Keller, Brockport, New York, U.S.*)
2967. Gas Engines, E. S. Wastfield, Bath.
2968. Vehicles, R. Brabyn, St. Wenn, Cornwall.
2969. Ventilating, E. Aldous, Peckham.
2970. Nails, H. Booth, Bilston.
2971. Eye Glasses, G. F. Redfern.—(*F. Terstegen, Elizabeth, New Jersey, U.S.*)
2972. Looms, W. Atherton, Preston.
2973. Indicating Apparatus, W. C. Pagan and J. Hore, Liverpool.
2974. Cases for Fruit, &c., G. A. Cochrane, Liverpool.
2975. Bricks, &c., E. Johnson, St. Helen's, Lancashire.
2976. Extracting Fatty Matters, W. P. Thompson.—*F. Seltsam, Forcheim, Germany.*)
2977. Mills, W. Wawlen, jun., and F. Hawley, Duffield.
2978. Chimney Caps, H. J. Haddan.—(*A. Picheeraw Cailly, France.*)
2979. Indicating Apparatus, B. Hunt.—(*A. Lagrange, A. Aubert, and G. Nos, Paris.*)
2980. Weaving, W. S. Mackie, Manchester.
2981. Middlings Purifiers, E. G. Brewer.—(*K. Smith, St. Paul, Minnesota, U.S.*)
2982. Gathering Corn, &c., W. Woolnough and C. Kingsford, Kingston.
2983. Propelling Vessels, R. Meek, Southend-on-Sea.
2984. Feed Pumps, H. P. Phillips, Hammersmith.
2985. Working Celluloids, T. B. Gibson, Yorkshire.
2986. Signalling, J. Imray.—(*C. Ader, Paris.*)
2987. Malt, J. Johnson.—(*C. Golay, Paris.*)
2988. Telephonic Apparatus, G. L. Anders, London.
2989. Transmission of Power, J. Hopkinson, London.
2990. Gas Engines, C. and C. T. Linford, Leicestershire.
2991. Shaping Machine, J. R. Kelsey, Bristol.
2992. Steam, &c., Engines, J. E. Outridge, Egham.
2993. Small-arms, S. B. Allport, Birmingham.
2994. Preserving Food in Bottles, F. Pool, London.
2995. Telephonic Apparatus, A. C. Brown and H. A. C. Saunders, London.
2996. Propulsion of Ships, W. Coppin, jun., London.
2997. Sulphate of Alumina, C. Semper, Philadelphia.
2998. Pile, A. S. Murphy, Philadelphia, U.S.
2999. Cleaning Knives, H. Lake.—(*P. Godard, Paris.*)

8th July, 1881.

3000. Taps, &c., G. Crawford, Port Glasgow.
3001. Anchors, H. Terrell.—(*S. Chapleau, U.S.*)
3002. Purifying Smoke, J. Griffiths, Weobley.
3003. Taps, G. Furness & J. Robertshaw, Manchester.
3004. Gauges, G. Furness & J. Robertshaw, Manchester.
3005. Chlorate of Soda, J. W. Bottomley, Widnes, and R. F. S. Molesworth, Rochdale.
3006. Pumps, J. McEwen and S. Spencer, Manchester.
3007. Binding Books, H. Thompson.—(*S. Mower, U.S.*)
3008. Dredging Machines, W. Lake.—(*J. Menge, U.S.*)
3009. Tills, B. W. Webb, London.
3010. Signalling, H. Gardner.—(*E. Roe, Perth.*)
3011. Tobacco Pipe Joints, W. H. Sharman, London.
3012. Castings, J. J. Sachs, Sunbury.
3013. Spring Motors, J. H. Johnson.—(*J. B. Powell & J. H. Harper, Philadelphia, U.S.*)
3014. Photographic Cameras, G. Smith, London.
3015. Electric Lighting Apparatus, W. R. Lake.—(*J. J. C. W. Greb, Frankfort-on-the-Main.*)

9th July, 1881.

3016. Velocipedes, G. L. O. Davidson, London.
3017. Horse Collars, H. J. Haddan.—(*D. Duplant, France.*)
3018. Spinning Machine Rollers, H. J. Haddan.—(*J. B. William, Ober Soultz.*)
3019. Combing Cotton, W. R. Moss, Bolton.
3020. Sash Bar, W. Howitt, Ilford.
3021. Engine Regulator, R. M. Marchant, London.
3022. Wagons, W. F. Lotz.—(*A. Wilkè, Brunswick.*)
3023. Lathe, J. A. Armstrong, Blackheath.
3024. Grinders, R. R. Gubbins, London.
3025. Roasting Tobacco, C. H. Andrew, Stockport.
3026. Brushing, &c., Leather, P. Newall and J. Barker, Warrington.
3027. Fire-arms, T. and T. Woodward, Birmingham.
3028. Axles, H. H. Lake.—(*A. Cohen, Poland.*)
3029. Binding Apparatus, G. Spencer, Derby.
3030. Cigarettes, A. Clark.—(*J. Bonsack, Roanoke, U.S.*)
3031. Earrings, T. Perks, jun., and B. J. Perryman, Birmingham.
3032. Regulating Apparatus, Sir W. Thomson, Glasgow

11th July, 1881.

3033. Corsets, A. Henderson.—(*D. F. Trefcon, Paris.*)
3034. Show-cases, R. Laws, London.
3035. Textile Fabrics, G. W. von Nawrocki.—(*Schütz and Juel, Wurzen, Germany.*)
3036. Raking Hay, H. J. Macey, Wilts.
3037. Securing Joints, J. Gooddy, Wombwell.
3038. Fire-lighters, J. F. Wiles, Kent.
3039. Playing Pianos, H. Newton.—(*C. Gavioli, Paris.*)
3040. Softening, &c., Water, J. H. Porter, London.
3041. Tubing, &c., A. S. Murphy, Philadelphia, U.S.

Inventions Protected for Six Months on deposit of Complete Specifications.

2926. Metallurgic Furnaces, H. A. Bonneville, Cannon-street, London.—A communication from W. Moller, New York, U.S.—*5th July*, 1881.
2942. Railway Tipping Wagons, G. F. Redfern, South-street, Finsbury, London.—A communication from M. V. Wormer, Dayton, Ohio, U.S.—*5th July*, 1881.
2943. Electro-magnetic Motors, S. Pitt, Sutton.—A communication from M. G. Farmer, Newport, Rhode Island, U.S.—*5th July*, 1881.
2947. Cleaning, &c., Fibrous Materials, W. R. Lake, Southampton-buildings, London.—A communication from C. A. Dresser, Southbridge, U.S.—*5th July*, 1881.
2963. Cooling, &c., Apparatus, J. T. King, Clayton-square, Liverpool.—A communication from T. Rose, San Antonio, Texas, U.S.—*6th July*, 1881.
2966. Grain Binding Machines, G. E. Vaughan, Chancery-lane, London.—A communication from M. A. Keller, Brockport, New York, U.S.—*7th July*, 1881.
2977. Sulphate of Alumina, C. Semper, Philadelphia, U.S.—*7th July*, 1881.
2998. Tubing, &c., A. S. Murphy, Philadelphia, U.S.—*7th July*, 1881.
3007. Binding Books, H. G. Thompson, New Haven, Connecticut, U.S.—A communication from S. E. Mower, Milford, U.S.—*8th July*, 1881.

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

2683. Governing, the Flow, &c., of Water, W. Foulis, Glasgow.—*5th July*, 1878.
2686. Gas Governors, W. Cowan, Edinburgh.—*5th July*, 1878.
2720. Adjusting Railway Switches, W. R. Lake, Southampton-buildings, London.—*6th July*, 1878.
2704. Treating Smoke, &c., J. Smethurst, Clifton, Lancashire.—*6th July*, 1878.
2747. Crushing Coal, &c., A. Hewlett, Cappul, and J. Shearer, Whelley.—*9th July*, 1878.
2796. Hinges, J. T. Collins, Birmingham.—*12th July*, 1878.
2249. Cutting Screw Threads, H. H. Lake, Southampton-buildings, London.—*24th July*, 1878.
2754. Rolling Wire, &c., G. Bedson, Manchester.—*9th July*, 1878.
2735. Machine Guns, W. R. Lake, Southampton-buildings, London.—*8th July*, 1878.
2743. Sieve Purifiers, C. Hopkinson, South Retford.—*9th July*, 1878.
2744. Railroad Spikes, B. J. B. Mills, Southampton-buildings, London.—*9th July*, 1878.
2750. Barrels, W. R. Lake, Southampton-buildings, London.—*9th July*, 1878.
2751. Bicycle Saddles, J. A. Lamplugh and G. F. Brown, Birmingham.—*9th July*, 1878.
2766. Cutting, &c., Wood, R. E. Shill, Derwent-grove, East Dulwich, Surrey.—*10th July*, 1878.
2873. Compressing Air, T. Sturgeon, Newlay-grove, Horsforth.—*18th July*, 1878.
2740. Reaping Machines, H. J. H. King, Newmarket.—*9th July*, 1878.
2756. Moulding Apparatus, A. Ripley, Southwark.—*9th July*, 1878.

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

2387. Bread, &c., J. C. Pooley, George-street, Bath.—*7th July*, 1874.
2459. Screw-cutting Machines, J. H. Johnson, Lincoln's-inn-fields, London.—*14th July*, 1874.
2462. Electric Batteries, A. V. Newton, Chancery-lane, London.—*14th July*, 1874.
2375. Carriages, S. Hart, New Bond-street, London.—*7th July*, 1874.
2411. Heating Plates of Iron, R. Taylor, Llantrissant, Glamorganshire.—*9th July*, 1874.
2421. Railway Points, J. Kelly, Liverpool. — *10th July*, 1874.

Notices of Intention to Proceed with Applications.

Last day for filing opposition, 29th July, 1881.

898. Pumps, W. Wright, Plymouth.—*2nd March*, 1881.
904. Looms, J. Hollingworth, Yorkshire.—*2nd March*, 1881.
908. Rolling Mill, L. A. Groth, London.—A communication from E. von Zweigbergk.—*3rd March*, 1881.
913. Twisting Wire, &c., W. T. Glover and G. F. James, Manchester.—*3rd March*, 1881.
922. Galvanising Iron, J. Elmore, London.—*3rd March*, 1881.
923. Heating Apparatus, G. C. Gibbs, London.—*3rd March*, 1881.
932. Looms, T. Hanson, Bradford.—*4th March*, 1881.
934. Core or Skeleton Metals, T. Hyatt, London.—*4th March*, 1881.
935. Tram Rails, E. Thompson and S. Tomkins, London.—*4th March*, 1881.
941. Delivering Tickets, M. Bebro, London.—*4th March*, 1881.
942. Fig Powder, F. Pool, London.—*5th March*, 1881.
944. Snap for Bracelets, &c., A. and E. Downing, Birmingham.—*5th March*, 1881.
949. Lifting Carriages, &c., P. Bell, Norfolk.—*5th March*, 1881.
961. Metallic Bedsteads, C. S. P. Wood, Birmingham.—*7th March*, 1881.
987. Watch Keys, F. A. Walton, Birmingham.—*8th March*, 1881.
992. Obtaining Motive Power, H. E. Newton, London.—Com. from H. G. Hosmer.—*8th March*, 1881.
997. Roller Mills, H. J. Haddan, London.—Com. from J. G. Koerner.—*9th March*, 1881.
1000. Expanding Mandril, J. Harrison, Manchester.—*9th March*, 1881.
1011. Spinning, &c., Yarns, A. Combe, Belfast.—*9th March*, 1881.
1143. Door Locks, W. R. Comings, London.—*16th March*, 1881.
1154. Holding, &c., Bottles, J. Packham and T. Pelton, Croydon.—*16th March*, 1881.
1242. Breech-loading Fire-arms, H. A. A. Thorn, London.—*21st March*, 1881.
1273. Wheels, A. C. Uljée and J. Cleminson, London. *22nd March*, 1881.
1274. Fixing Tires on Wheels, A. C. Uljée and J. Cleminson, London.—*22nd March*, 1881.
1290. Bells, &c., W. R. Comings, London.—*23rd March*, 1881.
1324. Boiling, &c., Apparatus, A. M. Clark, London.—Com. from H. Coker.—*24th March*, 1881.
1345. Lamps, A. Ragg, Bebington.—*26th March*, 1881.
1485. Preventing Escape of Steam, &c., G. Tall and J. Daddy, Kingston-upon-Hull.—*5th April*, 1881.
1973. Presses, H. C. Gover, London.—*6th May*, 1881.
2246. Velocipedes, G. Singer, Coventry.—*23rd May*, 1881.
2348. India-rubber Valves, A. Pegler and T. J. Watson, Retford.—*28th May*, 1881.
2356. Washing Coal, &c., T. J. Bell, jun., Yorkshire, and W. Ramsey, Durham.—*28th May*, 1881.
2459. Axle Pulleys, F. Ryland, West Bromwich.—*4th June*, 1881.
2645. Gas Engines, C. W. Pinkney, Smethwick.—*17th June*, 1881.
2676. Mill Gearing, N. Macbeth, Bolton.—*18th June*, 1881.
2731. Keys for Locks, C. Strauss, Birmingham.—Com. from O. Strauss.—*22nd June*, 1881.
2804. Attachment to Mining Cages, &c., F. Haddan, London.—Com. from S. Henrard.—*27th June*, 1881.

Last day for filing opposition, 3rd August, 1881.

988. Wheels for Velocipedes, E. C. F. Otto, Peckham.—*8th March*, 1881.
996. Turning, &c., Lathe, O. Jones, London.—*9th March*, 1881.
998. Landaus, J. Lewis, T. Hammond, and J. Hiller, Kilburn.—*9th March*, 1881.
1006. Brakes, S. C. Taylor and J. Wild, Morton.—*9th March*, 1881.
1012. Furnaces, B. R. Huntley, West Hartlepool.—*9th March*, 1881.
1015. Heels, W. Brewster, Hunslet, Leeds.—*9th March*, 1881.
1021. Mounts for Tobacco Pipes, D. O. Sandheim, London.—*9th March*, 1881.
1023. American Organs, G. Green and C. Savage, Islington, London.—*10th March*, 1881.
1029. Carding Cotton Materials, F. Mills, Heywood.—*10th March*, 1881.
1040 Electric Lamps, A. A. Common and H. T. Joel, London.—*10th March*, 1881.
1057. Looms, C. Catlow, Burnley.—*11th March*, 1881.
1059. Gas Lamps, W. T. Sugg and R. Pierson, Westminster.—*11th March*, 1881.
1103. Fastenings for Shirt Studs, &c., J. M. Banks, Birmingham.—*14th March*, 1881.
1111. Expanding Rollers, J. Hawthorn, J. P. Liddell, and P. Hawthorn, Newtown.—*15th March*, 1881.
1117. Safety Fittings, H. S. Wilton and B. S. Weston, London.—*15th March*, 1881.
1120. Lamps, S. Pitt, Sutton, Surrey.—A communication from W. B. Robins.—*15th March*, 1881.
1136. Combing Wool, W. R. Lake, London.—A communication from F. G. Lange.—*16th March*, 1881.
1150. Nails, J. Noad, Ham.—*16th March*, 1881.
1156. Postal Wrappers, J. A. and C. M. Elstob, Camberwell-road, London.—*16th March*, 1881.
1226. Printing Machines, W. Evans, M. Smith, and D. Braithwaite, Manchester.—*21st March*, 1881.
1261. Sulphocyanides, H. E. Newton, Chancery-lane, London.—A communication from U. de Günzburg and J. Tcherniac.—*22nd March*, 1881.
1364. Constructing Ships, J. H. Johnson, London.—A communication from Baron C. A. H. C. de Winter.—*28th March*, 1881.
1368. Gas, E. P. Alexander, London.—A communication from E. Mertz.—*28th March*, 1881.
1396. Thrashing Machines, J. Marshall, Gainsborough.—*29th March*, 1881.
1651. Excavating Tunnels, J. D. Brunton, London.—*14th April*, 1881.
1859. Brick-making Machinery, T. C. Fawcett, Leeds.—*29th April*, 1881.
2023. Regulator Gas Burners, H. Zwanziger, Vienna.—Com. from J. Janky, J. and C. Rimanoczy.—*9th May*, 1881.
2182. Treating Ores, J. Hargreaves and T. Robinson, Widnes.—*19th May*, 1881.
2370. Slide Valves, &c., H. E. Newton, Chancery-lane, London.—A communication from A. Nathan.—*30th May*, 1881.
2426. Looms for Weaving, R. L. Hattersley, Keighley, and D. Bailey, Huddersfield.—*2nd June*, 1881.
2428. Cleaning Knives, J. Hargrave, Leeds.—*2nd June*, 1881.
2462. Soap Leys, C. Thomas, Bristol, and A. Domeier, London.—*4th June*, 1881.
2651. Steel, C. W. Siemens, Westminster. — *17th June*, 1881.
2743. Pavements, H. H. Lake, London.—Com. from D. McLean.—*22nd June*, 1881.
2768. Engines, W. R. Lake, London.—Com. from E. Hill—*24th June*, 1881.
2836. Removing Stiff Hairs from Fur, W. R. Lake, London.—A communication from F. Lambert and J. Kokesch.—*28th June*, 1881.
2852. Violins, W. R. Lake, London.—A communication from E. Berliner.—*29th June*, 1881.
2943. Electro-magnetic Motors, S. Pitt, Sutton.—Com. from M. G. Farmer.—*5th July*, 1881.
2963. Cooling Apparatus, J. T. King, Liverpool.—Com. from T. Rose.—*6th July*, 1881.
2997. Sulphate of Alumina, C. Semper, Philadelphia.—*7th July*, 1881.
2998. Pile, &c., A. S. Murphy, Philadelphia, U.S.—*7th July*, 1881.

Patents Sealed

List of Letters Patent which passed the Great Seal on the 8th July, 1881.)

5503. Stretchers for Umbrellas, C. A. Smith, Hagley-road, Edgbaston.—*31st December*, 1880.
113. Twisting, &c., Yarns, J. Farrar, Halifax.—*10th January*, 1881.
115. Bearings, &c., for Shafts, L. A. Groth, Finsbury-pavement, London.—*10th January*, 1881.
121. Furnaces, &c., W. P. Thompson, High Holborn, London.—*11th January*, 1881.
127. Revolving Shutters, J. Stones, Ulverston, T. Kirby, Barrow-in-Furness, and E. Phillips, Ulverston.—*11th January*, 1881.
134. Tools, J. M. Bibbins, High Holborn, London.—*12th January*, 1881.
135. Stone-breaking Machines, W. Taylor, Leicester.—*12th January*, 1881.
137. Withdrawing, &c., the Plugs of Urinals, J. Reffitt and W. Irwin, Leeds.—*12th January*, 1881.
139. Relieving Strains in Towing, &c., C. Mace, Sunderland.—*12th January*, 1881.
142. Useful Products from Seaweeds, E. C. C. Stanford, Glasgow.—*12th January*, 1881.
147. Securing Contents of Bottles, J. Betjemann, Pentonville-road, London.—*12th January*, 1881.
155. Cutting Grass, &c., I. Whitehouse, Bridgtown, Staffordshire.—*12th January*, 1881.
157. Colouring Fibrous Materials, J. Young, jun., Kelly, Renfrew, N.B.—*12th January*, 1881.
159. Checking Apparatus, S. Fynn, Pigott-street, Limehouse.—*13th January*, 1881.
166. Stoppers for Bottles, J. Wilkinson, Swinton.—*13th January*, 1881.
171. Furnace Bars, C. Whitfield, Newcastle-on-Tyne.—*13th January*, 1881.
176. Hand Stamps, G. K. Cooke and E. Hurles, Fleet-street, London.—*13th January*, 1881.
188. Sewing Machines, J. C. Mewburn, Fleet-street, London.—*14th January*, 1881.
189. Taps, &c., for Beer, J. K. Starley, Coventry.—*14th January*, 1881.
200. Transforming, &c., Power, J. Imray, Southampton-buildings, London.—*15th January*, 1881.
218. Electric Light, J. E. H. Gordon, Dorking.—*17th January*, 1881.
228. Cleansing Wine, &c., M. W. Proudlock, Newcastle-upon-Tyne, and R. Weatherburn, Burton-on-Trent.—*18th January*, 1881.
236. Blacking Borders of Paper, A. C. Henderson, Southampton-buildings, London.—*20th January*, 1881.
242. Purifying, &c., Feed-water, J. H. Dane, San Francisco, U.S.—*20th January*, 1881.
254. Self-feeding, &c., Furnaces, L. W. Sutcliffe, Birmingham.—*20th January*, 1881.
270. Heating Apparatus, C. D. Abel, Southampton-buildings, London.—*21st January*, 1881.
272. Raising Trees, S. Newington, Ridgeway, Ticehurst.—*21st January*, 1881.
293. Creaming Milk, &c., F. W. Unterilp, Düsseldorf.—*22nd January*, 1881.
314. Gymnastic Apparatus, G. Zander, Stockholm.—*24th January*, 1881.
316. Gymnastic Apparatus, G. Zander, Stockholm.—*24th January*, 1881.
317. Brakes, &c., J. A. Steward, Wolverhampton.—*24th January*, 1881.
324. Cards, C. M. Sombart, Magdeburg.—*25th January*, 1881.
393. Chains, &c., F. Ley, Derby.—*28th January*, 1881.
408. Steam Engine, H. H. Lake, Southampton-buildings, London.—*29th January*, 1881.
428. Stocking, &c., Suspenders, H. M. Knight, Surbiton.—*1st February*, 1881.
459. Sowing, &c., Manure, H. A. Bonneville, Cannon-street, London.—*3rd February*, 1881.
519. Alarum Apparatus, P. Everitt, Queen Victoria-street, London.—*7th February*, 1881.
577. Compound Marine Steam Engine, A. C. Kirk, Glasgow.—*10th February*, 1881.
631. Railway Brake Apparatus, W. L. Wise, Whitehall-place, London.—*14th February*, 1881.
918. Producing Audible Signals, E. Tyer, Old-street, Finsbury, London.—*3rd March*, 1881.
943. Roasting Coffee, &c., H. Faulder, Stockport.—*5th March*, 1881.
974. Gas Brackets, &c., F. W. Thorn, Elgin-terrace, Maida Vale, London.—*7th March*, 1881.
982. Propelling Vessels, &c., L. A. Groth, Finsbury-pavement, London.—*8th March*, 1881.
1042. Sheep Shears, T. A. and R. H. Sorby, Sheffield.—*11th March*, 1881.
1100. Giving Motion to Carriages, &c., L. A. Groth, Finsbury-pavement, London.—*14th March*, 1881.
1214. Holding Photographic Pictures, R. Sherwin and G. Evans, London-road, Worcester. — *19th March*, 1881.
1312. Hot Blast Stoves, H. Massicks, the Oaks, and W. Crooke, Duddon-villa, Millom. —*24th March*, 1881.
1614. Roller Mills, &c., W. L. Wise, Whitehall-place, London.—*13th April*, 1881.
1661. Velocipedes, W. Hillman, Coventry. — *14th April*, 1881.
1662. Crate for Packing Fruit, J. Pullen, Bayswater, London.—*14th April*, 1881.
1717. Compound Marine Steam Engines, A. C. Kirk, Glasgow.—*20th April*, 1881.
1719. Bending, &c., Glass, D. and W. H. Thompson, Queen-square, Leeds.—*20th April*, 1881.
1800. Oyster Culture, E. Johnson, Tower House Isle of Wight.—*26th April*, 1881.
1846. Rotary Engines, J. Swalwell, Acre-street, Battersea.—*28th April*, 1881.
1891. Permanent Way, A. J. H. Smythe, Athlone, Ireland.—*2nd May*, 1881.
1894. Combustible Gas, C. D. Abel, Southampton-buildings, London.—*2nd May*, 1881.
1896. Separating Lime, &c., from Dolomite, S. Cliff, Wortley, Leeds.—*2nd May*, 1881.
1898. Folding Paper, J. H. Johnson, Lincoln's-inn-fields, London.—*3rd May*, 1881.
1911. Food for Cattle, A. E. Brooke-Hunt, Peer's-court, Gloucester.—*3rd May*, 1881.
1924. Casting Stereotype Plates, J. E. Taylor, P. Allen, W. Evans, and D. Blaithwaite, Manchester.—*4th May*, 1881.
1940. Combustible Gas, N. A. Otto, Muelheim-on-the-Rhine.—*4th May*, 1881.
1958. Centrifugal Machines, C. D. Abel, Southampton-buildings, London.—*5th May*, 1881.
1970. Paranitro Compounds, C. D. Abel, Southampton-buildings, London.—*6th May*, 1881.
2003. Breech-loading Fire-arms, W. W. Greener, Birmingham.—*9th May*, 1881.
2043. Conveying Heat, W. T. Whiteman, Staple-inn, London.—*10th May*, 1881.
2045. Burning Liquid Hydrocarbon, W. R. Lake, Southampton-buildings, London.—*10th May*, 1881.

(*List of Letters Patent which passed the Great Seal on the 12th July*, 1881.)

158. Producing Architectural Ornaments, L. A. Groth, Finsbury-pavement, London.—*12th January*, 1881.
162. Ventilating Buildings, &c., T. Rowan, Ryde.—*13th January*, 1881.
169. Planing, &c., Wood, G. Richards, Manchester.—*13th January*, 1881.
190. Caoutchouc, &c., E. Edmonds, Fleet-street, London.—*14th January*, 1881.
198. Sheaf-binding Machine, E. G. C. Bomford, Fladbury, and H. J. H. King, Newmarket.—*15th January*, 1881.
204. Brake Gear, B. Lefebvre, South Lambeth.—*15th January*, 1881.

205. DISTILLING APPARATUS, T. Rayner, Chancery-lane, London.—15*th January*, 1881.
209. CANDLES and TAPERS, E. G. Brewer, Chancery-lane, London.—15*th January*, 1881.
210. BEDS for INVALIDS, G. Lowry, Salford.—15*th January*, 1881.
211. SIZING, &c., WORSTED, C. Anderson, Osborne-terrace, Leeds.—15*th January*, 1881.
257. FASTENINGS for BRACELETS, O. Vaughton, Birmingham.—20*th January*, 1881.
276. VALVES of PERCUSSIVE ROCK DRILLS, J. H. Harrison, Chester.—21*st January*, 1881.
313. OPENING, &c., WINDOWS, H. Skerrett, Whitby-road, Sparkbrook, near Birmingham.—24*th January*, 1881.
417. RAILWAY SIGNALLING APPARATUS, J. N. Maskelyne, Piccadilly, London.—31*st January*, 1881.
544. CONSOLIDATION of METALS, D. Adamson, Dukinfield.—9*th February*, 1881.
600. LINES, &c., J. D. Sprague, Norwood.—11*th February*, 1881.
651. SHEEP SHEARS, A. M. Clark, Chancery-lane, London.—15*th February*, 1881.
760. TELEPHONES, E. W. Anderson, Washington, U.S.—23*rd February*, 1881.
1334. SNOW, F. N. Mackay, Liverpool.—25*th March*, 1881.
1522. TRIMMING the SOLES of BOOTS, &c., W. R. Lake, Southampton-buildings, London.—7*th April*, 1881.
1696. TELEGRAPHY, S. Pitt, Sutton.—19*th April*, 1881.
1761. STEAM COOKING VESSELS, M. von Zyka-Radvanszky, G. Liedman, and F. W. Scharrath, Berlin.—23*rd April*, 1881.
1791. RAISING a NAP on CLOTH, A. M. Clark, Chancery-lane, London.—26*th April*, 1881.
1820. MAGNESIA, &c., S. Pitt, Sutton.—27*th April*, 1881.
1936. CUTTING CHEESE, &c., J. Richardson, Gainsborough.—4*th May*, 1881.
1937. BLEACHING, C. T. Jacoby and W. Jennings, Nottingham.—4*th May*, 1881.
1964. DOOR KNOBS, &c., A. and R. F. Heath, Birmingham.—5*th May*, 1881.
2001. WATERPROOF CASING, H. A. Bonneville, Cannon-street, London.—9*th May*, 1881.
2016. ENGRAVING on GLASS, J. H. Johnson, Lincoln's-inn-fields, London.—9*th May*, 1881.

List of Specifications published during the week ending July 9th, 1881.

4422, 6d.; 4526, 6d.; 4610, 6d.; 4988, 6d.; 4989, 6d.; 4990, 6d.; 4991, 6d.; 4993, 6d.; 4997, 10d.; 4998, 6d.; 5001, 8d.; 5003, 8d.; 5004, 6d.; 5006, 6d.; 5014, 6d.; 5015, 6d.; 5016, 6d.; 5017, 10d.; 5018, 6d.; 5021, 8d.; 5023, 6d.; 5029, 1s. 4d.; 5034, 4d.; 5040, 4d.; 5041, 6d.; 5045, 8d.; 5046, 8d.; 5047, 6d.; 5048, 1s. 2d.; 5049, 8d.; 5050, 6d.; 5051, 6d.; 5952, 4d.; 5055, 4d.; 5060, 8d.; 5065, 6d.; 5069, 2d.; 5070, 2d.; 5072, 2d.; 5073, 2d.; 5074, 6d.; 5075, 2d.; 5077, 2d.; 5078, 2d.; 5080, 6d.; 5081, 4d.; 5082, 6d.; 5083, 6d.; 5084, 6d.; 5085, 4d.; 5087, 6d.; 5088, 10d.; 5090, 2d.; 5093, 6d.; 5096, 2d.; 5097, 6d.; 5098, 2d.; 5099, 6d.; 5100, 2d.; 5101, 2d.; 5104, 6d.; 5105, 2d.; 5106, 2d.; 5107, 10d.; 5108, 6d.; 5109, 2d.; 5110, 2d.; 5111, 4d.; 5112, 2d.; 5114, 6d.; 5115, 2d.; 5116, 6d.; 5118, 6d.; 5122, 6d.; 5125, 4d.; 5126, 2d.; 5127, 2d.; 5128, 2d.; 5130, 6d.; 5131, 2d.; 5132, 6d.; 5134, 8d.; 5139, 2d.; 5140, 6d.; 5141, 2d.; 5143, 2d.; 5144, 4d.; 5145, 6d.; 5148, 10d.; 5150, 6d.; 5156, 4d.; 5157, 2d.; 5165, 2d.; 5167, 2d.; 5172, 6d.; 5173, 2d.; 5174, 2d.; 5178, 6d.; 5179, 6d.; 5180, 4d.; 5181, 2d.; 5182, 2d.; 5185, 2d.; 5686, 2d.; 5188, 4d.; 5189, 2d.; 5191, 6d.; 5193, 6d.; 5197, 6d.; 5198, 2d.; 5202, 2d.; 5201, 2d.; 5294, 3d.; 5313, 4d.; 5327, 4d.; 229, 4d.; 471, 6d.; 1599, 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.*

4140. PROVISION BOXES, &c., *T. S. Colas.—9th December*, 1880. 6*d*.
The box is furnished with a lid having a rim projecting downwards, by tearing which the box can be opened. Inside the rim a small band is placed, the end projecting and forming a ring for the introduction of a key, by turning which the rim will be torn off.

4422. BAG-MAKING MACHINERY, *H. Rankine.—29th October*, 1880. 6*d*.
This consists, First, in the use of folders of thin sheet metal in a bag-making machine for the folding over of the sides to make a pasted joint. Secondly, the combination of an adjustable hopper, guides, travelling tapes, pasting rollers, folders, and grip rollers. Thirdly, the combination of a cutting and folding apparatus for making suitable folded sheets with the pasting, and forming portion of a bag-making machine.

4526. SURFACE POLISHING and PASTING MACHINERY, *W. Weems and C. D. Douglas. — 4th November*, 1880. 6*d*.
This consists in having a disc or otherwise shaped area, containing one or more revolving pads composed of fibrous or porous material or materials, brushes, or other suitable agents of communication having an arranged construction to perform various gyrations.

4886. IMPROVEMENTS in DYNAMO-ELECTRIC MACHINES, *J. Hopkinson and A. Muirhead.—24th November*, 1880. 8*d*.
To reduce the sparks between the commutator and the collecting brushes, the latter are divided into parts, and that part which is latest in contact with

4886

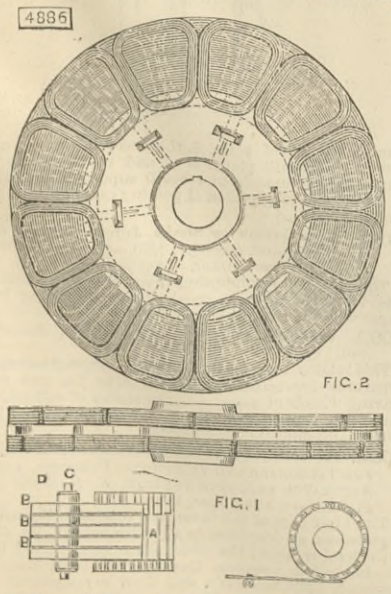


FIG. 2

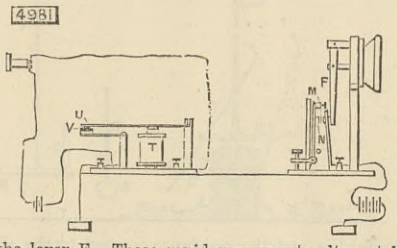
FIG. 1

any section of the commutator passes the current through a resistance, thus gradually checking the current as the contact is broken. Where the arrangement of the machine is such that the armature coils lie in planes parallel with the plane of revolution of the armature, the latter is thus constructed: The circumference of a pulley is surrounded with a series of layers of sheet iron insulated from each other. On one or both sides of this ring radial slots are cut to admit the insulated wire. When a continuous current is required the coils are placed on both faces of the armature and arranged alternately. The field magnets are made similarly to the armature. Each coil is packed close against its neighbour, so that each is of approximately quadrilateral form. Fig. 1 shows the means for reducing sparks. A are segments of the commutator, B brushes, D a metal cylinder, the brush is attached to D, and the spindle C is in contact with another cylinder. The space between the cylinder is filled with a mixture of plumbago and lamp black, having a suitable resistance; the ends of the space are closed with discs of ivory. The brush is so adjusted that it remains in contact with any segment of the commutator for a short space after the other brushes have left contact with that segment. Fig. 2 shows the armature as arranged for a continuous current.

4610. BLEACHING, &c., WOVEN FABRICS and YARN CONTINUOUSLY, *W. Birch.—10th November*, 1880. 6*d*.
This consists in the use of a tube, partly or wholly filled with a liquid, the tube to be either straight or shaped like a syphon, and such tube attached to a kier or other vessel in such a manner as to form a hydraulic seal joint or lute, or the tube to be without any liquid or without forming a lute, but providing an inlet or outlet at a lower level than the vessel to which it is attached for the purpose of bleaching, dunging, soaping, washing, dyeing, steaming, and other operations upon woven fabrics or yarn.

4981. TELEPHONIC APPARATUS, *W. R. Lake.—30th November*, 1880.—(*A communication from C. A. Randall.*) 1*s*.
This invention relates to that class of telephone systems in which a battery current traverses the circuit of wires connecting the stations, and is qualified by tension changing and current breaking devices operated by the vibrations of a transmitter diaphragm. Its object is to utilise to a maximum degree the force of a line battery connected with a receiving apparatus, to cause an extended range of variation in the strength of the current of the line battery in correspondence with the variations of the transmitter diaphragm, and to effect an increased amplitude and force of vibration in the diaphragm of the receiver. The figure shows one of the arrangements of apparatus used by the inventor, the operation of which is as follows:—Upon speaking into the mouthpiece of the transmitting apparatus there is given to the diaphragm a to-and-fro movement, the effect of which is increased in force and amplitude at the circuit closer, viz., the plumbago button N and platinum stud M, by means

4981



of the lever F. These rapid movements alternately make and break the circuit over the main line, and the currents in turn pass over and through the receiving magnet T of the receiving apparatus, and cause a varying attraction of its armature corresponding to the amplitude of the vibrations of the diaphragm, which causes a varying contact between the carbon button V and platinum stud U in the local circuit, having the local battery and the telephonic receiver therein, so that the electrical impulses over the telephonic receiver correspond in number and in varying power to the vibrations of the diaphragm. Several modifications of the above apparatus are also described.

4988. IMPROVEMENTS in ELECTRIC LAMPS, *K. W. Hedges.—30th November*, 1880. 6*d*.
The first portion of the specification refers to an improvement on former patents, No. 81, 8th January, 1879, and No. 925, 8th March, 1879, in the method of regulating the consumption of the carbons in an arc lamp. The inventor employs three carbons, A, B, and C, as shown in the figures; two of these, B and C, constitute the positive electrode and lie in open

4988

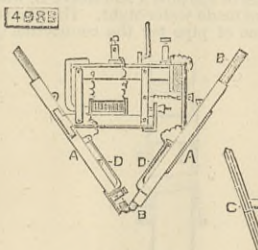


FIG. 1

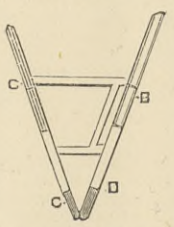


FIG. 2

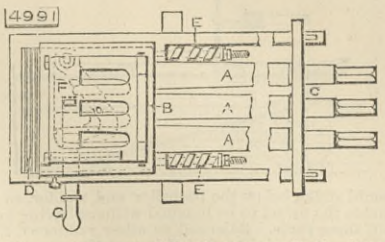
troughs inclined to one another, the two carbons descending by gravity, and remain in contact notwithstanding their consumption. The third and negative carbon A also lies in an inclined trough and descends as it is consumed, butting against the stop shown, which permits its descent only according as the portion of the carbon against which it bears becomes wasted away. Contact is made by pieces of metal D hinged to the troughs as shown. In order to adjust the distance between the negative carbon and the meeting point of the positive carbons the inventor mounts the trough containing A, so that it can move horizontally towards or away from those containing B and C, and connects it to the armature of an electro-magnet. When the lamp is inert, the end of the negative is brought into contact with the positive carbons by a weight or spring, and the lamp being put in circuit, the current passing through the carbons and through the coil of the electro-magnet, the armature is attracted, and a movement is given to the trough of the negative carbon, withdrawing it from the positive carbons and establishing an arc. The latter part of the specification refers to an incandescent lamp, so arranged that it may be used without glass.

4989. WARMING RAILWAY CARRIAGES, *C. D. Abel.—30th November*, 1880.—(*A communication from G. Westinghouse, jun.*) 6*d*.
This consists in a method of warming a railway carriage by causing a current of air supplying the carriage to pass over surfaces heated by the carriage lamp, so as to be warmed thereby.

4990. OPENING, CLOSING, and FASTENING CASEMENTS, SASHES, &c., *J. Bruce.—30th November*, 1880. 6*d*.
The sashes, &c., are hung upon pivots or hinges, and are caused to be opened by means of levers and links.

4991. MACHINE GUNS, *T. Nordenfelt.—30th November*, 1880. 6*d*.
The object is to render machine guns more safe and more perfect in mechanism and in taking up the recoil, and for facilitating the quick change of aim with the gun. Two or more barrels A lie in a horizontal plane or in an arc, their breech ends being screwed to a centre piece B, and their muzzle ends passing through and sliding in a front crosspiece C keyed to the trunnion frame, which forms three sides of an oblong, the crosspiece forming the fourth side. Between the trunnion frame and the sliding frame is a strong spring D to take up the recoil. Two spiral springs E are also compressed when the gun is discharged. The feed is effected through openings in the cover F, which

4991



allow the cartridges to fall into recesses in the breech block, which at the time are opposite the open ends of barrels A, when the lever G causes plungers to push them into the chambers, and carries the breech block forward so as to close the breeches and fire the cartridges.

4993. FELTING MACHINES, *G. Yule.—1st December*, 1880. 6*d*.
Felting aprons or rollers acting in concert with felting beds receive reciprocative and oscillating movements in addition to progressive, forward, or rotary motions. In one arrangement two rollers carrying a felting apron are mounted above a hot water tank, in which is partly immersed a felting bed, shaped to correspond to the path or traverse of the lower part of the said apron, and immersed sufficiently to soak the articles to be felted. The bed is or may be sustained by means of spiral or other springs, which can be adjusted so as to regulate the upward pressure of the bed. A reciprocating and progressive rotary motion is imparted to one of the rollers.

4997. MAKING DOORWAYS, &c., CLOSE AND TIGHT, *W. Morgan-Brown.—1st December*, 1880.—(*A communication from G. B. Thompson.*) 10*d*.
This consists partly in the method and means for tightly closing a doorway or similar opening having one or more straight sides, a swinging door or the like, and its frame constructed without rabbet or stop, and with all their corners rounded, and constructed respectively with a continuous bevelled edge and an internal bevelled seat.

4998. MANUFACTURE and PURIFICATION of GAS, *W. J. B. Symes.—1st December*, 1880. 6*d*.
The First part of this invention refers to means for ascertaining the condition of the charge in the retort—that is, if gas is still being made or whether all the gas has been given off; and it consists, as shown in Fig. 1, of a retort of L shape with a valve A fitted in the cover of the vertical branch, by opening which it can be seen if gas is still being given off. To prevent the explosion of sulphurous vapours, a valve B is fitted

4998

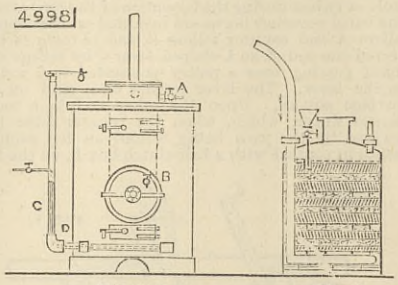
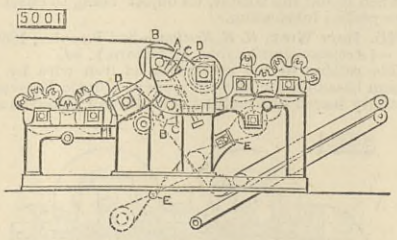


FIG. 1 FIG. 2

to the horizontal branch of the retort, by opening which (before loosening the cover to remove the charge) such vapours can escape. To supply steam to the retort, ascension pipe, or the hydraulic main, a pipe is arranged within the fire chamber above the fire bars, and into it passes a perforated pipe G to supply water, the steam generated passing into pipe D surrounding pipe G, and thence into the retort ascension pipe or hydraulic main. Fig. 2 shows a filter for purifying gas.

5001. PRINTING, CUTTING, and FOLDING NEWSPAPERS, &c., *P. D. Hedderwick.—1st December*, 1880. 8*d*.
This relates to web printing machines, and consists, First, in means for adapting the machine to print different sizes of sheets; Secondly, to the cutting mechanism for severing different lengths from the web; Thirdly, to folding mechanism to fold the sheets cut lengthways of the web; and Fourthly, to mechanism to bring pairs or sets of sheets formed by cutting the web transversely and slitting it lengthways, one over the other, and then folding them together. The drawing shows an arrangement for effecting the first

5001



and second parts of the invention, and it consists in forming the slots A in the frame, to receive the bearings of the impression cylinder B, of a curved form, and the bearing blocks C of an angular or sector-like form, such arrangements allowing the employment of different sized cylinders. The type cylinders D may be mounted in a similar manner if desired. The cutting knife has a combined reciprocating and vibrating motion, and is carried by rods fitted to slide through adjustable rocking centres E.

5003. MIXING, &c., VARIOUS SUBSTANCES, *P. Pfleiderer.—1st December*, 1880. 8*d*.
This relates, First, to means to facilitate the automatic lifting up and tilting of the machine, and lowering it down again; Secondly, to the employment of a new kind of movable scrapers; Thirdly, to varying the form of the blades or mixers.

5004. MEASURING and RECORDING ELECTRIC CURRENTS, *J. W. Swan.—1st December*, 1880. 6*d*.
This invention consists of an apparatus for measuring currents for electric lamps or other purposes. In the figures, A is a cylinder revolved continuously by clockwork at a fixed rate. A number of pins are arranged on this cylinder, according to the number of lights to be registered, as shown in Fig. 2, each pin acting on a set of levers. The action is as follows:—A lever B kept fixed against a stop B^1 has attached to it another lever C, so that its own weight causes its extremity to engage with the teeth of the ratchet-wheel E. If A acts on B it will propel E to the extent of one tooth, D serving to retain E in position until again propelled by C. E is connected with counting mechanism F. An electro-magnet G, the coil of which is in circuit with one of the lamps, is placed under the arm H, mounted in an iron bracket G^1 constituting one of the poles of the magnet. When H is attracted by G, the rod and with it the lever C are lowered, and E will be propelled one tooth for each revolution. E is mounted on an axis of the same length as A, and there are as many wheels E as pins

5004

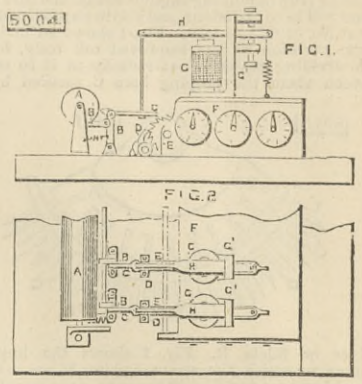


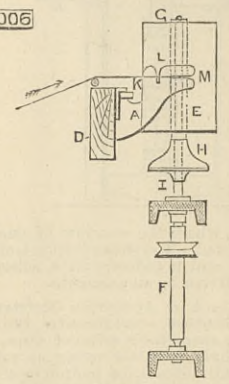
FIG. 1.

FIG. 2

on the cylinder A; for each wheel there are the levers B and C, and arms and electro-magnets H and G.

5006. SPINNING MACHINERY, &c., *H. B. Arundel.—1st December*, 1880. 6*d*.
A guide A is pivotted to a plate screwed to the guide rail D. A roll of yarn E, built upon a paper tube, is slipped on to the metal tube G, which runs loose on spindle F and is driven by the friction between its washer H and the washer I on the spindle.

5006



K is a spring catch engaging with and retaining the guide A when it is turned back during the operation of doffing or piercing. The guide has two slots, one M, to conduct the yarn to the bobbin, and the other L, to increase the draft.

5014. ELECTRIC LAMPS, *J. W. Swan.—2nd December*, 1880. 6*d*.
This specification relates more particularly to improvements in the method of preparing the carbons for the inventor's incandescent lamps, as described in his patent No. 4933, 27th November, 1880. The inventor's object is to thicken the ends of the carbons, so as to facilitate the connection between them and the metallic conductors, and to prevent heat at the points of contact. This is obtained as follows: the inventor wraps the ends of the converted cotton thread—patent No. 4933—Figs. 1 and 2, with strips of bibulous paper. The thread thus thickened, as shown at B, is subjected to the action of sulphuric

5014

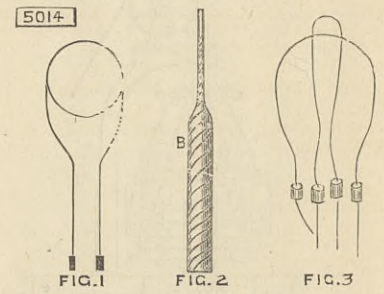


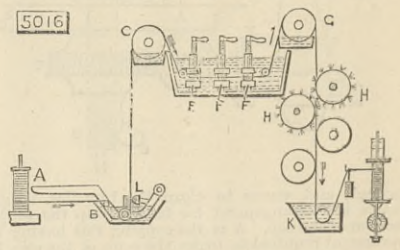
FIG. 1 FIG. 2 FIG. 3

acid, as described in the former patent mentioned above, and having been washed and dried is compressed into shape as shown in Fig. 1, it is then carbonised. Various other methods are also described. Fig. 3 shows a lamp arranged with multiple carbons, so that one or more may be rendered incandescent at the same time, a system which permits of variation in the intensity of the light. The carbon is sometimes also flattened, thus obtaining a greater radiating surface and more light.

5015. LAMPS, *A. Thurlow.—2nd December*, 1880. 6*d*.
Instead of cutting the wick convex in shape, the top of the wick tube is made concave, either of a regular or concentric curve, or a parabolic or other curve; but in either and every case the effect is to produce a convex flame from a wick cut flat.

5016. WAXED THREADS, *J. C. Mewburn.—2nd December*, 1880.—(*A communication from E. Guillemaud.*) 6*d*.
This relates to the employment, after waxing the threads, of coatings consisting of powders, varnishes, or waxes obtained from fatty bodies to render the threads less sticky. The thread passes from bobbin A through trough B containing the wax in a liquid state, and between a pair of pads L pressed together

5016



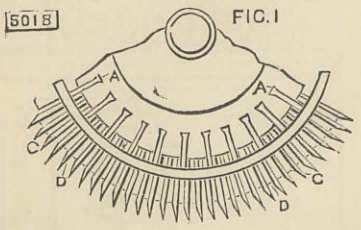
so as to remove excess of wax. The thread then passes vertically to a horizontal roller C revolving in a box containing a powder such as talc, which prevents the thread sticking. The thread is then acted upon by elastic pads F covered with a textile fabric, which rub and polish the thread, and are immersed in hot water, which softens the wax on the thread. The roller G supplies a further quantity of powder, and the brushes H finish the polishing. The thread finally passes through the box K containing powder, and is then wound on bobbins.

5017. RAILROAD WAGONS for CARRYING LIVE STOCK, *W. Morgan-Brown.—2nd December*, 1880.—(*A communication from J. Montgomery.*) 10*d*.
This relates to novel features of construction and arrangements of parts of a stock car for facilitating feeding and watering the stock, and for separating or stalling the same.

5018. REFINING AND STRAINING PULP IN THE MANUFACTURE OF PAPER, *G. and G. Tidcombe.—2nd December*, 1880. 6*d*.

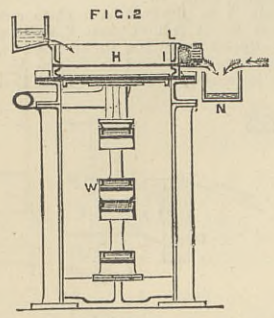
This relates to constructing rollers for refining and straining pulp in pulping engines so that the bars of the rollers will be equi-distant, and also to improvements on patent No. 5108, A.D. 1879. Fig. 1 shows an end view of the skeleton of the improved roll body, formed with dividing plates A set radially in it to receive between them the pulping bars C secured by the

5018 FIG. 1



wedges or fillets D. Fig. 2 shows the improved strainer in which the strainer plates H are set in a hinged frame or box L, and the gate, dam, or valve for allowing the overflowing pulp from the strainer plates to escape, is placed at L to effect an even cleansing of the plates. An overflow channel N passes to an

5018 FIG. 2



auxiliary strainer, where the overflow of unstrained pulp is further treated. The shake motion is of double action, adjustable and noiseless, and is actuated by the cross arm W, driven by an excentric.

5021. DRIVING GEAR OR ACTUATING MECHANISM OF MANGLES, *T. Bradford.—2nd December*, 1880. 8*d*.

This consists in arranging a series of cams, levers, and balance weights, the latter acting as rollers, so that while the continuous chain motion or any other kind of continuous motion is given to the ordinary box mangle, the riser-bars for raising the ends of the loaded mangle-box are made partially self-acting, inasmuch as that when they are relieved of the weight of the mangle-box they will automatically rise clear of the roller or other portion of the driving gear with which they engage without personal attention, which has hitherto been necessary, and will continue in this position until one or other end of the mangle-box is again required to be raised, which, by means of this improved gear, can now be accomplished by a gentle pressure of the finger upon a small lever forming part of the addition.

5023. WIRE ROPES AND CABLES, *A. S. Hallidie.—2nd December*, 1880.—(*Complete.*) 6*d*.

This consists mainly in increasing the durability of the rope by the employment of wires which are flattened, the flattened surface being exposed to wear,

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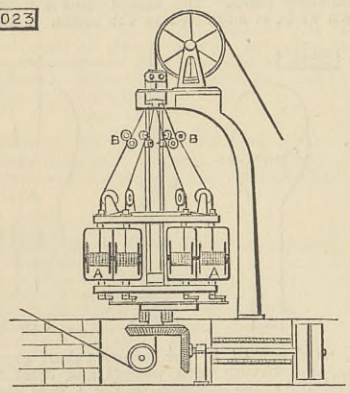
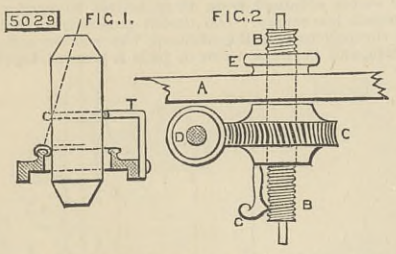


and in laying the same into strands or ropes, either separately or in combination with cylindrical wires, the drawing showing the machine employed for this purpose. The wire passes from the bobbins A through flattening rolls B, and thence through the laying plate, and are formed into the strand.

5029. RING SPINNING FRAMES, *A. M. Clark.—2nd December*, 1880.—(*A communication from J. J. Bourcart.*) 1*s*. 4*d*.

This consists in the employment of a second thread board or guide rising with the copping rail, so as to regulate the tension of the yarn and control its whirling movement in such a manner that the yarn is subjected constantly to the same tension during the formation of the cop. Fig. 1 shows the thread board formed as an abutment T, against which the yarn rubs either periodically or continually. To the thread board moving with the copping rail a small blade is

5029 FIG. 1 FIG. 2



secured, and serves to clean the traveller. Fig. 2 shows the arrangement for building up the middle portion of the cop. A is the copping rail having the movement required to make the cone of the cop, B a screw-threaded rod supporting a ring E, C a worm wheel driven from worm D, and having a finger G to take it in or out of gear with rod B, in order to make another cop.

5046. VELOCIPEDES, *J. K. Starley.—3rd December*, 1880. 8*d*.

This relates, First, to a novel arrangement of mechanism for transmitting the motion of the crank or pedal shaft to both or either of the travelling wheels of a tricycle as required; Secondly, to an improved arrangement of brake for braking both driving wheels simultaneously; and Thirdly, to an improved arrangement of roller bearing for velocipede wheels.

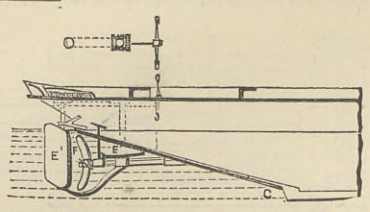
5047. RECEPTACLES FOR TEA, &c., *C. Cheswright.—3rd December*, 1880. 6*d*.

This relates to the application of a peculiar lining to the interior of the wooden body.

5034. STEAMSHIPS, &c., *J. S. White.—3rd December*, 1880. 4*d*.

The after deadwood and keel of the ship is dispensed with for a certain distance, such portion of the body of the ship gradually diminishing to a point at the load water-line level. The depth of the keel of the vessel is increased at the point C of "cut-off," whence it tapers forward at an angle that, if continued aft,

5034



would strike below the propeller and rudder, so as to enable the vessel to be beached without having to protect these parts. Balanced or other rudders E E¹ are used, one placed directly before and the other directly abaft the propeller F, the two rudders moving simultaneously.

5040. GAS REGULATORS, *H. Devine.—3rd December*, 1880. 4*d*.

This relates to regulators in which a diaphragm is used as the controlling mechanism, and its object is to effect a more perfect connection of the casing with the gas supply. This is effected by forming a branch

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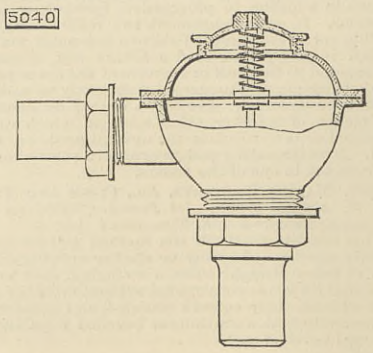


pipe projecting from the casing, and being screw threaded to connect it with the meter. A branch and tail-piece of a union joint connect the regulator to the supply pipe.

5041. SPINNING MACHINERY, *B. A. Dobson and R. C. Tonge.—3rd December*, 1880. 6*d*.

This relates, First, to the governor motion for automatically regulating the winding on of a self-acting mule or twiner during the formation of the cop bottom. The usual governor horns are mounted on the copping fallers A and counter fallers B, and to them is connected one end of an L-shaped lever C by means of a chain passing over a pulley connected to a weight on the lever. The lever swings on a stud on the carriage square. Upon the other end is a tooth-shaped finger, which, when the counter faller B is lowered by the yarn being wound on too rapidly, comes in contact with a half-clutch-box F, on the face

5041 FIG. 1.

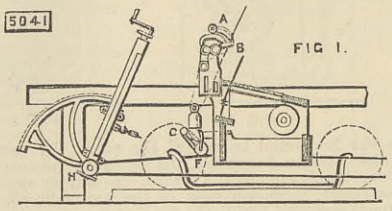
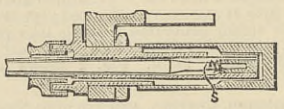


FIG. 2



of which are projections. This clutch-box forms a pulley with two V grooves, and it turns on a stud mounted in a bracket, also carrying a carrier pulley, over which passes an endless band connected to the quadrant H. Fig. 2 shows an improved spindle with a removable lower oil cup, a spiral wire S being wound round the spindle, and nearly filling the space between it and the bolster, its object being to effect a more perfect lubrication.

5045. IRON WIRE, *H. E. Newton.—3rd December*, 1880. —(*A communication from E. Minary.*) 8*d*.

This relates to the production of iron wire by a system based on the exclusive use of elliptic grooves, regularly traced to a methodical rule, and placed so as

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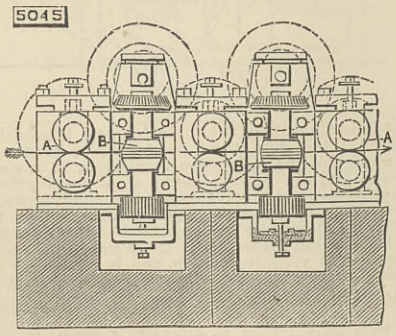

to obtain a uniform and constant rolling or drawing-out motion, such rule consisting in adopting a constant relation between the sections of the grooves which follow one another. The drawing shows one arrangement of the machine employed to produce iron wire, and has a series of vertical rolls A, and a series of horizontal rolls B, formed with elliptic grooves as described.

5048. MANUFACTURE OF STOCKINGS, &c., *H. J. Griswold.—3rd December*, 1880. 1*s*. 2*d*.

This relates, First, to the combination with an upper knitted part of a leather, felt, india-rubber, or other sole, to form a sock, which will serve as a bed-room or house slipper, or as a bathing shoe; Secondly, to the combination in a stocking of a spring knee-cap and a knitted strap or straps provided with button-holes; Thirdly, to the improved knitting machine.

5049. TRIMMING THE HEELS OF BOOTS AND SHOES, *W. H. Dorman.—3rd December*, 1880. 8*d*.

This relates to the means for producing automatically or mechanically a varying inclination of the knife so as to effect the trimming of such heels in an advantageous and expeditious manner.

5050. BOILERS FOR GENERATING STEAM, *W. H. Mirfin and E. Nield.—4th December*, 1880. 6*d*.

This relates to boilers with internal flues, and consists in improved combinations of the same to obtain a better combustion of the gases and increased heating surfaces, so disposed as to divide, divert, and break up the currents of gases, and compel them to give up their heat more fully to the surfaces to be acted upon. The flue tubes are made up of sections formed of single tubes B with sections formed of a

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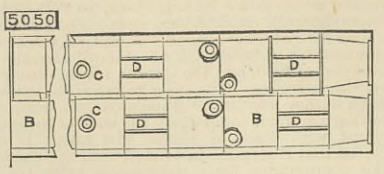

series of small tubes D. One, two, or more plain cylindrical sections B are connected together alternately with sections of small tubes D. The cylindrical sections have each one or more conical or cylindrical water tubes C secured across them, or they may have water pockets, or water pockets combined with water tubes.

5051. IMPROVEMENTS IN TIMEPIECES WORKED BY ELECTRICITY, *W. P. Thompson.—4th December*, 1880.—(*A communication from A. Lemoine.*) 6*d*.

This invention has for its object a system of electric timekeeping by means of an electro-magnet, which gives automatically to the pendulum a fresh impulsion each time that its oscillation fails to attain a certain amplitude of course. This is done by means of the light spindle with vane attached mounted on the pendulum, as shown, the vane being of mica or paper. As long as the range of oscillation of the pendulum does not descend below the normal limit, the spindle E passes the contact L without lowering it, by following the inclined path that the resistance of the air gives it, acting upon its vane. If, however, the oscillation diminishes, the speed of the pendulum

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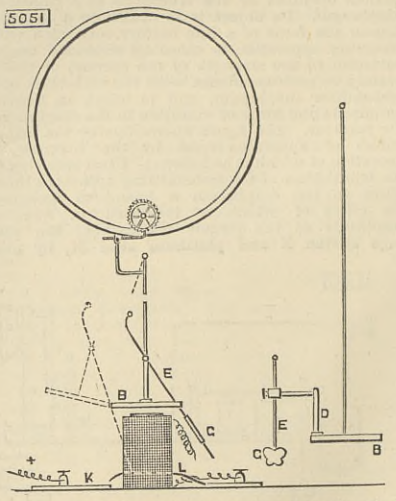


diminishes, and the resistance opposed by the air to the movement of the vane G must equally lessen in such manner that the spindle approaches the vertical. It then presses the contact L, which bends upon K, so that the circuit being closed the current traverses the electro-magnet, which becomes active. As this effect is produced before the pendulum becomes vertical—see dotted lines—the armature B is attracted, and the pendulum regains its full range of oscillation under the influence of this impulsion; E gliding over L, which again rises, the circuit is broken, and the pendulum oscillates as before.

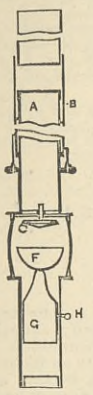
5052. BUTTONS, &c., *W. P. Thompson.—4th December*, 1880.—(*A communication from L. Gillon, sen.*)—(*Not proceeded with.*) 4*d*.

This relates to a machine for the fabrication of all parts of buttons (with shanks as well as with holes), whatever be the material, by the aid of which this fabrication is made, or the form it is desired to give to the product fabricated.

5055. SYPHONS, *J. Delord.—4th December*, 1880. 4*d*.

A is a pipe which can be moved to and fro in the sleeve B, which communicates with the liquid to be syphoned. The sides of the pipe A and sleeve B, which touch each other, are made water-tight. The sleeve B carries a short piece of pipe for the connection of a

5055



hose, which is led to the liquid to be syphoned. The pipe A is furnished with valve C, which opens when the pipe A is pushed inwards in the sleeve B, and closes directly the pipe A is moved in the opposite direction. The hemispherical valve F is fixed to a short movable pipe G and the outlet orifice can be opened and shut thereby at will by means of the button H.

5065. METALLIC PLATES AND STUDS FOR BOOTS AND SHOES, &c., *B. Bloomer.—4th December*, 1880. 6*d*.

This consists in plates, studs, or tips, &c., having projections in imitation of nails, and of any required design, and provided with an upturned edge serrated, or an upturned edge with points, by means of which they are secured or held.

5069. METALLIC DRUMS OR CASKS, &c., *J. Donnelly.—6th December*, 1880.—(*Not proceeded with.*) 2*d*.

This relates to an aperture and lid or cover, which may be advantageous as regards filling and convenient as regards closing and securing.

5070. LOOMS, *D. Sykes, P. Pontefract, and J. A. Greenwood.—6th December*, 1880.—(*Not proceeded with.*) 2*d*.

This consists in the combination and arrangement of parts, whereby the rising and falling shuttle-boxes may be lowered easily and gradually by self-acting mechanism with mechanical exactness.

5060. REFRIGERATING APPARATUS, &c., *A. S. Haslam.—4th December*, 1880. 8*d*.

This relates to an apparatus for collecting and separating aqueous vapour from compressed air and converting it into ice, which is utilised for reducing the temperature of the compressed air both in the formation of, and in the melting of, such ice. Also to the surcharging of the air compressing pumps with air by means of a fan driven by the compressing engine. The drawing shows the arrangement of the collector and separator A with reference to the air compressing cylinders B and the expansion cylinders C. The collector and separator is used in combination with the refrigerating apparatus described in patent

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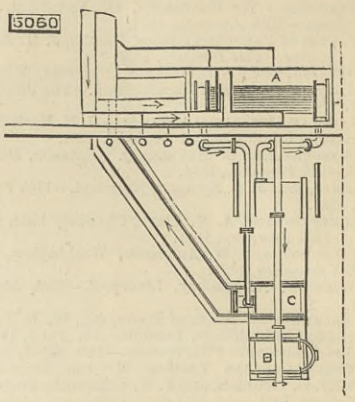

No. 1484, A.D. 1880, and it consists of tubes fixed in tube plates at both ends and connected with chambers for receiving the air before and after parting with its aqueous vapour. The collector and separator is placed in a chamber through which cold air circulates.

5072. STRAIGHTENING DEFORMED TREES, *H. G. Grant.—6th December*, 1880.—(*A communication from A. Peltier.*—(*Not proceeded with.*) 2*d*.

This relates to a metallic framing.

5073. CARTRIDGE COMPRESSORS, *H. Head.—6th December*, 1880.—(*Not proceeded with.*) 2*d*.

This relates to means to compress or turn in the edges of a number of cartridges simultaneously, instead of manipulating a single cartridge at a time as hitherto.

5074. MINERS' SAFETY LAMPS, &c., *E. Robathan.—6th December*, 1880. 6*d*.

The novelty consists in so constructing the lamp as to receive one or more reflectors A and B, that can be applied to existing lamps with little or no

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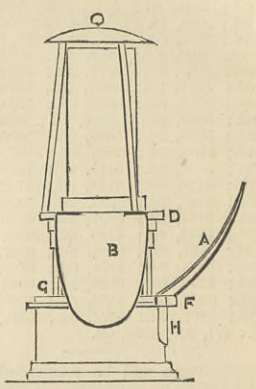

alteration. The stem H of the reflector A is fitted into a recess in a projection F cast on the frame G of the lamp, and the stem of the reflector B is fitted into a recess in the frame D, or fitted into a recess in a projection on the frame D.

5075. GASSING YARN OR THREAD, *J. M. Cryer.—6th December*, 1880.—(*Not proceeded with.*) 2*d*.

The principal feature of novelty consists in so constructing the gas burners that the yarn or thread passes in a vertical direction through the flame instead of in a horizontal direction.

5077. DIGGING MACHINERY, *C. A. Barrett and F. H. Faviell.—6th December*, 1880.—(*Not proceeded with.*) 2*d*.

This machine consists of a portable or traction steam engine and boiler, combined with digging tools or instruments attached at one end.

5078. FLUSHING DRAINS, &c., *S. H. Adams.—6th December*, 1880.—(*Not proceeded with.*) 2*d*.

This consists of a syphon of a rectangular form, having an internal smaller syphon, which is for the purpose of discharging with a small flow of liquid into the falling or outlet leg of the larger syphon.

5080. CLOCKS, *A. M. Clark.—6th December*, 1880.—(*A communication from F. A. Lane.*) 6*d*.

This relates to a clock consisting of the back plate A and intermediate plate B, the actuating mechanism being supported between the lower parts thereof, in combination with the short front plate C attached to

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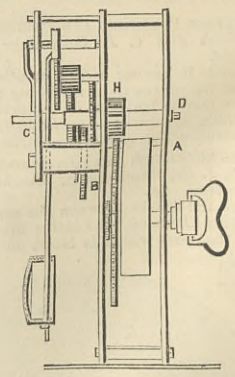

the upper part of plate B, the train being arranged between the said plates B C, and connected to the actuating mechanism by arbor D supported in plates A C, and carrying pinion H gearing directly with the main wheel.

5081. PURIFICATION OF SUGAR JUICES, SYRUPS, &c., *C. D. Abel.—6th December*, 1880.—(*A communication from A. P. Dubrunfaut.*—(*Not proceeded with.*) 4*d*.

This relates to combining divers processes more or less known for the purpose of manufacturing beet sugar without residue of molasses.

5082. VELOCIPEDES, &c., *A. Kirby.—6th December*, 1880. 6*d*.

This relates to combinations and arrangements of apparatus for transmitting power to the two road driving wheels of velocipedes by means of self-acting, equalising, and distributing gear composed of toothed wheels and double-ended pinions.

5083. IMPROVEMENTS IN THE MANUFACTURE OF CABLES FOR TELEGRAPH AND TELEPHONIC PURPOSES, AND IN APPARATUS EMPLOYED THEREIN, *E. Berthoud and F. Borel.—6th December*, 1880. 6*d*.

The First part of the invention relates to the cables themselves, as described in a former patent, No. 4346, 29th October, 1878; the cables are so constructed that all induction between the several conductors is obviated. The materials and their arrangement are shown in the figure. The outer ring 1 is a leaden sheathing, 2 is gas tar; 3, leaden sheathing; 4, insulating material; of the inner cables, the outer

ing 5 is composed of cotton impregnated with insulating material, 6 is a leaden strip; 7, cotton same as 5; and 8 is the copper wire conductor. The Second

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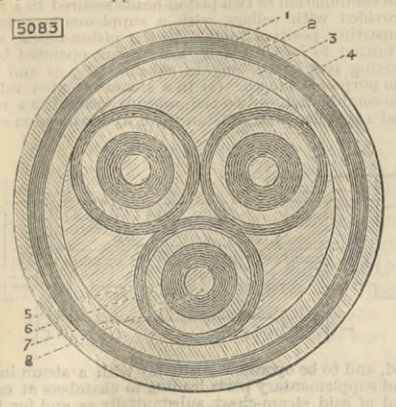

portion of the invention refers to the machinery and method of making these cables.

5084. DEVICE FOR HOLDING THE DRILL OR TOOL IN A ROCK-DRILLING MACHINE, *J. McCulloch.—6th December*, 1880. 6*d*.

The device is formed with a socket A to receive the piston rod C, secured by a cotter or other means. In its forward end is a parallel hole or socket D to receive

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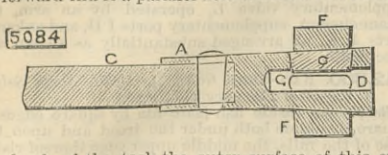

the shank of the tool, the outer surface of this end being taper, and over it passes a collar E fitting over a series of blocks G, inserted in slots in the forward end of the device, and bearing on the shank of the tool.

5085. MACHINE FOR SORTING, &c., GRAIN OR SEED, *H. H. Lake.—6th December*, 1880.—(*A communication from W. A. Stone.*) 4*d*.

A hopper A is provided, into which the grain or seed is poured, its fall being regulated by means of a rough slowly revolving, transporting, or feed roller B. The grain or seed as it leaves this roller is purified by means of a current of air produced by the blower C, and is conducted over four or more flat sieves D E F G,

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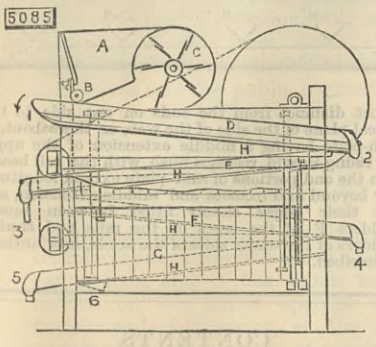

placed one below the other. To compel the grain to pass successively over the entire surface of each of these sieves, under the frames of the sieves are placed solid bottoms H H, so that the grain is separated into six different grades or qualities which leave the machine at the spouts 1 2 3 4 5 6; the separation being thus effected.

5087. SEPARATING THE FINER FROM THE COARSER PARTICLES OF MATERIALS FOR VARIOUS PURPOSES, *G. Wilson.—7th December*, 1880. 6*d*.

This consists, First, in obtaining a complete mixture of the particles to be separated, with water or liquid, in a vessel where afterwards separation according to degree of fineness is allowed to take place; Secondly, removing liquid from the deposit by syphoning off, or other mechanical means; Thirdly, further separation of liquid or moisture from the deposit by evaporisation whilst the deposit still remains in the vessel in which it was deposited; Fourthly, mechanical removal of one stratum of deposit from another.

5088. HARVESTING MACHINES, *W. G. Mainwaring.—7th December*, 1880.—(*A communication from C. W. Marsh.*) 10*d*.

This relates to means for tying the sheaves with a knotted cord instead of a twisted wire, and for regulating the size of the sheaves in machines constructed according to patent No. 530, A.D. 1880. According to one arrangement, the string is held in the first instance by a nipping apparatus at one end and a reel at the other, and the grain is forced against it by the progress of the chain platform, thus forming a bow. A needle then descends carrying a sufficient

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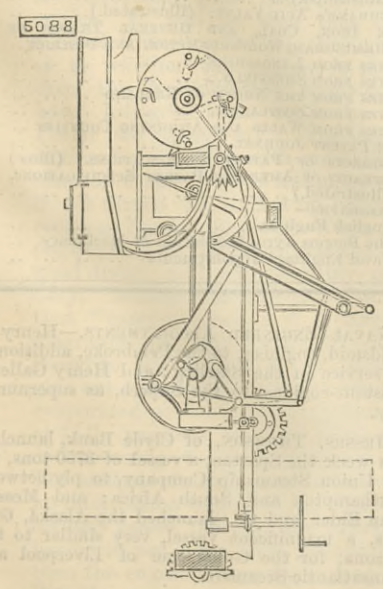

quantity of string off the reel, and brings it to the nipping apparatus. Both the end of the string and the string carried down as described are then laid hold of by a knotter, and when the knot is formed the string is severed by a cutter. The sheaf is supported on the side opposite to the string by one or more cradles.

5090. GAS ENGINES, *W. Foulis.—7th December*, 1880.—(*Not proceeded with.*) 2*d*.

This relates to improvements on patent No. 2422, April, 1880. Under the present improvements the compression pump, by means of which the air and gas are forced into the cylinder or cylinders of gas engines is connected by means of a passage or passages to a chamber or chambers containing layers of wire gauze, through which the compressed mixture of air and gas passes to the combustion chamber or chambers accordingly as the engine has one, two, or more cylinders. The chamber containing the layers of wire gauze is cooled by a water or air jacket, which may also extend round the tubular part wherein the igniter is placed, so as to keep the said part at a sufficiently low temperature. By preference one valve only is used between the compressing pump and the chamber containing the wire gauze layers, but more than one valve may be used.

5093. SCREW PROPELLERS, *W. Cooke and D. Mylchreest.—7th December*, 1880. 6*d*.

The screw propeller bosses are arranged and combined in two or more pieces—that is, two or more

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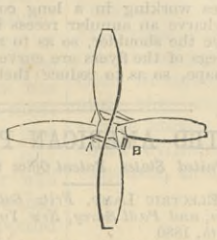

pieces A and B in their length, which pieces are connected together by bolts and nuts or equivalent fastenings.

5096. SUPPORTING SADDLES OR SEATS OF BICYCLES, TRICYCLES, &c., *J. A. Lamplugh.—7th December*, 1880.—(*Not proceeded with.*) 2*d*.

A framework or plate affixed to the backbone or bar carries, by means of suitable sockets, one, two, or more india-rubber arched forms, either longitudinal or crosswise of the backbone or bar for the purpose of reducing the vibration.

5097. HYDRO-CARBON LAMPS, *D. P. Wright.—7th December*, 1880. 6*d*.

This consists in the construction and formation of the cone of the lamp, by which it sustains and carries both the chimney and moon while in the act of lighting the wick.

5098. MANUFACTURE OF BALLS FOR CHILDREN, *A. Browne.—7th December*, 1880.—(*A communication from the Continental Caoutchouc and Gutta-percha Company.*)—(*Not proceeded with.*) 2*d*.

This relates to india-rubber balls, such balls being covered with wool dust.

5099. METERS, &c., *W. Stead.—7th December*, 1880. 6*d*.

This consists in the employment of feathering discs or pallets adapted to a cylinder or case having an expanded acting channel or passage and a contracted return channel or passage, the discs or pallets being so constructed and arranged in relation to each other and to the cylinder or case, that for a portion of their stroke they fill and travel through the expanded acting channel or passage, and that they are then automatically feathered or turned upon their axes and return through the contracted channel or passage.

5100. REGULATING PRESSURE AND ECONOMISING CONSUMPTION OF GAS, *H. Barlow.—7th December*, 1880.—(*Not proceeded with.*) 2*d*.

The apparatus consists of two sockets, chambers, or receptacles, which are screwed together, the inlet end of the lower socket being attached to the outlet pipe of the meter, and the outlet end of the upper socket being attached to the service pipe. The upper portion of the lower socket is provided with a neck which forms a seat for a valve, and the lower portion of this neck carries a screw threaded flange or collar, which engages in the lower socket which is tapped to receive it, and by means of which the two sockets are screwed together, and over this neck is placed a conical metal cap or valve, which works up and down in the upper socket. The lower portion of the lower chamber is provided with a hollow screw plug, which forms a seat for another conical metal cap or valve, thus the lower socket carries the two caps or valves and their seats. Projections in both the sockets guide the conical metal caps or valves in their rise and fall, and against these projections the caps or valves are forced when all the burners are opened.

5101. GAS ENGINES, &c., *W. B. Richardson.—7th December*, 1880.—(*Not proceeded with.*) 2*d*.

This consists in attaching or in casting on to the cylinder of the engine a carburator chamber or vessel capable of containing hydrocarbon liquids, such as petroleum and other oils or liquids of a like character. There is also attached to the engine a pump, by means of which atmospheric air may be drawn in through the carburator in suitable quantity to render the air thus carburated explosive, and fit it for duty as an explosive motive agent, the heat generated by the explosions being made available for using liquids that would be otherwise valueless for such purpose at ordinary temperatures.

5103. EMPTYING, &c., CESSPOOLS, *N. Talard.—7th December*, 1880. 6*d*.

This relates to a method of and apparatus for emptying and conveying away the contents of cesspools, wherein such contents are first drawn from the cesspools into recipients by suction, and are then discharged from these into a floating vessel of special construction on a river or other water-way, by which the sewage is conveyed to wherever required.

5104. PULVERISING MINERALS, &c., *W. R. Lake.—7th December*, 1880.—(*A communication from F. A. Luckenbach, J. Wolfenden, and L. F. Holman.*) 6*d*.

The apparatus is provided with an annular steam or air chamber A, current tubes B B¹ with removable linings, passages or valves C, hoppers D, movable caps

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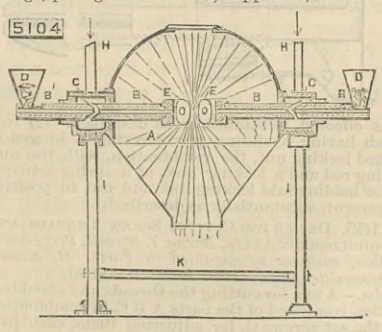


E, inlet tubes H, and supports I, connected by rods K. The inner tubes B and outer tubes B¹ form straight inlet passages for the substance to be pulverised, and are by preference provided with hardened metal linings, which may be readily removed when desired.

5105. SLIDES FOR MAGIC LANTERNS, *E. H. Doubell.—7th December*, 1880.—(*Not proceeded with.*) 2*d*.

This consists of an opaque plate with translucent lines, marks, or perforations to represent the rain, in combination with a movable semi-transparent screen of gauze, canvas, or other open fabric wound on rollers mounted on the slide, and to which motion is imparted by winding it off one roller on to another, so as to impart the desired appearance of falling motion to the images or representations of the rain-drops upon the screen.

5106. TUBES FOR STEAM BOILERS, REFRIGERATORS, &c., *W. Scantlebury.—7th December*, 1880.—(*Not proceeded with.*) 2*d*.

One novel form consists in forming the tubes with special corrugations or hollow threads from end to end, so as to offer greatly increased heating or cooling surface in a given length over that of an ordinary plain surface tube.

5107. STEAM PUMPS, &c., *G. Tangye, T. Jefferiss, jun., and J. R. Williams.—7th December*, 1880. 10*d*.

This relates to steam pumps for constant and variable loads, when used for the latter the pumps being fitted with automatic expansion gearing controlled by an improved governor, and effecting the condensation of the exhaust steam. The improvements may be used conjointly or separately, and are in part applicable to steam engines other than pumping engines, and to other motive power engines. The automatic expansion gear is shown in Fig. 1, in which A is the expansion valve secured to a spindle, on the ends of

5107 FIG. 1.

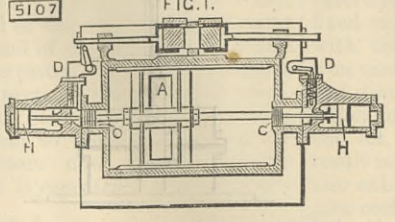
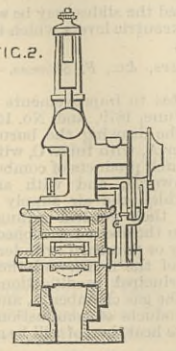


FIG. 2.



which are pistons C working in cylinders connected by passages to opposite ends of the main steam cylinder. Intersecting these passages, and near the small cylinder, are lift valves D worked by tappets controlled by the action of the governor. The spindle at its extreme ends also carries pistons H working in air cylinders, the air in which acts as a cushion to prevent injury. The springs of the governor act as a counterbalance to retard the rising of the pendulums, and allow them to be driven at an increased velocity. Fig. 2 shows the construction of governor combined with an equilibrium valve controlled by the governor, or used as a stop valve.

5108. SECURING THE ENDS OF WIRE FOR FENCING, &c., *H. Eyre and E. Heathfield.—7th December*, 1880. 6*d*.

This consists in securing together lengths of wire by flattening out the ends of the wires and inserting them into a buckle or its equivalent.

5109. TREATING GAUZE, BOBBINET, &c., *O. Wolff.—7th December*, 1880.—(*A communication from G. H. Gruner.*)—(*Not proceeded with.*) 2*d*

This relates to heating the material by mechanical and chemical means, so that the operations connected with the process can be carried out in a few hours.

5110. APPARATUS FOR BLOWING FOG HORNS, &c., *W. B. Barker.—8th December*, 1880.—(*Not proceeded with.*) 2*d*.

The horn is caused to give a long or short sound, so as to indicate by a code of signals the position from whence the sound comes.

5111. CATCHING BEETLES, COCKROACHES, &c., *A. Nash.—8th December*, 1880. 2*d*.

This consists essentially in the construction and use of a trap coated with an adhesive composition.

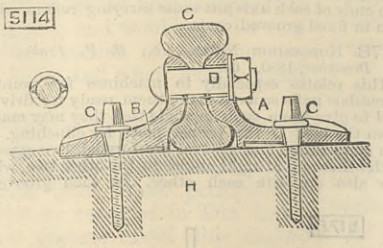
5112. FLUSHING APPARATUS FOR CLOSETS, DRAINS, &c., *W. Wildig.—8th December*, 1880.—(*Not proceeded with.*) 2*d*.

This consists of a circular drum of sufficient size to hold a regulated quantity of liquid. Internally this revolves itself spirally to hold said liquid, the weight of which is equally balanced by a metal disc. The drum is free to revolve on a perforated metal pipe connected to the supply and passing through the side of the tank in which the drum is contained. The liquid is supplied to the drum by the perforated pipe, the drum thereby being turned over and discharging its contents. By the use of a stop tap the apparatus can be discharged periodically at any given time.

5114. SUPPORT AND FASTENING FOR THE RAILS OF RAILWAYS, *H. A. Houllier.—8th December*, 1880. 6*d*.

This consists in the employment instead of the chairs heretofore in use, of a support divided into two fish-plate like angle brackets A and B, the upright

5114



cheeks of which are adapted as accurately as possible to the foot and head of the rail, the horizontal cheeks being secured by suitable means, such as screws G, to the wooden sleepers H. A screw bolt D connects the two angle brackets and the rail C between them.

5115. MANUFACTURE OF BREAD AND CONFECTIONERY, *A. Esilman and A. Hassall.—8th December*, 1880.—(*Not proceeded with.*) 2*d*.

This consists in the employment of bi-sulphates and phospho-sulphates of potash, soda, or ammonia, the said sulphates being used with any suitable carbonate for the production of carbonic acid in the manufacture of bread or confectionery where yeast or barm cannot be used.

5116. WATER-METERS, *R. Schloesser.—8th December*, 1880.—(*A communication from Messrs. Dreyer, Rosenkranz and Droop.*) 6*d*.

This consists principally of a circular shallow vessel in which is placed centrally a vertical spindle, which is so mounted as to be capable of revolving, and which is provided with six horizontal arms. Three of these arms carry small wings or vanes, and as the water flows through the vessel in passing from the inlet to the outlet, the fluid pressure carries these vanes with it like floating bodies, and the other three form the stops between the inlet and outlet passages.

5117. DREDGING BUCKETS, *R. Hadfield.—8th December*, 1880. 6*d*.

This consists in casting the buckets in steel, iron, or other suitable metal.

5118. WORKING HOBBY-HORSES, &c., ON ROUNDABOUTS, *A. Waddington.—8th December*, 1880. 6*d*.

This consists of a roundabout having hobby-horses or other figures of animals constructed and arranged in such a manner that they receive a circular lifting and falling action or motion to resemble the movement of horses or animals galloping or jumping.

5122. GAS GOVERNORS, *W. Cowan.—8th December*, 1880. 6*d*.

This consists in placing on or attaching to the exterior of the roof of the governor bell A, a tank B capable of being charged with water, glycerine, or other suitable liquid, called the water tank, and which in some cases may be annular, the central chamber C being closed at the top. This tank moves up and down along with the governor bell, to the outside of the roof of which it may be either fixed or upon which it may simply rest. Into this water tank there dips a bell D which does not move, but is fixed to and suspended by a disc, cross-bar, or other suitable means. This moving tank with a fixed bell

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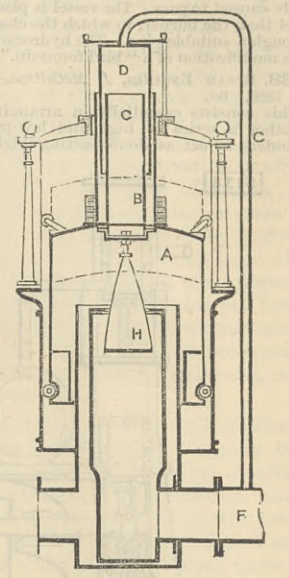

forms a water slide, like that of some gasaliers. Into this fixed bell gas, and consequently pressure from the inlet F of the governor, is introduced by means of a pipe G connecting the two, and as the area of the fixed bell D corresponds with the area of the base of the governor cone H, it follows that the influence of the initial pressure upon the latter will, under all circumstances, be balanced by an equivalent effect produced on the former.

5125. PRODUCING WRITING AND OTHER MARKS ON PAPER, &c., *A. Ford.—8th December*, 1880. 4*d*.

To the pulp is added a solution of a salt of iron. To produce writing or other marks on the paper made from this pulp, a solution of one or other of the following chemicals is applied by a pen or other instrument:—Tannin, tannic acid, or gallic acid, or of some vegetable extract containing these which will produce a black stain, or of the ferro-cyanide of potassium which will produce a blue stain, or of the sulpho-cyanide of iron which will produce a red stain, the per-salts of iron being used with the ferro and sulpho-cyanide of potassium, and the proto-salts of iron with ferri-cyanide of potassium.

5126. VALVES, *J. A. Mays.—8th December*, 1880.—(*Not proceeded with.*) 2*d*.

This consists essentially in so arranging the valve proper in relation to its seat, that when the said valve is in its normal position, that is to say, when the same is open to permit the passage of the water, the area of the outlet aperture or passage corresponds with that of the inlet or supply pipe, and the water passes freely.

5127. STOPPERS FOR PERFUMERY BOTTLES, &c., *E. G. Brewer.—8th December*, 1880.—(*A communication from A. Allilaire and L. Gerome.*—(*Not proceeded with.*) 2*d*.

This relates to stoppers having an exit tube communicating with the interior of the vessel. The stopper is fixed on a cap, which may be raised or lowered at will by means of a screw-threaded nut or washer taking into a thread forming the exterior of the tube.

5128 COUPLING THE ENDS OF MAIN AND OTHER SHAFTS, &c., *W. Pollard.—8th December*, 1880.—(*Not proceeded with.*) 2*d*.

The coupling consists of one or more bush keys of conical form each way from the centre, each cone having a ring recessed internally to the form of the cone keys, on to which they are driven. A key with a projection at each end is driven in between the ends of the shafts, which are slotted to receive it.

5130. GAS MOTOR ENGINES, *J. Livesey.—8th December*, 1880.—(*A communication from F. H. W. Livesey.*) 6*d*.

This relates to an engine worked by the expansion of a mixture of combustible gas and air ignited in a cylinder, the chief object being to employ a combustible charge in a compressed condition when ignited, the compression being effected in the same cylinder as that in which the combustion takes place, and the same cylinder being also available for working the engine as a compound engine. The front part of

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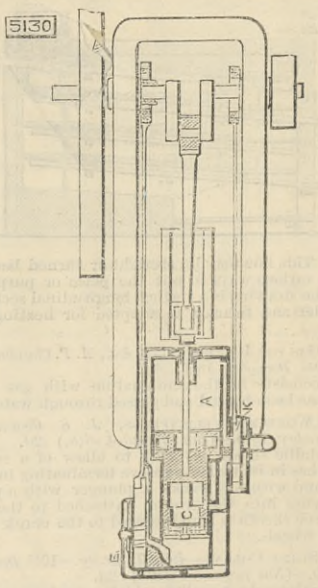


the cylinder A is fitted with a piston having a trunk C working in the back part of the cylinder. The annular space round the trunk in the front part of the cylinder receives the charge, which is compressed during the back stroke of the piston. A cylindrical slide J communicates with the annular space and with the front of the cylinder, and a second slide K communicates with the middle of the cylinder and also with its front end.

5131. TRAMWAYS, *B. Johnson.—8th December*, 1880.—(*Not proceeded with.*) 2*d*.

Two rails with double heads formed to overhang one side of the web are arranged with their flat sides

facing inside a double-jawed chair, a key being driven in between them to secure them in position.

5132. TREATING DISEASED HOP PLANTS, *T. J. Wall.*—*8th December*, 1880. 6*d*.

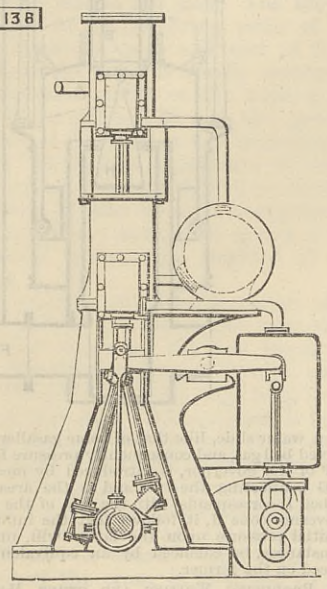
This relates to apparatus for causing the fumes of sulphur or other suitable material to be thrown on to the plants so as to cure or stop the spread of the disease.

5134. PRODUCING LIGHT AND HEAT BY THE COMBUSTION OF HYDROCARBON OILS, &c., *F. Wilkins.*—*8th December*, 1880. 8*d*.

This relates, First, to impregnating air with hydrocarbon vapour, and consists of a shallow vessel containing the hydrocarbon, over the surface of which the air is caused to pass. The vessel is placed on a higher level than the burner, to which the charged air passes through a suitable pipe. The hydrocarbon is supplied by a modification of a "bird fountain."

5138. STEAM ENGINES, *J. McCallum.*—*9th December*, 1880. 6*d*.

This consists essentially in arranging and fitting together a series of high and low-pressure engine cylinders to act as double-acting high-pressure and



single-acting atmospheric engines, combined and connected to one crank shaft. The drawing is an end elevation, showing a steam engine of small size adapted for marine purposes.

5139. SKATES, *T. B. Drybrough.*—*9th December*, 1880.—(*Not proceeded with.*) 2*d*.

The blade is formed in two or more pieces connected by links which will permit of the different parts yielding to the elastic action of the foot.

5141. MAGNETIC APPARATUS FOR SEPARATING IRON PARTICLES FROM WHEAT, FLOUR, &c., *T. M. Clarke.*—*9th December*, 1880.—(*Not proceeded with.*) 2*d*.

The magnets are caused to rotate and come in contact with scrapers on the opposite side to that over which the wheat passes, so as to remove the particles of iron from off the magnets.

5143. METALLIC BUTTONS, *W. J. Loyd.*—*9th December*, 1880.—(*Not proceeded with.*) 2*d*.

This relates to machinery for manufacturing buttons composed of a single disc cupped at the middle, and pierced with holes to permit of its being sewn on the garment, and consists of a reciprocating feeder to feed a long strip of metal to hole piercing tools, a pair of hole countersinking tools, and a pair of cutting out tools; also of a slide by the motion of which the disc is thickened and rounded on its edge, and convey to a pair of cupping and impressing dies.

5144. UNFERMENTED NON-INTOXICATING COMPOUNDS FOR BEVERAGES, *T. H. Larmuth.*—*9th December*, 1880. 4*d*.

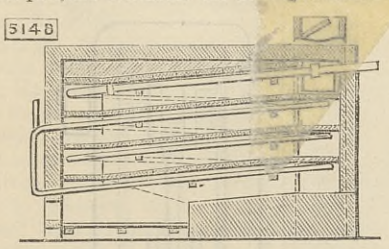
Distilled water rendered antiseptic by salicylic acid is heated to boiling point and used to manufacture essences of fruits and other raw materials.

5145. SKATES, *R. H. Bishop and H. F. Hailes.*—*9th December*, 1880. 6*d*.

A sole plate is carried in front by a bracket rivetted to the blade, and at the rear by a short standard to which it is secured by a screw. The standard is carried by a bracket rivetted to the blade. The sole plate has adjustable clips to hold the sole of the boot. The rear end of the sole-plate overlies the heel-plate and is slotted to allow the adjustment of a gripping toe-piece to enter the front of the heel. A lever actuates the clips and the heel-gripping piece.

5148. FURNACES AND BOILERS, &c., *A. M. Clark.*—*9th December*, 1880.—(*A communication from S. W. Underhill.*) 6*d*.

The nature of this invention consists in a fire-box and long continuous flue through which the water-tubes pass, and constitute the heating surface of the



boiler. This flue may be straight or turned back and forth in various ways to suit the place or purpose of use. The drawing is a vertical longitudinal section of the boiler and furnace, as adapted for heating purposes.

5156. GAS FOR ILLUMINATING, &c., *A. P. Chamberlain.*—*10th December*, 1880. 4*d*.

This consists in the combination with gas of air which has been heated and passed through water.

5157. WORKING VELOCIPEDES, *J. S. Cooke.*—*10th December*, 1880.—(*Not proceeded with.*) 2*d*.

A metallic sheath pivotted to allow of a rocking motion has in its inside a groove terminating in a cam shape, and within it works a plunger with a projection taking into the groove. Attached to the lower end of the sheath is a rod jointed to the crank of the driving wheels.

5165. SHIRT COLLARS, &c., *G. Berry.*—*10th December*, 1880.—(*Not proceeded with.*) 2*d*.

This relates to a collar which may be used as a "stand-up" or a "turn-down" collar.

5167. STEEL, *T. Hampton.*—*10th December*, 1880. 2*d*.

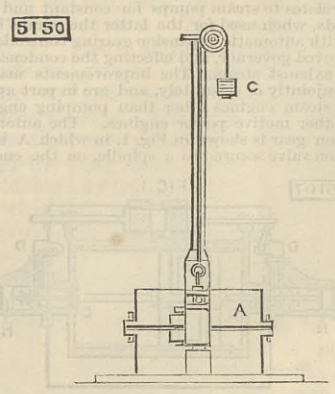
This consists chiefly in melting the raw material in a cupola or air furnace, running the molten metal in a suitable converter, and afterwards transferring it into prepared crucibles for the purpose of refining and recarbonising.

5173. ARTIFICIAL MANURES, &c., *F. J. Bolton and J. A. Wanklyn.*—*10th December*, 1880. 2*d*.

This relates to the manufacture of artificial manures and ammoniacal products, by mixing urine or sewage with superphosphate of lime or other convenient acid substance.

5150. PREPARING MOULDS FOR CASTING, *H. Gibbons.*—*9th December*, 1880. 6*d*.

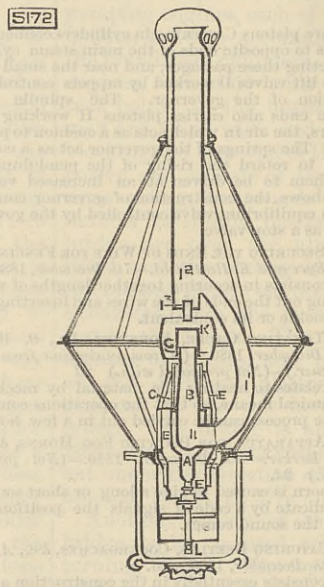
This relates to means for effecting a mechanical lift of the moulding block, and it consists in securing the moulding block A to slides connected by cords to counterweights G, whereby the block is lifted, but



when desired the slides may be secured in position by means of excentric levers which bind the slides on the guide rods.

5172. LAMPS, &c., *F. Siemens.*—*10th December*, 1880. 6*d*.

This relates to improvements on patents No. 2231, dated 5th June, 1879, and No. 1561, dated 16th April, 1880. In the drawing the burner, consisting of the gas chamber A, with tubes C, with central chamber B, through which products of combustion from the flame pass downwards, and with an outer chamber E, through which the air supply passes upwards, are similar in their general arrangement to the lamp described in the above-mentioned patents, as also are the fire-clay or porcelain cylinder K which determines the height of the flame, and the notched air deflector G. The principal modifications consists, First, in enlarging the gas chamber A, and causing the passage I for the products of combustion to pass through it, whereby the heat thereof will be more effectually taken



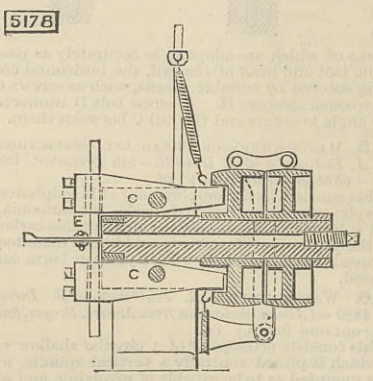
up by the gas; Secondly, in extending the air chamber E downwards, so as by the heat imparted by conduction to its sides, to produce a column of heated air within it sufficient to supply a current of the requisite intensity to enable the flame to burn effectually without the ordinary chimney draught above it; Thirdly, in dispensing with the ordinary chimney guard and allowing the upward draught from the flame to communicate direct with the chimney I^2 through a small opening I^3, the chimney I^2, together with the pipe I^4, connecting it with the passage I, being formed of comparatively large diameter, so that notwithstanding the direct communication between the flame and I^2, the greater part of the products of combustion will still be drawn down through the chamber I when the pipe i becomes heated.

5174. DIGGING MACHINES, *H. de Mornay.*—*10th December*, 1880.—(*Not proceeded with.*) 2*d*.

The spades or forks are fixed to a number of horizontal axes arranged around and parallel with a central axle supported on wheels fixed thereto. At the ends of each axis are arms carrying rollers which run in fixed grooved cams.

5178. HORSESHOE NAILS, &c., *H. P. Fenby.*—*10th December*, 1880. 6*d*.

This relates especially to machines for pointing horseshoe nails so as to make them ready for driving, and to give them such an angle that they may emerge from the hoof at the proper place for clinching. In the main frame four grooves are formed, two opposite each other and at right angles to the other two, which are also opposite each other. In each groove is



mounted a lever C on an axis in the middle of its length, all the levers oscillating towards a common centre and coming in contact with an anvil bed E. The front ends of the levers carry steel blocks which strike the nail alternately in pairs

5180. PREPARATION OF ALKALI SALTS OF SULPHONIC ACIDS, *J. A. Dixon.*—*11th December*, 1880.—(*A communication from Dr. C. Koeniy.*) 4*d*.

This relates to the production of the alkali salts, Firstly, of the mono and disulphonic acids of anthraquinone; Secondly, of the sulphonic acids of rosaniline; and Thirdly, of the mono and disulphonic acids of amido-azo benzol and its homologues, by acting on anthraquinone, rosaniline, and amido-azo benzol or its homologues, respectively with pyrosulphate of soda or of potash, preferably dissolved in monohydrated sulphuric acid.

5181. MANUFACTURE AND APPLICATION OF JUTE, *W. M. Black and A. Taylor.*—*11th December*, 1880. 2*d*.

Bleached yarns of jute are dyed to the required colour, and are braided in a braid machine, or partly woven and braided and then starched and finished by pressing plates.

5182. COMPRESSED AIR APPARATUS FOR PROPELLING TRAM-CARS, *A. Nosbaume.*—*11th December*, 1880.—(*Not proceeded with.*) 2*d*.

An air reservoir formed by a series of steel pipes, all connected with a cross bronze pipe, is placed under the tram-car, and on the platform is a small boiler heated by gas or petroleum, so as to produce steam, which is mixed with the air and serves to drive the engine.

5185. SPINDLES AND FLYERS, *G. C. Haworth and J. Mounsey.*—*11th December*, 1880.—(*Not proceeded with.*) 2*d*.

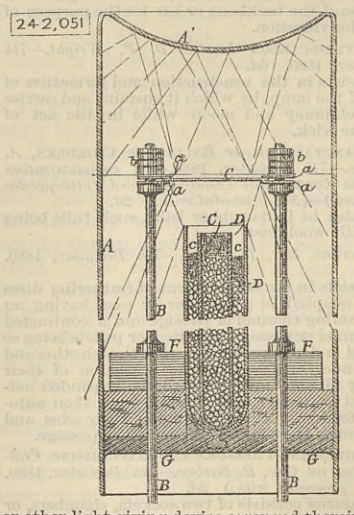
In spindles working in a long collar or bearing above the wharve an annular recess is made in the spindle above the shoulder, so as to reduce the friction. The legs of the flyers are curved to an irregular wave shape, so as to reduce their tendency to expand.

SELECTED AMERICAN PATENTS.

From the United States Patent Office Official Gazette.

242,051. ELECTRIC LAMP, *Fritz Salathé, John E. Brustlein, and Paul Sarey, New York, N.Y.*—*Filed March 5th*, 1880.

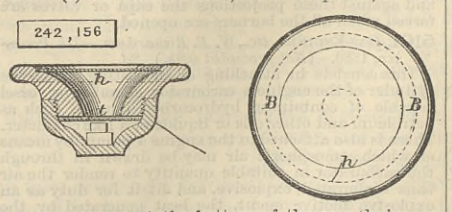
Claim.—(1) The combination, in an electric lamp, of a transparent shell or globe, two metallic rod conductors arranged therein, a carbon ring forming the light-giving portion, and carbon clamps holding the carbon ring between them fitting upon the metallic rod conductors, and screw nuts for tightening said clamps upon said rods, substantially as and for the purpose specified. (2) The combination, in an electric light, of a closed transparent shell or globe, a carbon



or other light-giving device arranged therein, and two vases or vessels, one containing a chemical or chemicals for absorbing oxygen and the other a substance for absorbing nitrogen, placed one within the other, and arranged in the shell or globe substantially as specified. (3) The combination in an electric lamp of a closed transparent shell or globe, a carbon or other light-giving device arranged therein, and a vase or vessel for holding a chemical, also arranged in said shell or globe, and having a silvered surface, whereby it is made to constitute a reflector, substantially as and for the purpose specified.

242,156. TELEPHONE, *Chas. W. Raymond, New York, N.Y.*—*Filed January 29th*, 1881.

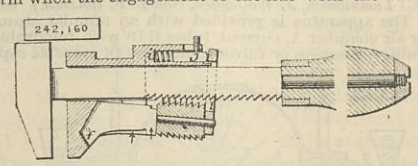
Claim.—(1) A telephone in which a supplemental diaphragm covers the mouthpiece, substantially as set forth. (2) The combination, in a telephone, of the



usual diaphragm at the bottom of the mouthpiece, a diaphragm covering and extending over the mouthpiece, and a disc H beneath the outer diaphragm, substantially as described.

242,160. WRENCH, *Charles Scholz, Dayton, Ohio.*—*Filed April 7th*, 1881.

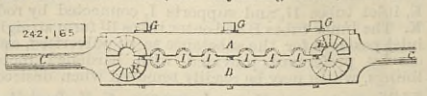
Claim.—(1) In a wrench, the combination of the following instrumentalities, to wit, a rack-bar with a stationary jaw, a sliding jaw carrying a hinged nut-bearing arm or rod, an adjusting nut, a skeleton frame encompassing said rack-bar and forming part of said sliding jaw, a locking link attached to and moving with said hinged arm and encompassing the rack-bar, and a locking bolt adapted to lock said link and hinged arm when the engagement of the nut with the rack-



bar is effected, substantially as described. (2) In a wrench having a sliding jaw carrying a hinged or pivotted locking nut, the combination, with the nut-carrying rod and a locking link, of a spring-actuated bolt for holding said locking link and nut in positive engagement, substantially as described.

242,165. DEVICE FOR CUTTING SCREW THREADS AND SHOULDERS ON AXLES, *Barna T. Stowell, Perrysburg, Ohio, assignor of one-third to Porter M. Smart, Somerville, Mass.*—*Filed March 11th*, 1881.

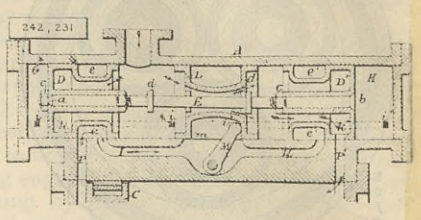
Claim.—A tool for cutting the threads and shoulders on axles, composed of the parts A B C, in combination with the set screws G, for adjusting them, each part



being provided with teeth E, for cutting away the shoulder of the axle, and the dies I, for cutting the screw threads, substantially as shown.

242,231. STEAM-ACTUATED VALVE, *Andrew V. Smith Washington, D.C.*—*Filed April 19th*, 1881.

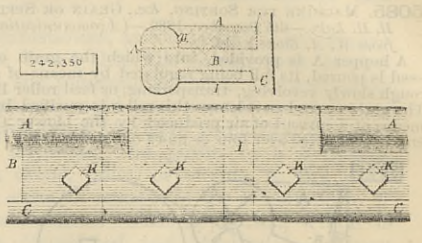
Claim.—(1) A steam-actuated balance valve consisting of two piston-heads secured to a rod, and a loose supplementary piston valve arranged between them, to be operated by an arm receiving motion from a moving part of the engine, substantially as shown and specified. (2) A balanced valve consisting of two piston-heads secured to a rod and provided with inlet and outlet openings, in combination with supplementary ports, and a loose supplementary piston valve operated by an arm receiving motion from a crosshead or any other moving part of the engine, substantially as specified. (3) In a steam-actuated valve, the combination of two piston-heads secured to a rod provided with collars, with a supplementary valve imparting positive motion to the piston-heads, and arranged to be shifted by mechanism operated by a moving part of the engine, substantially as and for the purpose set forth. (4) In a steam-actuated valve, the combination of two piston-heads secured to a rod and a supplementary piston valve free to move on said



rod, and to be operated positively with a steam inlet and supplementary ports leading to chambers at each end of said steam-chest, substantially as and for the purpose herein specified. (5) The combination of two piston-heads D D^1, having inlet and outlet ports, and secured to a rod E, with a loose supplementary valve L, operated positively by an arm M or its equivalent, and the supplementary ports I I^1 and chambers G H, all substantially as shown and specified. (6) The combination of the two piston-heads D D^1, having pockets E^{II} E^{III}, and secured to a rod E, with the supplementary valve L, operated by an arm, the steam-chest A, supplementary ports I I^1, and exhaust-ports I K, all arranged substantially as shown and specified.

242,350. RAIL-JOINT, *George A. Mead, North Salem, N.Y.*—*Filed February 26th*, 1880.

Brief.—An inside fish-plate fits by square edges to square shoulders both under the tread and upon the base of the rails, the middle upper edge thereof rising and forming a half-tread at the joint in a recess formed in the rail ends. *Claim.*—The combination, with the railroad rails having the head A recessed for



a short distance from the ends on one side to the vertical plane of the side of the web, or thereabout, of a fish-plate having a middle extension of the upper edge rising in said recesses flush with the rail heads, when the end portions of said plate extend longitudinally beyond said recesses and middle extension, and have their edges closely fitted between square shoulders F of the bases of the rails and similar shoulders of the under sides of the heads, substantially as described.

CONTENTS.

THE ENGINEER, July 15th, 1881.

NAVAL ENGINEER APPOINTMENTS.—Henry C. Goldsmid, engineer, to the Pembroke, additional, for service in the Starling; and Henry Gallery, assistant-engineer to the Superb, as supernumerary.

MESSRS. THOMSON, of Clyde Bank, launched this week the Spartan, a vessel of 3750 tons, for the Union Steamship Company, to ply between Southampton and South Africa; and Messrs. John Elder and Co. launched the Alaska, 6800 tons, a magnificent vessel, very similar to the Arizona, for the Guion line of Liverpool and Transatlantic Steamers.

MOST of the census returns for the Australian colonies have been completed. The population of Victoria is 855,000. New South Wales is about 100,000 less. But the Victorian gain, during the last decade, has been at the rate of 17 per cent. only, while the New South Wales gain has amounted to 48·81 per cent. The Conservatives have returned to the battle of free-trade against protection, and are commenting loudly upon the fact that the relative prosperity of New South Wales is attributable to her fiscal policy.

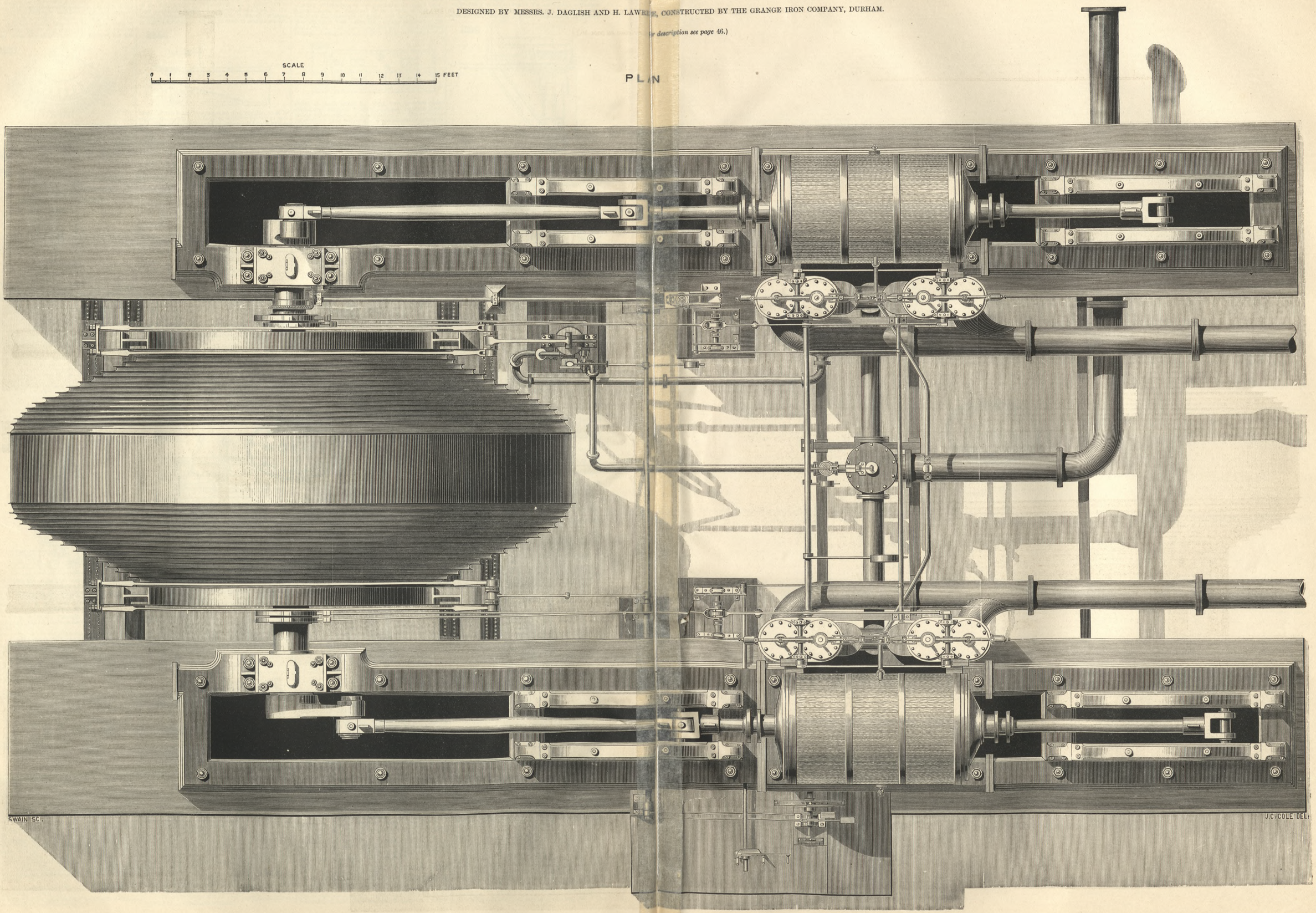
No. 3 WINDING ENGINE, ILKSWORTH COLLIERY.

DESIGNED BY MESSRS. J. DAGLISH AND H. LAWRENCE, CONSTRUCTED BY THE GRANGE IRON COMPANY, DURHAM.

(For description see page 46.)

SCALE
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 FEET

PLAN



SWAIN SC.

J.C. COLE DEL.